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Classroom Instruction, Self-study Exercises
Scientific Research, Engineering Computations

Program examples for Earth Tide, Load Effect and Deformation Monitoring Computation

- Analytically geodetic and geodynamic algorithms with unified standards and coordinated geophysical models
- IERS conventions (2010) compliant and improved, with clarified concepts and fully derived and verified algorithms
- Uniform computation of tidal, polar shift, and COM variation effects on full-space various geodetic elements
- Analytical computation of surface load effects and collaborative monitoring of temporal local gravity field
- Geodetic estimation of terrestrial water EWH and computation of spatiotemporal ground stability variations

Earth Tide, Load Effect and Deformation Monitoring Computation

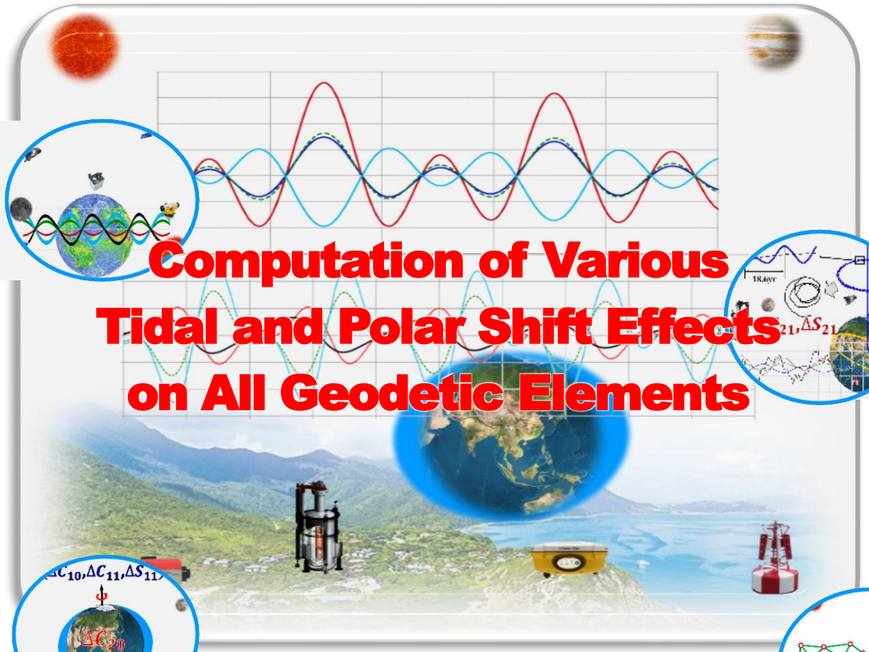
ETideLoad4.5

Chinese Academy of Surveying & mapping

June 2026, Beijing, China

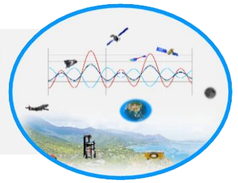
- Computation of Various Tidal and Polar Shift Effects on All Geodetic Elements
  - Computation of Solid Earth Tidal Effects on Various Geodetic elements External to the Solid Earth
  - Spherical Harmonic Synthesis of Ocean Tidal Load Effects External to the Solid Earth
  - Spherical Harmonic Synthesis of Atmosphere tidal Load Effects External to the Solid Earth
  - Computation of Earth Rotation Polar Shift Effects on Geodetic Elements and Tidal Effects on EPR
  - Computation of Permanent Tide and Earth's COM Variation Effects on Geodetic Elements
  - Computation of Solid Earth Tide and Tidal Load Effects for Geodetic Networks
  - Regional Approximation of Tidal Load Effects via Load Green's Function Integration
  - Forecast of Various Tidal Effects on Various Surface Geodetic Elements
- Load Deformation Field Approximation and Monitoring from Heterogeneous Variations
  - Spherical Harmonic Analysis on Global Surface Load Time Series
  - Spherical Harmonic Analysis of Tidal Harmonic Constants and Construction of Tidal Load Model
  - Computation of Load Model Values via Spherical Harmonic Synthesis
  - Computation of Load Deformation Field via Spherical Harmonic Synthesis
  - Regional Refinement of Load Deformation Field via Green's Integration
  - Regional Approximation of Load Deformation Field Using Spherical Radial Basis Functions
  - Load Deformation Field Recovery from Heterogeneous Variations via Green's Integral Constraint
  - SRBF Approximation of Terrestrial Water Variations and Load Effects from Heterogeneous Variations
  - Geodynamic Calculation on Geodetic Field Grid Time Series
  - Appoximation Processes for Surface Loads and All-element Load Deformation Field with SRBFs
- Processing and Analysis of Non-Tidal Geodetic Variation Time Series
  - Separation and Processing for Irregular Geodetic Variation Time Series
  - Low-pass Filtering and Signal Reconstruction for Irregular Time Series
  - Weighted Operations, Differencing, Integration, and Interpolation on Variation Time Series
  - Normalized Extraction from Batch Geodetic Monitoring Network Time Series
  - Processing and Analysis for Batch Geodetic Monitoring Network Time Series
  - Construction and Analysis of Record Time Series from Geodetic Network
  - Processing and Analysis of Variation (Vector) Grid Time Series
  - Multi-form Spatiotemporal Interpolation from Grid Time Series
- CORS/InSAR Collaborative Monitoring and Ground Stability Estimation
  - Pseudo-Stable Adjustment of Variation Record Time Series for Geodetic Monitoring Network
  - Gross Error Detection and Spatial Deformation Analysis on InSAR Variations
  - Collaborative Monitoring and Processing of InSAR with CORS Network
  - Deep Fusion and Time Series Analysis on Multi-Source InSAR Variations
  - Computation of Ground Stability Variation Based on Vertical Deformation
  - Computation of Ground Stability Variation Based on Gravity Variations
  - Computation of Ground Stability Variation Based on Variation Vectors
  - Statistical Synthesis and Prediction of Ground Stability Variations
- ETideLoad4.5 Summary, Setting and Visualization
  - Scientific Goals and Strengths of ETideLoad4.5
  - Dominant Concepts and Ideas
  - Geophysical Models and Numerical Standards
  - Visualization for Multi-Attributes in Ground Variation Time Series
  - Visualization for Variation Record Time Series on Geodetic Network
  - Visualization of Specified Attributes in Discrete Point File
  - Visualization of Geodetic Grid or Variation Grid Time Series Files
  - Visualization of Geodetic Vector Grid File
- Editing and Calculation Tools for Geodetic Data Files
  - Conversion of General ASCII Data into ETideLoad Format
  - Data Interpolation, Extraction, and Land/Sea Masking
  - Simple and Direct Calculations on Geodetic Data Files
  - Operations on Variation Time Series with Same Specifications
  - Simple Gridding and Regional Geodetic Grid Construction
  - Construction and Transformation of Vector Grid Files
  - Statistical Analysis of Geodetic Data File
  - Gross Error Detection and Weighted Basis Function Gridding of Geodetic Observations

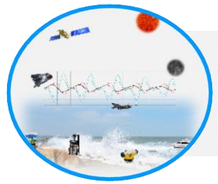
Computation of Various Tidal and Polar Shift Effects on All Geodetic Elements



- Computation of Solid Earth Tidal Effect Time Series at a Ground Point
- Computation of Solid Earth Tidal Effects at Batch Points with Given Time
- Computation of Solid Earth Tidal Effects for Earth Satellites or External Points to the Solid Earth
- Global Forecast of Solid Tidal Effects on Various Surface Geodetic Elements

Computation of Solid Earth Tidal Effects on Various Geodetic elements External to the Solid Earth





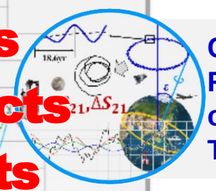
Spherical Harmonic Synthesis of Ocean Tidal Load Effects External to the Solid Earth

- Computation of Ocean Tidal Load Effect Time Series at a Ground Point
- Computation of Ocean Tidal Load Effects at Batch Points with Given Time
- Computation of Ocean Tidal Load Effects for Earth Satellites or External Points
- Global Forecast of Ocean Tidal Load Effects on Various Surface Geodetic elements

- Computation of Surface Atmosphere tidal Load Effect Time Series at a Ground Point
- Computation of Surface Atmosphere tidal Load Effects at Batch Points with Given Time
- Computation of Atmosphere Tidal Load Effects for Earth Satellites or External Points to the Solid Earth
- Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

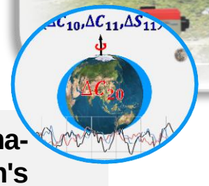
Spherical Harmonic Synthesis of Atmosphere tidal Load Effects External to the Solid Earth

- Computation of Rotation Polar Shift or Ocean Pole Tidal Effect Time Series at a Ground Point
- Computation of Rotation Polar Shift or Ocean Pole Tidal Effects at Batch Points with Given Time
- Computation of Rotation Polar Shift or Ocean pole tidal Effects for Satellites or Points External to the Solid Earth
- Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere
- Forecast of Tide Effect Time Series on Earth Rotation Parameters

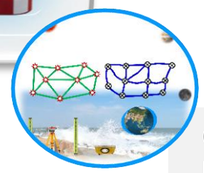


Computation of Earth Rotation Polar Shift Effects on Geodetic Elements and Tidal Effects on EPR

- Computation of Permanent Tide Effects on Various Geodetic Elements
- Computation of Earth's COM Variation Effects on Various Geodetic elements
- Forecast of Ocean Tidal Load Effects on Earth's Center of Mass
- Forecast of Atmosphere Tidal Load Effects on Earth's Center of Mass



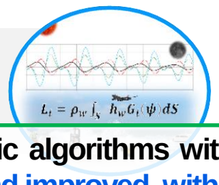
Computation of Permanent Tide and Earth's COM Variation Effects on Geodetic Elements

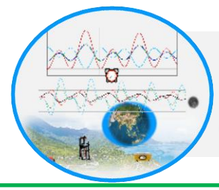


Computation of Solid Earth Tide and Tidal Load Effects for Geodetic Networks

- Computation of Residual Ocean Tidal Load Effects via Green's Integration
- Computation of Residual Atmosphere tidal Load Effects via Green's Integration

Regional Approximation of Tidal Load Effects via Load Green's Function Integration





Forecast of Various Tidal Effects on Various Surface Geodetic Elements

- Numerical Forecast of Solid Earth Tidal Effects on Various Geodetic Elements
- Numerical Forecast of Ocean Tidal Load Effects on Various Geodetic Elements
- Numerical Forecast of Surface Atmosphere Tidal Load Effects on Various Geodetic Elements

- Analytically geodetic and geodynamic algorithms with unified standards and coordinated geophysical models
- IERS conventions (2010) compliant and improved, with clarified concepts and fully derived and verified algorithms
- Uniform computation of tidal, polar shift, and COM variation effects on full-space various geodetic elements

Computation of Solid Earth Tidal Effects on Various Geodetic elements External to the Solid Earth

Computation of Solid Earth Tidal Effect Time Series at a Ground Point

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Solid Earth Tidal Effect Time Series at a Ground Point | Computation of Solid Earth Tidal Effects at Batch Points with Given Time | Computation of Solid Earth Tidal Effects for Earth Satellites or External Points to the Solid Earth | Global Forecast of Solid Tidal Effects on Various Surface Geodetic Elements

Open the ground variation time series file | Save program process as | Algorithm formulas

Set the file parameters

Column ordinal number of ellipsoidal height in the header: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

```
>> [Function] Given a ground varoation time series file, this module computes the time series of solid Earth tidal effects on the following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW: South and West, mas), vertical deflection (SW, mas), Horizontal displacement (EN: East and North, mm), radial displacement (mm), ground normal/orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/Tideffectsolidearth/Tmseries.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the tidal effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the computed results as C:/ETideLoad4.5_win64en/examples/Tideffectsolidearth/tmsqurst.txt.
  ** Appends the selected tidal effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-06 10:48:20
>> The program also outputs a time series file of the solid Earth tidal effects on the degree-2 geopotential coefficients and figure pole (*Stdsfptm.txt) into the current directory (* = input filename).
  ** • Format: First row is the header. Subsequent rows contain: Epoch time, ΔC20, ΔC21, ΔS21, ΔC22, ΔS22 (×10-8), Δx_sfp, Δy_sfp (in the ITRS, unit: m).
>> Complete the computation of solid earth tidal effects!
```

Save the computed results as | Import setting parameters | Start computation

Display of the input-output file↓ | Save data in the text box as

```
Forcast  121.240000   29.428100   17.830   58456.959028
 201812042301   0.000000   -9.1781  -156.8405   -64.8337   -72.7348    6.9147   -9.0453   13.06
 201812042316   0.010417   -9.0405  -126.4444   -52.4062   -58.7014    7.9809   -9.4946   15.01
 201812042331   0.020833   -8.9068   -94.9272   -39.5093   -44.1436    9.0491   -9.7445   16.97
 201812042346   0.031250   -8.7789   -62.9361   -26.4105   -29.3615   10.1045   -9.7926   18.90
 201812050001   0.041667   -8.5474   -31.1200    -0.6789    -0.3259   11.1382   -9.6398   20.78
 201812050016   0.052083   -8.3580    -0.1200    25.1430    28.7426   12.1177   -9.2907   22.58
 201812050031   0.062500   -8.2822    25.1430    49.1529    57.3426   13.0468   -8.7535   24.28
 201812050046   0.072917   -8.3580    56.9866    22.7100    26.0757   13.9061   -8.0396   25.85
 201812050101   0.083333   -8.2822    81.9584    32.9291    37.6197   14.6833   -7.1638   27.27
 201812050116   0.093750   -8.2201   103.8654    41.8842    47.7447   15.3671   -6.1436   28.51
 201812050131   0.104167   -8.1724   122.2731    49.3954    56.2491   15.9477   -4.9992   29.57
 201812050146   0.114583   -8.1392   136.8147    55.3112    62.9628   16.4168   -3.7529   30.41
 201812050201   0.125000   -8.1208   147.1977    59.5112    67.7505   16.7675   -2.4290   31.04
```

Columns 2 and 3 of the file header are agreed as the longitude and latitude of the ground point

- Tide-Generating Potential (TGP) Model: Lunar: Degrees 2 to 6; Solar: Degrees 2 to 3; and Planetary (others): Degree 2.
- The solid tidal effect on the normal height (amplitude ~300 mm) is out of phase (opposite in sign) with the effect on the ellipsoidal height or geoid (amplitude ~600 mm).
- The east-west component of the effect vector on ground displacement, tilt, or horizontal gradient is generally significantly larger than the north-south component.
- The range (max-min) of solid Earth tidal effects on the figure pole generally exceeds 1 km.

Computation of Solid Earth Tidal Effects on Various Geodetic elements External to the Solid Earth

Computation of Solid Earth Tidal Effects at Batch Points with Given Time

Open file Save as Import parameters Start computation Save process Follow example

Computation of Solid Earth Tidal Effect Time Series at a Ground Point | Computation of Solid Earth Tidal Effects at Batch Points with Given Time | Computation of Solid Earth Tidal Effects for Earth Satellites or External Points to the Solid Earth | Global Forecast of Solid Tidal Effects on Various Surface Geodetic Elements

Open the location and time file of the computation points | Save program process as | Algorithm formulas

Set the file parameters

Column ordinal number of ellipsoidal height in the record: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

```
>> Computation end time: 2026-06-06 10:48:21
>> [Function] According to the location and time in the calculation point file, compute the solid Earth tidal effects on the geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, mas), vertical deflection (SW, to the south and to the west, mas), horizontal displacement (EN, to the east and to the north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE) or horizontal gravity gradient (NW, to the north and to the west, 10μE).
>> Open the location and time file of the computation points C:/ETideLoad4.5_win64en/examples/Tideffectsolidearth/Postiontm.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the tidal effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the computed results as C:/ETideLoad4.5_win64en/examples/Tideffectsolidearth/Postmrst.txt.
  ** Appends the selected tidal effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-06 10:50:51
>> Complete the computation of solid earth tidal effects!
>> Computation end time: 2026-06-06 10:50:51
```

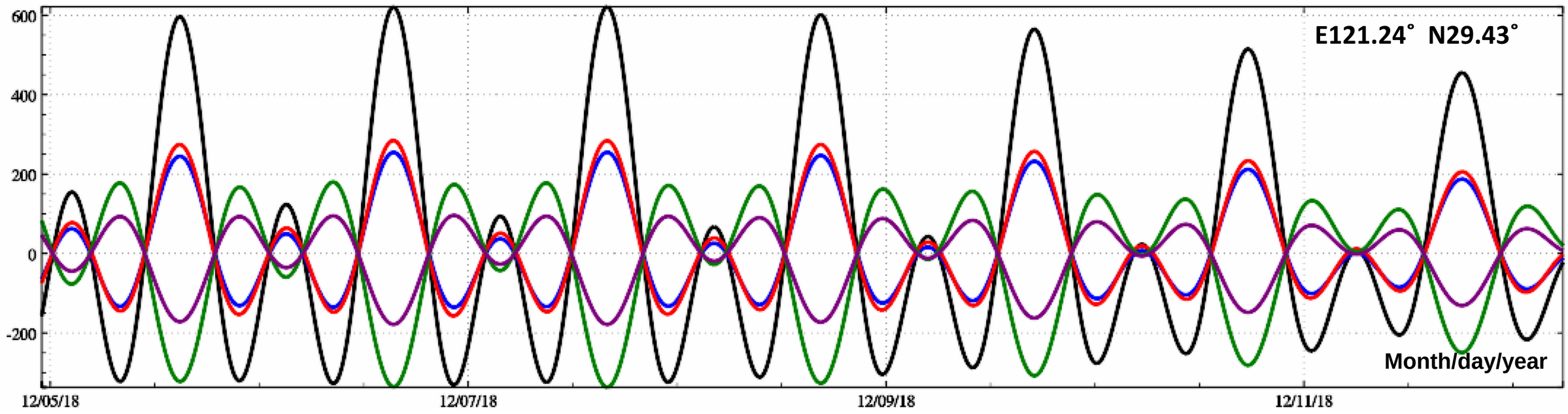
Columns 2 and 3 of the record are agreed as the longitude and latitude of the calculated point

Save the computed results as | Import setting parameters | Start computation

Display of the input-output file↓ | Save data in the text box as

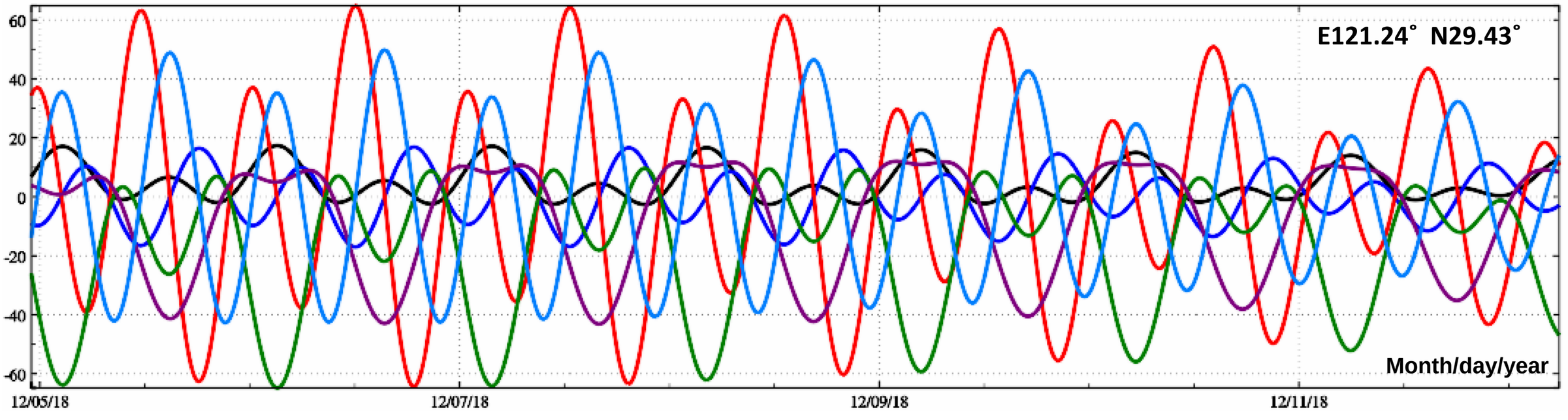
```
101.230000    29.910000    47.218   58484.000000
201901010000   101.230000    29.910000    47.218     4.5400     1.5938     1.8815    10.3967    -5.0328
201901010100   101.230000    29.910000    47.218    58.3841    23.5680    26.8064    12.8415    -2.9395
201901010200   101.230000    29.910000    47.218    77.7136    31.2014    35.6850    14.1545     0.3355
201901010300   101.230000    29.910000    47.218    53.3053    20.7449    24.2861    14.0836     3.7768
201901010400   101.230000    29.910000    47.218   -10.6764    -5.9421    -5.3630    12.6903     6.3132
201901010500   101.230000    29.910000    47.218   -97.6404   -41.8707   -45.4873    10.3233     7.1142
201901010600   101.230000    29.910000    47.218  -182.8869   -76.7981   -84.6356     7.5204     5.8108
201901010700   101.230000    29.910000    47.218  -240.0672   -99.9398  -110.7040     4.8711     2.5864
201901010800   101.230000    29.910000    47.218  -248.0760  -102.7831  -114.0960     2.8762    -1.8762
201901010900   101.230000    29.910000    47.218  -196.6498   -81.3022   -90.2338     1.8393    -6.5659
201901011000   101.230000    29.910000    47.218   -89.3439   -37.0804   -40.8477     1.8121   -10.3839
201901011100   101.230000    29.910000    47.218    56.7775    22.8815    26.2172     2.5980   -12.3987
201901011200   101.230000    29.910000    47.218   214.6442    87.5974    98.6094     3.8130   -12.0601
```

- Tide-Generating Potential (TGP) Model: Lunar: Degrees 2 to 6; Solar: Degrees 2 to 3; and Planetary (others): Degree 2.
- The solid tidal effect on the normal height (amplitude ~300 mm) is out of phase (opposite in sign) with the effect on the ellipsoidal height or geoid (amplitude ~600 mm).
- The east-west component of the effect vector on ground displacement, tilt, or horizontal gradient is generally significantly larger than the north-south component.
- The range (max-min) of solid Earth tidal effects on the figure pole generally exceeds 1 km.



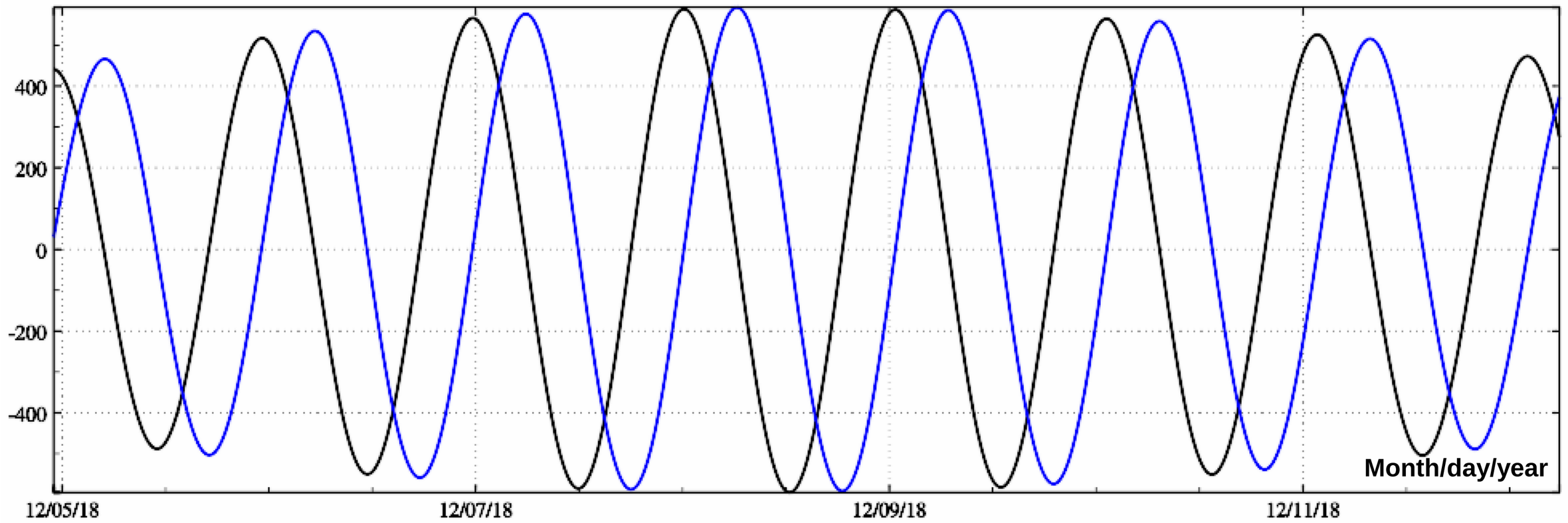
Solid tidal effects : geoid or height anomaly (mm) ground gravity (μGal) radial displacement (mm) normal or orthometric height (mm) radial gravity gradient (10μE)

The solid tidal effect on normal height (approximately 300mm) is out of phase with the effect on the ellipsoidal height or geoid (approximately 600mm, namely the sign is opposite).



Solid tidal effects : ground tilt (S, mas) tilt (W, mas) horizontal displacement (E, mm) horizontal displacement (N, mm) horizontal gradient (N, 10μE) horizontal gradient (W, 10μE)

$$\Delta x_{sfp} = -\frac{\sqrt{3}b}{\bar{C}_{20}}\Delta\bar{C}_{21} - \frac{6\bar{S}_{22}b}{(\bar{C}_{20})^2}\Delta\bar{S}_{21}, \quad \Delta y_{sfp} = +\frac{\sqrt{3}b}{\bar{C}_{20}}\Delta\bar{S}_{21} - \frac{6\bar{S}_{22}b}{(\bar{C}_{20})^2}\Delta\bar{C}_{21}$$



Solid Earth tidal effects on the Figure Pole of the Earth: Δx_{sfp}, Δy_{sfp} (in the ITRS, unit: m)

The range (max-min) of solid Earth tidal effects on the figure pole generally exceeds 1 km.

Solid Earth tide theory is derived from the equilibrium theory of celestial gravitation and centrifugal force; by definition, the tidal force exerted by a celestial body at the Earth's COM is invariably zero. Therefore, geodesy does not specifically investigate the COM variations induced by solid Earth tides.

Computation of Solid Earth Tidal Effects on Various Geodetic elements External to the Solid Earth

Computation of Solid Earth Tidal Effects for Earth Satellites or External Points to the Solid Earth

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Solid Earth Tidal Effect Time Series at a Ground Point | Computation of Solid Earth Tidal Effects at Batch Points with Given Time | Computation of Solid Earth Tidal Effects for Earth Satellites or External Points to the Solid Earth | Global Forecast of Solid Tidal Effects on Various Surface Geodetic Elements

Open the location and time file of the external points | Save program process as | Algorithm formulas

Set the file parameters

Column ordinal number of ellipsoidal height in the record: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [x] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [x] gravity gradient (ENU, 10μE)

```
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-06 10:50:51
>> Complete the computation of solid earth tidal effects!
>> Computation end time: 2026-06-06 10:50:51
>> [Function] Based on the location and time provided in the external space point file, this module computes the solid Earth tidal
effects on Geopotential (0.1m²/s²), Gravity (μGal), or Gravity gradient (10μE) at external points to the solid Earth
>> Open the location and time file of the external space points C:/ETideLoad4.5_win64en/examples/Tideffectsolidearth/outerptm.txt.
** Set the file format parameters according to the text box below, and then select the type of the tidal effect to be computed. After
giving the output file name, click the control button [Import setting parameters]...
>> Save the computed results as C:/ETideLoad4.5_win64en/examples/Tideffectsolidearth/outerst.txt.
** Appends the selected tidal effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-06 11:02:16
>> Complete the computation of solid earth tidal effects!
>> Computation end time: 2026-06-06 11:02:16
```

Columns 2 and 3 of the record are agreed as the longitude and latitude of the satellite

GRACE satellite altitude

Save the computed results as | Import setting parameters | Start computation

Display of the input-output file↓ | Save data in the text box as

```
NY  101.23  29.91  450000.0  58484.000000
2019010100  101.23  29.91  450000.0    0.3604  -70.1968  35.9074  -1.4347  -5.6569  -0.41
2019010101  101.23  29.91  450000.0    4.6518  -86.1581  21.8362  -20.3774 -12.8867  0.02
2019010102  101.23  29.91  450000.0    6.1944  -94.6243  -0.3418  -27.1374 -16.1680  0.70
2019010103  101.23  29.91  450000.0    4.2516  -93.8995  -23.8846 -18.4910 -14.5544  1.72
2019010104  101.23  29.91  450000.0   -0.8480  -84.3469  -41.5914   4.0409  -8.4398  2.98
2019010105  101.23  29.91  450000.0   -7.7849  -68.2530  -47.7595  34.5670   0.5710  4.11
2019010106  101.23  29.91  450000.0  -14.5906  -49.2170  -39.7054  64.3857  10.1118  4.66
2019010107  101.23  29.91  450000.0  -19.1615  -31.2465  -18.4674  84.2772  17.6806  4.14
2019010108  101.23  29.91  450000.0  -19.8092  -17.8013  11.4510   86.9118  21.2684  2.23
2019010109  101.23  29.91  450000.0  -15.7095  -11.0186  43.1839   68.7753  19.8363  -1.14
2019010110  101.23  29.91  450000.0   -7.1432  -11.2874  69.1547   31.1672  13.5472  -5.77
2019010111  101.23  29.91  450000.0    4.5274  -17.2502  82.8776  -19.9374   3.7183  -11.14
2019010112  101.23  29.91  450000.0   17.1380  -26.2132  80.5037  -75.1125  -7.4804  -16.52
```

- Tide-Generating Potential (TGP) Model: Lunar: Degrees 2 to 6; Solar: Degrees 2 to 3; and Planetary (others): Degree 2.
- The solid tidal effect on the normal height (amplitude ~300 mm) is out of phase (opposite in sign) with the effect on the ellipsoidal height or geoid (amplitude ~600 mm).
- The east-west component of the effect vector on ground displacement, tilt, or horizontal gradient is generally significantly larger than the north-south component.
- The range (max-min) of solid Earth tidal effects on the figure pole generally exceeds 1 km.

Computation of Solid Earth Tidal Effects on Various Geodetic elements External to the Solid Earth

Computation of Solid Earth Tidal Effects for Earth Satellites or External Points to the Solid Earth

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Solid Earth Tidal Effect Time Series at a Ground Point | Computation of Solid Earth Tidal Effects at Batch Points with Given Time | Computation of Solid Earth Tidal Effects for Earth Satellites or External Points to the Solid Earth | Global Forecast of Solid Tidal Effects on Various Surface Geodetic Elements

Open the location and time file of the external points | Save program process as | Algorithm formulas

Set the file parameters

Column ordinal number of ellipsoidal height in the record: 4

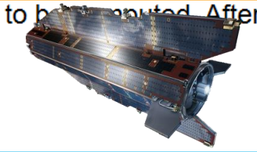
Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [ ] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [x] gravity gradient (ENU, 10μE)

```
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-06 11:02:16
>> Complete the computation of solid earth tidal effects!
>> Computation end time: 2026-06-06 11:02:16
>> [Function] Based on the location and time provided in the external space point file, this module computes the solid Earth tidal
effects on Geopotential (0.1m²/s²), Gravity (μGal), or Gravity gradient (10μE) at external points to the solid Earth.
>> Open the location and time file of the external space points C:/ETideLoad4.5_win64en/examples/Tideffectsolidearth/satptm.txt.
** Set the file format parameters according to the text box below, and then select the type of the tidal effect to be computed. After
giving the output file name, click the control button [Import setting parameters]...
>> Save the computed results as C:/ETideLoad4.5_win64en/examples/Tideffectsolidearth/satprst.txt.
** Appends the selected tidal effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-06 11:03:40
>> Complete the computation of solid earth tidal effects!
>> Computation end time: 2026-06-06 11:03:41
```



Columns 2 and 3 of the record are agreed as the longitude and latitude of the satellite

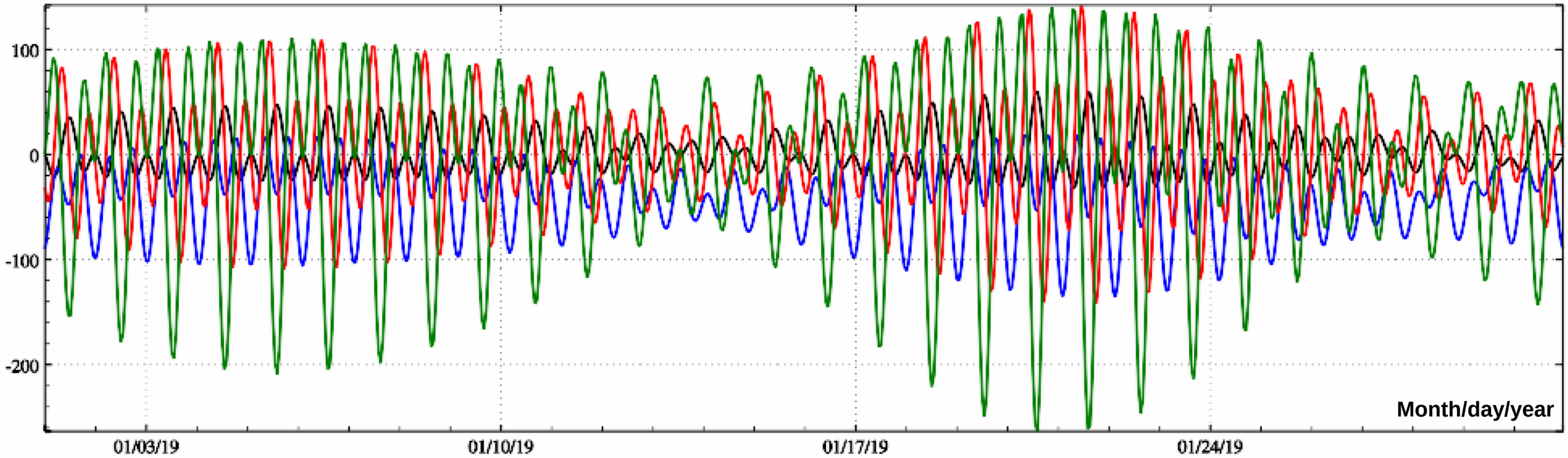
GOCE satellite altitude

Save the computed results as | Import setting parameters | Start computation

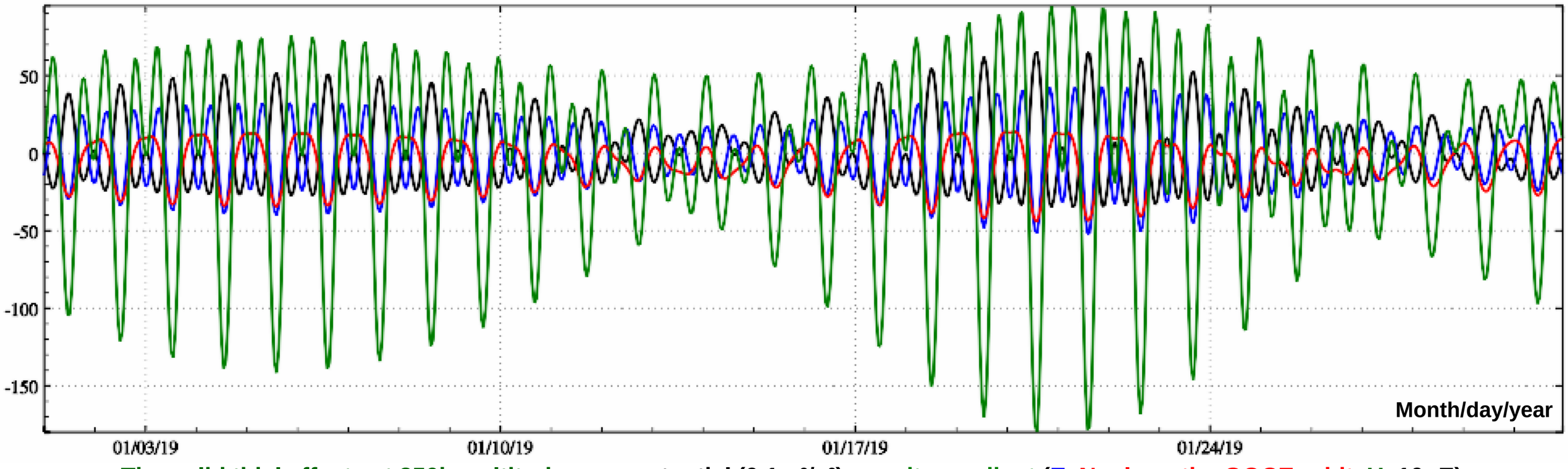
Display of the input-output file↓ | Save data in the text box as

```
NYB 150.24  32.42   250000.0   58119.000000
 201901010000   150.24   32.42   250000.0     0.2777   -14.0775     4.4894    -0.4489
 201901010100   150.24   32.42   250000.0    -5.9123    -5.5368     5.7527    16.6033
 201901010200   150.24   32.42   250000.0   -13.1543     5.2957     6.5691    36.3888
 201901010300   150.24   32.42   250000.0   -19.3259    15.5801     6.4614    53.0735
 201901010400   150.24   32.42   250000.0   -22.3930    22.6134     5.0126    61.1675
 201901010500   150.24   32.42   250000.0   -20.9443    24.4922     1.9985    56.9495
 201901010600   150.24   32.42   250000.0   -14.5749    20.5536    -2.5187    39.4422
 201901010700   150.24   32.42   250000.0    -4.0300    11.5134    -8.1597    10.7348
 201901010800   150.24   32.42   250000.0     8.9232    -0.7050   -14.2705   -24.3961
 201901010900   150.24   32.42   250000.0    21.8654   -13.4028   -20.0322   -59.4712
 201901011000   150.24   32.42   250000.0    32.2542   -23.7069   -24.6126   -87.6891
 201901011100   150.24   32.42   250000.0    37.9959   -29.2208   -27.3295  -103.4147
 201901011200   150.24   32.42   250000.0    37.9288   -28.5910   -27.7875  -103.4592
 201901011300   150.24   32.42   250000.0    32.1058   -21.8628   -25.9573   -87.8569
```

- Tide-Generating Potential (TGP) Model: Lunar: Degrees 2 to 6; Solar: Degrees 2 to 3; and Planetary (others): Degree 2.
- The solid tidal effect on the normal height (amplitude ~300 mm) is out of phase (opposite in sign) with the effect on the ellipsoidal height or geoid (amplitude ~600 mm).
- The east-west component of the effect vector on ground displacement, tilt, or horizontal gradient is generally significantly larger than the north-south component.
- The range (max-min) of solid Earth tidal effects on the figure pole generally exceeds 1 km.



The solid tidal effects at 450km altitude： geopotential (0.1m²/s²), gravity vector (E, N: along the GRACE orbit/SST-II, U, μGal)



The solid tidal effects at 250km altitude： geopotential (0.1m²/s²), gravity gradient (E, N: along the GOCE orbit, U, 10μE)

Global Forecast of Solid Tidal Effects on Various Surface Geodetic Elements

Global Forecast of Solid Tidal Effects on Various Surface Geodetic Elements

Location of surface point to be forecast

Longitude 121.240000°

Latitude 29.428100°

Ellipsoidal height 17.830m

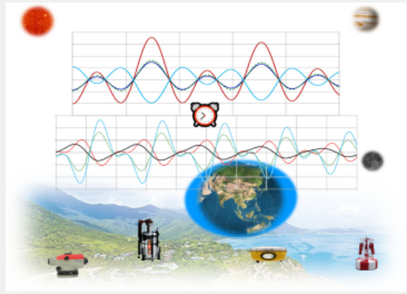
Forecast time series parameters

Start time 20160701

End time 20160704

Time interval 10.00 min

Calculate and save as



Tidal effects to be plot

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] normal (orthometric) height (mm)
- [x] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)

Tidal effect time series on all geodetic elements

201607032040	2.861111	-357.1604	-147.1050	-164.6183	0.7322	1.0685
201607032050	2.868056	-357.9992	-147.5027	-165.0620	0.2210	-0.1083
2016070321	2.875000	-356.3099	-146.8649	-164.3405	-0.2467	-1.3169
201607032110	2.881944	-352.0355	-145.1672	-162.4264	-0.6691	-2.5490
201607032120	2.888889	-345.1367	-142.3926	-159.3010	-1.0443	-3.7961
201607032130	2.895833	-335.5930	-138.5315	-154.9538	-1.3709	-5.0493
201607032140	2.902778	-323.4025	-133.5821	-149.3833	-1.6478	-6.3000
201607032150	2.909722	-308.5825	-127.5506	-142.5966	-1.8745	-7.5390
2016070322	2.916667	-291.1692	-120.4506	-134.6095	-2.0504	-8.7574
201607032210	2.923611	-271.2180	-112.3039	-125.4469	-2.1757	-9.9465
201607032220	2.930556	-248.8027	-103.1400	-115.1422	-2.2507	-11.0973
201607032230	2.937500	-224.0159	-92.9958	-103.7374	-2.2762	-12.2013
201607032240	2.944444	-196.9676	-81.9159	-91.2827	-2.2534	-13.2502
201607032250	2.951389	-167.7855	-69.9518	-77.8366	-2.1836	-14.2360
2016070323	2.958333	-136.6134	-57.1621	-63.4650	-2.0687	-15.1510
201607032310	2.965278	-103.6110	-43.6116	-48.2413	-1.9108	-15.9881
201607032320	2.972222	-68.9523	-29.3717	-32.2456	-1.7122	-16.7405
201607032330	2.979167	-32.8249	-14.5190	-15.5645	-1.4758	-17.4021
201607032340	2.986111	4.5714	0.8646	1.7098	-1.2045	-17.9673
201607032350	2.993056	43.0259	16.6924	19.4799	-0.9014	-18.4311
2016070400	3.000000	82.3184	32.8740	37.6440	-0.5700	-18.7895

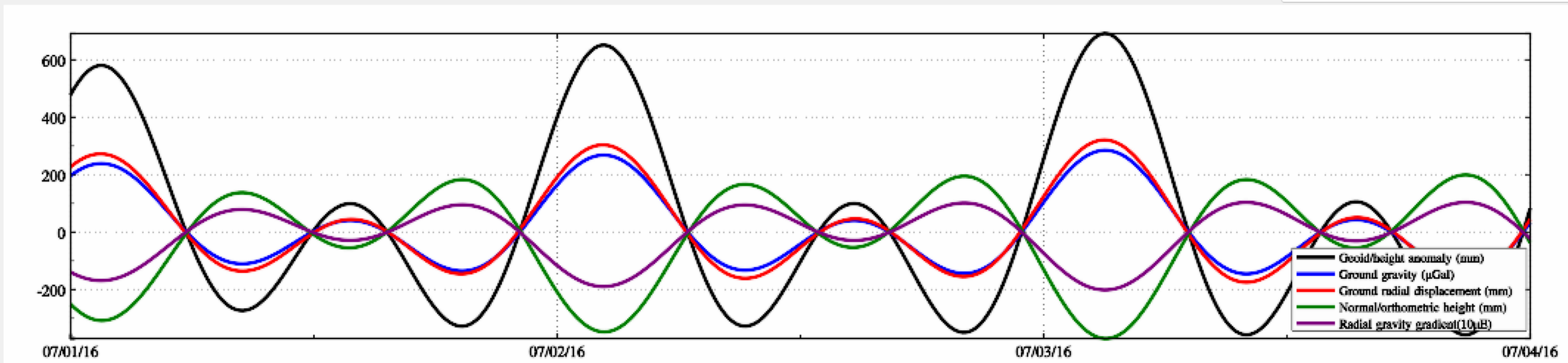
Set line thickness 3

Extract time series to be plot

Plot↓

Tidal effect curve on surface geodetic elements

Save the current plot as



Firstly, compute the time series of solid tidal effects on all types of geodetic elements, and then select the effects to be plot.

Look at the amplitude of various solid tidal effects, the in-phase or out-of-phase (same or opposite sign) relationship between different types of effects, and the time-varying characteristics of the tidal effect curves.

Global Forecast of Solid Tidal Effects on Various Surface Geodetic Elements

Global Forecast of Solid Tidal Effects on Various Surface Geodetic Elements

Location of surface point to be forecast

Longitude 121.240000°

Latitude 29.428100°

Ellipsoidal height 17.830m

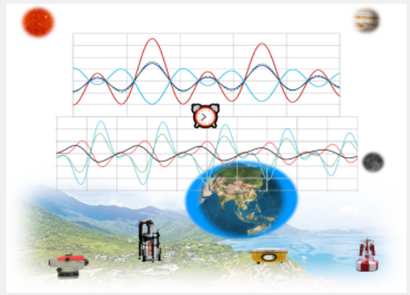
Forecast time series parameters

Start time 20160701

End time 20160704

Time interval 10.00 min

Calculate and save as



Tidal effects to be plot

- [ ] geoid or height anomaly (mm)
- [ ] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [ ] ground radial displacement (mm)
- [ ] normal (orthometric) height (mm)
- [ ] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

Tidal effect time series on all geodetic elements

201607032040	2.861111	-357.1604	-147.1050	-164.6183	0.7322	1.0685
201607032050	2.868056	-357.9992	-147.5027	-165.0620	0.2210	-0.1083
2016070321	2.875000	-356.3099	-146.8649	-164.3405	-0.2467	-1.3169
201607032110	2.881944	-352.0355	-145.1672	-162.4264	-0.6691	-2.5490
201607032120	2.888889	-345.1367	-142.3926	-159.3010	-1.0443	-3.7961
201607032130	2.895833	-335.5930	-138.5315	-154.9538	-1.3709	-5.0493
201607032140	2.902778	-323.4025	-133.5821	-149.3833	-1.6478	-6.3000
201607032150	2.909722	-308.5825	-127.5506	-142.5966	-1.8745	-7.5390
2016070322	2.916667	-291.1692	-120.4506	-134.6095	-2.0504	-8.7574
201607032210	2.923611	-271.2180	-112.3039	-125.4469	-2.1757	-9.9465
201607032220	2.930556	-248.8027	-103.1400	-115.1422	-2.2507	-11.0973
201607032230	2.937500	-224.0159	-92.9958	-103.7374	-2.2762	-12.2013
201607032240	2.944444	-196.9676	-81.9159	-91.2827	-2.2534	-13.2502
201607032250	2.951389	-167.7855	-69.9518	-77.8366	-2.1836	-14.2360
2016070323	2.958333	-136.6134	-57.1621	-63.4650	-2.0687	-15.1510
201607032310	2.965278	-103.6110	-43.6116	-48.2413	-1.9108	-15.9881
201607032320	2.972222	-68.9523	-29.3717	-32.2456	-1.7122	-16.7405
201607032330	2.979167	-32.8249	-14.5190	-15.5645	-1.4758	-17.4021
201607032340	2.986111	4.5714	0.8646	1.7098	-1.2045	-17.9673
201607032350	2.993056	43.0259	16.6924	19.4799	-0.9014	-18.4311
2016070400	3.000000	82.3184	32.8740	37.6440	-0.5700	-18.7895

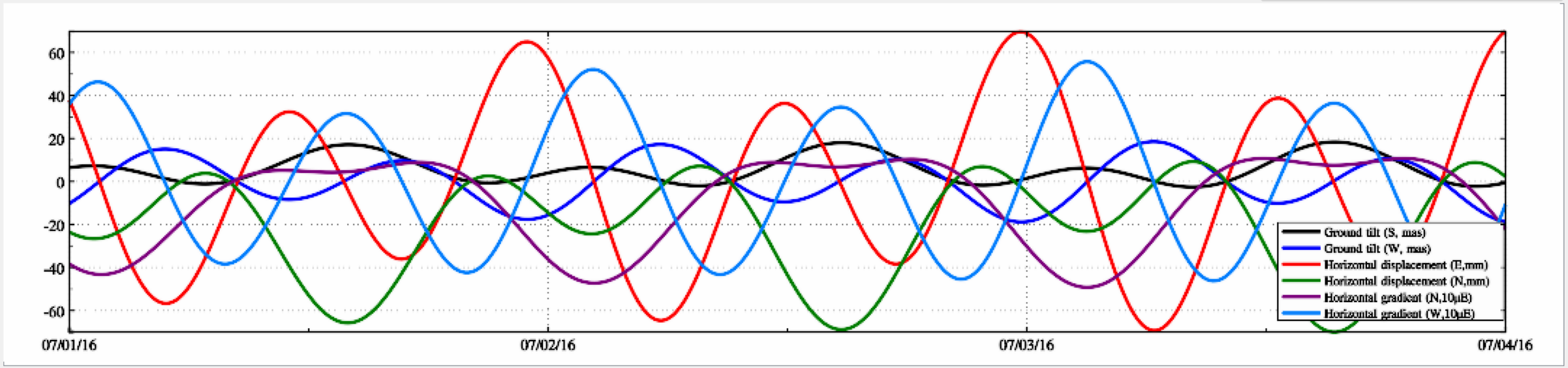
Set line thickness 3

Extract time series to be plot

Plot↓

Tidal effect curve on surface geodetic elements

Save the current plot as



Firstly, compute the time series of solid tidal effects on all types of geodetic elements, and then select the effects to be plot.

Look at the amplitude of various solid tidal effects, the in-phase or out-of-phase (same or opposite sign) relationship between different types of effects, and the time-varying characteristics of the tidal effect curves.

Spherical Harmonic Synthesis of Ocean Tidal Load Effects External to the Solid Earth

Computation of Ocean Tidal Load Effect Time Series at a Ground Point

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of ocean tidal load effect time series at a ground site | Computation of ocean tidal load effects at ground sites with given time | Computation of ocean tidal load effects of Earth satellite or outside solid Earth | Global forecast of ocean tidal load effects on various surface geodetic variations

Open the ground variation time series file

Set the file parameters

Column ordinal number of normal or orthometric height in the header: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

>> Program Process ** Operation Prompts

Save program process as

```
>> Open the ground variations time series file C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/Tmseries.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the tidal load effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the computed results as C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/Tmsqurst.txt.
  ** Appends the selected tidal load effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
  ** The computation process needs to wait... During the computation period, you can open the output file C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/Tmsqurst.txt, to look at the computation progress!
>> Computation start time：2026-06-07 09:24:22
>> The program also outputs a time series file of the ocean tidal load effects on the degree-1 and degree-2 geopotential coefficients (*Otdcmsfptm.txt) into the current directory (* = input filename).
  ** • Format: First row is the header. Subsequent rows contain: Epoch time, 3 columns of ΔC10, ΔC11, ΔS11 (×10⁻¹⁰), 5 columns of ΔC20, ΔC21, ΔS21, ΔC22, ΔS22 (×10⁻¹⁰), 3 columns effects on the Earth's center of mass (unit: mm), and 2 columns of effects on the figure pole Δx_sfp, Δy_sfp (in ITRS, unit: m).
>> Complete the computation of the ocean tidal load effects!
```

Maximum truncated degree of the coefficient model: 120

Save the results as | Import setting parameters | Start computation

Save text box as

Columns 2 and 3 of the file header are agreed as the longitude and latitude of the ground point

Display of the input-output file↓

NYB	101.230000	29.910000	47.218	58484.000000					
201901010000	0.000000	2.764	1.7717	-0.8065	-0.5333	-0.3260	0.1351	0.0020
201901010100	0.041667	2.778	1.1277	-0.3570	-0.2073	-0.3976	0.0118	-0.0177
201901010200	0.083333	2.762	0.1811	0.0404	-0.0049	-0.4110	-0.1253	-0.0464
201901010300	0.125000	2.724	-0.8863	0.2795	0.0081	-0.2791	-0.2769	-0.0589
201901010400	0.166667	2.675	-1.8226	0.4877	0.0176	-0.1319	-0.4500	-0.0691
201901010500	0.208333	2.626	-2.3880	0.6370	0.0485	-0.0720	-0.5929	-0.0812
201901010600	0.250000	2.582	-2.4797	0.5023	-0.0996	0.0143	-0.6538	-0.0618
201901010700	0.291667	2.546	-2.1169	0.1065	-0.4004	0.2000	-0.6556	0.0044
201901010800	0.333333	2.517	-1.3803	-0.2650	-0.5803	0.3634	-0.6313	0.0881
201901010900	0.375000	2.489	-0.4362	-0.4885	-0.5524	0.4001	-0.5473	0.1586
201901011000	0.416667	2.455	0.4859	-0.6369	-0.4446	0.3657	-0.3595	0.2130
201901011100	0.458333	2.410	1.1845	-0.6862	-0.2841	0.3571	-0.1032	0.2554
201901011200	0.500000	2.354	1.5253	-0.4881	0.0397	0.3524	0.1333	0.2678
201901011300	0.541667	2.288	1.4545	-0.0193	0.5286	0.2566	0.3072	0.2244
201901011400	0.583333	2.223	1.0144	0.4953	0.9573	0.1114	0.4397	0.1376
201901011500	0.625000	2.169	0.3251	0.8369	1.1313	0.0596	0.5359	0.0451
201901011600	0.666667	2.139	-0.4155	1.0569	1.1504	0.0658	0.5641	-0.0472
201901011700	0.708333	2.140	-0.9659	1.2274	1.1443	-0.0187	0.5323	-0.1499

Since ocean tidal loads are generally considered to act on the sea surface, the height of the computation point refers to the normal or orthometric height relative to the sea surface (geoid).

The global ocean tidal load spherical harmonic coefficient model (cm) adopts the FES2004 format. Which can be constructed from global tidal height harmonic constant grid models using the function [Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants].

Spherical Harmonic Synthesis of Ocean Tidal Load Effects External to the Solid Earth

Computation of Ocean Tidal Load Effects at Batch Points with Given Time

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of ocean tidal load effect time series at a ground site

Computation of ocean tidal load effects at ground sites with given time

Computation of ocean tidal load effects of Earth satellite or outside solid Earth

Global forecast of ocean tidal load effects on various surface geodetic variations

Open the location and time file of the computation points

>> Program Process ** Operation Prompts

Save program process as

Set the file parameters

Column ordinal number of normal or orthometric height in the record: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

```
>> [Function] According to the location and time specified in the computation point file, this module calculates the ocean tidal load effects on the following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the location and time file of the computation points C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/Postiontm.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the tidal load effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the computed results as C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/Postmrst.txt.
  ** Appends the selected tidal load effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
  ** The computation process needs to wait... During the computation period, you can open the output file C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/Postmrst.txt, to look at the computation progress!
>> Computation start time：2026-06-07 09:35:15
>> Complete the computation of the ocean tidal load effects!
>> Computation end time: 2026-06-07 09:38:58
```

Columns 2 and 3 of the record are agreed as the longitude and latitude of the computation point

Maximum truncated degree of the coefficient model: 120

Save the results as | Import setting parameters | Start computation

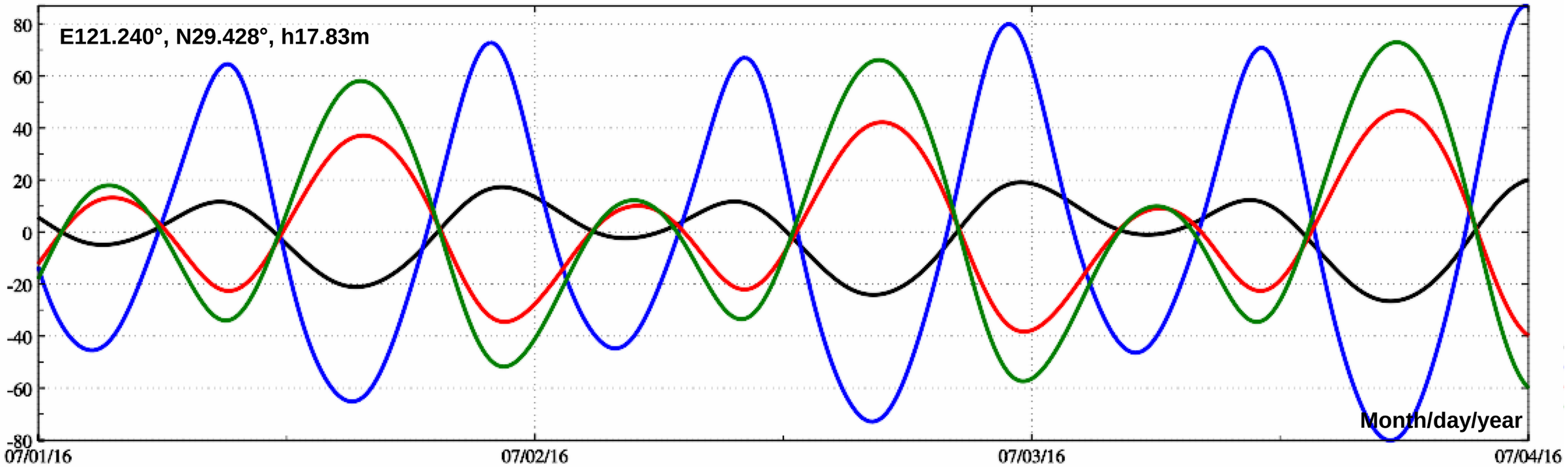
Display of the input-output file↓

Save data in the text box as

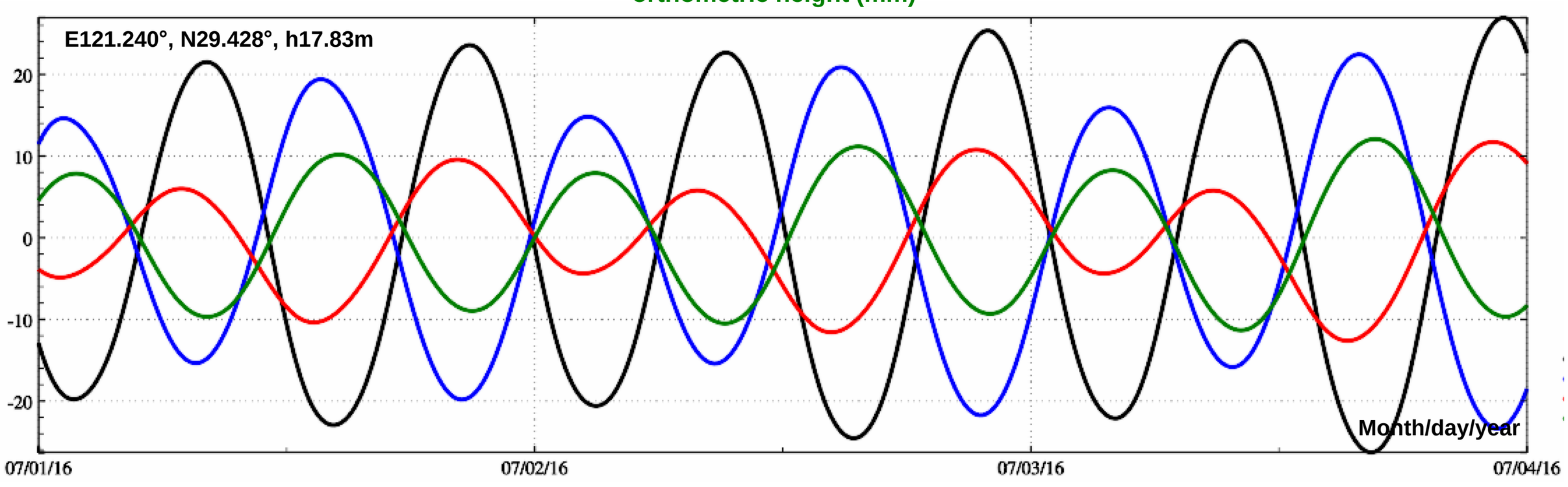
```
NY 151.0901  12.5001   47.218  58484.000000
 2019010100  151.0901  12.5001  2.52    6.8195   2.6525   3.7841   0.0601  -5.2443   0.0716
 2019010101  151.0901  12.5001  2.52    9.1418   3.0137   4.4889   0.6043  -4.8543   0.3262
 2019010102  151.0901  12.5001  2.52   10.7919   3.3139   5.0467   1.0761  -3.2011   0.5498
 2019010103  151.0901  12.5001  2.52   11.3862   3.4869   5.3330   1.3877  -0.7025   0.6975
 2019010104  151.0901  12.5001  2.52   10.6640   3.4233   5.1902   1.5095   2.0883   0.7518
 2019010105  151.0901  12.5001  2.52    8.5686   2.9811   4.4517   1.4505   4.5559   0.7190
 2019010106  151.0901  12.5001  2.52    5.3233   2.1095   3.0875   1.2049   6.0784   0.6034
 2019010107  151.0901  12.5001  2.52    1.4544   0.9701   1.3387   0.7815   6.2269   0.4107
 2019010108  151.0901  12.5001  2.52   -2.3524  -0.1609  -0.4067   0.2781   4.9513   0.1760
 2019010109  151.0901  12.5001  2.52   -5.5336  -1.1485  -1.9271  -0.1563   2.5616  -0.0412
 2019010110  151.0901  12.5001  2.52   -7.8127  -2.0656  -3.2601  -0.4290  -0.4074  -0.1956
 2019010111  151.0901  12.5001  2.52   -9.1073  -2.9640  -4.4449  -0.5308  -3.3007  -0.2753
 2019010112  151.0901  12.5001  2.52   -9.4064  -3.7153  -5.3348  -0.4979  -5.4368  -0.2915
 2019010113  151.0901  12.5001  2.52   -8.8148  -4.1478  -5.7517  -0.3925  -6.2859  -0.2671
 2019010114  151.0901  12.5001  2.52   -7.6135  -4.2084  -5.6707  -0.2978  -5.6771  -0.2358
 2019010115  151.0901  12.5001  2.52   -6.1835  -3.9368  -5.1832  -0.2908  -3.8355  -0.2340
 2019010116  151.0901  12.5001  2.52   -4.8731  -3.4076  -4.4190  -0.3977  -1.2256  -0.2774
 2019010117  151.0901  12.5001  2.52   -3.9036  -2.7433  -3.5451  -0.5872   1.5665  -0.3521
```

Since ocean tidal loads are generally considered to act on the sea surface, the height of the computation point refers to the normal or orthometric height relative to the sea surface (geoid).

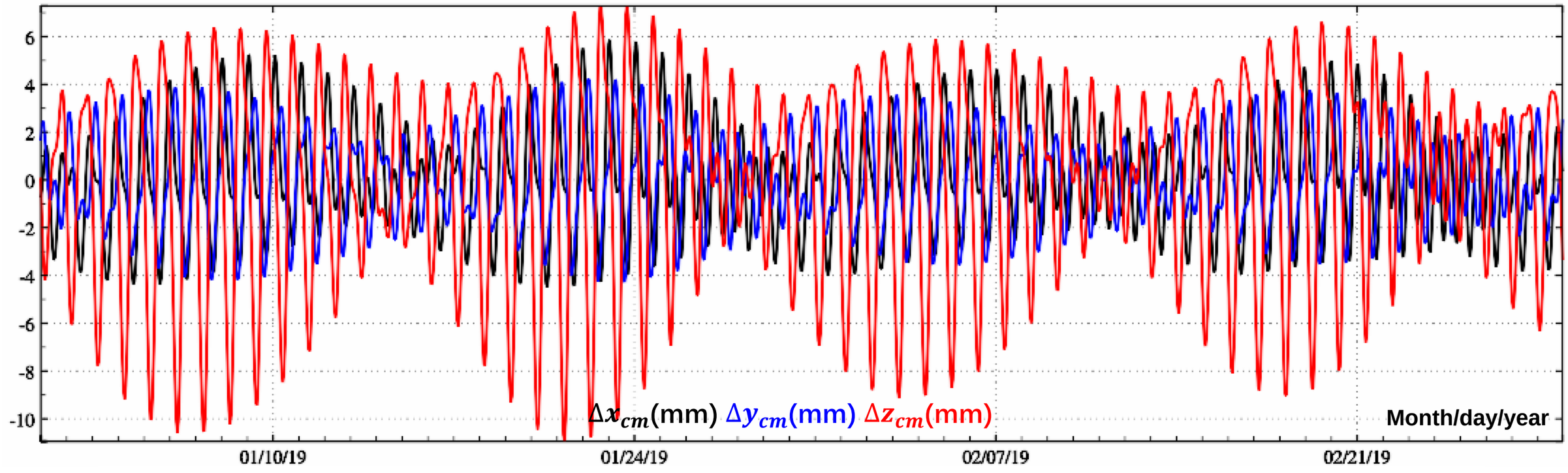
The global ocean tidal load spherical harmonic coefficient model (cm) adopts the FES2004 format. Which can be constructed from global tidal height harmonic constant grid models using the function [Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants].



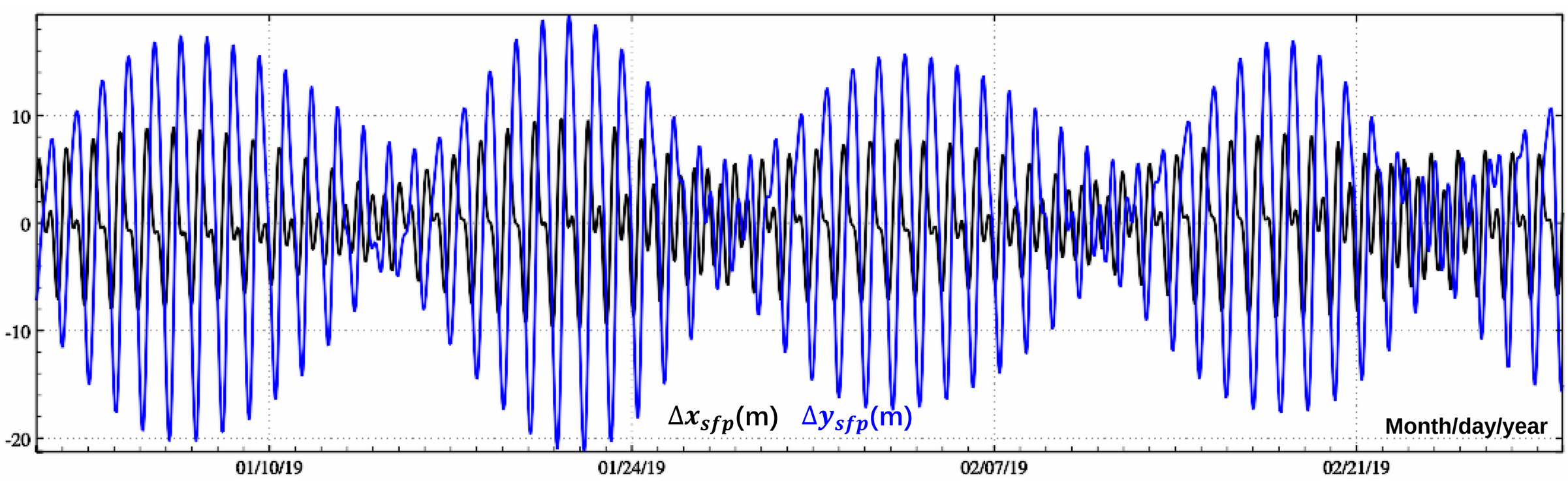
The ocean tidal load effects (360-degree) : height anomaly (mm) ground gravity (μGal) radial displacement (mm) orthometric height (mm)



The ocean tidal load effects (360-degree) : ground tilt (S, mas) tilt (W, mas) horizontal displacement (E, mm) horizontal displacement (N, mm)



The ocean tidal load effect time series (mm) on Center of Mass of the Earth



The ocean tidal load effect time series (m) on Earth's figure pole in ITRS

Spherical Harmonic Synthesis of Ocean Tidal Load Effects External to the Solid Earth

Computation of Ocean Tidal Load Effects for Earth Satellites or External Points

Open file Save as Import parameters Start computation Save process Follow example

Computation of ocean tidal load effect time series at a ground site | Computation of ocean tidal load effects at ground sites with given time | Computation of ocean tidal load effects of Earth satellite or outside solid Earth | Global forecast of ocean tidal load effects on various surface geodetic variations

Open the location and time file of the external points

>> Program Process ** Operation Prompts

Save program process as

Set the file parameters

Column ordinal number of normal or orthometric height in the record: 4

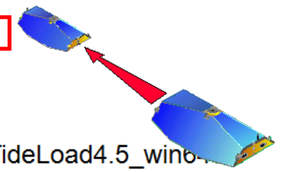
Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [x] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [ ] gravity gradient (ENU, 10μE)

```
>> Complete the computation of the ocean tidal load effects!
>> Computation end time: 2026-06-07 09:38:58
>> [Function] Based on the location and time provided in the external space point file, this module computes the ocean tidal load effects on the geopotential (0.1m²/s²), gravity (μGal), or gravity gradient (10μE) at points external to the solid Earth.
>> Open the location and time file of the external points C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/outerptm.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the tidal load effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the computed results as C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/outerptmrst.txt.
  ** Appends the selected tidal load effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
  ** The computation process needs to wait... During the computation period, you can open the output file C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/outerptmrst.txt, to look at the computation progress!
>> Computation start time：2026-06-07 10:32:33
>> Complete the computation of the ocean tidal load effects!
>> Computation end time: 2026-06-07 10:37:52
```



Columns 2 and 3 of the record are agreed as the longitude and latitude of the satellite

Maximum truncated degree of the coefficient model: 120

Save the results as | Import setting parameters | Start computation

Display of the input-output file↓

GRACE satellite altitude

Save data in the text box as

```
NYB 150.24  32.42   450000.0   58119.000000
 201901010000   150.24   32.42   450000.0    0.7062    1.8994    3.6395   -4.5368
 201901010100   150.24   32.42   450000.0    0.7226    1.2392    2.2724   -4.9812
 201901010200   150.24   32.42   450000.0    0.6455    0.1608    0.1145   -4.7514
 201901010300   150.24   32.42   450000.0    0.4814   -1.1760   -2.3711   -3.8555
 201901010400   150.24   32.42   450000.0    0.2474   -2.5020   -4.6259   -2.3812
 201901010500   150.24   32.42   450000.0   -0.0279   -3.5198   -6.1243   -0.4961
 201901010600   150.24   32.42   450000.0   -0.3059   -4.0274   -6.5031    1.5358
 201901010700   150.24   32.42   450000.0   -0.5459   -3.9739   -5.6522    3.3925
 201901010800   150.24   32.42   450000.0   -0.7143   -3.4097   -3.7274    4.7711
 201901010900   150.24   32.42   450000.0   -0.7902   -2.4276   -1.1052    5.4721
 201901011000   150.24   32.42   450000.0   -0.7698   -1.1688    1.6849    5.4405
 201901011100   150.24   32.42   450000.0   -0.6668    0.1603    4.0655    4.7565
 201901011200   150.24   32.42   450000.0   -0.5092    1.3309    5.5536    3.6224
 201901011300   150.24   32.42   450000.0   -0.3310    2.1604    5.8885    2.3125
 201901011400   150.24   32.42   450000.0   -0.1594    2.5516    5.0887    1.0591
 201901011500   150.24   32.42   450000.0   -0.0108    2.5163    3.4329   -0.0001
 201901011600   150.24   32.42   450000.0    0.1052    2.1898    1.3849   -0.7773
 201901011700   150.24   32.42   450000.0    0.1857    1.7899   -0.5166   -1.2273
 201901011800   150.24   32.42   450000.0    0.2399    1.5064   -1.7959   -1.4002
```

- Since ocean tidal loads are generally considered to act on the sea surface, the height of the computation point refers to the normal or orthometric height relative to the sea surface (geoid).
- The global ocean tidal load spherical harmonic coefficient model (cm) adopts the FES2004 format. Which can be constructed from global tidal height harmonic constant grid models using the function [Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants].

Spherical Harmonic Synthesis of Ocean Tidal Load Effects External to the Solid Earth

Computation of Ocean Tidal Load Effects for Earth Satellites or External Points

Open file Save as Import parameters Start computation Save process Follow example

Computation of ocean tidal load effect time series at a ground site | Computation of ocean tidal load effects at ground sites with given time | Computation of ocean tidal load effects of Earth satellite or outside solid Earth | Global forecast of ocean tidal load effects on various surface geodetic variations

Open the location and time file of the external points

>> Program Process ** Operation Prompts

Save program process as

Set the file parameters

Column ordinal number of normal or orthometric height in the record: 4

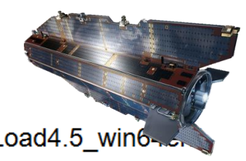
Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [ ] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [x] gravity gradient (ENU, 10μE)

```
>> Complete the computation of the ocean tidal load effects!
>> Computation end time: 2026-06-07 10:37:52
>> [Function] Based on the location and time provided in the external space point file, this module computes the ocean tidal load effects on the geopotential (0.1m²/s²), gravity (μGal), or gravity gradient (10μE) at points external to the solid Earth.
>> Open the location and time file of the external points C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/satptm.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the tidal load effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the computed results as C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/satprst.txt.
  ** Appends the selected tidal load effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
  ** The computation process needs to wait... During the computation period, you can open the output file C:/ETideLoad4.5_win64en/examples/OTideloadharmsynth/satprst.txt, to look at the computation progress!
>> Computation start time：2026-06-07 10:39:34
>> Complete the computation of the ocean tidal load effects!
>> Computation end time: 2026-06-07 10:44:58
```



Columns 2 and 3 of the record are agreed as the longitude and latitude of the satellite

Maximum truncated degree of the coefficient model: 120

Save the results as | Import setting parameters | Start computation

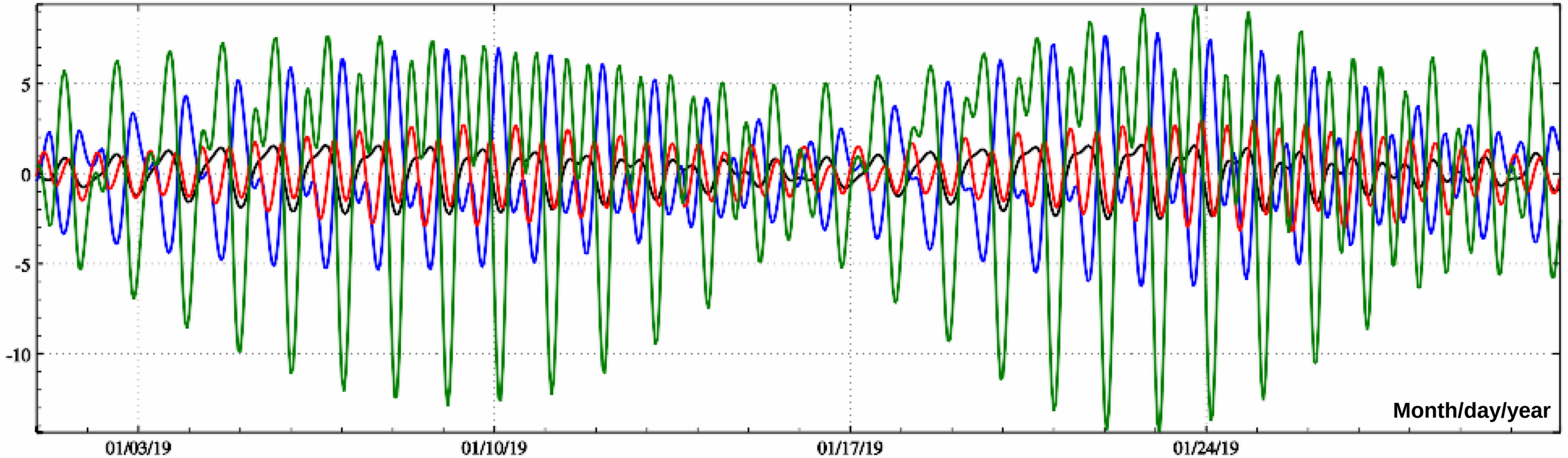
Display of the input-output file↓

GOCE satellite altitude

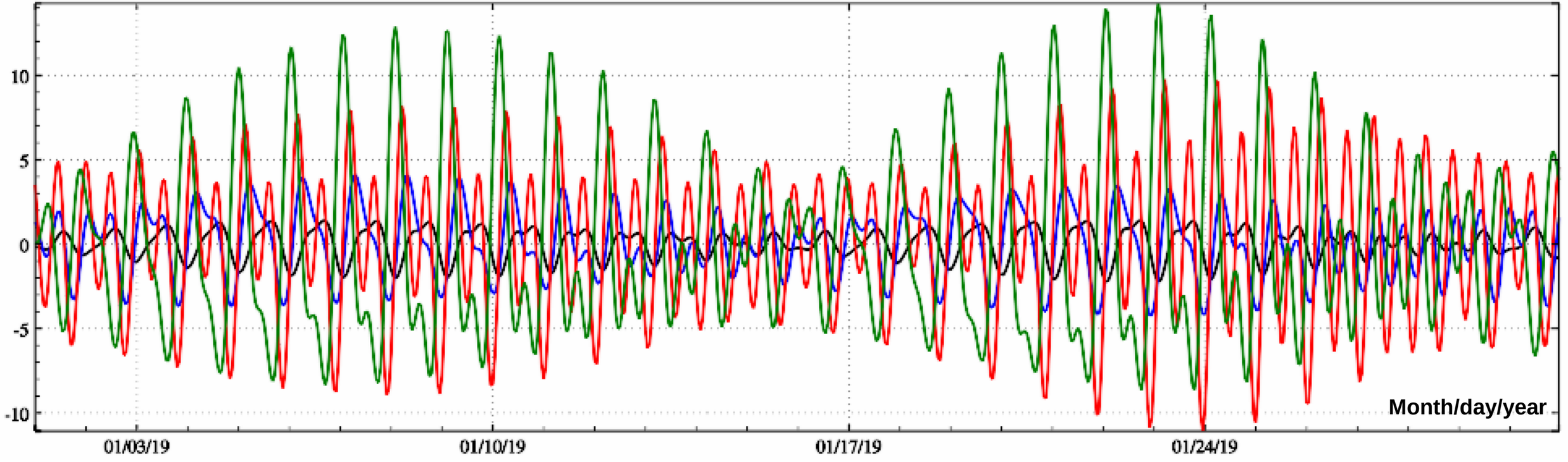
Save data in the text box as

```
NYB 150.24  32.42   250000.0   58119.000000
 201901010000   150.24   32.42   250000.0    0.8053    -3.1881    -0.5733     4.7552
 201901010100   150.24   32.42   250000.0    0.8319    -3.6135    -0.2601     5.4440
 201901010200   150.24   32.42   250000.0    0.7499    -3.4396     0.0527     5.2184
 201901010300   150.24   32.42   250000.0    0.5661    -2.7244     0.3243     4.1564
 201901010400   150.24   32.42   250000.0    0.2997    -1.5932     0.4757     2.3948
 201901010500   150.24   32.42   250000.0   -0.0173    -0.1972     0.4659     0.1546
 201901010600   150.24   32.42   250000.0   -0.3400     1.2391     0.3024    -2.2075
 201901010700   150.24   32.42   250000.0   -0.6210     2.4250     0.0029    -4.2682
 201901010800   150.24   32.42   250000.0   -0.8196     3.1060    -0.3676    -5.6278
 201901010900   150.24   32.42   250000.0   -0.9105     3.2028    -0.6885    -6.0611
 201901011000   150.24   32.42   250000.0   -0.8888     2.8216    -0.8345    -5.5836
 201901011100   150.24   32.42   250000.0   -0.7700     2.1150    -0.7272    -4.3450
 201901011200   150.24   32.42   250000.0   -0.5869     1.2442    -0.3975    -2.6412
 201901011300   150.24   32.42   250000.0   -0.3794     0.4417     0.0376    -0.9329
 201901011400   150.24   32.42   250000.0   -0.1803    -0.0826     0.5006     0.4233
 201901011500   150.24   32.42   250000.0   -0.0087    -0.2765     0.9518     1.3248
 201901011600   150.24   32.42   250000.0    0.1237    -0.1893     1.2933     1.7398
 201901011700   150.24   32.42   250000.0    0.2132     0.1102     1.4158     1.6557
 201901011800   150.24   32.42   250000.0    0.2701     0.4983     1.2777     1.2036
```

- Since ocean tidal loads are generally considered to act on the sea surface, the height of the computation point refers to the normal or orthometric height relative to the sea surface (geoid).
- The global ocean tidal load spherical harmonic coefficient model (cm) adopts the FES2004 format. Which can be constructed from global tidal height harmonic constant grid models using the function [Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants].



The ocean tidal load effects at 450km altitude： geopotential (0.1m²/s²), gravity vector (E, N: along the GRACE orbit/SST-II, U, μGal)



The ocean tidal load effects at 250km altitude： geopotential (0.1m²/s²), gravity gradient (E, N: along the GOCE orbit, U, 10μE)

Global Forecast of Ocean Tidal Load Effects on Various Surface Geodetic Elements

Global Forecast of Ocean Tidal Load Effects on Various Surface Geodetic Elements

Location of surface point to be forecast

Longitude	121.240000°
Latitude	29.428100°
Normal or ortho-metric height	17.830m

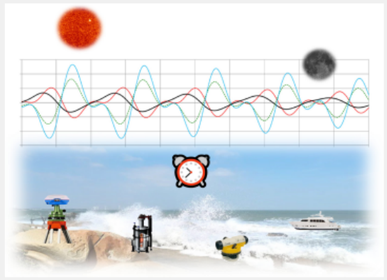
Forecast time series parameters

Start time	20160701
End time	20160704
Time interval	10.00 min

Maximum truncated degree of the coefficients model: 360

Calculate and save as

The program needs some time to compute the time series of ocean tidal load effects. Please wait until the button [Extract time series to be plot] becomes available.



Tidal load effects to be plot

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] normal (orthometric) height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)
- [x] Sea surface tidal height (cm)

Tidal load effect time series on various geodetic elements

201607032010	2.840278	-2.9941	-38.4034	-40.8687	-15.6732	4.5441	-3.
201607032020	2.847222	-2.4838	-35.1985	-37.5062	-6.3060	-0.0888	-0.
201607032030	2.854167	-1.9043	-31.7056	-33.8271	3.0449	-4.6859	1.
201607032040	2.861111	-1.2581	-27.9283	-29.8352	12.2900	-9.2199	3.
201607032050	2.868056	-0.5488	-23.8674	-25.5323	21.3472	-13.6656	6.
2016070321	2.875000	0.2195	-19.5226	-20.9191	30.1430	-17.9995	8.
201607032110	2.881944	1.0413	-14.8934	-15.9964	38.6135	-22.1993	10.
201607032120	2.888889	1.9105	-9.9809	-10.7670	46.7040	-26.2429	12.
201607032130	2.895833	2.8195	-4.7898	-5.2378	54.3698	-30.1088	14.
201607032140	2.902778	3.7600	0.6696	0.5786	61.5743	-33.7746	16.
201607032150	2.909722	4.7226	6.3797	6.6616	68.2889	-37.2181	17.
2016070322	2.916667	5.6968	12.3137	12.9811	74.4909	-40.4162	19.
201607032210	2.923611	6.6716	18.4342	19.4962	80.1624	-43.3460	20.
201607032220	2.930556	7.6349	24.6927	26.1542	85.2884	-45.9844	22.
201607032230	2.937500	8.5742	31.0290	32.8906	89.8553	-48.3088	23.
201607032240	2.944444	9.4765	37.3719	39.6294	93.8493	-50.2976	24.
201607032250	2.951389	10.3286	43.6396	46.2840	97.2552	-51.9303	24.
2016070323	2.958333	11.1175	49.7423	52.7596	100.0555	-53.1880	25.
201607032310	2.965278	11.8304	55.5835	58.9546	102.2300	-54.0538	26.
201607032320	2.972222	12.4550	61.0636	64.7643	103.7551	-54.5125	26.
201607032330	2.979167	12.9800	66.0822	70.0838	104.6045	-54.5511	26.
201607032340	2.986111	13.3952	70.5422	74.8114	104.7500	-54.1588	26.
201607032350	2.993056	13.6920	74.3524	78.8520	104.1623	-53.3267	26.
2016070400	3.000000	13.8632	77.4314	82.1208	102.8130	-52.0484	26.

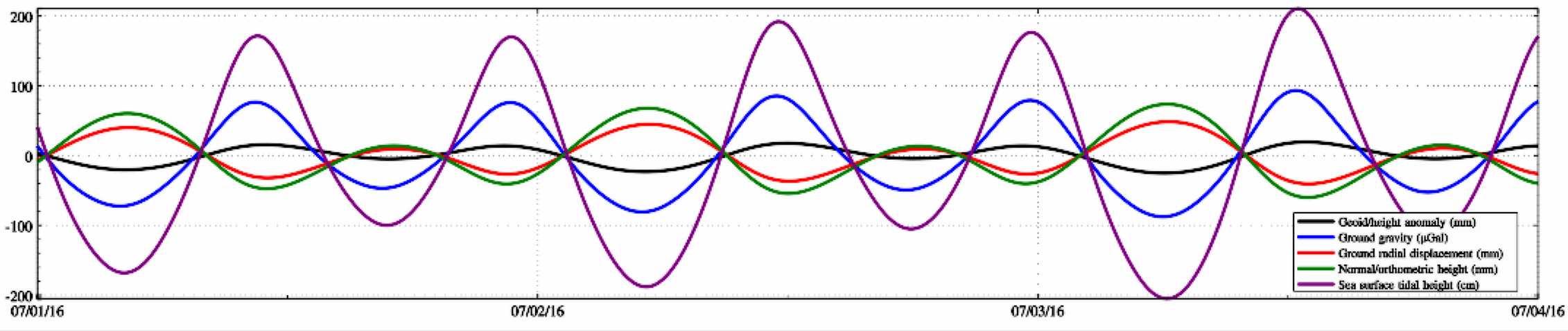
Set line thickness: 3

Extract time series to be plot

Plot↓

Tidal load effect curve of surface geodetic elements

Save the current plot as



Firstly, compute the time series of tidal load effects on all types of geodetic elements, and then select the effects to be plot.

Look at the amplitude of various tidal load effects, the in-phase or out-of-phase (same or opposite sign) relationship between different types of tidal load effects, and the time-varying characteristics of tidal load effect curves.

Global Forecast of Ocean Tidal Load Effects on Various Surface Geodetic Elements

Global Forecast of Ocean Tidal Load Effects on Various Surface Geodetic Elements

Location of surface point to be forecast

Longitude	121.240000°
Latitude	29.428100°
Normal or ortho-metric height	17.830m

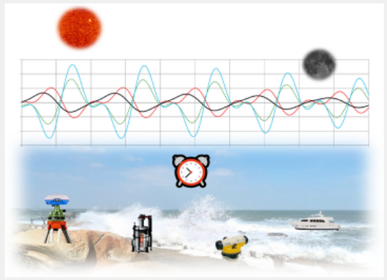
Forecast time series parameters

Start time	20160701
End time	20160704
Time interval	10.00 min

Maximum truncated degree of the coefficients model: 360

Calculate and save as

The program needs some time to compute the time series of ocean tidal load effects. Please wait until the button [Extract time series to be plot] becomes available.



Tidal load effects to be plot

- [ ] geoid or height anomaly (mm)
- [ ] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [ ] ground radial displacement (mm)
- [ ] normal (orthometric) height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)
- [ ] Sea surface tidal height (cm)

Tidal load effect time series on various geodetic elements

201607032010	2.840278	-2.9941	-38.4034	-40.8687	-15.6732	4.5441	-3.
201607032020	2.847222	-2.4838	-35.1985	-37.5062	-6.3060	-0.0888	-0.
201607032030	2.854167	-1.9043	-31.7056	-33.8271	3.0449	-4.6859	1.
201607032040	2.861111	-1.2581	-27.9283	-29.8352	12.2900	-9.2199	3.
201607032050	2.868056	-0.5488	-23.8674	-25.5323	21.3472	-13.6656	6.
2016070321	2.875000	0.2195	-19.5226	-20.9191	30.1430	-17.9995	8.
201607032110	2.881944	1.0413	-14.8934	-15.9964	38.6135	-22.1993	10.
201607032120	2.888889	1.9105	-9.9809	-10.7670	46.7040	-26.2429	12.
201607032130	2.895833	2.8195	-4.7898	-5.2378	54.3698	-30.1088	14.
201607032140	2.902778	3.7600	0.6696	0.5786	61.5743	-33.7746	16.
201607032150	2.909722	4.7226	6.3797	6.6616	68.2889	-37.2181	17.
2016070322	2.916667	5.6968	12.3137	12.9811	74.4909	-40.4162	19.
201607032210	2.923611	6.6716	18.4342	19.4962	80.1624	-43.3460	20.
201607032220	2.930556	7.6349	24.6927	26.1542	85.2884	-45.9844	22.
201607032230	2.937500	8.5742	31.0290	32.8906	89.8553	-48.3088	23.
201607032240	2.944444	9.4765	37.3719	39.6294	93.8493	-50.2976	24.
201607032250	2.951389	10.3286	43.6396	46.2840	97.2552	-51.9303	24.
2016070323	2.958333	11.1175	49.7423	52.7596	100.0555	-53.1880	25.
201607032310	2.965278	11.8304	55.5835	58.9546	102.2300	-54.0538	26.
201607032320	2.972222	12.4550	61.0636	64.7643	103.7551	-54.5125	26.
201607032330	2.979167	12.9800	66.0822	70.0838	104.6045	-54.5511	26.
201607032340	2.986111	13.3952	70.5422	74.8114	104.7500	-54.1588	26.
201607032350	2.993056	13.6920	74.3524	78.8520	104.1623	-53.3267	26.
2016070400	3.000000	13.8632	77.4314	82.1208	102.8130	-52.0484	26.

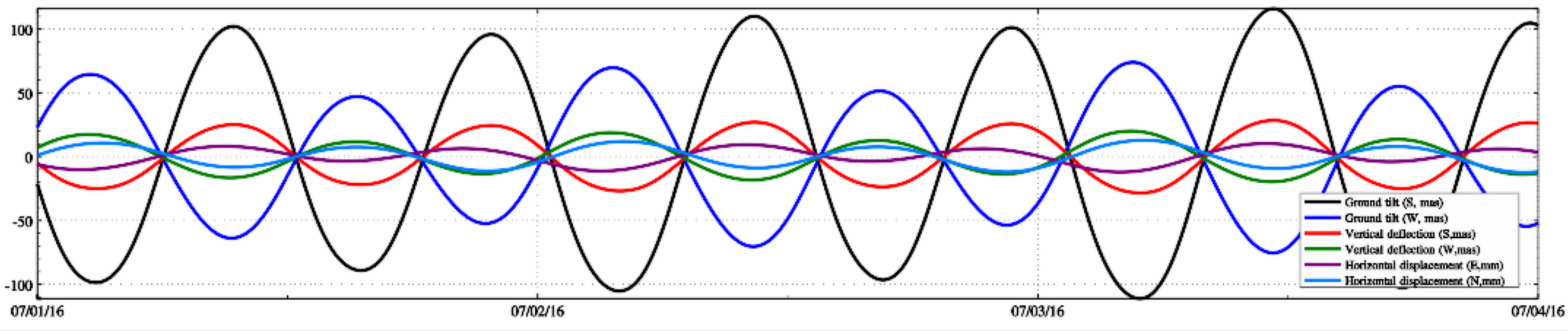
Set line thickness: 3

Extract time series to be plot

Plot↓

Tidal load effect curve of surface geodetic elements

Save the current plot as



Firstly, compute the time series of tidal load effects on all types of geodetic elements, and then select the effects to be plot.

Look at the amplitude of various tidal load effects, the in-phase or out-of-phase (same or opposite sign) relationship between different types of tidal load effects, and the time-varying characteristics of tidal load effect curves.

Global Forecast of Ocean Tidal Load Effects on Various Surface Geodetic Elements

Global Forecast of Ocean Tidal Load Effects on Various Surface Geodetic Elements

Location of surface point to be forecast

Longitude	121.240000°
Latitude	29.428100°
Normal or ortho-metric height	17.830m

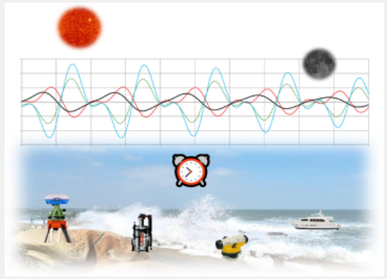
Forecast time series parameters

Start time	20160701
End time	20160704
Time interval	10.00 min

Maximum truncated degree of the coefficients model: 360

Calculate and save as

The program needs some time to compute the time series of ocean tidal load effects. Please wait until the button [Extract time series to be plot] becomes available.



Tidal load effects to be plot

- [ ] geoid or height anomaly (mm)
- [ ] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [ ] ground radial displacement (mm)
- [ ] normal (orthometric) height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)
- [ ] Sea surface tidal height (cm)

Tidal load effect time series on various geodetic elements

201607032010	2.840278	-2.9941	-38.4034	-40.8687	-15.6732	4.5441	-3.
201607032020	2.847222	-2.4838	-35.1985	-37.5062	-6.3060	-0.0888	-0.
201607032030	2.854167	-1.9043	-31.7056	-33.8271	3.0449	-4.6859	1.
201607032040	2.861111	-1.2581	-27.9283	-29.8352	12.2900	-9.2199	3.
201607032050	2.868056	-0.5488	-23.8674	-25.5323	21.3472	-13.6656	6.
2016070321	2.875000	0.2195	-19.5226	-20.9191	30.1430	-17.9995	8.
201607032110	2.881944	1.0413	-14.8934	-15.9964	38.6135	-22.1993	10.
201607032120	2.888889	1.9105	-9.9809	-10.7670	46.7040	-26.2429	12.
201607032130	2.895833	2.8195	-4.7898	-5.2378	54.3698	-30.1088	14.
201607032140	2.902778	3.7600	0.6696	0.5786	61.5743	-33.7746	16.
201607032150	2.909722	4.7226	6.3797	6.6616	68.2889	-37.2181	17.
2016070322	2.916667	5.6968	12.3137	12.9811	74.4909	-40.4162	19.
201607032210	2.923611	6.6716	18.4342	19.4962	80.1624	-43.3460	20.
201607032220	2.930556	7.6349	24.6927	26.1542	85.2884	-45.9844	22.
201607032230	2.937500	8.5742	31.0290	32.8906	89.8553	-48.3088	23.
201607032240	2.944444	9.4765	37.3719	39.6294	93.8493	-50.2976	24.
201607032250	2.951389	10.3286	43.6396	46.2840	97.2552	-51.9303	24.
2016070323	2.958333	11.1175	49.7423	52.7596	100.0555	-53.1880	25.
201607032310	2.965278	11.8304	55.5835	58.9546	102.2300	-54.0538	26.
201607032320	2.972222	12.4553	61.0686	64.7744	103.7560	-54.5000	26.
201607032330	2.979167	12.9814	66.1102	70.1344	104.6100	-54.5000	26.
201607032340	2.986111	13.3952	70.5422	74.8114	104.7500	-54.1588	26.
201607032350	2.993056	13.6900	74.2911	78.6844	104.1500	-53.4000	26.
2016070400	3.000000	13.8600	77.3214	81.7500	102.8100	-52.0484	26.

The ocean tidal loading effect on gravity gradient can reach more than tens of mE. The high-accuracy and high-resolution ocean tide model should be employed for high precision gravity gradient measurement in coastal areas.

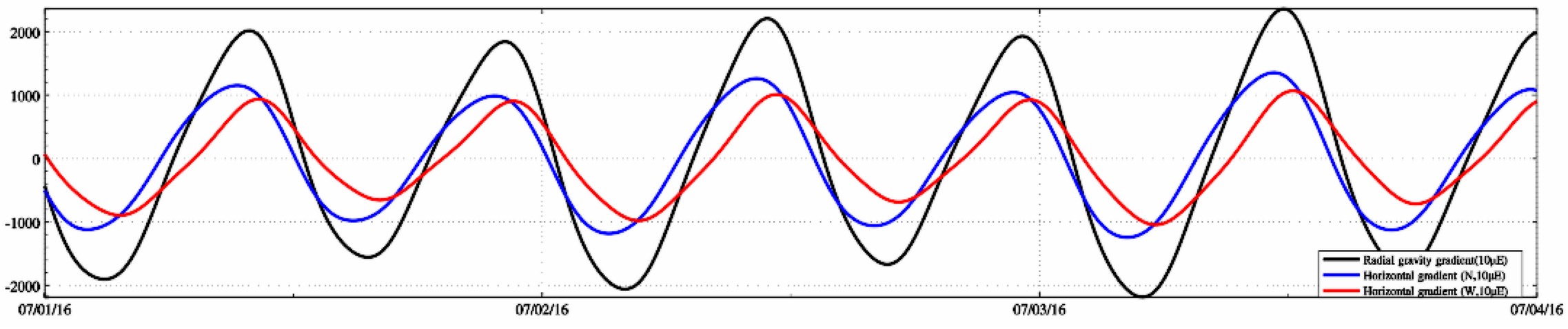
Set line thickness: 3

Extract time series to be plot

Plot↓

Tidal load effect curve of surface geodetic elements

Save the current plot as



Firstly, compute the time series of tidal load effects on all types of geodetic elements, and then select the effects to be plot.

Look at the amplitude of various tidal load effects, the in-phase or out-of-phase (same or opposite sign) relationship between different types of tidal load effects, and the time-varying characteristics of tidal load effect curves.

Spherical Harmonic Synthesis of Atmosphere tidal Load Effects External to the Solid Earth

Computation of Surface Atmosphere tidal Load Effect Time Series at a Ground Point

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Surface Atmosphere tidal Load Effect Time Series at a Ground Point | Computation of Surface Atmosphere tidal Load Effects at Batch Points with Given Time | Computation of Atmosphere Tidal Load Effects for Earth Satellites or External Points to the Solid Earth | Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Open the ground variation time series file

Set the file parameters

Column ordinal number of height relative to the surface in the header: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

>> Program Process ** Operation Prompts

Save program process as

```
>> [Function] Given a ground variation time series file, this module computes the time series of surface atmosphere tidal load effects on the following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/Tmseries.txt.
   ** Set the file format parameters according to the text box below, and then select the type of the tidal load effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/Tmsqurst.txt.
   ** Appends the selected tidal load effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
   ** Click the control button [Start computation], or the tool button [Start computation]...
   ** The computation process needs to wait... During the computation period, you can open the file C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/Tmsqurst.txt, to look at the computation progress!
>> Computation start time:  2026-06-08 11:45:00
>> The program also outputs a time series file of the atmosphere tidal load effects on the degree-1 and degree-2 geopotential coefficients (*Otdcmsfptm.txt) into the current directory (* = input filename).
   ** • Format: First row is the header. Subsequent rows contain: Epoch time, 3 columns of ΔC10, ΔC11, ΔS11 (×10⁻¹⁰), 5 columns of ΔC20, ΔC21, ΔS21, ΔC22, ΔS22 (×10⁻¹⁰), 3 columns effects on the Earth's center of mass (unit: mm), and 2 columns of effects on the figure pole Δx_sfp, Δy_sfp (in ITRS, unit: m).
>> Complete the computation of the atmosphere tidal load effects!
```

Columns 2 and 3 of the file header are agreed as the longitude and latitude of the ground point

Maximum truncated degree of the coefficient model: 120

Save the results as | Import setting parameters | Start computation

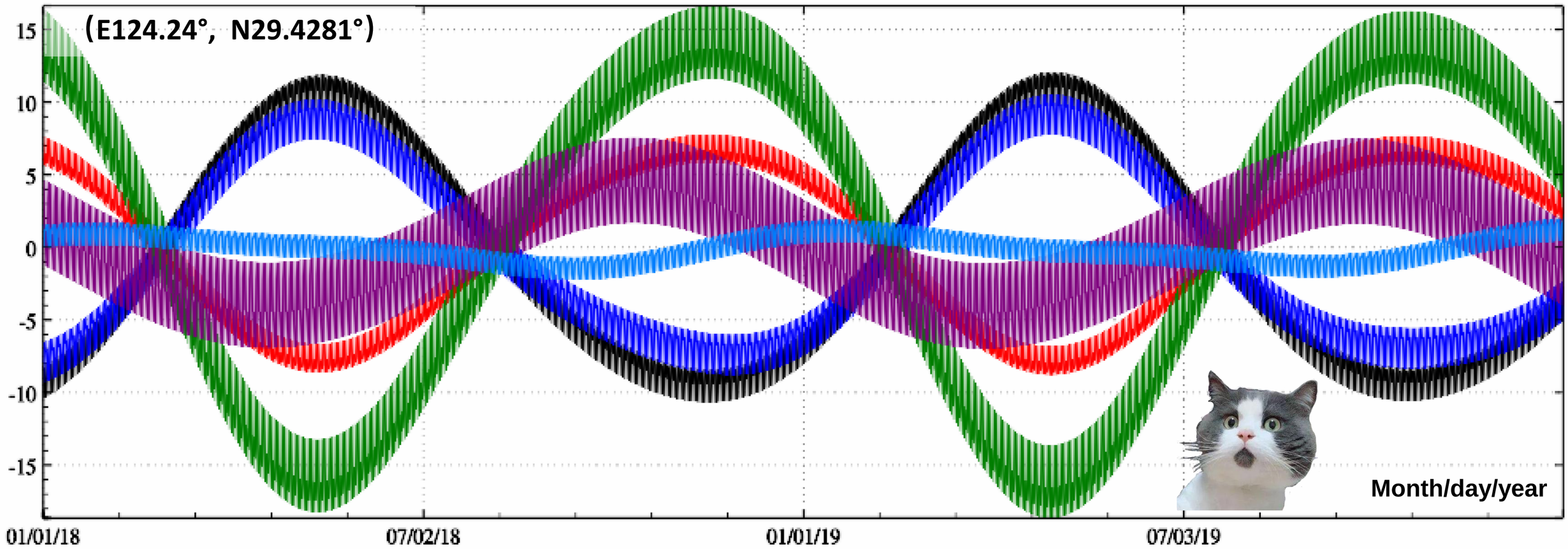
Display of the input-output file↓

Save data in the text box as

```
Forcast   121.240000    29.428100     0.000    58119.000000
  2018010100    0.000000    -8.6691    -7.9206     6.3697     4.9036     0.8431    -0.5672     0.3648    -0.2596     0.47
  2018010103    0.125000    -8.2147    -7.1096     5.8940     4.5588     0.8537    -0.2702     0.3702    -0.1412     0.32
  2018010106    0.250000    -9.1342    -7.3395     6.5245     5.1688     0.7244    -0.1673     0.3216    -0.0971     0.24
  2018010109    0.375000    -9.1453    -7.1337     6.5116     5.1977     0.6881    -0.2389     0.3091    -0.1186     0.21
  2018010112    0.500000    -8.2336    -6.5034     5.7666     4.5417     0.7813    -0.2378     0.3494    -0.1009     0.13
  2018010115    0.625000    -8.6656    -7.1527     6.0979     4.7569     0.7905    -0.2430     0.3563    -0.0885     0.11
  2018010118    0.750000   -10.1846    -8.8031     7.3996     5.7968     0.6932    -0.4551     0.3159    -0.1800     0.28
  2018010121    0.875000   -10.1570    -9.1459     7.5287     5.8738     0.7033    -0.6698     0.3135    -0.2871     0.48
  2018010200    1.000000    -8.5912    -7.8709     6.3132     4.8559     0.8303    -0.5563     0.3596    -0.2550     0.46
  2018010203    1.125000    -8.1364    -7.0595     5.8372     4.5108     0.8409    -0.2593     0.3649    -0.1365     0.31
  2018010206    1.250000    -9.0554    -7.2889     6.4674     5.1205     0.7116    -0.1564     0.3163    -0.0925     0.23
  2018010209    1.375000    -9.0660    -7.0827     6.4542     5.1491     0.6752    -0.2280     0.3039    -0.1139     0.20
  2018010212    1.500000    -8.1539    -6.4520     5.7088     4.4930     0.7683    -0.2269     0.3441    -0.0963     0.12
  2018010215    1.625000    -8.5854    -7.1009     6.0398     4.7078     0.7775    -0.2320     0.3510    -0.0839     0.10
  2018010218    1.750000   -10.1040    -8.7509     7.3411     5.7475     0.6801    -0.4441     0.3106    -0.1753     0.27
  2018010221    1.875000   -10.0760    -9.0933     7.4699     5.8243     0.6902    -0.6588     0.3082    -0.2824     0.47
  2018010300    2.000000    -8.5097    -7.8178     6.2541     4.8061     0.8172    -0.5452     0.3543    -0.2503     0.46
  2018010303    2.125000    -8.0545    -7.0060     5.7778     4.4608     0.8277    -0.2482     0.3596    -0.1319     0.30
  2018010306    2.250000    -8.9731    -7.2350     6.4076     5.0702     0.6983    -0.1453     0.3109    -0.0878     0.23
```

When calculating the indirect effects of surface atmosphere tidal load, the program assumes that atmospheric loads are concentrated on the Earth's land/sea surface. When calculating the direct effects of surface atmosphere tidal load on gravity or gravity gradient, a proportional relationship is assumed between the atmosphere P_h at height h and the surface atmosphere P_0: $P_h=P_0\,(1-h/44330)^{5225}$.

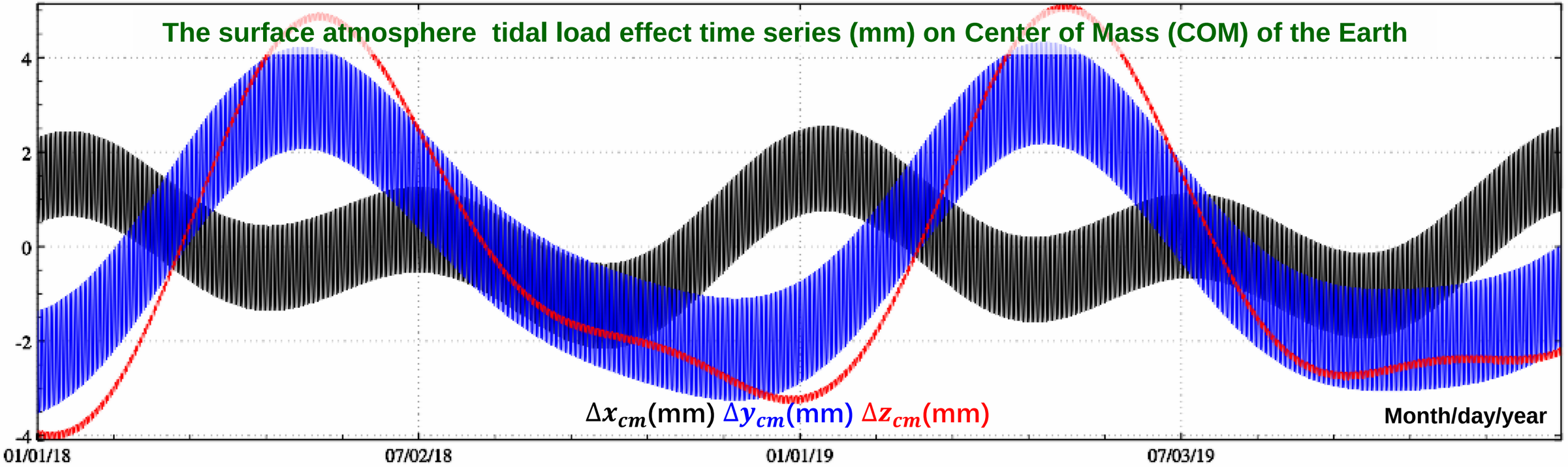
The annual periodic amplitude of the surface atmospheric tide is more than 10 times the diurnal periodic amplitude. In land areas, surface atmospheric pressure is high in winter and low in summer, causing the ground to subside in winter and uplift in summer. This results in annual and semi-annual periodic ground vertical deformations, which must be considered in centimeter-level geodesy.



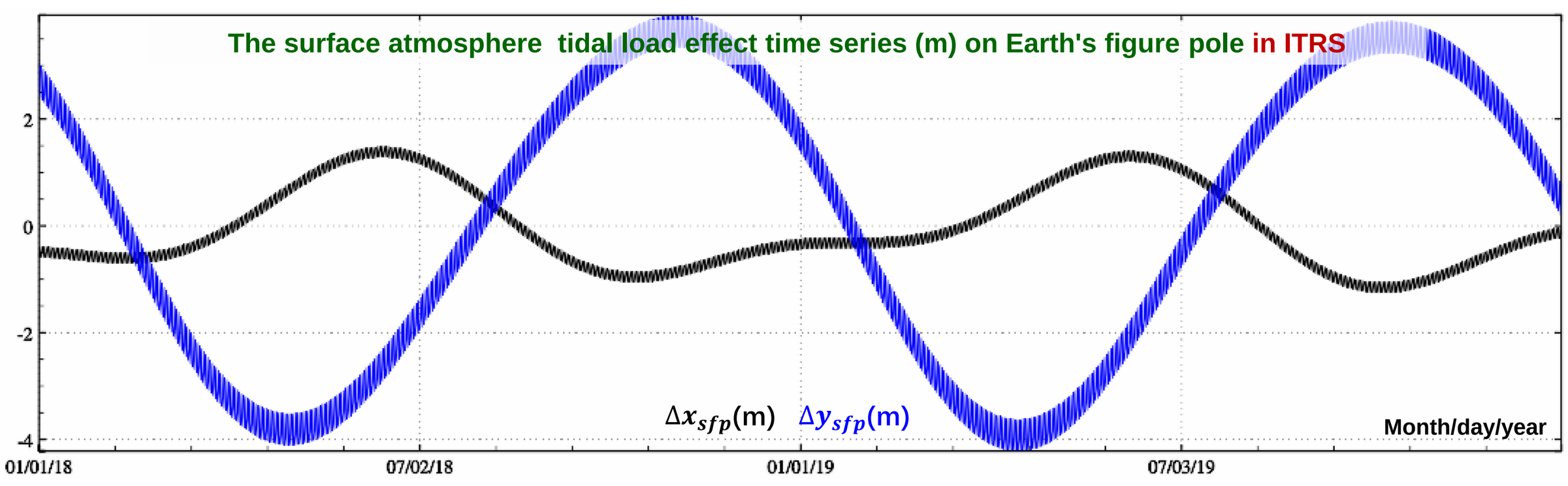
The Surface atmosphere tidal load effects (360-degree) : surface atmosphere(hPa/mbar) height anomaly (mm) ground gravity (μGal) orthometric height (mm) radial gravity gradient (10μE) horizontal displacement (N, 10μE)

The annual periodic amplitude of the surface atmospheric tide is more than 10 times the diurnal periodic amplitude. In land areas, surface atmospheric pressure is high in winter and low in summer, causing the ground to subside in winter and uplift in summer. This results in annual and semi-annual periodic ground vertical deformations, which must be considered in centimeter-level geodesy.

The surface atmosphere tidal load effect time series (mm) on Center of Mass (COM) of the Earth



The surface atmosphere tidal load effect time series (m) on Earth's figure pole in ITRS



Spherical Harmonic Synthesis of Atmosphere tidal Load Effects External to the Solid Earth

Computation of Surface Atmosphere tidal Load Effects at Batch Points with Given Time

Open file Save as Import parameters Start computation Save process Follow example

Computation of Surface Atmosphere tidal Load Effect Time Series at a Ground Point | Computation of Surface Atmosphere tidal Load Effects at Batch Points with Given Time | Computation of Atmosphere Tidal Load Effects for Earth Satellites or External Points to the Solid Earth | Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Open the location and time file of the computation points

Set the file parameters

Column ordinal number of height relative to the surface in the record: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

>> Program Process ** Operation Prompts

Save program process as

```
3 columns effects on the Earth's center of mass (unit: mm), and 2 columns of effects on the figure pole Δx_sfp, Δy_sfp (in ITRS, unit: m).
>> Complete the computation of the atmosphere tidal load effects!
>> Computation end time: 2026-06-08 11:47:23
>> [Function] According to the location and time specified in the computation point file, this module calculates the surface atmosphere tidal load effects on the following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the location and time file of the computation points C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/Postiontm.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the tidal load effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/Postmrst.txt.
  ** Appends the selected tidal load effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
  ** The computation process needs to wait... During the computation period, you can open the output file C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/Postmrst.txt, to look at the computation progress!
>> Computation start time: 2026-06-08 11:52:16
>> Complete the computation of the atmosphere tidal load effects!
>> Computation end time: 2026-06-08 11:52:36
```

Columns 2 and 3 of the record are agreed as the longitude and latitude of the computation point

Maximum truncated degree of the coefficient model: 120

Save the results as | Import setting parameters | Start computation

Display of the input-output file↓

Save data in the text box as

```
101.230000    29.910000    0.0   58484.000000
 201901010000   101.230000   29.910000   0.0   -6.1907   2.5717   1.5546   0.3532   -0.2690   0.1689   -0.0595
 201901010100   101.230000   29.910000   0.0   -5.4420   1.6589   0.7758   0.3615   -0.1645   0.1737   -0.0268
 201901010200   101.230000   29.910000   0.0   -4.7521   0.8807   0.1210   0.3615   -0.0105   0.1772    0.0250
 201901010300   101.230000   29.910000   0.0   -4.2262   0.3464   -0.3177  0.3492    0.1680   0.1768    0.0865
 201901010400   101.230000   29.910000   0.0   -3.9154   0.0949   -0.5095  0.3224    0.3442   0.1704    0.1475
 201901010500   101.230000   29.910000   0.0   -3.8085   0.0912   -0.4870  0.2813    0.4953   0.1574    0.1991
 201901010600   101.230000   29.910000   0.0   -3.8423   0.2432   -0.3317  0.2288    0.6068   0.1388    0.2357
 201901010700   101.230000   29.910000   0.0   -3.9239   0.4320   -0.1474  0.1710    0.6745   0.1170    0.2562
 201901010800   101.230000   29.910000   0.0   -3.9617   0.5498   -0.0279  0.1153    0.7041   0.0959    0.2631
 201901010900   101.230000   29.910000   0.0   -3.8947   0.5321   -0.0287  0.0693    0.7078   0.0792    0.2619
 201901011000   101.230000   29.910000   0.0   -3.7117   0.3775   -0.1510  0.0394    0.7000   0.0702    0.2586
 201901011100   101.230000   29.910000   0.0   -3.4571   0.1485   -0.3407  0.0293    0.6920   0.0707    0.2582
 201901011200   101.230000   29.910000   0.0   -3.2184   -0.0471  -0.5050  0.0393    0.6884   0.0804    0.2627
 201901011300   101.230000   29.910000   0.0   -3.1018   -0.0875  -0.5396  0.0665    0.6861   0.0974    0.2705
 201901011400   101.230000   29.910000   0.0   -3.2011   0.1248   -0.3610  0.1056    0.6747   0.1184    0.2770
 201901011500   101.230000   29.910000   0.0   -3.5674   0.6318   0.0660   0.1499    0.6408   0.1395    0.2759
 201901011600   101.230000   29.910000   0.0   -4.1910   1.4011   0.7134   0.1932    0.5720   0.1570    0.2612
 201901011700   101.230000   29.910000   0.0   -4.9973   2.3286   1.4913   0.2311    0.4621   0.1688    0.2292
 201901011800   101.230000   29.910000   0.0   -5.8605   3.2583   2.2667   0.2611    0.3145   0.1742    0.1801
```

When calculating the indirect effects of surface atmosphere tidal load, the program assumes that atmospheric loads are concentrated on the Earth's land/sea surface. When calculating the direct effects of surface atmosphere tidal load on gravity or gravity gradient, a proportional relationship is assumed between the atmosphere P_h at height h and the surface atmosphere P_0: $P_h=P_0\ (1-h/44330)^{5225}$.

The annual periodic amplitude of the surface atmospheric tide is more than 10 times the diurnal periodic amplitude. In land areas, surface atmospheric pressure is high in winter and low in summer, causing the ground to subside in winter and uplift in summer. This results in annual and semi-annual periodic ground vertical deformations, which must be considered in centimeter-level geodesy.

Spherical Harmonic Synthesis of Atmosphere tidal Load Effects External to the Solid Earth

Computation of Atmosphere Tidal Load Effects for Earth Satellites or External Points to the Solid Earth

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Surface Atmosphere tidal Load Effect Time Series at a Ground Point

Computation of Surface Atmosphere tidal Load Effects at Batch Points with Given Time

Computation of Atmosphere Tidal Load Effects for Earth Satellites or External Points to the Solid Earth

Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Open the location and time file of the external points

>> Program Process ** Operation Prompts

Save program process as

Set the file parameters

Column ordinal number of height relative to the surface in the record: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [x] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [ ] gravity gradient (ENU, 10μE)

```
** The computation process needs to wait... During the computation period, you can open the output file C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/Postmrst.txt, to look at the computation progress!
>> Computation start time：2026-06-08 11:52:16
>> Complete the computation of the atmosphere tidal load effects!
>> Computation end time: 2026-06-08 11:52:36
>> [Function] Based on the location and time provided in the external space point file, this module computes the surface atmosphere tidal load effects on the geopotential (0.1m²/s²), gravity (μGal), or gravity gradient (10μE) at points external to the solid Earth.
>> Open the location and time file of the external points C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/outerptm.txt.
** Set the file format parameters according to the text box below, and then select the type of the tidal load effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/outerprst.txt.
** Appends the selected tidal load effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
** The computation process needs to wait... During the computation period, you can open the output file C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/outerprst.txt, to look at the computation progress!
>> Computation start time：2026-06-08 12:01:52
>> Complete the computation of the atmosphere tidal load effects!
>> Computation end time: 2026-06-08 12:03:37
```

Columns 2 and 3 of the record are agreed as the longitude and latitude of the satellite

Maximum truncated degree of the coefficient model: 120

Save the results as | Import setting parameters | Start computation

GRACE satellite altitude

Display of the input-output file↓

Save data in the text box as

```
 Forcast  121.2400   29.4281  450000.0   58119.00
2018010100  121.2400   29.4281  450000.0   -0.6276   -1.1288    0.9385    2.6999
2018010104  121.2400   29.4281  450000.0   -0.5577   -1.1084    0.4650    2.5272
2018010108  121.2400   29.4281  450000.0   -0.5675   -0.9437    0.5120    2.6709
2018010112  121.2400   29.4281  450000.0   -0.5035   -1.1052    0.4518    2.3798
2018010116  121.2400   29.4281  450000.0   -0.6052   -1.1231    0.3106    2.6774
2018010120  121.2400   29.4281  450000.0   -0.7372   -0.9749    0.8376    3.1311
2018010124  121.2400   29.4281  450000.0   -0.6238   -1.1147    0.9249    2.6797
2018010204  121.2400   29.4281  450000.0   -0.5539   -1.0942    0.4514    2.5067
2018010208  121.2400   29.4281  450000.0   -0.5636   -0.9294    0.4984    2.6503
2018010212  121.2400   29.4281  450000.0   -0.4996   -1.0908    0.4382    2.3591
2018010216  121.2400   29.4281  450000.0   -0.6012   -1.1086    0.2970    2.6564
2018010220  121.2400   29.4281  450000.0   -0.7332   -0.9604    0.8239    3.1099
2018010224  121.2400   29.4281  450000.0   -0.6198   -1.1000    0.9112    2.6583
2018010304  121.2400   29.4281  450000.0   -0.5498   -1.0795    0.4376    2.4852
2018010308  121.2400   29.4281  450000.0   -0.5595   -0.9146    0.4846    2.6286
2018010312  121.2400   29.4281  450000.0   -0.4954   -1.0759    0.4244    2.3372
2018010316  121.2400   29.4281  450000.0   -0.5970   -1.0937    0.2832    2.6343
2018010320  121.2400   29.4281  450000.0   -0.7289   -0.9453    0.8100    3.0877
2018010324  121.2400   29.4281  450000.0   -0.6154   -1.0849    0.8973    2.6359
2018010404  121.2400   29.4281  450000.0   -0.5455   -1.0643    0.4237    2.4626
```

When calculating the indirect effects of surface atmosphere tidal load, the program assumes that atmospheric loads are concentrated on the Earth's land/sea surface. When calculating the direct effects of surface atmosphere tidal load on gravity or gravity gradient, a proportional relationship is assumed between the atmosphere P_h at height h and the surface atmosphere P_0: $P_h=P_0\,(1-h/44330)^{5225}$.

The annual periodic amplitude of the surface atmospheric tide is more than 10 times the diurnal periodic amplitude. In land areas, surface atmospheric pressure is high in winter and low in summer, causing the ground to subside in winter and uplift in summer. This results in annual and semi-annual periodic ground vertical deformations, which must be considered in centimeter-level geodesy.

Spherical Harmonic Synthesis of Atmosphere tidal Load Effects External to the Solid Earth

Computation of Atmosphere Tidal Load Effects for Earth Satellites or External Points to the Solid Earth

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Surface Atmosphere tidal Load Effect Time Series at a Ground Point

Computation of Surface Atmosphere tidal Load Effects at Batch Points with Given Time

Computation of Atmosphere Tidal Load Effects for Earth Satellites or External Points to the Solid Earth

Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Open the location and time file of the external points

>> Program Process ** Operation Prompts

Save program process as

Set the file parameters

Column ordinal number of height relative to the surface in the record: 4

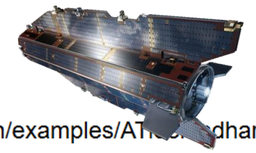
Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [ ] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [x] gravity gradient (ENU, 10μE)

```
** The computation process needs to wait... During the computation period, you can open the output file C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/outerprst.txt, to look at the computation progress!
>> Computation start time：2026-06-08 12:01:52
>> Complete the computation of the atmosphere tidal load effects!
>> Computation end time: 2026-06-08 12:03:37
>> [Function] Based on the location and time provided in the external space point file, this module computes the surface atmosphere tidal load effects on the geopotential (0.1m²/s²), gravity (μGal), or gravity gradient (10μE) at points external to the solid Earth.
>> Open the location and time file of the external points C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/satptm.txt.
** Set the file format parameters according to the text box below, and then select the type of the tidal load effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/satptmrst.txt.
** Appends the selected tidal load effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
** The computation process needs to wait... During the computation period, you can open the output file C:/ETideLoad4.5_win64en/examples/ATideloadharmsynth/satptmrst.txt, to look at the computation progress!
>> Computation start time：2026-06-08 12:07:32
>> Complete the computation of the atmosphere tidal load effects!
>> Computation end time: 2026-06-08 12:09:17
```



Columns 2 and 3 of the record are agreed as the longitude and latitude of the satellite

Maximum truncated degree of the coefficient model: 120

Save the results as | Import setting parameters | Start computation

GOCE satellite altitude

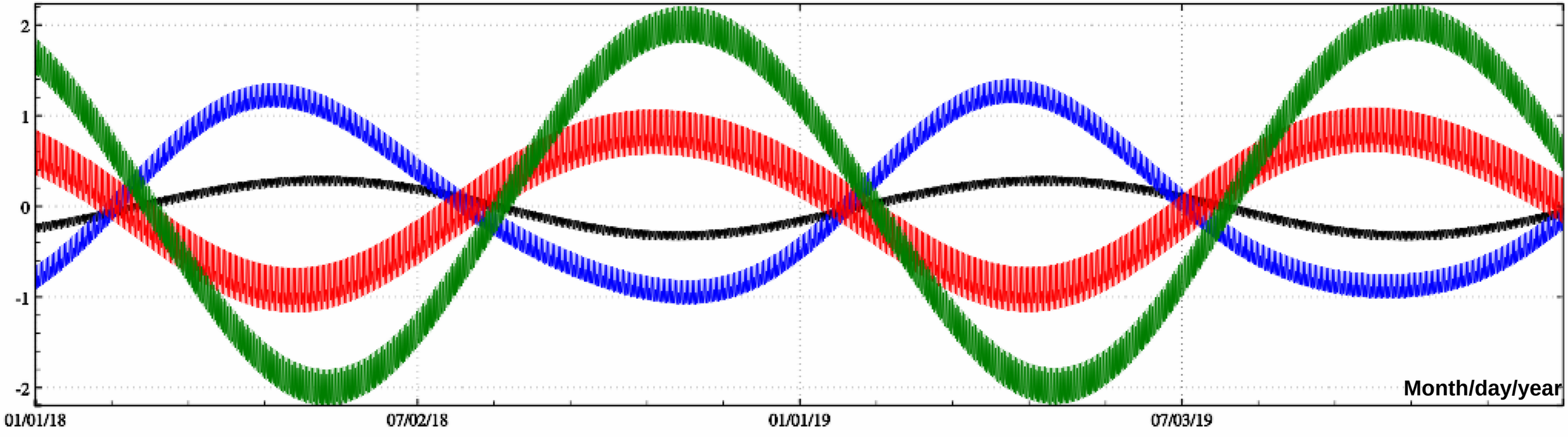
Display of the input-output file↓

Save data in the text box as

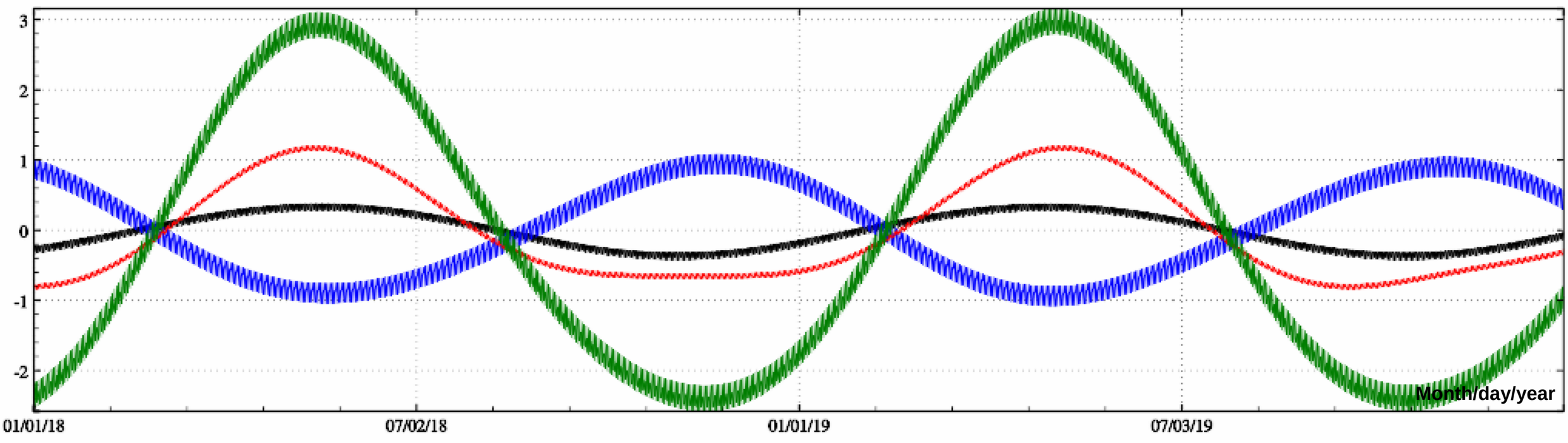
```
 Forcast  121.2400   29.4281  250000.0   58119.00
2018010100 121.2400   29.4281  250000.0   -0.6861    0.8041   -0.9135   -2.7813
2018010104 121.2400   29.4281  250000.0   -0.6128    0.9141   -0.9044   -2.8233
2018010108 121.2400   29.4281  250000.0   -0.6257    1.0474   -0.8697   -2.9583
2018010112 121.2400   29.4281  250000.0   -0.5555    0.9582   -0.8391   -2.7579
2018010116 121.2400   29.4281  250000.0   -0.6634    0.9732   -0.9110   -2.9476
2018010120 121.2400   29.4281  250000.0   -0.8048    0.9478   -0.9501   -3.0964
2018010124 121.2400   29.4281  250000.0   -0.6819    0.7949   -0.9121   -2.7619
2018010204 121.2400   29.4281  250000.0   -0.6086    0.9049   -0.9029   -2.8037
2018010208 121.2400   29.4281  250000.0   -0.6214    1.0381   -0.8681   -2.9385
2018010212 121.2400   29.4281  250000.0   -0.5511    0.9488   -0.8374   -2.7379
2018010216 121.2400   29.4281  250000.0   -0.6590    0.9637   -0.9093   -2.9274
2018010220 121.2400   29.4281  250000.0   -0.8004    0.9383   -0.9484   -3.0760
2018010224 121.2400   29.4281  250000.0   -0.6774    0.7853   -0.9103   -2.7414
2018010304 121.2400   29.4281  250000.0   -0.6040    0.8952   -0.9010   -2.7829
2018010308 121.2400   29.4281  250000.0   -0.6168    1.0284   -0.8662   -2.9176
2018010312 121.2400   29.4281  250000.0   -0.5465    0.9390   -0.8354   -2.7167
2018010316 121.2400   29.4281  250000.0   -0.6543    0.9539   -0.9073   -2.9061
2018010320 121.2400   29.4281  250000.0   -0.7956    0.9284   -0.9463   -3.0545
2018010324 121.2400   29.4281  250000.0   -0.6726    0.7754   -0.9081   -2.7196
2018010404 121.2400   29.4281  250000.0   -0.5992    0.8852   -0.8988   -2.7610
```

When calculating the indirect effects of surface atmosphere tidal load, the program assumes that atmospheric loads are concentrated on the Earth's land/sea surface. When calculating the direct effects of surface atmosphere tidal load on gravity or gravity gradient, a proportional relationship is assumed between the atmosphere P_h at height h and the surface atmosphere P_0: $P_h=P_0\ (1-h/44330)^{5225}$.

The annual periodic amplitude of the surface atmospheric tide is more than 10 times the diurnal periodic amplitude. In land areas, surface atmospheric pressure is high in winter and low in summer, causing the ground to subside in winter and uplift in summer. This results in annual and semi-annual periodic ground vertical deformations, which must be considered in centimeter-level geodesy.



Surface atmosphere tidal effects at 450km altitude：geopotential (0.1m²/s²), gravity vector (E, N: along the GRACE orbit/SST-ll, U, μGal)



Surface atmosphere tidal effects at 250km altitude：geopotential (0.1m²/s²), gravity gradient (E, N: along the GOCE orbit, U, 10μE)

Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Location of surface point to be forecast

Longitude: 121.240000°

Latitude: 29.428100°

Forecast time series parameters

Start time: 20180101

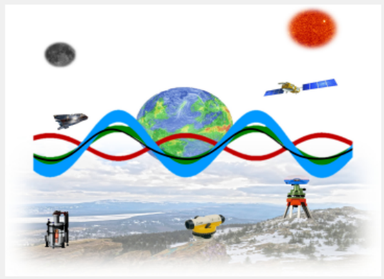
End time: 20200101

Time interval: 240.00 min

Maximum truncated degree of the coefficients model: 120

Calculate and save as

The program needs some time to compute the time series of atmosphere tidal load effects. Please wait until the button [Extract time series to be plot] becomes available.



Tidal effects to be plot

- [ ] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] normal (orthometric) height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)
- [x] surface atmosphere (hPa/mbar)

Tidal load effect time series on various geodetic elements

2019122804	726.166667	-3.2933	2.5342	1.9012	0.2835	0.2501
2019122808	726.333333	-3.4651	3.1292	2.4891	0.1465	0.2405
2019122812	726.500000	-2.6496	2.2293	1.7088	0.2478	0.2169
2019122816	726.666667	-3.8375	2.9789	2.2555	0.2265	0.1643
2019122820	726.833333	-5.4016	4.1488	3.1814	0.1449	-0.1691
2019122824	727.000000	-3.9926	2.7539	2.0054	0.2954	-0.1006
2019122904	727.166667	-3.1949	2.4334	1.8183	0.2679	0.2627
2019122908	727.333333	-3.3664	3.0282	2.4060	0.1308	0.2531
2019122912	727.500000	-2.5505	2.1281	1.6255	0.2320	0.2296
2019122916	727.666667	-3.7381	2.8774	2.1721	0.2107	0.1769
2019122920	727.833333	-5.3018	4.0471	3.0978	0.1291	-0.1565
2019122924	728.000000	-3.8926	2.6520	1.9217	0.2796	-0.0880
2019123004	728.166667	-3.0945	2.3312	1.7344	0.2520	0.2753
2019123008	728.333333	-3.2656	2.9258	2.3219	0.1149	0.2657
2019123012	728.500000	-2.4494	2.0255	1.5413	0.2161	0.2421
2019123016	728.666667	-3.6367	2.7746	2.0877	0.1947	0.1895
2019123020	728.833333	-5.2001	3.9440	3.0132	0.1131	-0.1440
2019123024	729.000000	-3.7905	2.5487	1.8369	0.2635	-0.0755
2019123104	729.166667	-2.9921	2.2277	1.6495	0.2359	0.2878
2019123108	729.333333	-3.1630	2.8221	2.2368	0.0988	0.2782
2019123112	729.500000	-2.3464	1.9215	1.4561	0.2000	0.2546
2019123116	729.666667	-3.5334	2.6704	2.0023	0.1785	0.2020
2019123120	729.833333	-5.0965	3.8396	2.9276	0.0969	-0.1315
2019123124	730.000000	-3.6866	2.4441	1.7512	0.2473	-0.0630

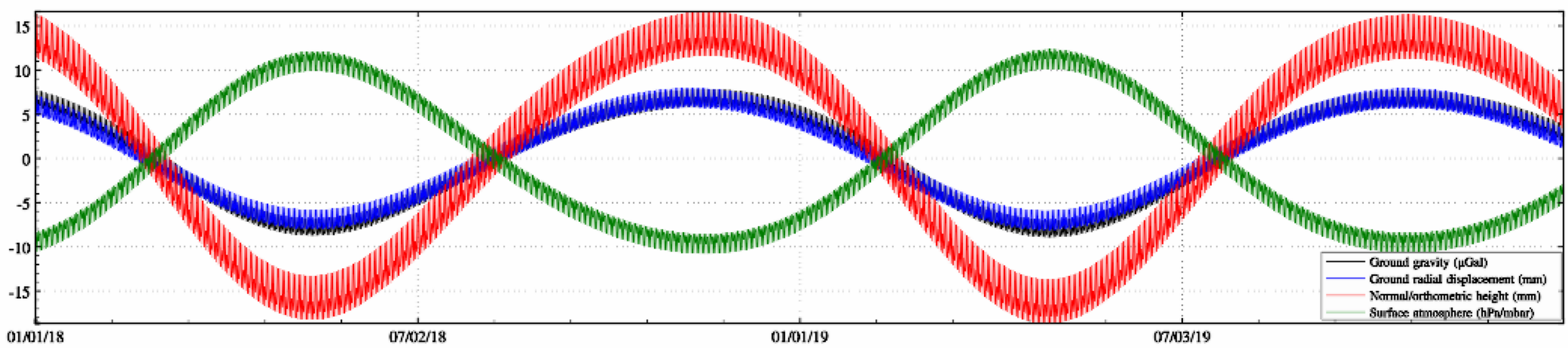
Set line thickness: 1

Extract time series to be plot

Plot↓

Tidal load effect curve of surface geodetic elements

Save the current plot as



Firstly, compute the time series of tidal load effects on all types of geodetic elements, and then select the effects to be plot.

Look at the amplitude of various tidal load effects, the in-phase or out-of-phase (same or opposite sign) relationship between different types of tidal load effects, and the time-varying characteristics of tidal load effect curves.

Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Location of surface point to be forecast

Longitude: 121.240000°

Latitude: 29.428100°

Forecast time series parameters

Start time: 20180101

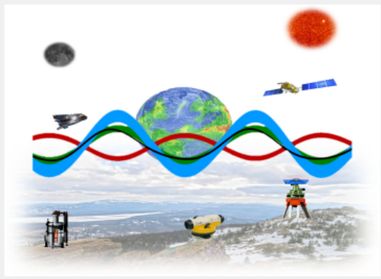
End time: 20200101

Time interval: 240.00 min

Maximum truncated degree of the coefficients model: 120

Calculate and save as

The program needs some time to compute the time series of atmosphere tidal load effects. Please wait until the button [Extract time series to be plot] becomes available.



Tidal effects to be plot

- [ ] geoid or height anomaly (mm)
- [ ] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [ ] ground radial displacement (mm)
- [ ] normal (orthometric) height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)
- [ ] surface atmosphere (hPa/mbar)

Tidal load effect time series on various geodetic elements

2019122804	726.166667	-3.2933	2.5342	1.9012	0.2835	0.2501
2019122808	726.333333	-3.4651	3.1292	2.4891	0.1465	0.2405
2019122812	726.500000	-2.6496	2.2293	1.7088	0.2478	0.2169
2019122816	726.666667	-3.8375	2.9789	2.2555	0.2265	0.1643
2019122820	726.833333	-5.4016	4.1488	3.1814	0.1449	-0.1691
2019122824	727.000000	-3.9926	2.7539	2.0054	0.2954	-0.1006
2019122904	727.166667	-3.1949	2.4334	1.8183	0.2679	0.2627
2019122908	727.333333	-3.3664	3.0282	2.4060	0.1308	0.2531
2019122912	727.500000	-2.5505	2.1281	1.6255	0.2320	0.2296
2019122916	727.666667	-3.7381	2.8774	2.1721	0.2107	0.1769
2019122920	727.833333	-5.3018	4.0471	3.0978	0.1291	-0.1565
2019122924	728.000000	-3.8926	2.6520	1.9217	0.2796	-0.0880
2019123004	728.166667	-3.0945	2.3312	1.7344	0.2520	0.2753
2019123008	728.333333	-3.2656	2.9258	2.3219	0.1149	0.2657
2019123012	728.500000	-2.4494	2.0255	1.5413	0.2161	0.2421
2019123016	728.666667	-3.6367	2.7746	2.0877	0.1947	0.1895
2019123020	728.833333	-5.2001	3.9440	3.0132	0.1131	-0.1440
2019123024	729.000000	-3.7905	2.5487	1.8369	0.2635	-0.0755
2019123104	729.166667	-2.9921	2.2277	1.6495	0.2359	0.2878
2019123108	729.333333	-3.1630	2.8221	2.2368	0.0988	0.2782
2019123112	729.500000	-2.3464	1.9215	1.4561	0.2000	0.2546
2019123116	729.666667	-3.5334	2.6704	2.0023	0.1785	0.2020
2019123120	729.833333	-5.0965	3.8396	2.9276	0.0969	-0.1315
2019123124	730.000000	-3.6866	2.4441	1.7512	0.2473	-0.0630

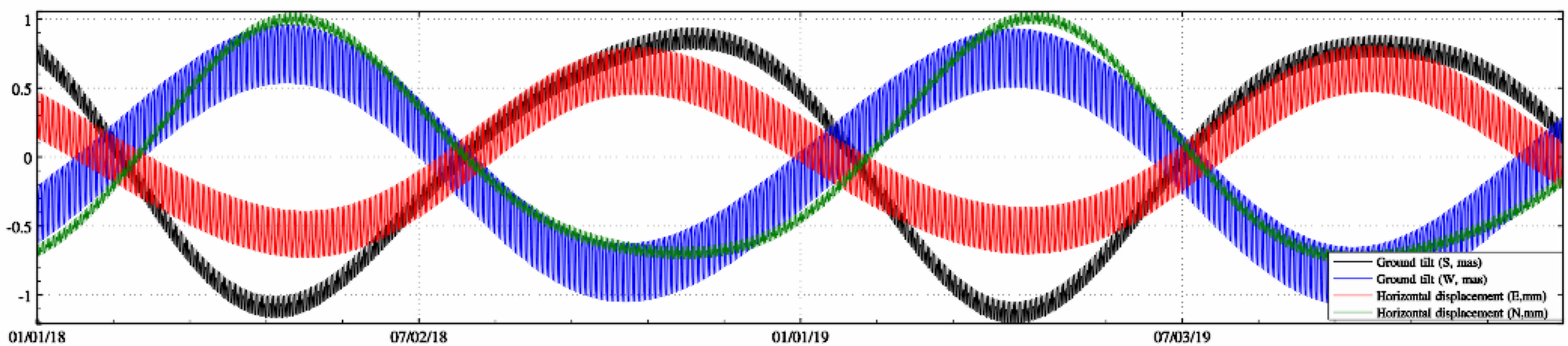
Set line thickness: 1

Extract time series to be plot

Plot↓

Tidal load effect curve of surface geodetic elements

Save the current plot as



Firstly, compute the time series of tidal load effects on all types of geodetic elements, and then select the effects to be plot.

Look at the amplitude of various tidal load effects, the in-phase or out-of-phase (same or opposite sign) relationship between different types of tidal load effects, and the time-varying characteristics of tidal load effect curves.

Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Global Forecast of Atmosphere Tidal Load Effects on Various Surface Geodetic Elements

Location of surface point to be forecast

Longitude: 121.240000°

Latitude: 29.428100°

Forecast time series parameters

Start time: 20180101

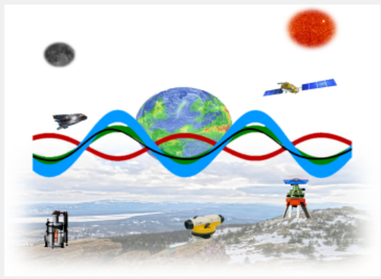
End time: 20200101

Time interval: 240.00 min

Maximum truncated degree of the coefficients model: 120

Calculate and save as

The program needs some time to compute the time series of atmosphere tidal load effects. Please wait until the button [Extract time series to be plot] becomes available.



Tidal effects to be plot

- [ ] geoid or height anomaly (mm)
- [ ] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [ ] normal (orthometric) height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)
- [ ] surface atmosphere (hPa/mbar)

Tidal load effect time series on various geodetic elements

2019122804	726.166667	-3.2933	2.5342	1.9012	0.2835	0.2501
2019122808	726.333333	-3.4651	3.1292	2.4891	0.1465	0.2405
2019122812	726.500000	-2.6496	2.2293	1.7088	0.2478	0.2169
2019122816	726.666667	-3.8375	2.9789	2.2555	0.2265	0.1643
2019122820	726.833333	-5.4016	4.1488	3.1814	0.1449	-0.1691
2019122824	727.000000	-3.9926	2.7539	2.0054	0.2954	-0.1006
2019122904	727.166667	-3.1949	2.4334	1.8183	0.2679	0.2627
2019122908	727.333333	-3.3664	3.0282	2.4060	0.1308	0.2531
2019122912	727.500000	-2.5505	2.1281	1.6255	0.2320	0.2296
2019122916	727.666667	-3.7381	2.8774	2.1721	0.2107	0.1769
2019122920	727.833333	-5.3018	4.0471	3.0978	0.1291	-0.1565
2019122924	728.000000	-3.8926	2.6520	1.9217	0.2796	-0.0880
2019123004	728.166667	-3.0945	2.3312	1.7344	0.2520	0.2753
2019123008	728.333333	-3.2656	2.9258	2.3219	0.1149	0.2657
2019123012	728.500000	-2.4494	2.0255	1.5413	0.2161	0.2421
2019123016	728.666667	-3.6367	2.7746	2.0877	0.1947	0.1895
2019123020	728.833333	-5.2001	3.9440	3.0132	0.1131	-0.1440
2019123024	729.000000	-3.7905	2.5487	1.8369	0.2635	-0.0755
2019123104	729.166667	-2.9921	2.2277	1.6495	0.2359	0.2878
2019123108	729.333333	-3.1630	2.8221	2.2368	0.0988	0.2782
2019123112	729.500000	-2.3464	1.9215	1.4561	0.2000	0.2546
2019123116	729.666667	-3.5334	2.6704	2.0023	0.1785	0.2020
2019123120	729.833333	-5.0965	3.8396	2.9276	0.0969	-0.1315
2019123124	730.000000	-3.6866	2.4441	1.7512	0.2473	-0.0630

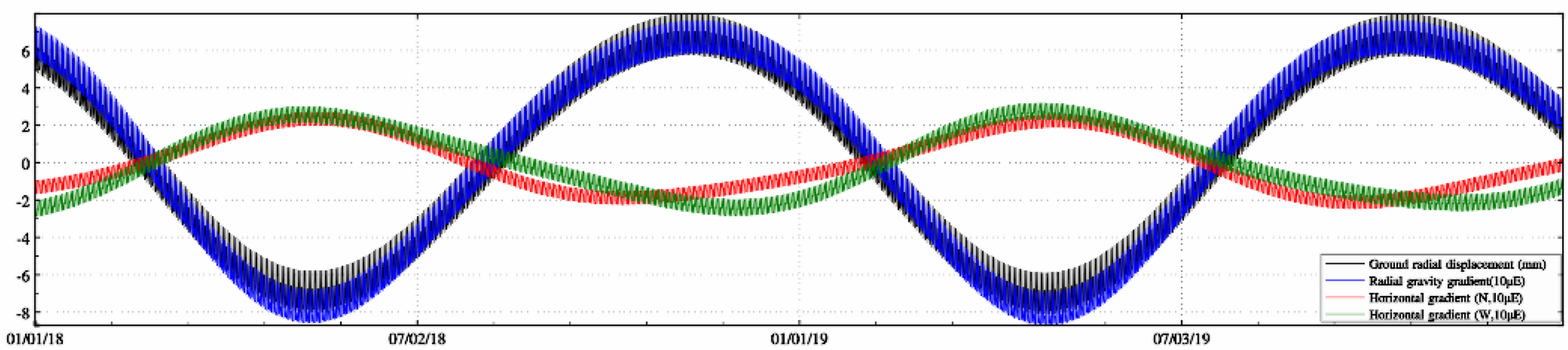
Set line thickness: 1

Extract time series to be plot

Plot↓

Tidal load effect curve of surface geodetic elements

Save the current plot as



Firstly, compute the time series of tidal load effects on all types of geodetic elements, and then select the effects to be plot.

Look at the amplitude of various tidal load effects, the in-phase or out-of-phase (same or opposite sign) relationship between different types of tidal load effects, and the time-varying characteristics of tidal load effect curves.

Computation of Earth Rotation Polar Shift Effects on Geodetic Elements and Tidal Effects on EPR

Computation of Rotation Polar Shift or Ocean Pole Tidal Effect Time Series at a Ground Point

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Rotation Polar Shift or Ocean Pole Tidal Effect Time Series at a Ground Point

Computation of Rotation Polar Shift or Ocean Pole Tidal Effects at Batch Points with Given Time

Computation of Rotation Polar Shift or Ocean pole tidal Effects for Satellites

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Open the ground variation time series file

Computation of figure polar shift effects from the measured ΔC_{21} and ΔS_{21}

Algorithm formulas

Save program process as

Forecast of Tide Effect Time Series on Earth Rotation Parameters

Set the file parameters

Column ordinal number of ellipsoidal height in the header: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

>> [Purpose] Using the IERS Earth Orientation Parameters (EOP) product file IERSeopc04.dat, this module computes the effects of Earth rotation polar shift and ocean pole tides on various geodetic elements – both terrestrial and those external to the solid Earth. Alternatively, it computes the tidal effects on Earth Rotation Parameters (ERP).
>> Select the computation function from the 6 control buttons on the top of the interface...
>> [Function] Based on a ground variation time series file, this module computes the time series of Earth rotation polar shift or ocean pole tidal effects on the following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/Tmseries.txt.
** Set the file format parameters according to the text box below, and then select the type of the effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/Tmsqurst.txt.
** Appends the selected effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
>> Prepare to compute Earth's rotation polar shift effects ...
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time: 2026-06-09 10:05:04
>> Complete the computation of Earth's rotation polar shift effects!
>> Computation end time: 2026-06-09 10:05:04

Columns 2 and 3 of the file header are agreed as the longitude and latitude of the ground point

Select the effects to be computed: Rotaion polar shift effects

Save the results as | Import setting parameters | Start computation

Display of the input-output file↓

Save data in the text box as

ASB	107.230000	29.910000	72.4	56658.000000						
201401010000	0.000000	6.713	-2.1021	-1.1883	0.9926	0.4196	0.4576	-0.0171	0.0908	-0.0329
201401011200	0.500000	6.375	-2.1060	-1.1772	0.9694	0.4102	0.4469	-0.0167	0.0908	-0.0321
201401020000	1.000000	6.751	-2.1099	-1.1660	0.9462	0.4007	0.4362	-0.0163	0.0908	-0.0313
201401021200	1.500000	6.412	-2.1188	-1.1547	0.9199	0.3899	0.4241	-0.0158	0.0910	-0.0305
201401030000	2.000000	6.786	-2.1277	-1.1434	0.8935	0.3792	0.4119	-0.0153	0.0912	-0.0296
201401031200	2.500000	6.445	-2.1378	-1.1363	0.8743	0.3714	0.4031	-0.0150	0.0915	-0.0290
201401040000	3.000000	6.818	-2.1480	-1.1293	0.8551	0.3636	0.3942	-0.0147	0.0918	-0.0283
201401041200	3.500000	6.476	-2.1553	-1.1226	0.8382	0.3567	0.3864	-0.0144	0.0920	-0.0278
201401050000	4.000000	6.847	-2.1626	-1.1158	0.8214	0.3499	0.3786	-0.0141	0.0922	-0.0272
201401051200	4.500000	6.504	-2.1712	-1.1055	0.7970	0.3400	0.3674	-0.0137	0.0924	-0.0264
201401060000	5.000000	6.874	-2.1799	-1.0953	0.7727	0.3300	0.3562	-0.0132	0.0926	-0.0256
201401061200	5.500000	6.529	-2.1932	-1.0809	0.7381	0.3160	0.3403	-0.0126	0.0929	-0.0244
201401070000	6.000000	6.897	-2.2065	-1.0666	0.7035	0.3019	0.3243	-0.0120	0.0932	-0.0233
201401071200	6.500000	6.551	-2.2200	-1.0500	0.6645	0.2860	0.3063	-0.0114	0.0935	-0.0220
201401080000	7.000000	6.917	-2.2336	-1.0335	0.6255	0.2701	0.2883	-0.0107	0.0938	-0.0207
201401081200	7.500000	6.570	-2.2405	-1.0167	0.5900	0.2556	0.2720	-0.0101	0.0939	-0.0195
201401090000	8.000000	6.935	-2.2474	-0.9998	0.5544	0.2411	0.2556	-0.0094	0.0939	-0.0184
201401091200	8.500000	6.586	-2.2532	-0.9781	0.5102	0.2230	0.2352	-0.0087	0.0939	-0.0169

The Earth's rotation polar shift and figure polar shift are distinct types of geodetic variations. The Earth's figure polar shift represents the normalized angular momentum, which corresponds to the mass load excitation of the Earth's rotation.

The program utilizes the IERS measured or predicted product IERSeopc04.dat (available from the IERS website), which can be updated via the module [System configs for the geophysical models and numerical standards].The program uses the following Love numbers: k_2 = 0.3077 + 0.0036i, h_2 = 0.6207 and l_2 = 0.0836.

Computation of Earth Rotation Polar Shift Effects on Geodetic Elements and Tidal Effects on EPR

Computation of Rotation Polar Shift or Ocean Pole Tidal Effect Time Series at a Ground Point

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Rotation Polar Shift or Ocean Pole Tidal Effect Time Series at a Ground Point

Computation of Rotation Polar Shift or Ocean Pole Tidal Effects at Batch Points with Given Time

Computation of Rotation Polar Shift or Ocean pole tidal Effects for Satellites

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Open the ground variation time series file

Computation of figure polar shift effects from the measured ΔC_{21} and ΔS_{21}

Algorithm formulas

Save program process as

Forecast of Tide Effect Time Series on Earth Rotation Parameters

Set the file parameters

Column ordinal number of ellipsoidal height in the header: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

```
>> Setting parameters have been imported into the program!
>> Prepare to compute Earth's rotation polar shift effects ...
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-09 10:05:04
>> Complete the computation of Earth's rotation polar shift effects!
>> Computation end time: 2026-06-09 10:05:04
>> [Function] Based on a ground variation time series file, this module computes the time series of Earth rotation polar shift or ocean pole tidal effects on the
following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical
deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height
(mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/Tmseries.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the effect to be computed. After giving the output file name, click the
control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/Tmsquotdrst.txt.
  ** Appends the selected effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
>> Prepare to compute ocean pole tidal effects ...
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-09 10:05:58
>> Complete the computation of ocean pole tidal effects!
>> Computation end time: 2026-06-09 10:06:33
```

Columns 2 and 3 of the file header are agreed as the longitude and latitude of the ground point

Select the effects to be computed: Ocean pole tidal effects

Save the results as | Import setting parameters | Start computation

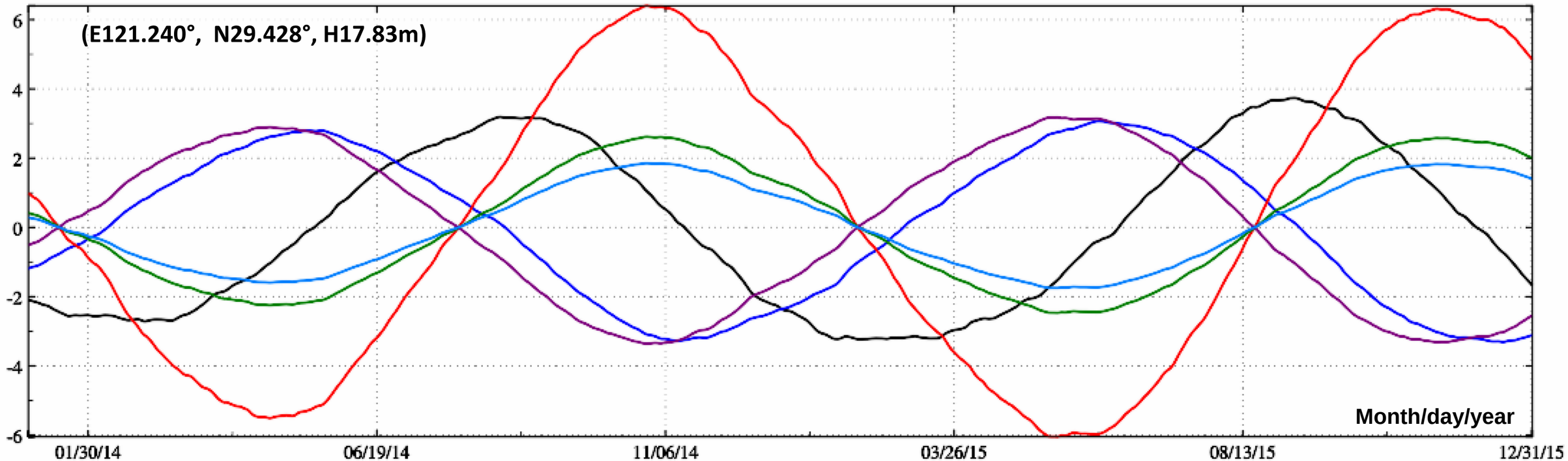
Display of the input-output file↓

Save data in the text box as

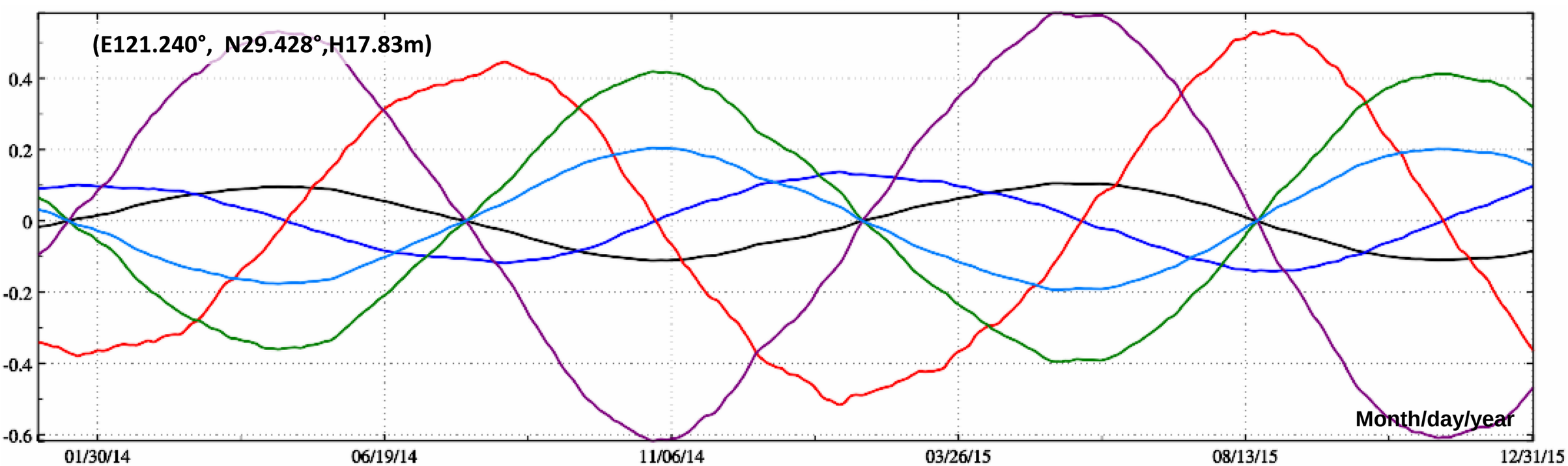
```
ASB   107.230000   29.910000   72.4   56658.000000
201401010000   0.000000   6.713   0.0297   0.0427   0.0535   0.0026   0.0417   0.0004   0.0173   -0.0134
201401011200   0.500000   6.375   0.0295   0.0427   0.0535   0.0026   0.0417   0.0003   0.0173   -0.0135
201401020000   1.000000   6.751   0.0294   0.0428   0.0536   0.0026   0.0418   0.0003   0.0173   -0.0135
201401021200   1.500000   6.412   0.0290   0.0428   0.0536   0.0026   0.0419   0.0003   0.0174   -0.0135
201401030000   2.000000   6.786   0.0287   0.0428   0.0536   0.0026   0.0419   0.0003   0.0174   -0.0136
201401031200   2.500000   6.445   0.0284   0.0429   0.0536   0.0026   0.0420   0.0003   0.0174   -0.0136
201401040000   3.000000   6.818   0.0280   0.0429   0.0536   0.0026   0.0420   0.0003   0.0174   -0.0137
201401041200   3.500000   6.476   0.0277   0.0429   0.0535   0.0026   0.0421   0.0003   0.0174   -0.0137
201401050000   4.000000   6.847   0.0275   0.0429   0.0535   0.0026   0.0421   0.0003   0.0175   -0.0138
201401051200   4.500000   6.504   0.0272   0.0430   0.0535   0.0026   0.0422   0.0003   0.0175   -0.0138
201401060000   5.000000   6.874   0.0269   0.0430   0.0535   0.0026   0.0422   0.0003   0.0175   -0.0138
201401061200   5.500000   6.529   0.0264   0.0430   0.0535   0.0026   0.0423   0.0003   0.0176   -0.0139
201401070000   6.000000   6.897   0.0259   0.0431   0.0535   0.0026   0.0424   0.0003   0.0176   -0.0140
201401071200   6.500000   6.551   0.0254   0.0431   0.0536   0.0026   0.0425   0.0003   0.0176   -0.0141
201401080000   7.000000   6.917   0.0250   0.0432   0.0536   0.0026   0.0426   0.0003   0.0177   -0.0141
201401081200   7.500000   6.570   0.0247   0.0432   0.0536   0.0026   0.0427   0.0003   0.0177   -0.0142
201401090000   8.000000   6.935   0.0244   0.0433   0.0536   0.0026   0.0428   0.0003   0.0178   -0.0142
201401091200   8.500000   6.586   0.0242   0.0434   0.0537   0.0026   0.0429   0.0003   0.0178   -0.0143
```

The Earth's rotation polar shift and figure polar shift are distinct types of geodetic variations. The Earth's figure polar shift represents the normalized angular momentum, which corresponds to the mass load excitation of the Earth's rotation.

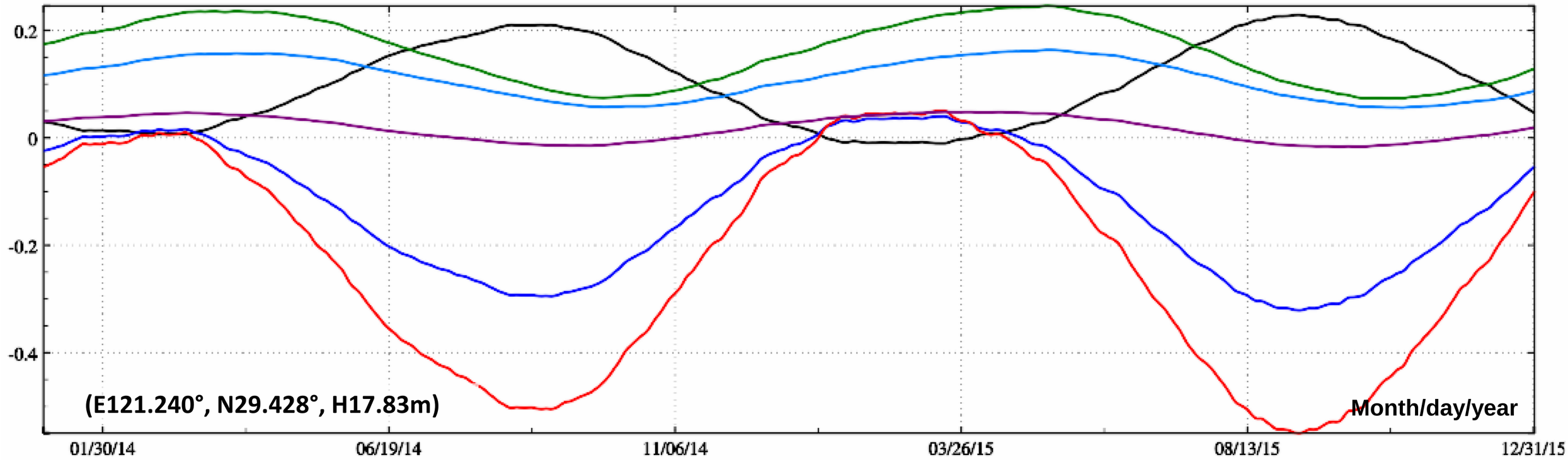
The program utilizes the IERS measured or predicted product IERSeopc04.dat (available from the IERS website), which can be updated via the module [System configs for the geophysical models and numerical standards].The program uses the following Love numbers: k_2 = 0.3077 + 0.0036i, h_2 = 0.6207 and l_2 = 0.0836.



Earth's rotation polar shift (Δx_pm, Δy_pm in ITRS) effects: height anomaly (mm) ground gravity (μGal)
orthometric height (mm) radial gravity gradient (10μE)

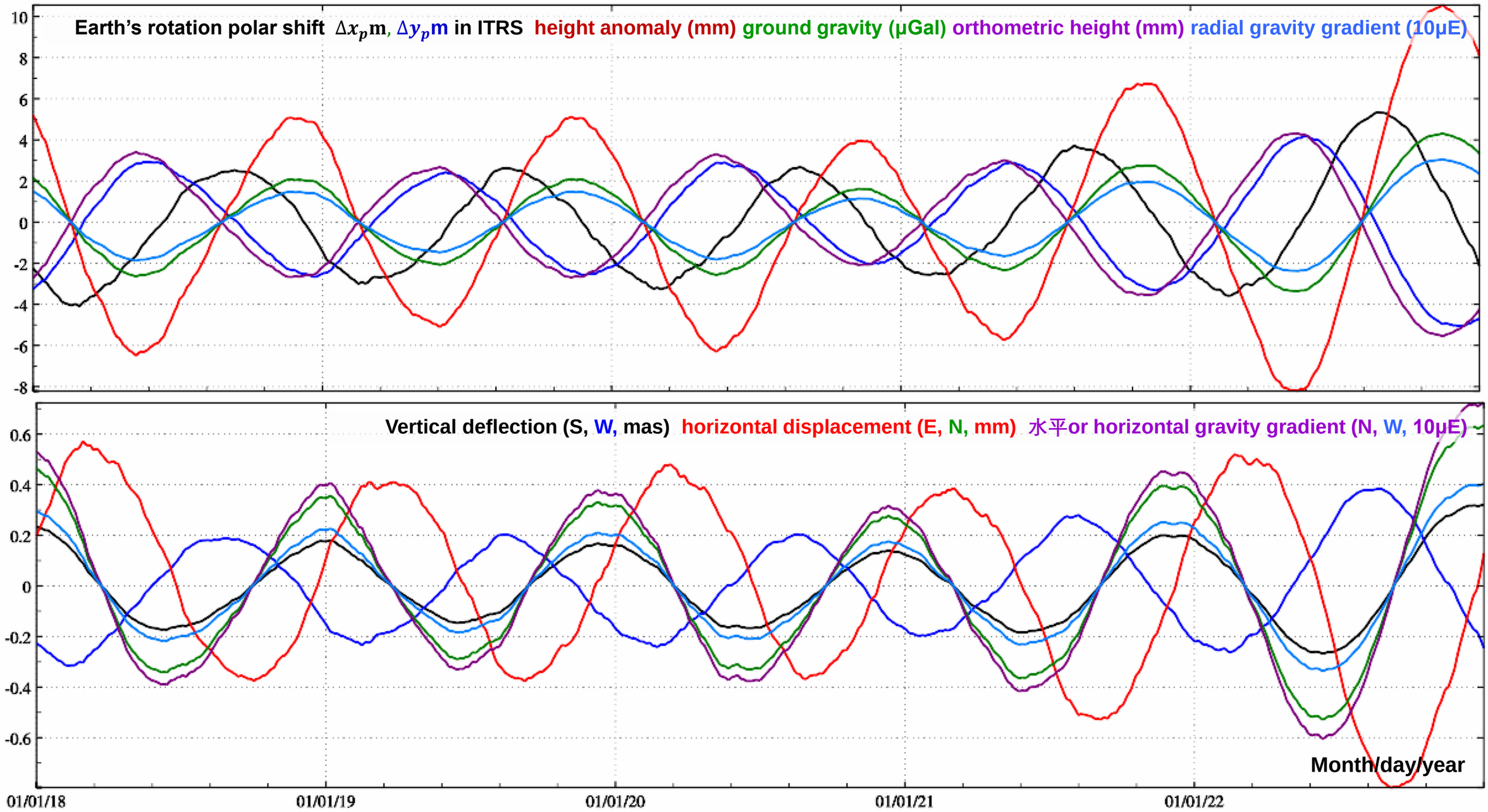


Earth's rotation polar shift effects: ground tilt (S, W, mas) horizontal displacement (E, N, mm) horizontal gravity gradient (N, W, 10μE)



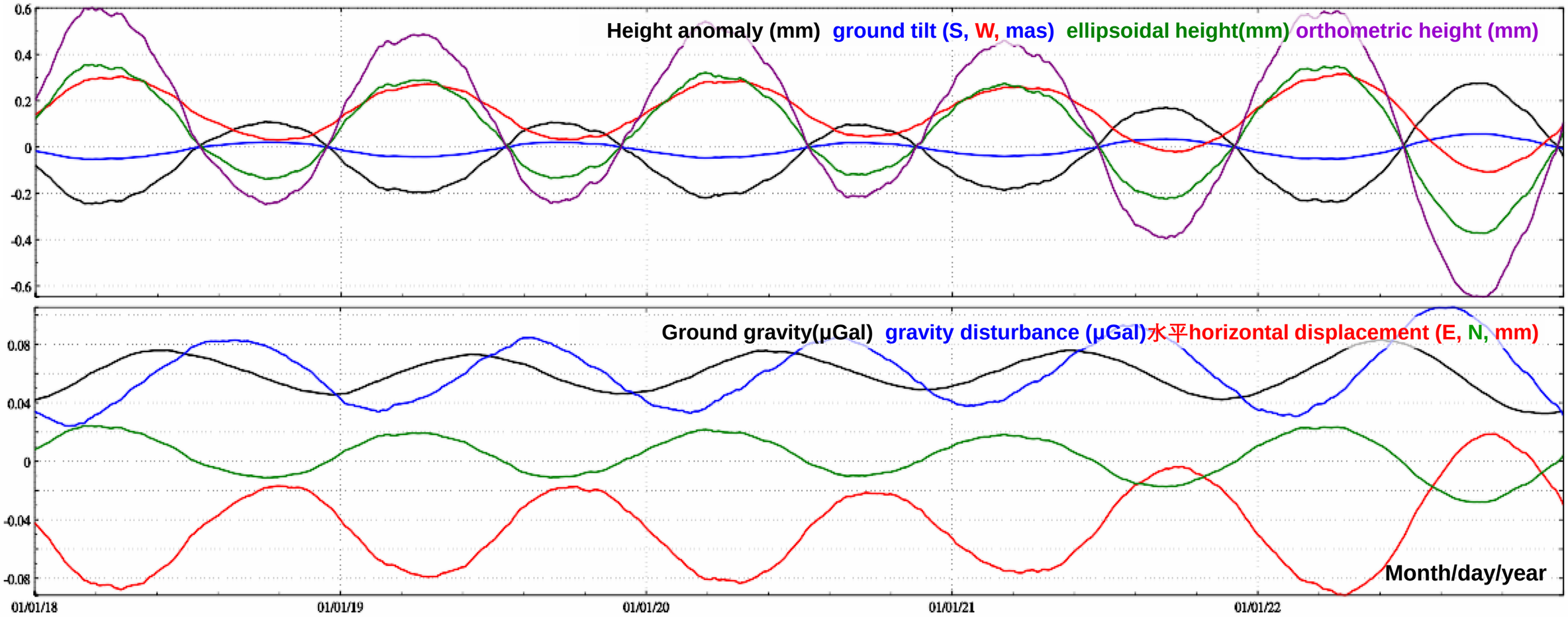
Ocean pole tidal effects: height anomaly (mm) ellipsoidal height (mm) orthometric height (mm)
radial gravity gradient (10μE)10μE horizontal gravity gradient (N, W, 10μE)

The ocean polar tide effects on various geodetic elements are small, which can be ignored for general geodetic cases.



Earth's rotation polar shift effect time series on various geodetic elements

Although the Earth's rotation polar shift itself can reach the meter level, the resulting effect on geoid or ground normal height is only in mm level, that on ground gravity is μGal level, that on radial gravity gradient is 10μE level, that on horizontal geodetic elements are small and can be generally ignored.



Ocean polar tide effect time series on geodetic elements at the point P in the coastal zone area

The ocean polar tide effects on geodetic elements are small, which can be ignored for general geodetic cases.

Computation of Earth Rotation Polar Shift Effects on Geodetic Elements and Tidal Effects on EPR

Computation of Rotation Polar Shift or Ocean Pole Tidal Effects at Batch Points with Given Time

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Rotation Polar Shift or Ocean Pole Tidal Effect Time Series at a Ground Point | Computation of Rotation Polar Shift or Ocean Pole Tidal Effects at Batch Points with Given Time | Computation of Rotation Polar Shift or Ocean pole tidal Effects for Satellites | Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Open the location and time file of the computation points | Computation of figure polar shift effects from the measured ΔC_{21} and ΔS_{21} | Algorithm formulas | Save program process as | Forecast of Tide Effect Time Series on Earth Rotation Parameters

Set the file parameters

Column ordinal number of ellipsoidal height in the record: 4

Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

```
>> Prepare to compute ocean pole tidal effects ...
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-09 10:13:26
>> Complete the computation of ocean pole tidal effects!
>> Computation end time: 2026-06-09 10:13:59
>> [Function] According to the location and time specified in the computation point file, this module calculates the Earth rotation polar shift or ocean pole tidal effects on the following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the location and time file of the computation points C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/Postiontm.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/Postmrst.txt.
  ** Appends the selected effect columns to the input record as the output record.
>> Setting parameters have been imported into the program!
>> Prepare to compute Earth's rotation polar shift effects ...
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-09 10:15:06
>> Complete the computation of Earth's rotation polar shift effects!
>> Computation end time: 2026-06-09 10:15:06
```

Columns 2 and 3 of the record are agreed as the longitude and latitude

Select the effects to be computed: Rotaion polar shift effects | Save the results as | Import setting parameters | Start computation

Display of the input-output file↓ | Save data in the text box as

```
 107.230000    29.910000  72.4  56658.000000
201401010000  107.230000  29.910000  72.4  -17.7068  -7.2595  -8.1628  0.3078  -0.1574  0.5865  -0.2979
201401011200  107.230000  29.910000  72.4  -17.7300  -7.2690  -8.1734  0.3082  -0.1574  0.5873  -0.2979
201401020000  107.230000  29.910000  72.4  -17.7532  -7.2785  -8.1841  0.3086  -0.1573  0.5880  -0.2979
201401021200  107.230000  29.910000  72.4  -17.7795  -7.2892  -8.1963  0.3090  -0.1571  0.5889  -0.2975
201401030000  107.230000  29.910000  72.4  -17.8059  -7.3000  -8.2084  0.3095  -0.1570  0.5898  -0.2971
201401031200  107.230000  29.910000  72.4  -17.8251  -7.3078  -8.2173  0.3098  -0.1567  0.5904  -0.2966
201401040000  107.230000  29.910000  72.4  -17.8443  -7.3156  -8.2261  0.3102  -0.1564  0.5910  -0.2960
201401041200  107.230000  29.910000  72.4  -17.8612  -7.3224  -8.2339  0.3105  -0.1562  0.5916  -0.2956
201401050000  107.230000  29.910000  72.4  -17.8781  -7.3293  -8.2417  0.3108  -0.1560  0.5922  -0.2953
201401051200  107.230000  29.910000  72.4  -17.9024  -7.3392  -8.2529  0.3112  -0.1558  0.5930  -0.2949
201401060000  107.230000  29.910000  72.4  -17.9267  -7.3491  -8.2641  0.3116  -0.1556  0.5938  -0.2945
201401061200  107.230000  29.910000  72.4  -17.9613  -7.3632  -8.2801  0.3122  -0.1553  0.5949  -0.2939
201401070000  107.230000  29.910000  72.4  -17.9959  -7.3773  -8.2960  0.3128  -0.1550  0.5961  -0.2933
201401071200  107.230000  29.910000  72.4  -18.0349  -7.3932  -8.3140  0.3135  -0.1547  0.5974  -0.2927
201401080000  107.230000  29.910000  72.4  -18.0739  -7.4091  -8.3320  0.3142  -0.1543  0.5986  -0.2921
201401081200  107.230000  29.910000  72.4  -18.1095  -7.4236  -8.3484  0.3148  -0.1543  0.5998  -0.2920
201401090000  107.230000  29.910000  72.4  -18.1450  -7.4381  -8.3647  0.3154  -0.1542  0.6010  -0.2919
201401091200  107.230000  29.910000  72.4  -18.1892  -7.4562  -8.3851  0.3162  -0.1543  0.6025  -0.2920
```

The Earth's rotation polar shift and figure polar shift are distinct types of geodetic variations. The Earth's figure polar shift represents the normalized angular momentum, which corresponds to the mass load excitation of the Earth's rotation.

The program utilizes the IERS measured or predicted product IERSeopc04.dat (available from the IERS website), which can be updated via the module [System configs for the geophysical models and numerical standards].The program uses the following Love numbers: k_2 = 0.3077 + 0.0036i, h_2 = 0.6207 and l_2 = 0.0836.

Computation of Earth Rotation Polar Shift Effects on Geodetic Elements and Tidal Effects on EPR

Computation of Rotation Polar Shift or Ocean pole tidal Effects for Satellites

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Rotation Polar Shift or Ocean Pole Tidal Effect Time Series at a Ground Point

Computation of Rotation Polar Shift or Ocean Pole Tidal Effects at Batch Points with Given Time

Computation of Rotation Polar Shift or Ocean pole tidal Effects for Satellites

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Open the location and time file of the external points

Computation of figure polar shift effects from the measured ΔC_{21} and ΔS_{21}

Algorithm formulas

Save program process as

Forecast of Tide Effect Time Series on Earth Rotation Parameters

Set the file parameters

Column ordinal number of ellipsoidal height in the record: 4

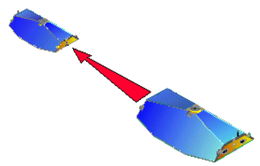
Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [x] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [ ] gravity gradient (ENU, 10μE)

>> [Purpose] Using the IERS Earth Orientation Parameters (EOP) product file IERSeopc04.dat, this module computes the effects of Earth rotation polar shift and ocean pole tides on various geodetic elements – both terrestrial and those external to the solid Earth. Alternatively, it computes the tidal effects on Earth Rotation Parameters (ERP).
>> Select the computation function from the 6 control buttons on the top of the interface...
>> [Function] According to the location and time in the external space point file, this module computes the Earth rotation polar shift or ocean pole tidal effects on the geopotential (0.1 m²/s²), gravity (μGal), or gravity gradient (10μE) external to the solid Earth.
>> Open the location and time file of the external points C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/outerptm.txt.
** Set the file format parameters according to the text box below, and then select the type of the effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/outsatrst.txt.
>> Setting parameters have been imported into the program!
>> Prepare to compute Earth's rotation polar shift effects ...
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-09 11:30:09
>> Complete the computation of Earth's rotation polar shift effects!
>> Computation end time: 2026-06-09 11:30:09



Columns 2 and 3 of the record are agreed as the longitude and latitude

Select the effects to be computed: Rotaion polar shift effects

Save the results as

Import setting parameters

Start computation

GRACE satellite altitude

Display of the input-output file↓

Save data in the text box as

Forcast	121.240000	29.428100	450000.000	58119.000000			
2018010100	121.240000	29.428100	450000.0	-0.8623	-1.3486	1.4417	3.7916
2018010104	121.240000	29.428100	450000.0	-0.8637	-1.3508	1.4403	3.7978
2018010108	121.240000	29.428100	450000.0	-0.8651	-1.3530	1.4389	3.8039
2018010112	121.240000	29.428100	450000.0	-0.8665	-1.3552	1.4374	3.8101
2018010116	121.240000	29.428100	450000.0	-0.8680	-1.3574	1.4360	3.8163
2018010120	121.240000	29.428100	450000.0	-0.8694	-1.3596	1.4346	3.8225
2018010124	121.240000	29.428100	450000.0	-0.8708	-1.3617	1.4331	3.8286
2018010204	121.240000	29.428100	450000.0	-0.8721	-1.3638	1.4319	3.8345
2018010208	121.240000	29.428100	450000.0	-0.8734	-1.3659	1.4307	3.8404
2018010212	121.240000	29.428100	450000.0	-0.8748	-1.3680	1.4294	3.8462
2018010216	121.240000	29.428100	450000.0	-0.8761	-1.3701	1.4282	3.8521
2018010220	121.240000	29.428100	450000.0	-0.8774	-1.3722	1.4269	3.8579
2018010224	121.240000	29.428100	450000.0	-0.8788	-1.3743	1.4257	3.8638
2018010304	121.240000	29.428100	450000.0	-0.8799	-1.3761	1.4249	3.8690
2018010308	121.240000	29.428100	450000.0	-0.8811	-1.3779	1.4241	3.8742
2018010312	121.240000	29.428100	450000.0	-0.8823	-1.3798	1.4233	3.8793
2018010316	121.240000	29.428100	450000.0	-0.8835	-1.3816	1.4225	3.8845
2018010320	121.240000	29.428100	450000.0	-0.8846	-1.3835	1.4217	3.8897
2018010324	121.240000	29.428100	450000.0	-0.8858	-1.3853	1.4209	3.8949

The Earth's rotation polar shift and figure polar shift are distinct types of geodetic variations. The Earth's figure polar shift represents the normalized angular momentum, which corresponds to the mass load excitation of the Earth's rotation.

The program utilizes the IERS measured or predicted product IERSeopc04.dat (available from the IERS website), which can be updated via the module [System configs for the geophysical models and numerical standards].The program uses the following Love numbers: k_2 = 0.3077 + 0.0036i, h_2 = 0.6207 and l_2 = 0.0836.

Computation of Earth Rotation Polar Shift Effects on Geodetic Elements and Tidal Effects on EPR

Computation of Rotation Polar Shift or Ocean pole tidal Effects for Satellites

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Rotation Polar Shift or Ocean Pole Tidal Effect Time Series at a Ground Point

Computation of Rotation Polar Shift or Ocean Pole Tidal Effects at Batch Points with Given Time

Computation of Rotation Polar Shift or Ocean pole tidal Effects for Satellites

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Open the location and time file of the external points

Computation of figure polar shift effects from the measured ΔC_{21} and ΔS_{21}

Algorithm formulas

Save program process as

Forecast of Tide Effect Time Series on Earth Rotation Parameters

Set the file parameters

Column ordinal number of ellipsoidal height in the record: 4

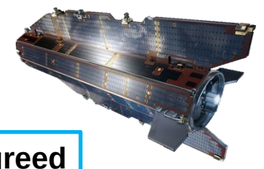
Column ordinal number of time in the record: 1

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [ ] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [x] gravity gradient (ENU, 10μE)

```
control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/outsatrst.txt.
>> Setting parameters have been imported into the program!
>> Prepare to compute Earth's rotation polar shift effects ...
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-09 11:30:09
>> Complete the computation of Earth's rotation polar shift effects!
>> Computation end time: 2026-06-09 11:30:09
>> [Function] According to the location and time in the external space point file, this module computes the Earth rotation polar shift or ocean pole tidal effects on the
geopotential (0.1 m²/s²), gravity (μGal), or gravity gradient (10μE) external to the solid Earth.
>> Open the location and time file of the external points C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/satptm.txt.
  ** Set the file format parameters according to the text box below, and then select the type of the effect to be computed. After giving the output file name, click the
control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/satorbrst.txt.
>> Setting parameters have been imported into the program!
>> Prepare to compute Earth's rotation polar shift effects ...
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-09 11:30:55
>> Complete the computation of Earth's rotation polar shift effects!
>> Computation end time: 2026-06-09 11:30:56
```



Columns 2 and 3 of the record are agreed as the longitude and latitude

Select the effects to be computed: Rotaion polar shift effects

Save the results as

Import setting parameters

Start computation

GOCE satellite altitude

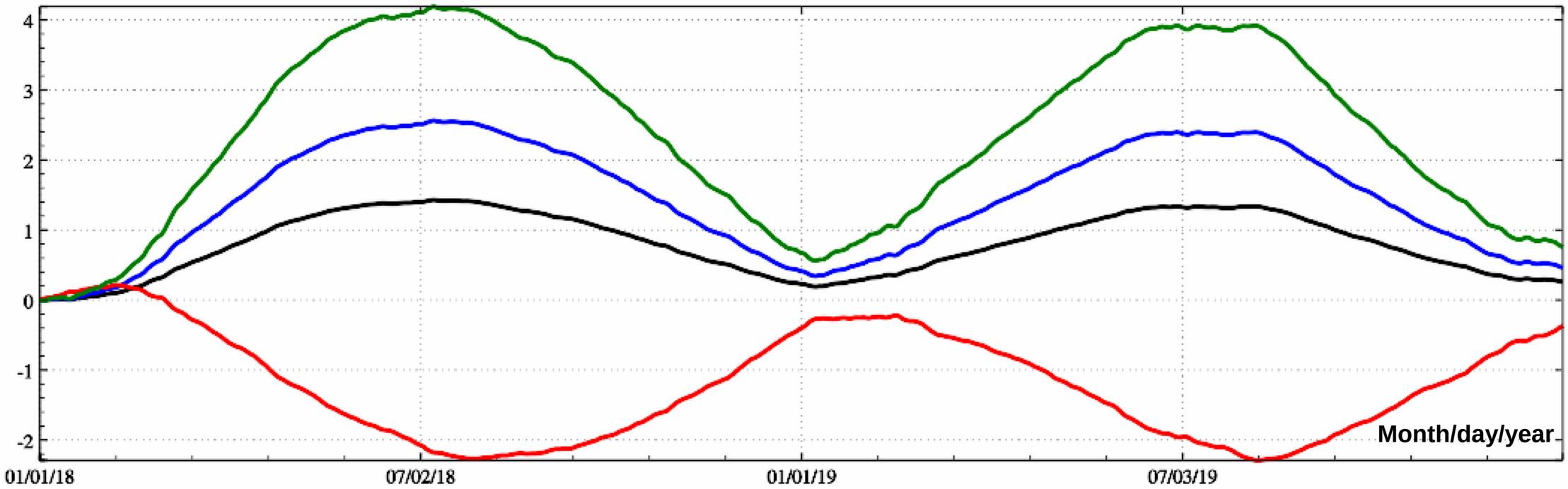
Display of the input-output file↓

Save data in the text box as

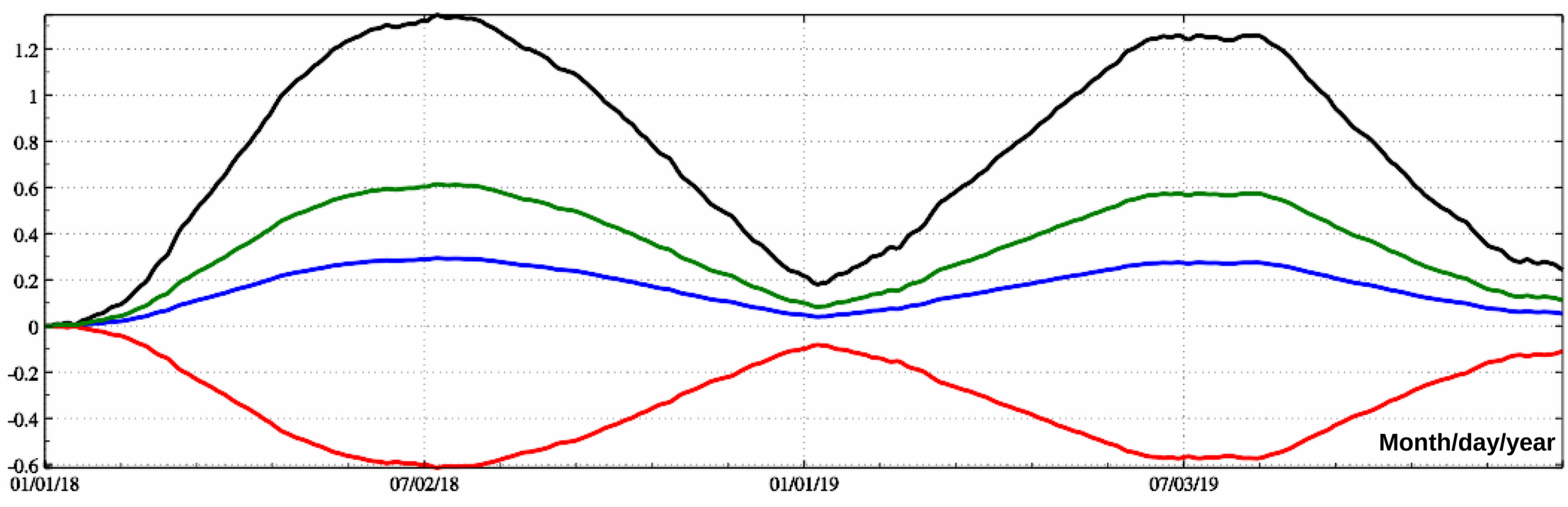
Forcast	121.240000	29.428100	250000.000	58119.000000			
2018010100	121.240000	29.428100	250000.0	-0.9427	0.2824	0.8597	-2.5791
2018010104	121.240000	29.428100	250000.0	-0.9443	0.2829	0.8611	-2.5833
2018010108	121.240000	29.428100	250000.0	-0.9458	0.2834	0.8625	-2.5875
2018010112	121.240000	29.428100	250000.0	-0.9474	0.2838	0.8639	-2.5917
2018010116	121.240000	29.428100	250000.0	-0.9489	0.2843	0.8653	-2.5959
2018010120	121.240000	29.428100	250000.0	-0.9504	0.2847	0.8667	-2.6001
2018010124	121.240000	29.428100	250000.0	-0.9520	0.2852	0.8681	-2.6043
2018010204	121.240000	29.428100	250000.0	-0.9534	0.2856	0.8694	-2.6083
2018010208	121.240000	29.428100	250000.0	-0.9549	0.2861	0.8708	-2.6123
2018010212	121.240000	29.428100	250000.0	-0.9563	0.2865	0.8721	-2.6162
2018010216	121.240000	29.428100	250000.0	-0.9578	0.2869	0.8734	-2.6202
2018010220	121.240000	29.428100	250000.0	-0.9592	0.2874	0.8747	-2.6242
2018010224	121.240000	29.428100	250000.0	-0.9607	0.2878	0.8761	-2.6282
2018010304	121.240000	29.428100	250000.0	-0.9620	0.2882	0.8772	-2.6317
2018010308	121.240000	29.428100	250000.0	-0.9633	0.2886	0.8784	-2.6353
2018010312	121.240000	29.428100	250000.0	-0.9646	0.2890	0.8796	-2.6388
2018010316	121.240000	29.428100	250000.0	-0.9659	0.2894	0.8808	-2.6423
2018010320	121.240000	29.428100	250000.0	-0.9671	0.2897	0.8819	-2.6458
2018010324	121.240000	29.428100	250000.0	-0.9684	0.2901	0.8831	-2.6493

The Earth's rotation polar shift and figure polar shift are distinct types of geodetic variations. The Earth's figure polar shift represents the normalized angular momentum, which corresponds to the mass load excitation of the Earth's rotation.

The program utilizes the IERS measured or predicted product IERSeopc04.dat (available from the IERS website), which can be updated via the module [System configs for the geophysical models and numerical standards].The program uses the following Love numbers: $k_2 = 0.3077 + 0.0036i$, $h_2 = 0.6207$ and $l_2 = 0.0836$.



Earth's rotation polar shift effects at 450km altitude： geopotential (0.1m²/s²), gravity vector (E, N: along the GRACE orbit/SST-II, U, μGal)



Earth's rotation polar shift effects at 250km altitude： geopotential (0.1m²/s²), gravity gradient (E, N: along the GOCE orbit, U, 10μE)

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

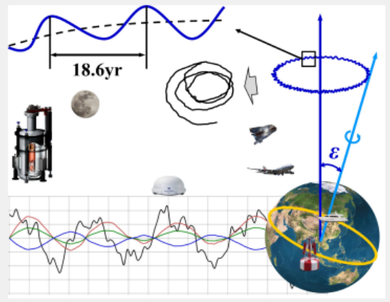
Location of surface point to be forecast

Longitude 121.240000°
Latitude 29.428100°
Ellipsoidal height 17.830m

Time series parameters

Start time 20180101
End time 20200101
Time interval 240.00 min

Calculate and save as



Effects to be plot

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] normal (orthometric) height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)

Rotation polar shift effect time series on various geodetic elements

Forcast	121.240000	29.428100	17.830	58119.000000			
2018010100	0.000000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
2018010104	0.166667	-0.0176	-0.0072	-0.0081	0.0003	0.0002	0.000
2018010108	0.333333	-0.0352	-0.0143	-0.0162	0.0006	0.0004	0.001
2018010112	0.500000	-0.0528	-0.0215	-0.0243	0.0010	0.0006	0.001
2018010116	0.666667	-0.0704	-0.0286	-0.0324	0.0013	0.0008	0.002
2018010120	0.833333	-0.0880	-0.0358	-0.0405	0.0016	0.0010	0.003
2018010124	1.000000	-0.1055	-0.0429	-0.0487	0.0019	0.0012	0.003
2018010204	1.166667	-0.1222	-0.0497	-0.0564	0.0022	0.0014	0.004
2018010208	1.333333	-0.1389	-0.0565	-0.0640	0.0025	0.0016	0.004
2018010212	1.500000	-0.1556	-0.0633	-0.0717	0.0028	0.0018	0.005
2018010216	1.666667	-0.1723	-0.0701	-0.0794	0.0031	0.0020	0.006
2018010220	1.833333	-0.1890	-0.0769	-0.0871	0.0034	0.0021	0.006
2018010224	2.000000	-0.2057	-0.0837	-0.0948	0.0037	0.0023	0.007
2018010304	2.166667	-0.2205	-0.0897	-0.1016	0.0040	0.0024	0.007
2018010308	2.333333	-0.2353	-0.0957	-0.1084	0.0043	0.0026	0.008
2018010312	2.500000	-0.2500	-0.1017	-0.1152	0.0045	0.0027	0.008
2018010316	2.666667	-0.2648	-0.1077	-0.1220	0.0048	0.0028	0.009
2018010320	2.833333	-0.2795	-0.1138	-0.1288	0.0051	0.0029	0.009
2018010324	3.000000	-0.2943	-0.1198	-0.1357	0.0054	0.0030	0.010
2018010404	3.166667	-0.3085	-0.1256	-0.1422	0.0056	0.0031	0.010

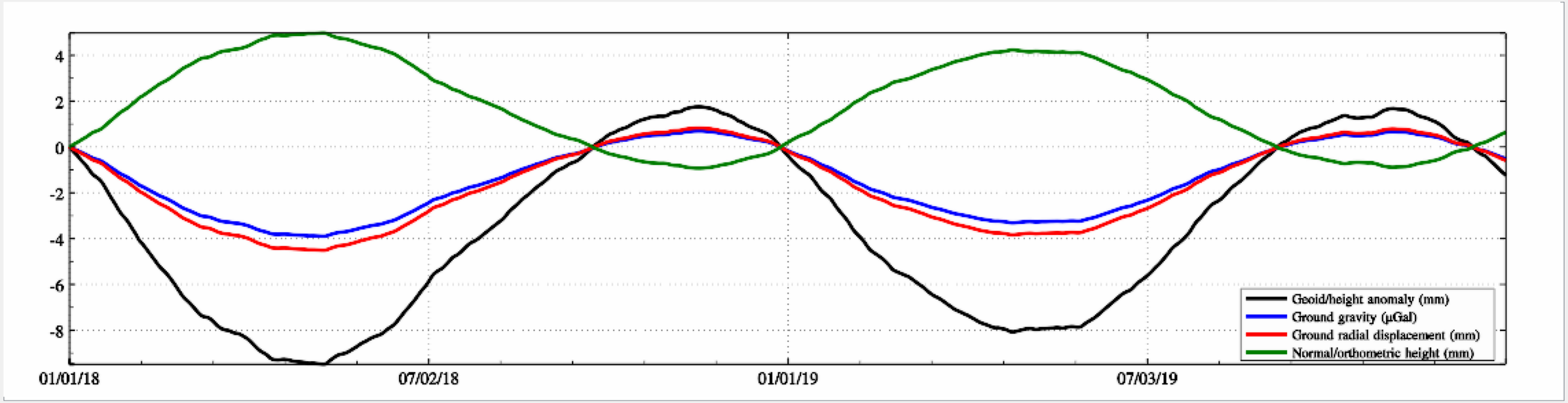
Set line thickness 3

Extract time series to be plot

Plot↓

Rotation polar shift effect curve on surface geodetic elements

Save the current plot as



- Firstly, compute the time series of Earth rotation polar shift effects on various geodetic elements; and Then select the specific effects to be plotted.
- Analyze the amplitude of various rotation polar shift effects, the in-phase or out-of-phase relationships between different types of effects, and the time-varying characteristics of the effect curves.

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Location of surface point to be forecast

Longitude 121.240000°

Latitude 29.428100°

Ellipsoidal height 17.830m

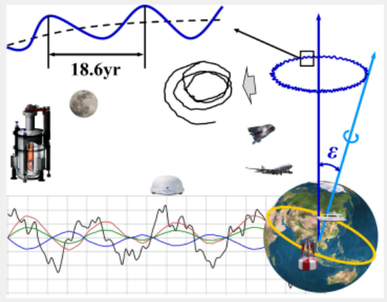
Time series parameters

Start time 20180101

End time 20200101

Time interval 240.00 min

Calculate and save as



Effects to be plot

- [ ] geoid or height anomaly (mm)
- [ ] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [ ] ground radial displacement (mm)
- [ ] normal (orthometric) height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)

Rotation polar shift effect time series on various geodetic elements

Forcast	121.240000	29.428100	17.830	58119.000000			
2018010100	0.000000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
2018010104	0.166667	-0.0176	-0.0072	-0.0081	0.0003	0.0002	0.000
2018010108	0.333333	-0.0352	-0.0143	-0.0162	0.0006	0.0004	0.001
2018010112	0.500000	-0.0528	-0.0215	-0.0243	0.0010	0.0006	0.001
2018010116	0.666667	-0.0704	-0.0286	-0.0324	0.0013	0.0008	0.002
2018010120	0.833333	-0.0880	-0.0358	-0.0405	0.0016	0.0010	0.003
2018010124	1.000000	-0.1055	-0.0429	-0.0487	0.0019	0.0012	0.003
2018010204	1.166667	-0.1222	-0.0497	-0.0564	0.0022	0.0014	0.004
2018010208	1.333333	-0.1389	-0.0565	-0.0640	0.0025	0.0016	0.004
2018010212	1.500000	-0.1556	-0.0633	-0.0717	0.0028	0.0018	0.005
2018010216	1.666667	-0.1723	-0.0701	-0.0794	0.0031	0.0020	0.006
2018010220	1.833333	-0.1890	-0.0769	-0.0871	0.0034	0.0021	0.006
2018010224	2.000000	-0.2057	-0.0837	-0.0948	0.0037	0.0023	0.007
2018010304	2.166667	-0.2205	-0.0897	-0.1016	0.0040	0.0024	0.007
2018010308	2.333333	-0.2353	-0.0957	-0.1084	0.0043	0.0026	0.008
2018010312	2.500000	-0.2500	-0.1017	-0.1152	0.0045	0.0027	0.008
2018010316	2.666667	-0.2648	-0.1077	-0.1220	0.0048	0.0028	0.009
2018010320	2.833333	-0.2795	-0.1138	-0.1288	0.0051	0.0029	0.009
2018010324	3.000000	-0.2943	-0.1198	-0.1357	0.0054	0.0030	0.010
2018010404	3.166667	-0.3085	-0.1256	-0.1422	0.0056	0.0031	0.010

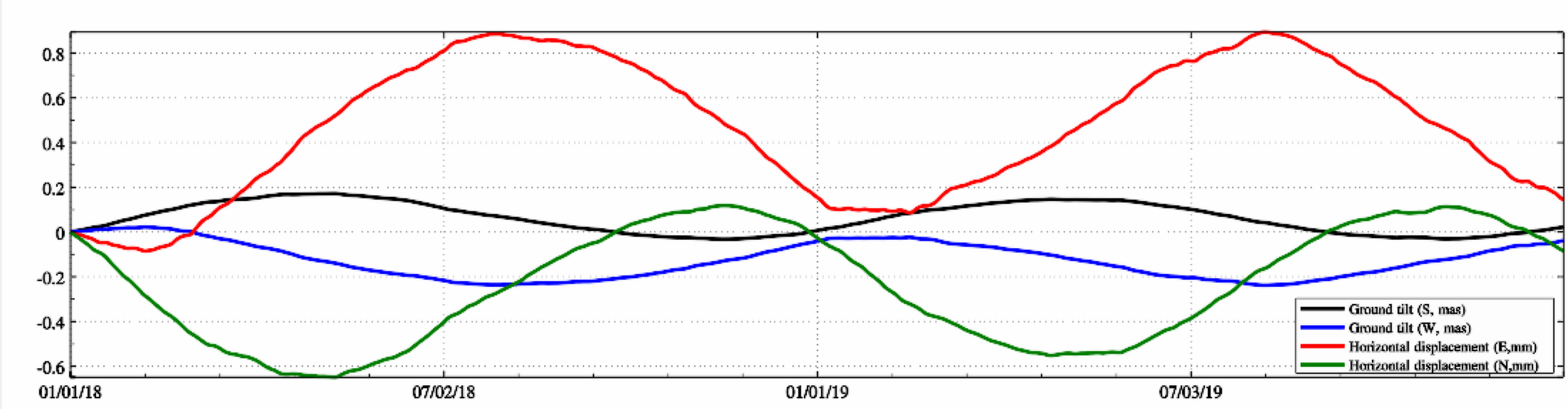
Set line thickness 3

Extract time series to be plot

Plot↓

Rotation polar shift effect curve on surface geodetic elements

Save the current plot as



Firstly, compute the time series of Earth rotation polar shift effects on various geodetic elements; and Then select the specific effects to be plotted.

Analyze the amplitude of various rotation polar shift effects, the in-phase or out-of-phase relationships between different types of effects, and the time-varying characteristics of the effect curves.

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

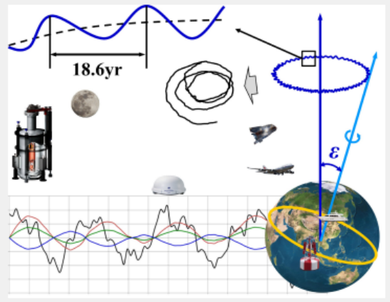
Location of surface point to be forecast

Longitude 121.240000°
Latitude 29.428100°
Ellipsoidal height 17.830m

Time series parameters

Start time 20180101
End time 20200101
Time interval 240.00 min

Calculate and save as



Effects to be plot

- [ ] geoid or height anomaly (mm)
- [ ] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [ ] ground radial displacement (mm)
- [ ] normal (orthometric) height (mm)
- [x] radial gravity gradient (10μE)
- [x] horizontal gravity gradient (NW, 10μE)

Rotation polar shift effect time series on various geodetic elements

Forcast	121.240000	29.428100	17.830	58119.000000			
2018010100	0.000000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000
2018010104	0.166667	-0.0176	-0.0072	-0.0081	0.0003	0.0002	0.000
2018010108	0.333333	-0.0352	-0.0143	-0.0162	0.0006	0.0004	0.001
2018010112	0.500000	-0.0528	-0.0215	-0.0243	0.0010	0.0006	0.001
2018010116	0.666667	-0.0704	-0.0286	-0.0324	0.0013	0.0008	0.002
2018010120	0.833333	-0.0880	-0.0358	-0.0405	0.0016	0.0010	0.003
2018010124	1.000000	-0.1055	-0.0429	-0.0487	0.0019	0.0012	0.003
2018010204	1.166667	-0.1222	-0.0497	-0.0564	0.0022	0.0014	0.004
2018010208	1.333333	-0.1389	-0.0565	-0.0640	0.0025	0.0016	0.004
2018010212	1.500000	-0.1556	-0.0633	-0.0717	0.0028	0.0018	0.005
2018010216	1.666667	-0.1723	-0.0701	-0.0794	0.0031	0.0020	0.006
2018010220	1.833333	-0.1890	-0.0769	-0.0871	0.0034	0.0021	0.006
2018010224	2.000000	-0.2057	-0.0837	-0.0948	0.0037	0.0023	0.007
2018010304	2.166667	-0.2205	-0.0897	-0.1016	0.0040	0.0024	0.007
2018010308	2.333333	-0.2353	-0.0957	-0.1084	0.0043	0.0026	0.008
2018010312	2.500000	-0.2500	-0.1017	-0.1152	0.0045	0.0027	0.008
2018010316	2.666667	-0.2648	-0.1077	-0.1220	0.0048	0.0028	0.009
2018010320	2.833333	-0.2795	-0.1138	-0.1288	0.0051	0.0029	0.009
2018010324	3.000000	-0.2943	-0.1198	-0.1357	0.0054	0.0030	0.010
2018010404	3.166667	-0.3085	-0.1256	-0.1422	0.0056	0.0031	0.010

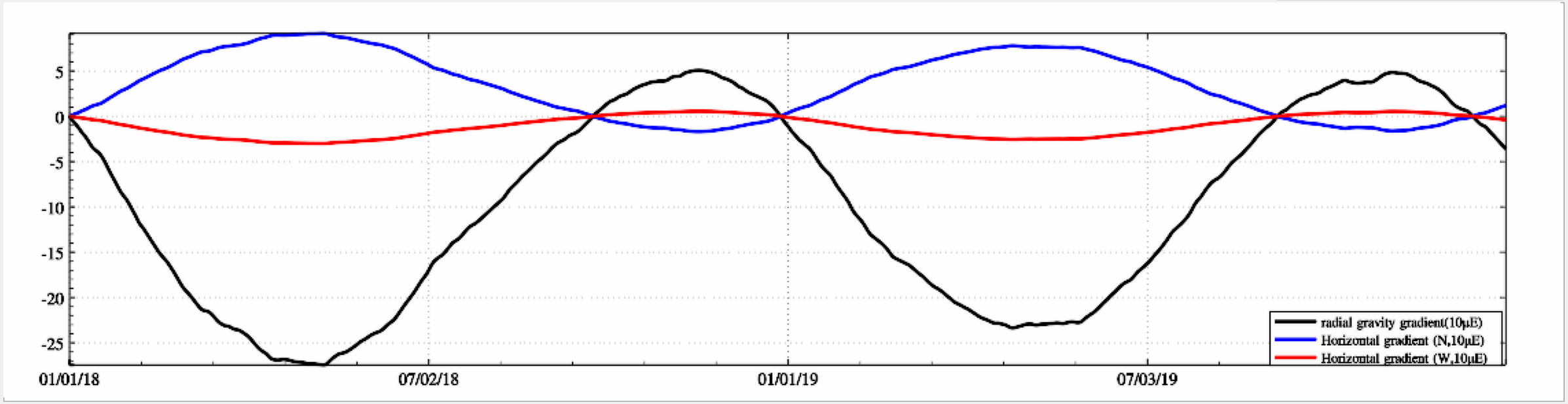
Set line thickness 3

Extract time series to be plot

Plot↓

Rotation polar shift effect curve on surface geodetic elements

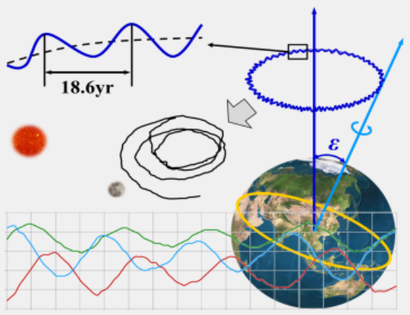
Save the current plot as



Firstly, compute the time series of Earth rotation polar shift effects on various geodetic elements; and Then select the specific effects to be plotted.
Analyze the amplitude of various rotation polar shift effects, the in-phase or out-of-phase relationships between different types of effects, and the time-varying characteristics of the effect curves.

Forecast of Tide Effect Time Series on Earth Rotation Parameters (EPR)

Forecast of Tide Effect Time Series on Earth Rotation Parameters (EPR)



Forecast time series parameters

Start time 20180101

End time 20200101

Time interval 240.00 min

select the type of tidal effect: Long period tidal effect

Calculate and save as

The tidal effect time series on EPR

date	day	m1	m2(uas)	dLOD(us/day)	dUT1(ms)	dX1(mas)	dX2(mas)	dw(e-14rad/s)		
2018010100			0.000000	176.3364	-80.0140	-16.4154	-109.4040	-0.8817	-0.5187	1.3851
2018010104			0.166667	178.0185	-77.2652	-28.0124	-109.4003	-1.0389	-0.7073	2.3639
2018010108			0.333333	180.1408	-74.1469	-37.8732	-109.3948	-1.1843	-0.8874	3.1961
2018010112			0.500000	182.6795	-70.6880	-45.8797	-109.3878	-1.3166	-1.0572	3.8719
2018010116			0.666667	185.6071	-66.9207	-51.9376	-109.3796	-1.4347	-1.2152	4.3832
2018010120			0.833333	188.8922	-62.8798	-55.9783	-109.3706	-1.5373	-1.3598	4.7242
2018010124			1.000000	192.5001	-58.6028	-57.9595	-109.3611	-1.6237	-1.4898	4.8915
2018010204			1.166667	196.3932	-54.1291	-57.8657	-109.3514	-1.6930	-1.6038	4.8836
2018010208			1.333333	200.5310	-49.5001	-55.7085	-109.3419	-1.7446	-1.7007	4.7015
2018010212			1.500000	204.8709	-44.7585	-51.5258	-109.3330	-1.7781	-1.7798	4.3485
2018010216			1.666667	209.3681	-39.9480	-45.3814	-109.3249	-1.7931	-1.8402	3.8300
2018010220			1.833333	213.9766	-35.1127	-37.3636	-109.3179	-1.7897	-1.8813	3.1533
2018010224			2.000000	218.6491	-30.2972	-27.5838	-109.3125	-1.7677	-1.9027	2.3279
2018010304			2.166667	223.3377	-25.5457	-16.1743	-109.3088	-1.7275	-1.9043	1.3650
2018010308			2.333333	227.9944	-20.9017	-3.2863	-109.3072	-1.6695	-1.8860	0.2773
2018010312			2.500000	232.5713	-16.4077	10.9126	-109.3078	-1.5942	-1.8479	-0.9211
2018010316			2.666667	237.0211	-12.1049	26.2411	-109.3109	-1.5022	-1.7903	-2.2148
2018010320			2.833333	241.2979	-8.0327	42.5072	-109.3166	-1.3945	-1.7137	-3.5876
2018010324			3.000000	245.3568	-4.2284	59.5107	-109.3251	-1.2720	-1.6188	-5.0227

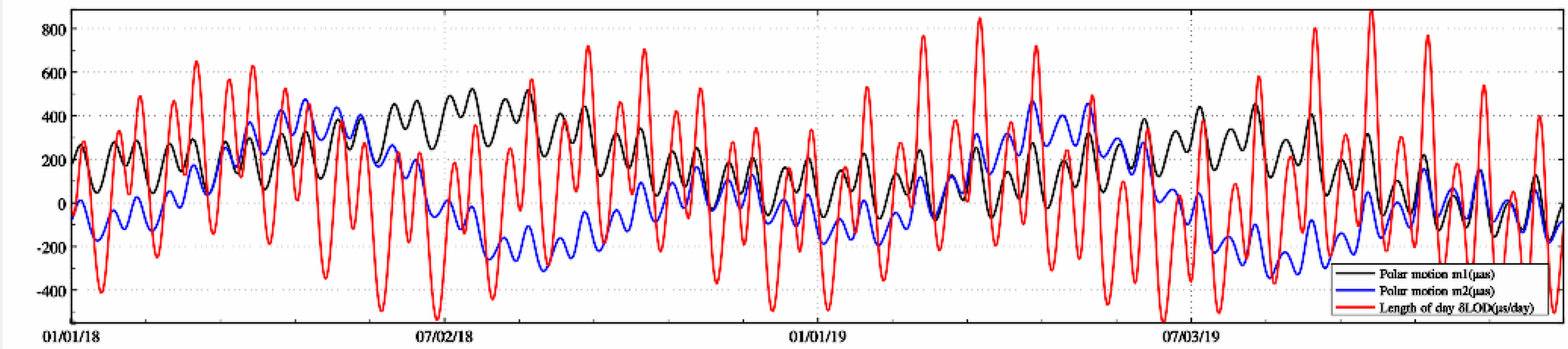
Set line thickness 2

Extract time series to be plot

Plot↓

The tidal effect time series curves on EPR

Save the current plot as

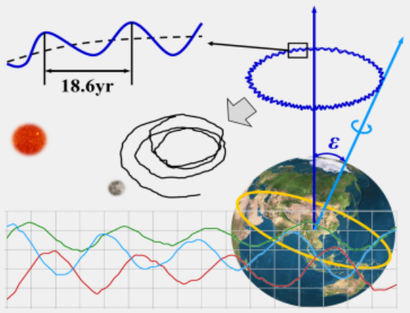


Firstly, set the time series parameters and select the type of tidal effects, then calculate and plot the tidal effect time series on Earth's rotation parameters (EPR).

The calculation function for the zonal tidal effects calls the routine RG_ZONT2.F, while that for the short period tidal effects calls the routine ORTHO_EOP.F. The two routines are available from the IERS Conventions (2010) website.

Forecast of Tide Effect Time Series on Earth Rotation Parameters (EPR)

Forecast of Tide Effect Time Series on Earth Rotation Parameters (EPR)



Forecast time series parameters

Start time 20180301

End time 20180501

Time interval 15.00 min

select the type of tidal effect: Short peroid tidal effect

Calculate and save as

The tidal effect time series on EPR

date	day	m1	m2(uas)	dLOD(us/day)	dUT1(us)	
2018030100		0.000000	-23.1557	75.6890	204.1958	9.9047
201803010015		0.010417	-99.7346	76.5366	190.3564	7.8459
201803010030		0.020833	-174.2225	73.2414	172.3248	5.9535
201803010045		0.031250	-245.5903	65.8178	150.5021	4.2690
2018030101		0.041667	-312.8575	54.3589	125.3551	2.8296
201803010115		0.052083	-375.1085	39.0358	97.4075	1.6672
201803010130		0.062500	-431.5059	20.0944	67.2315	0.8080
201803010145		0.072917	-481.3044	-2.1483	35.4381	0.2721
2018030102		0.083333	-523.8619	-27.3092	2.6667	0.0731
201803010215		0.093750	-558.6499	-54.9455	-30.4258	0.2177
201803010230		0.104167	-585.2612	-84.5620	-63.1759	0.7058
201803010245		0.114583	-603.4166	-115.6193	-94.9249	1.5304
2018030103		0.125000	-612.9687	-147.5426	-125.0301	2.6777
201803010315		0.135417	-613.9044	-179.7317	-152.8755	4.1273
201803010330		0.145833	-606.3445	-211.5707	-177.8827	5.8527
201803010345		0.156250	-590.5415	-242.4387	-199.5204	7.8215
2018030104		0.166667	-566.8756	-271.7203	-217.3138	9.9961
201803010415		0.177083	-535.8479	-298.8160	-230.8529	12.3341
201803010430		0.187500	-498.0722	-323.1527	-239.7994	14.7895

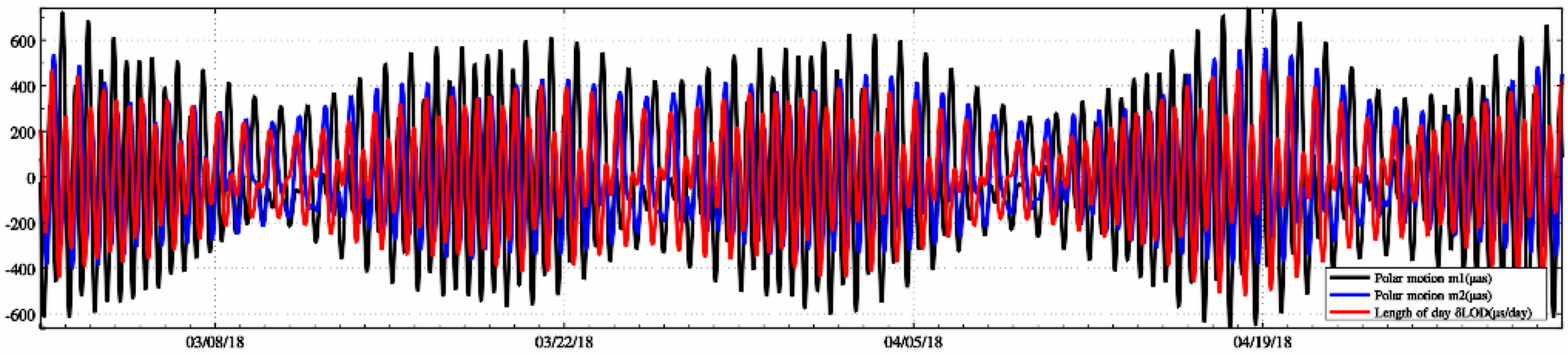
Set line thickness 3

Extract time series to be plot

Plot↓

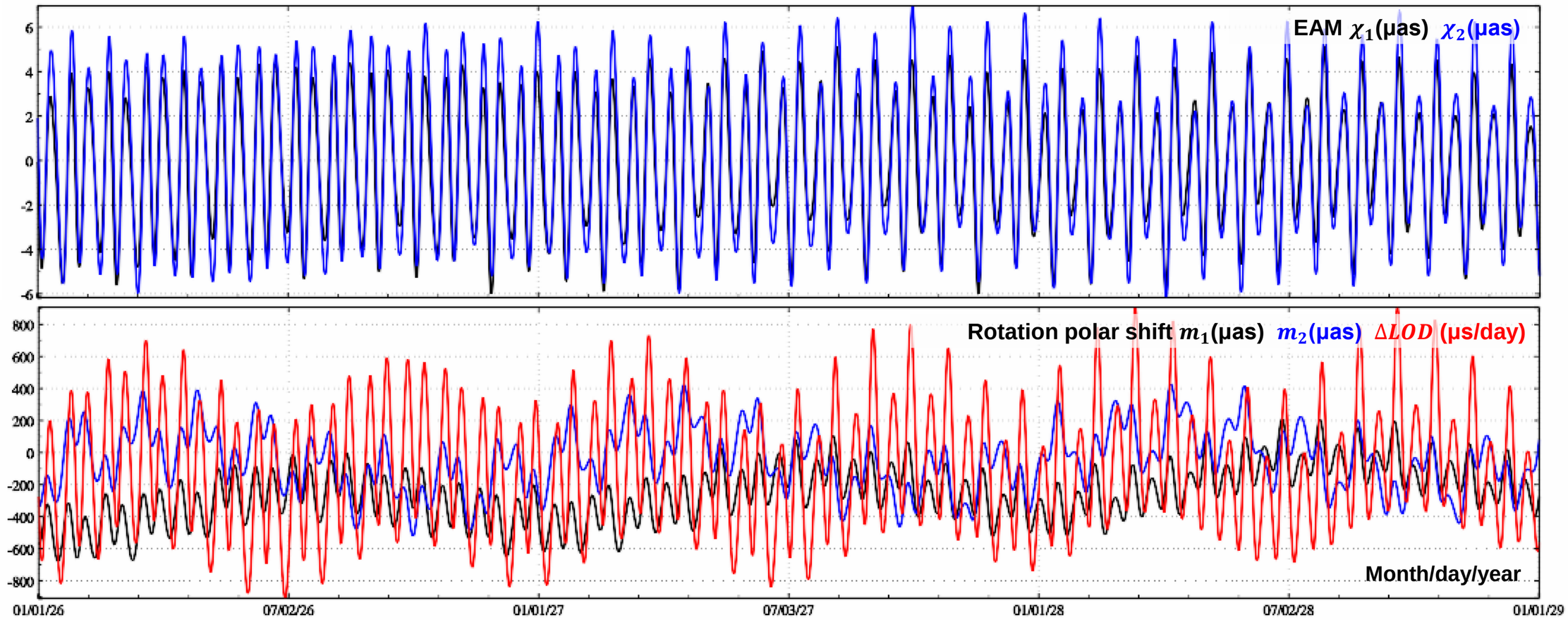
The tidal effect time series curves on EPR

Save the current plot as

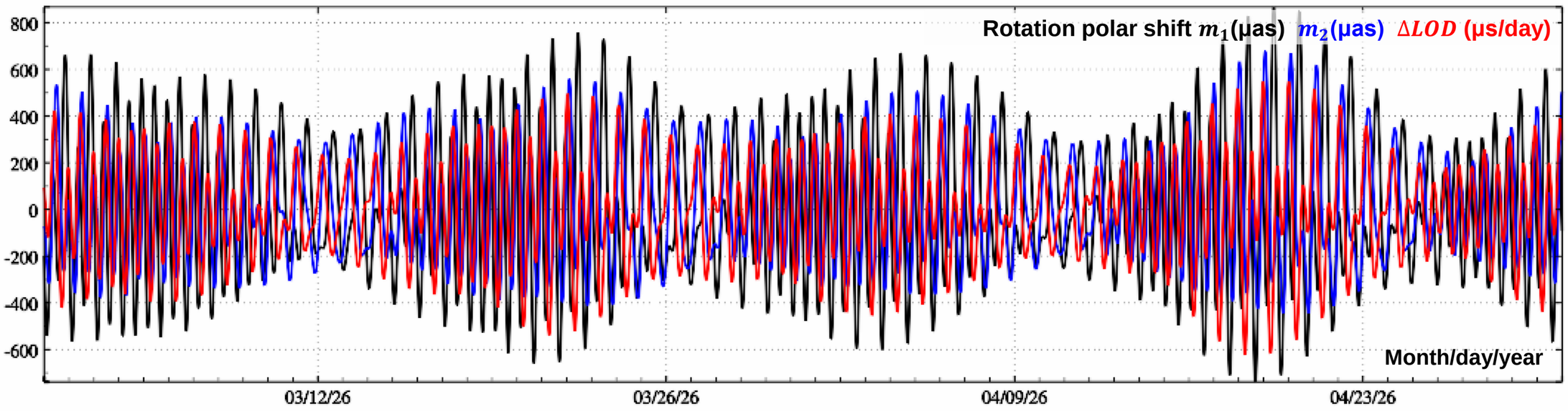


Firstly, set the time series parameters and select the type of tidal effects, then calculate and plot the tidal effect time series on Earth's rotation parameters (EPR).

The calculation function for the zonal tidal effects calls the routine RG_ZONT2.F, while that for the short period tidal effects calls the routine ORTHO_EOP.F. The two routines are available from the IERS Conventions (2010) website.



Long-period tidal effect time series for the Earth's rotation motion



The time series of diurnal and semi-diurnal tidal effects on ERP

Computation of Earth Rotation Polar Shift Effects on Geodetic Elements and Tidal Effects on EPR

Computation of Earth's Figure Polar Shift Effects on Geodetic elements from Measured ΔC_{21} and ΔS_{21}

Computation of Rotation Polar Shift or Ocean Pole Tidal Effect Time Series at a Ground Point

Computation of Rotation Polar Shift or Ocean Pole Tidal Effects at Batch Points with Given Time

Computation of Rotation Polar Shift or Ocean pole tidal Effects for Satellites

Computation of Rotation Polar Shift Effects on Various Surface Geodetic Elements Anywhere

Open the location and time file of the external points

Computation of figure polar shift effects from the measured ΔC_{21} and ΔS_{21}

Algorithm formulas

Save program process as

Forecast of Tide Effect Time Series on Earth Rotation Parameters

```
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-09 10:20:52
>> Complete the computation of Earth's rotation polar shift effects!
>> Computation end time: 2026-06-09 10:20:53
>> [Function] Input a ground variation time series file and the UT/CSR RL-06ΔC₂₁ and ΔS₂₁ monthly time series file C21_S21_RL06.txt (located in the directory C:ETideLoad4.5 _win64eniers; the program ignores the first 15 rows of the file) to compute the Earth's figure polar shift effects on the following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/Tmseries.txt.
 ** Set the file format parameters according to the text box below, and then select the type of the effect to be computed. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Poleshifteffectscalc/fgrpolareffect.txt.
>> Open the UT/CSR RL-06 ΔC₂₁ and ΔS₂₁ monthly time series file C:/ETideLoad4.5_win64en/iers/C21_S21_RL06.txt。
>> Setting parameters have been imported into the program!
>> Prepare to compute Earth's figure polar shift effects...
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-09 10:25:14
>> Complete the computation of Earth's figure polar shift effects!
>> Computation end time: 2026-06-09 10:25:14
```

Save the results as

Import setting parameters

Start computation

Display of the input-output file↓

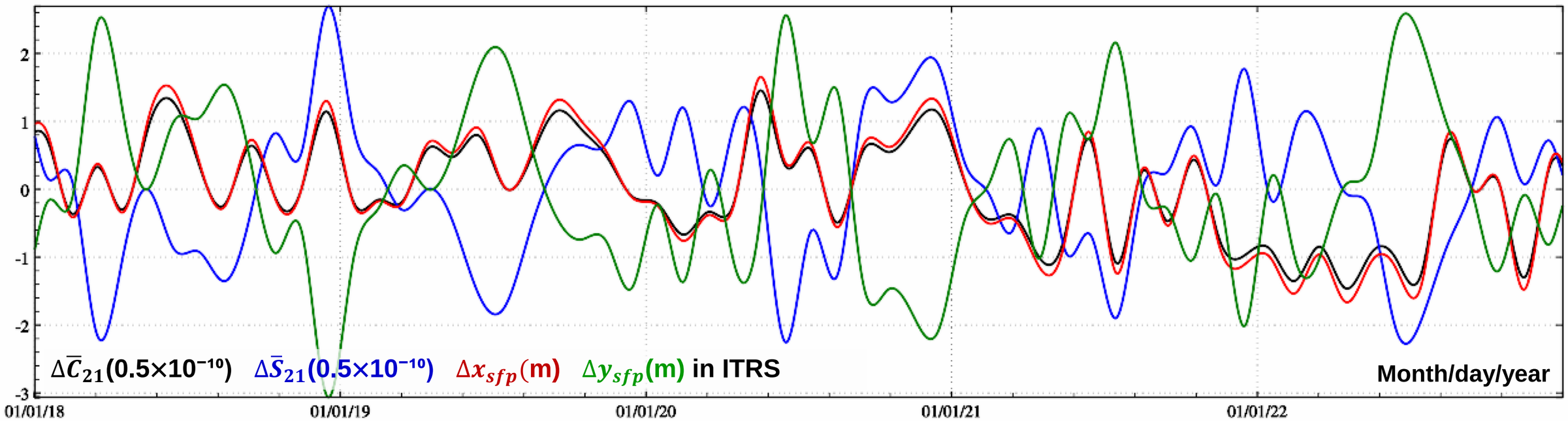
Save data in the text box as

```
ASB   107.23
  201501161200   380.500000     6.497     0.7126     0.4083     0.8102    -0.4642     0.1120     0.0345     0.0515    -0.0015
  201501170000   381.000000     6.833     0.6743     0.3920     0.7667    -0.4457     0.1118     0.0344     0.0514    -0.0014
  201501171200   381.500000     6.454     0.6361     0.3757     0.7233    -0.4272     0.1002     0.0308     0.0461    -0.0013
  201501180000   382.000000     6.789     0.5979     0.3594     0.6799    -0.4087     0.0994     0.0306     0.0457    -0.0012
  201501181200   382.500000     6.409     0.5598     0.3432     0.6365    -0.3902     0.0884     0.0272     0.0407    -0.0011
  201501190000   383.000000     6.742     0.5218     0.3271     0.5933    -0.3719     0.0872     0.0268     0.0401    -0.0011
  201501191200   383.500000     6.360     0.4840     0.3110     0.5503    -0.3536     0.0769     0.0236     0.0354    -0.0010
  201501200000   384.000000     6.692     0.4462     0.2950     0.5074    -0.3354     0.0751     0.0231     0.0345    -0.0010
  201501201200   384.500000     6.309     0.4087     0.2791     0.4647    -0.3174     0.0655     0.0201     0.0301    -0.0009
  201501210000   385.000000     6.640     0.3714     0.2634     0.4222    -0.2995     0.0632     0.0195     0.0291    -0.0009
  201501211200   385.500000     6.256     0.3342     0.2478     0.3800    -0.2817     0.0544     0.0167     0.0250    -0.0008
  201501220000   386.000000     6.585     0.2974     0.2323     0.3381    -0.2641     0.0517     0.0159     0.0238    -0.0009
  201501221200   386.500000     6.199     0.2608     0.2170     0.2965    -0.2468     0.0436     0.0134     0.0200    -0.0008
  201501230000   387.000000     6.527     0.2245     0.2019     0.2552    -0.2296     0.0405     0.0125     0.0186    -0.0009
  201501231200   387.500000     6.140     0.1885     0.1870     0.2143    -0.2127     0.0332     0.0102     0.0153    -0.0008
  201501240000   388.000000     6.467     0.1529     0.1724     0.1738    -0.1960     0.0297     0.0091     0.0137    -0.0009
  201501241200   388.500000     6.078     0.1177     0.1579     0.1338    -0.1795     0.0231     0.0071     0.0106    -0.0008
  201501250000   389.000000     6.404     0.0828     0.1437     0.0942    -0.1634     0.0194     0.0060     0.0089    -0.0009
```

The Earth's rotation polar shift and figure polar shift are distinct types of geodetic variations. The Earth's figure polar shift represents the normalized angular momentum, which corresponds to the mass load excitation of the Earth's rotation.

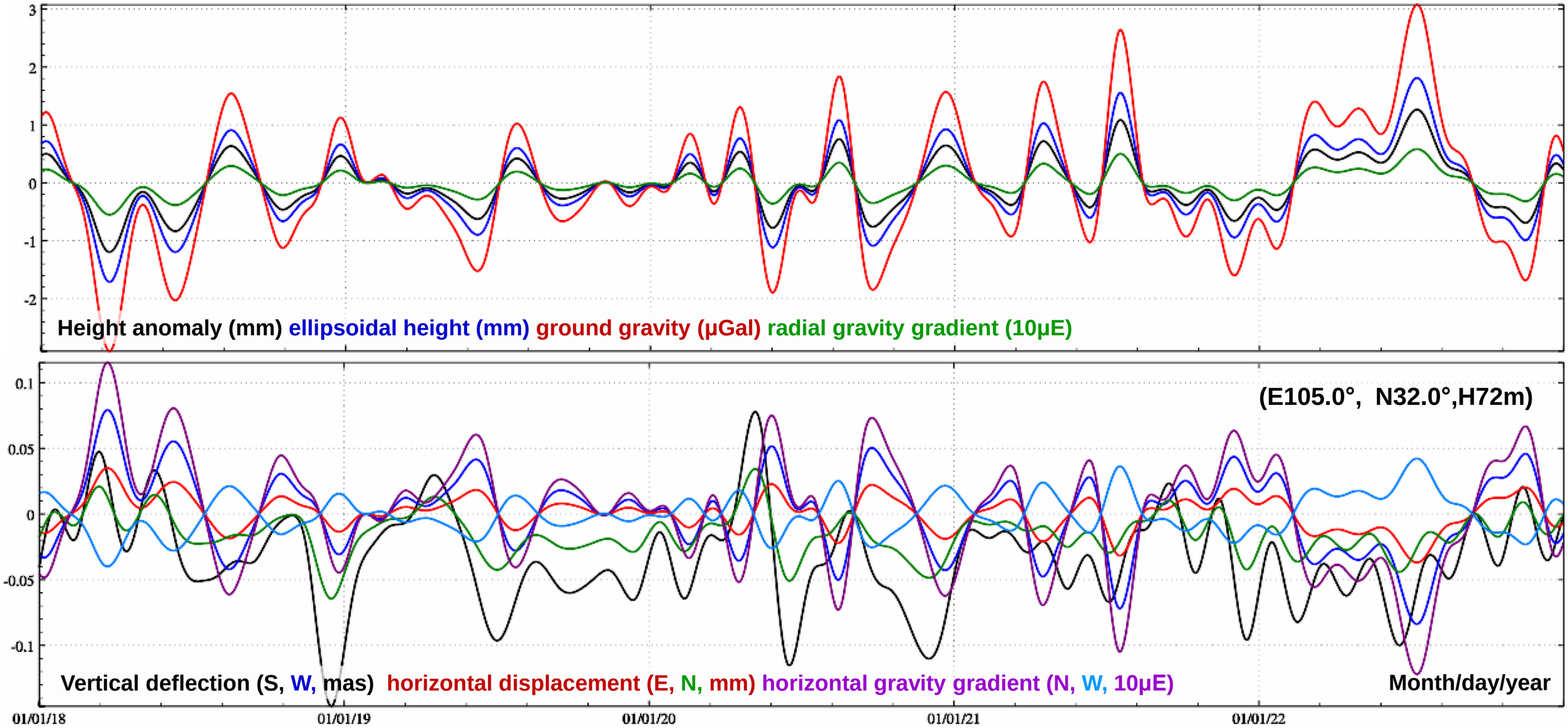
The program utilizes the IERS measured or predicted product IERSeopc04.dat (available from the IERS website), which can be updated via the module [System configs for the geophysical models and numerical standards].The program uses the following Love numbers: k_2 = 0.3077 + 0.0036i, h_2 = 0.6207 and l_2 = 0.0836.

In the Earth-fixed coordinate system with arbitrary positioning and orientation, the mechanical figure polar coordinates of the deforming Earth can be uniquely determined by the degree-2 tesseral harmonic geopotential coefficients $(\overline{C}_{21}, \overline{S}_{21})$. Therefore, the various tidal and non-tidal effects on figure pole can be accurately obtained in geodesy.



Degree-2 tesseral sector harmonic geopotential coefficient and Earth's figure polar shift time series measured by SLR from UT/CSR

Although the Earth's figure polar shift itself can reach the meter level, the resulting effect on geoid is not greater than 2mm. The figure polar shift effects on horizontal geodetic elements such as ground horizontal displacement, vertical deviation or horizontal gravity gradient are small and can be generally ignored.



Earth's figure polar shift effect time series on geodetic elements

The Earth's rotation polar shift and Earth's figure polar shift respectively represent the kinematic state of the whole Earth system and the characteristics of Earth's mechanical shape changing with time, which are both natural objective behaviors. Both of them will cause various geodetic elements in Earth's space to change with time.

Computation of Permanent Tide and Earth's COM Variation Effects on Geodetic Elements

Computation of Permanent Tide Effects on Various Geodetic Elements

Open file | Save as | Impor parameters | Start computation | Save process | Follow example

Computation of Permanent Tide Effects on Various Geodetic Elements | Computation of Earth's COM Variation Effects on Various Geodetic elements | Forecast of Ocean Tidal Load Effects on Earth's Center of Mass | Forecast of Atmosphere Tidal Load Effects on Earth's Center of Mass

Open the discrete geodetic point record file | Save program process as | Variation of the Earth's Center of Mass and its Load Effects

Set the file parameters

The number of rows of the file header: 0

Column ordinal number of ellipsoidal height in the record: 4

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] disturbing gravity gradient (radial, 10μE)
- [x] horizontal gravity gradient (NE, 10μE)

variations on various geodetic elements.
>> Select the computation function from the 4 control buttons on the top of the interface...
>> [Function] Based on the coordinates provided in the point record file, this module computes the permanent tide effects on the following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the discrete geodetic point record file C:/ETideLoad4.5_win64en/examples/Permanentdgeocenter/GNSSIksirent.txt.
** Enter the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Permanentdgeocenter/permrst.txt.
** Behind the input file record, add several columns of the computed results as the output file record.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]
>> Computation start time：2026-06-10 14:13:00

Columns 2 and 3 of the record are agreed as the longitude and latitude of the computation point.

Type of permanent tidal effects: Total effects | Save the results as | Import setting parameters | Start computation

Display of the input-output file↓ | Save the data in the text box as

2	102.546777	24.458002	1659.0410	-0.1046	63.3095	26.1954	12.5279	4.9793	0.0000
4	102.725921	24.460578	2111.3872	-0.0612	63.2920	26.1863	12.5236	4.9790	0.0000
6	102.528697	24.562786	1936.4260	-0.0491	62.7782	25.9745	12.4223	4.9949	0.0000
9	102.832641	24.575505	1977.4949	-0.1223	62.7136	25.9476	12.4094	4.9968	0.0000
10	102.345532	24.668953	1919.7825	-0.0782	62.2412	25.7525	12.3161	5.0111	0.0000
11	102.423972	24.652933	1959.3369	-0.0548	62.3220	25.7857	12.3320	5.0086	0.0000
13	102.631063	24.657055	1906.3415	-0.1185	62.3016	25.7775	12.3281	5.0093	0.0000
14	102.742718	24.652871	1935.7882	-0.0767	62.3226	25.7860	12.3322	5.0086	0.0000
15	102.843573	24.642787	1880.7707	-0.1319	62.3742	25.8076	12.3425	5.0072	0.0000
16	103.137778	24.658224	1838.4387	-0.0730	62.2964	25.7756	12.3272	5.0096	0.0000
17	102.426305	24.743284	1929.0475	-0.0771	61.8640	25.5964	12.2415	5.0223	0.0000
20	102.729945	24.734909	1856.2213	-0.1356	61.9073	25.6146	12.2502	5.0212	0.0000
21	102.840819	24.752018	2117.8582	-0.0459	61.8178	25.5765	12.2320	5.0233	0.0000

The permanent tide is a time-invariant potential, corresponding to the zero-frequency term (ΔC20) in long-period solid Earth tides. Its effects on geometric geodetic elements are longitude-independent. The computation employs the following Love numbers: k_{20}=0.29525, h_{20}=0.6078, and l_{20}=0.0847.

Geodetic measurements can be referenced to different tide systems based on the correction strategy. Mean Tide System: Retains the permanent tide effects; Zero Tide System: Removes the direct loading effects of the permanent tide; and Free Tide System: Removes the sum of direct and indirect (associated) loading effects of the permanent tide.

The variation of the Earth's Center of Mass (COM) is dynamically equivalent to the degree-1 (n=1) term of surface load deformation. It induces time-variable changes in both geometric and physical geodetic elements across the Earth's space. It should not be treated merely as a geometric translation (displacement) of the ground point.

Computation of Permanent Tide and Earth's COM Variation Effects on Geodetic Elements

Computation of Earth's COM Variation Effects on Various Geodetic Elements

Open file | Save as | Impor parameters | Start computation | Save process | Follow example

Computation of Permanent Tide Effects on Various Geodetic Elements

Computation of Earth's COM Variation Effects on Various Geodetic elements

Forecast of Ocean Tidal Load Effects on Earth's Center of Mass

Forecast of Atmosphere Tidal Load Effects on Earth's Center of Mass

Open the location and time file of computation points

Save program process as

Variation of the Earth's Center of Mass and its Load Effects

Set the file parameters

Column ordinal number of time in the record: 1

Column ordinal number of ellipsoidal height in the record: 4

Column ordinal number of starting MJD0 in the header: 5

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] disturbing gravity gradient (radial, 10μE)
- [x] horizontal gravity gradient (NE, 10μE)

```
>> [Function] Utilizing the COM variation time series derived from Satellite Laser Ranging (SLR) measurements, this module computes the effects of Earth's Center of Mass variations on the following geodetic elements: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the location and time file of computation points C:/ETideLoad4.5_win64en/examples/Permanentdgeocenter/Postiontm.txt.
  ** Enter the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Permanentdgeocenter/geocenterst.txt.
  ** Behind the input file record, add 3 columns of Earth's COM variations interpolated and one or several columns of Earth's mass centric variation effects selected as the output file record..
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]
>> Computation start time：2026-06-10 14:14:37
>> Complete the computation of Earth's COM variation effects!
```

Columns 2 and 3 of the record are agreed as the longitude and latitude of the computation point

Save the results as | Import setting parameters | Start computation

Display of the input-output file↓

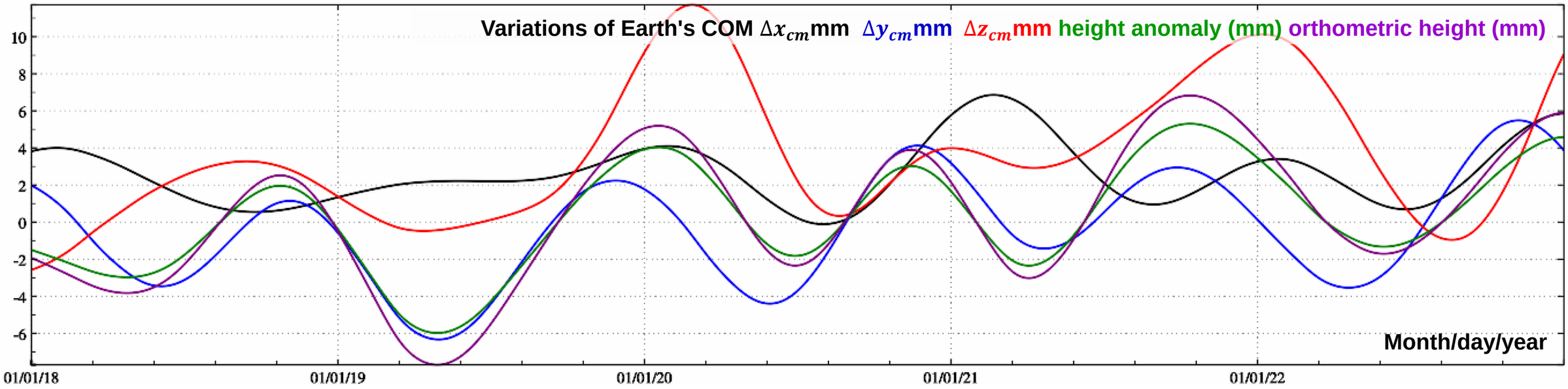
Save the data in the text box as

```
 107.230000    29.910000  72.4  56658.000000
201401010000  107.230000  29.910000  72.4  0.9547  0.1535  4.5946  2.1684  0.2837
201401011200  107.230000  29.910000  72.4  0.9543  0.1384  4.6096  2.1634  0.2831
201401020000  107.230000  29.910000  72.4  0.9539  0.1232  4.6244  2.1582  0.2824
201401021200  107.230000  29.910000  72.4  0.9534  0.1080  4.6389  2.1529  0.2817
201401030000  107.230000  29.910000  72.4  0.9528  0.0927  4.6533  2.1475  0.2810
201401031200  107.230000  29.910000  72.4  0.9522  0.0773  4.6675  2.1419  0.2803
201401040000  107.230000  29.910000  72.4  0.9515  0.0618  4.6814  2.1362  0.2795
201401041200  107.230000  29.910000  72.4  0.9507  0.0463  4.6952  2.1303  0.2788
201401050000  107.230000  29.910000  72.4  0.9499  0.0307  4.7088  2.1243  0.2780
201401051200  107.230000  29.910000  72.4  0.9490  0.0151  4.7222  2.1182  0.2772
201401060000  107.230000  29.910000  72.4  0.9480 -0.0006  4.7354  2.1120  0.2764
201401061200  107.230000  29.910000  72.4  0.9470 -0.0164  4.7484  2.1056  0.2755
```

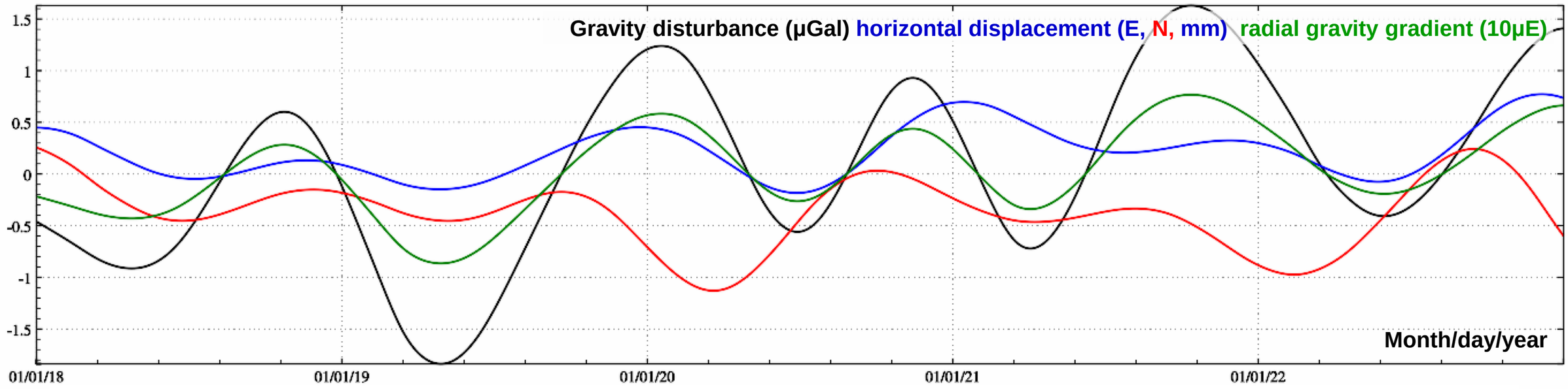
The permanent tide is a time-invariant potential, corresponding to the zero-frequency term (ΔC20) in long-period solid Earth tides. Its effects on geometric geodetic elements are longitude-independent. The computation employs the following Love numbers: k_{20}=0.29525, h_{20}=0.6078, and l_{20}=0.0847.

Geodetic measurements can be referenced to different tide systems based on the correction strategy. Mean Tide System: Retains the permanent tide effects; Zero Tide System: Removes the direct loading effects of the permanent tide; and Free Tide System: Removes the sum of direct and indirect (associated) loading effects of the permanent tide.

The variation of the Earth's Center of Mass (COM) is dynamically equivalent to the degree-1 (n=1) term of surface load deformation. It induces time-variable changes in both geometric and physical geodetic elements across the Earth's space. It should not be treated merely as a geometric translation (displacement) of the ground point.



Variations of Earth's COM and their effects on the height anomaly geoid and orthometric height



Variation effect time series of Earth's COM on various geodetic variations

The variation of the Earth's Center of Mass (COM) is dynamically equivalent to the degree-1 (n=1) term of surface load deformation. It induces time-variable changes in both geometric and physical geodetic elements across the Earth's space. It should not be treated merely as a geometric translation (displacement) of the ground point.

Computation of Permanent Tide and Earth's COM Variation Effects on Geodetic Elements

Forecast of Ocean Tidal Load Effects on Earth's Center of Mass

Open file | Save as | Impor parameters | Start computation | Save process | Follow example

Computation of Permanent Tide Effects on Various Geodetic Elements | Computation of Earth's COM Variation Effects on Various Geodetic elements | Forecast of Ocean Tidal Load Effects on Earth's Center of Mass | Forecast of Atmosphere Tidal Load Effects on Earth's Center of Mass

Forecast time series parameters

Start time	20160701
End time	20160715
Time interval	60.00 min

Save program process as

Variation of the Earth's Center of Mass and its Load Effects

```
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 14:17:04
>> Complete the computation of Earth's COM variation effects!
>> Computation end time: 2026-06-10 14:17:04
>> [Function] Generates a time series forecast of ocean tidal load effects on the Earth's Center of Mass (ΔXcm, ΔYcm, ΔZcm, unit: mm) based on the degree-1 atmosphere tidal load spherical harmonic coefficient file OtideOne.dat, which can be output by the function [Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants].
>> Save the results as C:/ETideLoad4.5_win64en/examples/Permanentdgeocenter/otdgeocntrst.txt.
  ** The output file record includes the sampling epoch time, 3 columns of the ocean tidal load effects on Earth's COM (Xcm, Ycm, Zcm, in unit mm).
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 14:17:30
>> Complete the computation of ocean tidal load effects on Earth's COM!
>> Computation end time: 2026-06-10 14:17:30
```

Save the results as | Import setting parameters | Start computation

Display of the input-output file↓

Save the data in the text box as

Otidegeocenter	0.00	0.00	0.00	57570.000000	
2016070100	0.000000	1.8250	4.1299	-1.8888	
2016070101	0.041667	0.5041	4.1937	-3.5160	
2016070102	0.083333	-0.8168	3.6263	-5.0214	
2016070103	0.125000	-1.9306	2.4942	-6.0838	
2016070104	0.166667	-2.6848	0.9966	-6.4140	
2016070105	0.208333	-3.0220	-0.5533	-5.9776	
2016070106	0.250000	-2.9774	-1.8460	-4.9099	
2016070107	0.291667	-2.6381	-2.7016	-3.3494	
2016070108	0.333333	-2.1152	-3.0653	-1.4945	
2016070109	0.375000	-1.5704	-2.9291	0.3139	
2016070110	0.416667	-1.2001	-2.3514	1.7377	
2016070111	0.458333	-1.1110	-1.5264	2.6398	
2016070112	0.500000	-1.2582	-0.7283	3.0545	

The permanent tide is a time-invariant potential, corresponding to the zero-frequency term (ΔC20) in long-period solid Earth tides. Its effects on geometric geodetic elements are longitude-independent. The computation employs the following Love numbers: k_{20}=0.29525, h_{20}=0.6078, and l_{20}=0.0847.

Geodetic measurements can be referenced to different tide systems based on the correction strategy. Mean Tide System: Retains the permanent tide effects; Zero Tide System: Removes the direct loading effects of the permanent tide; and Free Tide System: Removes the sum of direct and indirect (associated) loading effects of the permanent tide.

The variation of the Earth's Center of Mass (COM) is dynamically equivalent to the degree-1 (n=1) term of surface load deformation. It induces time-variable changes in both geometric and physical geodetic elements across the Earth's space. It should not be treated merely as a geometric translation (displacement) of the ground point.

Computation of Permanent Tide and Earth's COM Variation Effects on Geodetic Elements

Forecast of Atmosphere Tidal Load Effects on Earth's Center of Mass

Open file | Save as | Impor parameters | Start computation | Save process | Follow example

Computation of Permanent Tide Effects on Various Geodetic Elements | Computation of Earth's COM Variation Effects on Various Geodetic elements | Forecast of Ocean Tidal Load Effects on Earth's Center of Mass | Forecast of Atmosphere Tidal Load Effects on Earth's Center of Mass

Forecast time series parameters

Start time	20160701
End time	20160715
Time interval	60.00 min

Save program process as

Variation of the Earth's Center of Mass and its Load Effects

```
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 14:17:30
>> Complete the computation of ocean tidal load effects on Earth's COM!
>> Computation end time: 2026-06-10 14:17:30
>> [Function] Generates a time series forecast of atmosphere tidal load effects on the Earth's Center of Mass (ΔXcm, ΔYcm, ΔZcm, unit: mm) based on the degree-1 atmosphere tidal load spherical harmonic coefficient file AtideOne.dat, which can be output by the function  [Spherical Harmonic Analysis on Surface Atmosphere Tidal Harmonic Constants].
>> Save the results as C:/ETideLoad4.5_win64en/examples/Permanentdgeocenter/atdgeocntrst.txt.
  ** The output file record includes the sampling epoch time, 3 columns of the atmosphere tidal load effects on Earth's COM (Xcm, Ycm, Zcm, in unit mm).
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 14:18:06
>> Complete the computation of atmosphere tidal load effects on Earth's COM!
>> Computation end time: 2026-06-10 14:18:06
```

Save the results as | Import setting parameters | Start computation

Display of the input-output file↓

Save the data in the text box as

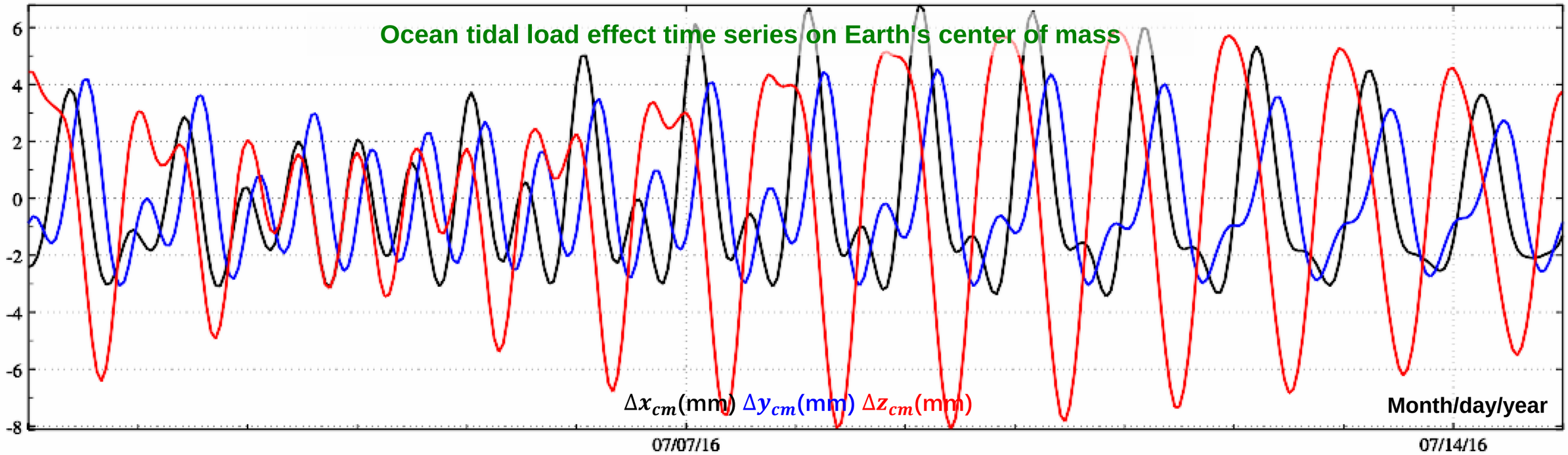
```
 Atidegeocenter     0.00     0.00     0.00    57570.000000
2016070100          0.000000       1.5728       2.0072       3.0910
2016070101          0.041667       1.5070       1.7158       3.0921
2016070102          0.083333       1.3772       1.4450       3.0968
2016070103          0.125000       1.1846       1.2199       3.1016
2016070104          0.166667       0.9395       1.0633       3.1041
2016070105          0.208333       0.6616       0.9921       3.1033
2016070106          0.250000       0.3779       1.0148       3.1005
2016070107          0.291667       0.1185       1.1292       3.0981
2016070108          0.333333      -0.0884       1.3234       3.0993
2016070109          0.375000      -0.2208       1.5775       3.1070
2016070110          0.416667      -0.2670       1.8664       3.1226
2016070111          0.458333      -0.2270       2.1642       3.1455
2016070112          0.500000      -0.1114       2.4469       3.1729
```

The permanent tide is a time-invariant potential, corresponding to the zero-frequency term (ΔC20) in long-period solid Earth tides. Its effects on geometric geodetic elements are longitude-independent. The computation employs the following Love numbers: k_{20}=0.29525, h_{20}=0.6078, and l_{20}=0.0847.

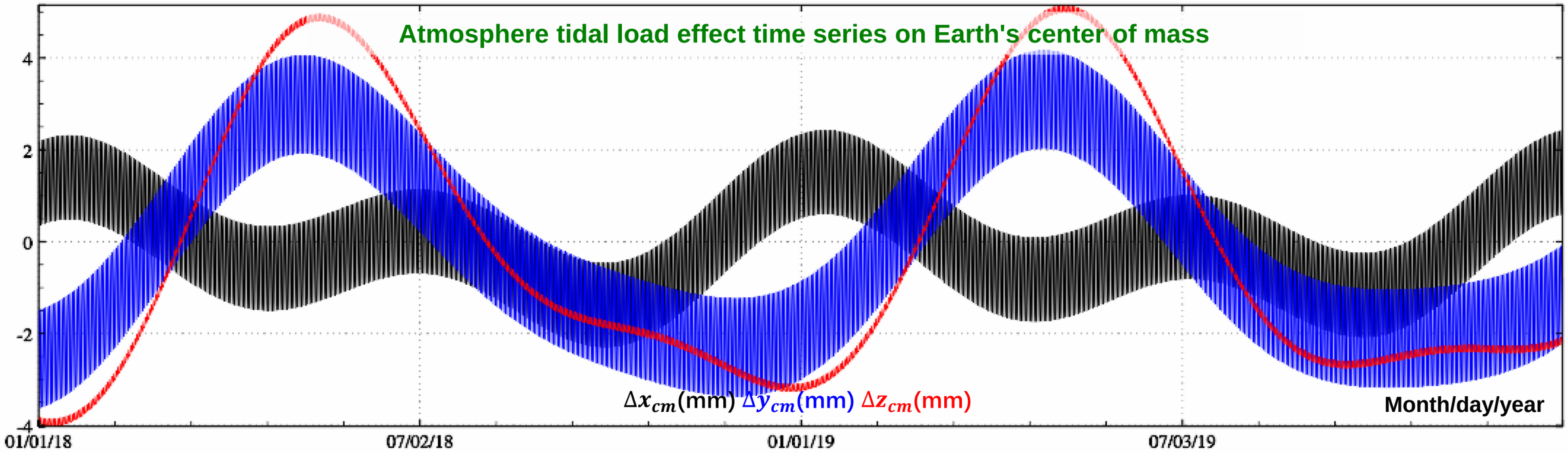
Geodetic measurements can be referenced to different tide systems based on the correction strategy. Mean Tide System: Retains the permanent tide effects; Zero Tide System: Removes the direct loading effects of the permanent tide; and Free Tide System: Removes the sum of direct and indirect (associated) loading effects of the permanent tide.

The variation of the Earth's Center of Mass (COM) is dynamically equivalent to the degree-1 (n=1) term of surface load deformation. It induces time-variable changes in both geometric and physical geodetic elements across the Earth's space. It should not be treated merely as a geometric translation (displacement) of the ground point.

Ocean tidal load effect time series on Earth's center of mass



Atmosphere tidal load effect time series on Earth's center of mass



The Earth's tidal force from the celestial body at the Earth's center of mass is always equal to zero, so geodesy does not specifically study the solid tidal effect on the Earth's center of mass. Ocean tides and surface atmosphere tides lead to the redistribution of surface mass, causing periodic variations of Earth's center of mass.

Computation of Solid Earth Tide and Tidal Load Effects for Geodetic Networks

Computation of Solid Earth Tidal Effects for Geodetic Networks

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Solid Earth Tidal Effects | Computation of Ocean Tidal Load Effects | Computation of Atmosphere Tidal Load Effects

Select the type of control network: GNSS baseline network

Open Geodetic Network Observation Record File

Set the file parameters

Column ordinal number of starting MJD0 in the header: 3

Column ordinal number of time in the record: 10

>> Program Process ** Operation Prompts

Save program process as

```
>> [Function] To compute the effects of Solid Earth Tides, Ocean Tidal Load, and Surface Atmosphere Tidal Load on GNSS baselines or leveling height differences, based on the observation times and locations in the input geodetic network file.
>> Select the type of the control network firstly, and select the computation function from the 3 control buttons on the top of the interface...
>> Compute the solid Earth tidal effects (mm)...
>> Compute the tidal effects on 3-D GNSS baseline vectors...
>> Open Geodetic Network Observation Record File C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/GNSSbaseline_levelingroutine.txt.
  ** Enter the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/GNSSbaselsolidtide.txt.
  ** Behind the input file record, add the tidal effects as the output file record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:27:50
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:27:51
```

Display of the input-output file↓

Save the results as | Import setting parameters | Start computation

```
 9   4   57022
CANN_DONT  120.424700  27.522580  21.8  121.150270  27.834630  28.6   79493.9  1.5  2016072412  1.2202    0.9021    0.1274   -2.7422
CANN_FDIQ  120.424700  27.522580  21.8  120.207320  27.335310  32.5   29876.4  1.5  2016072412  1.2721   -0.2673   -0.0267    1.0012
CANN_JHYW  120.424700  27.522580  21.8  120.078380  29.272690  32.5  196899.1  1.5  2016072412  1.3927   -0.4186   -0.2735   -1.9788
CANN_JINH  120.424700  27.522580  21.8  119.642580  29.217830  32.5  202930.8  1.5  2016072412  1.6668   -0.9439   -0.3836   -0.5259
CANN_JINX  120.424700  27.522580  21.8  119.379220  29.070950  32.5  199897.1  1.5  2016072412  1.3931   -1.0[illegible]   -0.[illegible]74
CANN_JNJZ  120.424700  27.522580  21.8  119.637540  27.976350  32.5   92473.9  1.5  2016072412  1.2143   -0.9635    0.2428    1.6815
CANN_JSAN  120.424700  27.522580  21.8  118.608560  28.727950  32.5  222881.6  2.5  2016072512  1.2766   -0.9303   -1.0175    2.8778
CANN_LHAI  120.424700  27.522580  21.8  121.109470  28.305910  32.5  170695.1  2.5  2016072512  1.3588    0.7499    0.3[illegible]   -6.9378
CANN_LISH  120.424700  27.522580  21.8  119.028480  28.[illegible]  32.5  114864.2  2.5  2016072512  1.6040   -0.1649    0.3840   -1.1000
CANN_LONQ  120.424700  27.522580  21.8  119.133090  28.080720  32.5  141509.7  2.5  2016072512  1.3241   -0.7295   -0.0605    2.9925
CANN_LUOY  120.424700  27.522580  21.8  119.705090  27.552460  32.5   71164.3  2.5  2016072512  1.1005   -0.4621   -0.3085    2.5352
CANN_PANA  120.424700  27.522580  21.8  120.436660  29.054190  32.5  169743.8  2.5  2016072512  1.8985    0.2692   -0.2575   -4.7458
CANN_PCHQ  120.424700  27.522580  21.8  118.542210  27.923210  32.5  190867.4  2.5  2016072512  1.4645   -1.1110   -0.8864    5.6815
CANN_PCJM  120.424700  27.522580  21.8  118.445440  28.167970  32.5  207660.5  2.5  2016072512  1.7441   -1.1253   -0.9801    5.2647
CANN_QINT  120.424700  27.522580  21.8  120.289980  28.139380  32.5   69628.7  2.5  2016072512  1.1991    0.0136   -0.1716   -1.4049
```

Longitude, latitude, and ellipsoidal height of Starting-ending stations

The solid tidal effects on GNSS baseline displacement (ENU, mm)

Tidal effects must be computed at the precise actual observation time. For leveling height differences, the observation duration should not exceed 2 hours to ensure valid computation of semi-diurnal tidal constituents.

Height Definitions: Solid Earth Tide: Use Ellipsoidal Height; Ocean Tidal Load: Use Normal Height or Orthometric Height; and Atmosphere Tidal Load: Use height relative to the surface (typically set to zero in the program).

Computation of Solid Earth Tide and Tidal Load Effects for Geodetic Networks

Computation of Solid Earth Tidal Effects for Geodetic Networks

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Solid Earth Tidal Effects | Computation of Ocean Tidal Load Effects | Computation of Atmosphere Tidal Load Effects

Select the type of control network: Levelling control network

Open Geodetic Network Observation Record File

Set the file parameters

Column ordinal number of starting MJD0 in the header: 3

Column ordinal number of time in the record: 10

>> Program Process ** Operation Prompts

Save program process as

```
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:27:50
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:27:51
>> Compute the solid Earth tidal effects (mm)...
>> Compute the tidal effects on levelling height differences...
>> Open Geodetic Network Observation Record File C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/
GNSSbaseline_levelingroutine.txt.
  ** Enter the file format parameters according to the text box below. After giving the output file name, click the control button [Import
setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/levelroutinesolidtide.txt.
  ** Behind the input file record, add the tidal effects as the output file record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:29:23
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:29:23
```

Display of the input-output file↓ | Save the results as | Import setting parameters | Start computation

```
 9  4  57022
CANN_DONT 120.424700 27.522580 21.8 121.150270 27.834630 28.6  79493.9 1.5 2016072412 1.2202   3.2574
CANN_FDIQ 120.424700 27.522580 21.8 120.207320 27.335310 32.5  29876.4 1.5 2016072412 1.2721  -1.1628
CANN_JHYW 120.424700 27.522580 21.8 120.078380 29.272690 32.5 196899.1 1.5 2016072412 1.3927   1.8728
CANN_JINH 120.424700 27.522580 21.8 119.642580 29.217830 32.5 202930.8 1.5 2016072412 1.6668   0.1125
CANN_JINX 120.424700 27.522580 21.8 119.379220 29.070950 32.5 199897.1 1.5 2016072412 1.3931  -1.1770
CANN_JNJZ 120.424700 27.522580 21.8 119.637540 27.876350 32.5  92473.9 1.5 2016072412 1.2143  -2.1936
CANN_JSAN 120.424700 27.522580 21.8 118.608560 28.727950 32.5 222881.6 2.5 2016072512 1.2766  -3.8987
CANN_LHAI 120.424700 27.522580 21.8 119.189490 28.655610 32.5 170695.1 2.5 2016072512 1.3588   7.8461
CANN_LISH 120.424700 27.522580 21.8 119.929490 28.461260 32.5 114864.2 2.5 2016072512 1.6040   0.9773
CANN_LONQ 120.424700 27.522580 21.8 119.133090 28.080720 32.5 141509.7 2.5 2016072512 1.3241  -3.7956
CANN_LUOY 120.424700 27.522580 21.8 119.705090 27.552460 32.5  71164.3 2.5 2016072512 1.1005  -3.0525
CANN_PANA 120.424700 27.522580 21.8 120.436660 29.054190 32.5 169743.8 2.5 2016072512 1.8985   5.1476
CANN_PCHQ 120.424700 27.522580 21.8 118.542210 27.923210 32.5 190867.4 2.5 2016072512 1.4645  -6.9589
CANN_PCJM 120.424700 27.522580 21.8 118.445440 28.167970 32.5 207660.5 2.5 2016072512 1.7441  -6.5510
CANN_QINT 120.424700 27.522580 21.8 120.289980 28.139380 32.5  69628.7 2.5 2016072512 1.1991   1.4622
```

Longitude, latitude, and ellipsoidal height of Starting-ending stations

The solid tidal effects on height difference of the levelling routine

Tidal effects must be computed at the precise actual observation time. For leveling height differences, the observation duration should not exceed 2 hours to ensure valid computation of semi-diurnal tidal constituents.

Height Definitions: Solid Earth Tide: Use Ellipsoidal Height; Ocean Tidal Load: Use Normal Height or Orthometric Height; and Atmosphere Tidal Load: Use height relative to the surface (typically set to zero in the program).

Computation of Solid Earth Tide and Tidal Load Effects for Geodetic Networks

Computation of Ocean Tidal Load Effects for Geodetic Networks

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Solid Earth Tidal Effects | Computation of Ocean Tidal Load Effects | Computation of Atmosphere Tidal Load Effects

Select the type of control network: GNSS baseline network

Open Geodetic Network Observation Record File

Set the file parameters

Column ordinal number of starting MJD0 in the header: 3

Column ordinal number of time in the record: 10

Maximum truncated degree of the coefficients model: 120

>> Program Process ** Operation Prompts

Save program process as

```
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:31:37
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:31:37
>> Compute the ocean tidal load effects (mm)....
>> Compute the tidal effects on 3-D GNSS baseline vectors...
>> Open Geodetic Network Observation Record File C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/
GNSSbaseline_levelingroutine.txt.
 ** Enter the file format parameters according to the text box below. After giving the output file name, click the control button [Import
setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/GNSSbaselotideload.txt.
 ** Behind the input file record, add the tidal effects as the output file record.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:32:02
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:33:06
```

Display of the input-output file↓

Save the results as | Import setting parameters | Start computation

```
 9   4   57022
CANN_DONT  120.424700  27.522580  21.8  121.150270  27.834630  28.6   79493.9  1.5  2016072412  1.2202    2.9653   -1.5855   -5.9971
CANN_FDIQ  120.424700  27.522580  21.8  120.207320  27.335310  32.5   29876.4  1.5  2016072412  1.2721   -0.8555    0.2769    1.8802
CANN_JHYW  120.424700  27.522580  21.8  120.078380  29.272690  32.5  196899.1  1.5  2016072412  1.3927   -4.4438   -0.6162  -16.3385
CANN_JINH  120.424700  27.522580  21.8  119.642580  29.217830  32.5  202930.8  1.5  2016072412  1.6668   -5.4186   -0.4014  -21.1547
CANN_JINX  120.424700  27.522580  21.8  119.379220  29.070950  32.5  199897.1  1.5  2016072412  1.3931   -5.7[illegible]  [illegible]  [illegible]9150
CANN_JNJZ  120.424700  27.522580  21.8  119.637540  27.976350  32.5   92473.9  1.5  2016072412  1.2143   -4.8333    1.2520  -11.1695
CANN_JSAN  120.424700  27.522580  21.8  118.608560  28.727950  32.5  222881.6  2.5  2016072512  1.2766   -4.1073    0.7879  -36.4190
CANN_LHAI  120.424700  27.522580  21.8  121.169470  28.405910  32.5  170695.1  2.5  2016072512  1.3588    0[illegible]  [illegible]  [illegible]827
CANN_LISH  120.424700  27.522580  21.8  119.820490  28.461460  32.5  114864.2  2.5  2016072512  1.6040   -3.5675    0.0229  -16.0621
CANN_LONQ  120.424700  27.522580  21.8  119.133090  28.080720  32.5  141509.7  2.5  2016072512  1.3241   -5.2100    1.7568  -23.4411
CANN_LUOY  120.424700  27.522580  21.8  119.705090  27.552460  32.5   71164.3  2.5  2016072512  1.1005   -3.7635    1.1878   -7.1760
CANN_PANA  120.424700  27.522580  21.8  120.436660  29.054190  32.5  169743.8  2.5  2016072512  1.8985   -2.2732    1.8436  -17.6809
CANN_PCHQ  120.424700  27.522580  21.8  118.542210  27.923210  32.5  190867.4  2.5  2016072512  1.4645   -5.1840    1.1543  -30.9806
CANN_PCJM  120.424700  27.522580  21.8  118.445440  28.167970  32.5  207660.5  2.5  2016072512  1.7441   -4.6945    0.9737  -34.2959
CANN_QINT  120.424700  27.522580  21.8  120.289980  28.139380  32.5   69628.7  2.5  2016072512  1.1991   -1.9022    1.5178   -7.6866
```

Longitude, latitude, and ellipsoidal height of Starting-ending stations

The ocean tidal load effects on GNSS baseline displacement (ENU, mm)

Tidal effects must be computed at the precise actual observation time. For leveling height differences, the observation duration should not exceed 2 hours to ensure valid computation of semi-diurnal tidal constituents.

Height Definitions: Solid Earth Tide: Use Ellipsoidal Height; Ocean Tidal Load: Use Normal Height or Orthometric Height; and Atmosphere Tidal Load: Use height relative to the surface (typically set to zero in the program).

Computation of Solid Earth Tide and Tidal Load Effects for Geodetic Networks

Computation of Ocean Tidal Load Effects for Geodetic Networks

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Solid Earth Tidal Effects | Computation of Ocean Tidal Load Effects | Computation of Atmosphere Tidal Load Effects

Select the type of control network: Levelling control network

Open Geodetic Network Observation Record File

Set the file parameters

Column ordinal number of starting MJD0 in the header: 3

Column ordinal number of time in the record: 10

Maximum truncated degree of the coefficients model: 120

>> Program Process ** Operation Prompts

Save program process as

```
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:32:02
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:33:06
>> Compute the ocean tidal load effects (mm)....
>> Compute the tidal effects on levelling height differences...
>> Open Geodetic Network Observation Record File C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/
GNSSbaseline_levelingroutine.txt.
 ** Enter the file format parameters according to the text box below. After giving the output file name, click the control button [Import
setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/levelroutineotideload.txt.
 ** Behind the input file record, add the tidal effects as the output file record.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:33:50
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:34:56
```

Display of the input-output file↓ | Save the results as | Import setting parameters | Start computation

```
 9  4  57022
 CANN_DONT  120.424700  27.522580  21.8  121.150270  27.834630  28.6   79493.9  1.5  2016072412  1.2202   -8.5306
 CANN_FDIQ  120.424700  27.522580  21.8  120.207320  27.335310  32.5   29876.4  1.5  2016072412  1.2721    2.6530
 CANN_JHYW  120.424700  27.522580  21.8  120.078380  29.272690  32.5  196899.1  1.5  2016072412  1.3927  -22.2233
 CANN_JINH  120.424700  27.522580  21.8  119.642580  29.217830  32.5  202930.8  1.5  2016072412  1.6668  -28.6171
 CANN_JINX  120.424700  27.522580  21.8  119.379220  29.070950  32.5  199897.1  1.5  2016072412  1.3931  -32.2487
 CANN_JNJZ  120.424700  27.522580  21.8  119.637540  27.876350  32.5   92473.9  1.5  2016072412  1.2143  -14.7665
 CANN_JSAN  120.424700  27.522580  21.8  118.608560  28.727950  32.5  222881.6  2.5  2016072512  1.2766  -49.4794
 CANN_LHAI  120.424700  27.522580  21.8  119.xxxxxx  28.xxxxxx  32.5  170695.1  2.5  2016072512  1.3588  -16.2967
 CANN_LISH  120.424700  27.522580  21.8  119.929490  28.461260  32.5  114864.2  2.5  2016072512  1.6040  -21.7500
 CANN_LONQ  120.424700  27.522580  21.8  119.133090  28.080720  32.5  141509.7  2.5  2016072512  1.3241  -31.6039
 CANN_LUOY  120.424700  27.522580  21.8  119.705090  27.552460  32.5   71164.3  2.5  2016072512  1.1005   -9.5573
 CANN_PANA  120.424700  27.522580  21.8  120.436660  29.054190  32.5  169743.8  2.5  2016072512  1.8985  -24.1759
 CANN_PCHQ  120.424700  27.522580  21.8  118.542210  27.923210  32.5  190867.4  2.5  2016072512  1.4645  -41.8315
 CANN_PCJM  120.424700  27.522580  21.8  118.445440  28.167970  32.5  207660.5  2.5  2016072512  1.7441  -46.4215
 CANN_QINT  120.424700  27.522580  21.8  120.289980  28.139380  32.5   69628.7  2.5  2016072512  1.1991  -10.4147
```

Longitude, latitude, and ellipsoidal height of Starting-ending stations

The ocean tidal load effects on height difference of the levelling routine

Tidal effects must be computed at the precise actual observation time. For leveling height differences, the observation duration should not exceed 2 hours to ensure valid computation of semi-diurnal tidal constituents.

Height Definitions: Solid Earth Tide: Use Ellipsoidal Height; Ocean Tidal Load: Use Normal Height or Orthometric Height; and Atmosphere Tidal Load: Use height relative to the surface (typically set to zero in the program).

Computation of Solid Earth Tide and Tidal Load Effects for Geodetic Networks

Computation of Atmosphere Tidal Load Effects for Geodetic Networks

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Solid Earth Tidal Effects | Computation of Ocean Tidal Load Effects | Computation of Atmosphere Tidal Load Effects

Select the type of control network: GNSS baseline network

Open Geodetic Network Observation Record File

Set the file parameters

Column ordinal number of starting MJD0 in the header: 3

Column ordinal number of time in the record: 10

Maximum truncated degree of the coefficients model: 120

>> Program Process ** Operation Prompts

Save program process as

```
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:33:50
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:34:56
>> Compute the atmosphere tidal load effects (mm)....
>> Compute the tidal effects on 3-D GNSS baseline vectors...
>> Open Geodetic Network Observation Record File C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/
GNSSbaseline_levelingroutine.txt.
  ** Enter the file format parameters according to the text box below. After giving the output file name, click the control button [Import
setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/GNSSbaselatideload.txt.
  ** Behind the input file record, add the tidal effects as the output file record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:36:06
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:36:09
```

Display of the input-output file↓

Save the results as | Import setting parameters | Start computation

```
 9  4  57022
CANN_DONT  120.424700  27.522580  21.8  121.150270  27.834630  28.6   79493.9  1.5  2016072412  1.2202  -0.0310  -0.0199   0.0046
CANN_FDIQ  120.424700  27.522580  21.8  120.207320  27.335310  32.5   29876.4  1.5  2016072412  1.2721   0.0101   0.0082   0.0158
CANN_JHYW  120.424700  27.522580  21.8  120.078380  29.272690  32.5  196899.1  1.5  2016072412  1.3927  -0.0253  -0.0468  -0.3490
CANN_JINH  120.424700  27.522580  21.8  119.642580  29.217830  32.5  202930.8  1.5  2016072412  1.6668  -0.0092  -0.0386  -0.3743
CANN_JINX  120.424700  27.522580  21.8  119.379220  29.070950  32.5  199897.1  1.5  2016072412  1.3931   0.0[illegible]  -0.3670
CANN_JNJZ  120.424700  27.522580  21.8  119.637540  27.976350  32.5   92473.9  1.5  2016072412  1.2143   0.0120   0.0009  -0.1325
CANN_JSAN  120.424700  27.522580  21.8  118.608560  28.727950  32.5  222881.6  2.5  2016072512  1.2766   0.0251  -0.0117  -0.3621
CANN_LHAI  120.424700  27.522580  21.8  121.169470  28.903910  32.5  170695.1  2.5  2016072512  1.3588  -0.[illegible]  -0.[illegible]718
CANN_LISH  120.424700  27.522580  21.8  119.020490  28.631460  32.5  114864.2  2.5  2016072512  1.6040  -0.0044  -0.0161  -0.1988
CANN_LONQ  120.424700  27.522580  21.8  119.133090  28.080720  32.5  141509.7  2.5  2016072512  1.3241   0.0209   0.0049  -0.1898
CANN_LUOY  120.424700  27.522580  21.8  119.705090  27.552460  32.5   71164.3  2.5  2016072512  1.1005   0.0186   0.0104  -0.0494
CANN_PANA  120.424700  27.522580  21.8  120.436660  29.054190  32.5  169743.8  2.5  2016072512  1.8985  -0.0333  -0.0434  -0.2715
CANN_PCHQ  120.424700  27.522580  21.8  118.542210  27.923210  32.5  190867.4  2.5  2016072512  1.4645   0.0348   0.0161  -0.2217
CANN_PCJM  120.424700  27.522580  21.8  118.445440  28.167970  32.5  207660.5  2.5  2016072512  1.7441   0.0339   0.0087  -0.2787
CANN_QINT  120.424700  27.522580  21.8  120.289980  28.139380  32.5   69628.7  2.5  2016072512  1.1991  -0.0085  -0.0131  -0.1126
```

Longitude, latitude, and ellipsoidal height of Starting-ending stations

The atmosphere tidal load effects on GNSS baseline displacement (ENU, mm)

Tidal effects must be computed at the precise actual observation time. For leveling height differences, the observation duration should not exceed 2 hours to ensure valid computation of semi-diurnal tidal constituents.

Height Definitions: Solid Earth Tide: Use Ellipsoidal Height; Ocean Tidal Load: Use Normal Height or Orthometric Height; and Atmosphere Tidal Load: Use height relative to the surface (typically set to zero in the program).

Computation of Solid Earth Tide and Tidal Load Effects for Geodetic Networks

Computation of Atmosphere Tidal Load Effects for Geodetic Networks

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Solid Earth Tidal Effects | Computation of Ocean Tidal Load Effects | Computation of Atmosphere Tidal Load Effects

Select the type of control network: Levelling control network

Open Geodetic Network Observation Record File

Set the file parameters

Column ordinal number of starting MJD0 in the header: 3

Column ordinal number of time in the record: 10

Maximum truncated degree of the coefficients model: 120

>> Program Process ** Operation Prompts

Save program process as

```
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:36:06
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:36:09
>> Compute the atmosphere tidal load effects (mm)....
>> Compute the tidal effects on levelling height differences...
>> Open Geodetic Network Observation Record File C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/
GNSSbaseline_levelingroutine.txt.
  ** Enter the file format parameters according to the text box below. After giving the output file name, click the control button [Import
setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Controlnetworktidef/levelroutineatideload.txt.
  ** Behind the input file record, add the tidal effects as the output file record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-10 15:37:02
>> Complete the computation of the tidal effects!
>> Computation end time: 2026-06-10 15:37:05
```

Display of the input-output file↓

Save the results as | Import setting parameters | Start computation

```
 9   4   57022
CANN_DONT  120.424700  27.522580  21.8  121.150270  27.834630  28.6   79493.9  1.5  2016072412  1.2202    0.0128
CANN_FDIQ  120.424700  27.522580  21.8  120.207320  27.335310  32.5   29876.4  1.5  2016072412  1.2721    0.0263
CANN_JHYW  120.424700  27.522580  21.8  120.078380  29.272690  32.5  196899.1  1.5  2016072412  1.3927   -0.5863
CANN_JINH  120.424700  27.522580  21.8  119.642580  29.217830  32.5  202930.8  1.5  2016072412  1.6668   -0.6324
CANN_JINX  120.424700  27.522580  21.8  119.379220  29.070950  32.5  199897.1  1.5  2016072412  1.3931   -0.6227
CANN_JNJZ  120.424700  27.522580  21.8  119.637540  27.776350  32.5   92473.9  1.5  2016072412  1.2143   -0.2327
CANN_JSAN  120.424700  27.522580  21.8  118.608560  28.727950  32.5  222881.6  2.5  2016072512  1.2766   -0.6146
CANN_LHAI  120.424700  27.522580  21.8  119.189490  28.655710  32.5  170695.1  2.5  2016072512  1.3588   -0.2838
CANN_LISH  120.424700  27.522580  21.8  119.929490  28.461260  32.5  114864.2  2.5  2016072512  1.6040   -0.3408
CANN_LONQ  120.424700  27.522580  21.8  119.133090  28.080720  32.5  141509.7  2.5  2016072512  1.3241   -0.3294
CANN_LUOY  120.424700  27.522580  21.8  119.705090  27.552460  32.5   71164.3  2.5  2016072512  1.1005   -0.0908
CANN_PANA  120.424700  27.522580  21.8  120.436660  29.054190  32.5  169743.8  2.5  2016072512  1.8985   -0.4549
CANN_PCHQ  120.424700  27.522580  21.8  118.542210  27.923210  32.5  190867.4  2.5  2016072512  1.4645   -0.3771
CANN_PCJM  120.424700  27.522580  21.8  118.445440  28.167970  32.5  207660.5  2.5  2016072512  1.7441   -0.4717
CANN_QINT  120.424700  27.522580  21.8  120.289980  28.139380  32.5   69628.7  2.5  2016072512  1.1991   -0.1938
```

Longitude, latitude, and ellipsoidal height of Starting-ending stations

The atmosphere tidal load effects on height difference of the levelling routine

Tidal effects must be computed at the precise actual observation time. For leveling height differences, the observation duration should not exceed 2 hours to ensure valid computation of semi-diurnal tidal constituents.

Height Definitions: Solid Earth Tide: Use Ellipsoidal Height; Ocean Tidal Load: Use Normal Height or Orthometric Height; and Atmosphere Tidal Load: Use height relative to the surface (typically set to zero in the program).

Regional Approximation of Tidal Load Effects via Load Green's Function Integration

Computation of Residual Ocean Tidal Load Effects via Green's Integration

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Open any residual ocean tidal harmonic constant grid file

Open the location and time file of near-Earth points

Set the format of input file

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal number of the normal or orthometric height in record: 4

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (mE)
- [x] horizontal gravity gradient (NW, mE)

Green's integral radius: 400 km

Computation of Residual Ocean Tidal Load Effects via Green's Integration

Computation of Residual Atmosphere Tidal Load Effects via Green's Integration

>> Program Process ** Operation Prompts

Save program process as

>> [Purpose] To compute residual ocean or surface atmosphere tidal load effects on ground stations or in near-Earth space using regional residual harmonic constant grids, based on the Load Green's Function Integration method.
>> Select the computation function from the two control buttons on the upper right of the interface...
>> [Function] Using regional residual ocean tidal harmonic constant grids, this module computes the residual ocean tidal load effects on the following geodetic elements via Load Green's Function integration: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, south and west, mas), vertical deflection (SW, south and west, mas), horizontal displacement (EN, east and north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (mE), or horizontal gravity gradient (NW, mE).
** The valid files of the residual ocean tidal harmonic constants:

C:/ETideLoad4.5_win64en/residOTide/K1got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/K2got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/M2got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/N2got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/O1got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/P1got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/Q1got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/S2got4.8_FES2004.dat

8 residual ocean tidal constituent harmonic constants from difference between GOT4.8 and FES2004

Save the results as | Import setting parameters | Start computation

Display of the input-output file↓

Save data in the text box as

```
100.000000  140.000000    0.000000   50.000000   0.50000000   0.50000000   165555
     0.000       0.000       0.000       0.000        0.000        0.000    0.000    14.520
    -4.420       0.100       9.510       0.000        0.000        0.000    0.000     0.000
     0.000       0.000       0.000       0.000        0.000      -12.330   -7.470    -3.630
    -6.130      -6.230      -6.310      -5.000       -4.690       -3.260   -2.210    -1.950
     0.950       1.000      -0.610       0.000        0.000        0.000   -0.800    -0.020
    -0.220      -0.410      -0.490       0.000        0.000        0.000
     0.000       0.000       0.000       0.000        0.000        0.000   18.180     0.000
    -3.190       0.410       6.660       0.000        0.000        0.000    0.000     0.000
     0.000       0.000       0.000       0.000        0.000        0.000   -9.290    -4.210
     0.000       0.000       0.000       0.000       -3.860       -2.070   -1.050    -1.130
    -0.290      -1.750      -2.980      -3.580       -3.450       -2.570   -1.360    -0.330
    -0.370      -0.270      -0.220      -0.160       -0.090
```

The seventh attribute of the file header is the Doodson constant

Residual Harmonic Constants: The difference between the observed harmonic constants and the values synthesized from a global tidal load spherical harmonic coefficient model.
By applying the Remove-Restore technique, the software refines the computation using Load Green's Function integration. Consequently, the program outputs represent solely the regional residuals of the tidal load effects.

Regional Approximation of Tidal Load Effects via Load Green's Function Integration

Computation of Residual Ocean Tidal Load Effects via Green's Integration

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Open any residual ocean tidal harmonic constant grid file

Open the location and time file of near-Earth points

Set the format of input file

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal number of the normal or orthometric height in record: 4

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [x] gravity disturbance (μGal)
- [x] ground tilt (SW, mas)
- [x] vertical deflection (SW, mas)
- [x] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (mE)
- [x] horizontal gravity gradient (NW, mE)

Green's integral radius: 400 km

Computation of Residual Ocean Tidal Load Effects via Green's Integration

Computation of Residual Atmosphere Tidal Load Effects via Green's Integration

>> Program Process ** Operation Prompts

Save program process as

```
C:/ETideLoad4.5_win64en/residOTide/M2got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/N2got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/O1got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/P1got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/Q1got4.8_FES2004.dat
C:/ETideLoad4.5_win64en/residOTide/S2got4.8_FES2004.dat
>> Open the location and time file of near-Earth points C:/ETideLoad4.5_win64en/examples/Tdloadgreenintegral/
Postiontm.txt.
  ** Enter the file format parameters according to the text box below, and then enter the Green's integral radius. After giving the
output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Tdloadgreenintegral/otdloadchdais.txt.
  ** Appends the computed residual effect values to the input record.
>> Setting parameters have been imported into the program!
>> Prepare to compute the residual ocean tidal load effects...
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-11 08:12:52
>> Complete the Green's Integration for residual ocean tidal load effects!
  ** There are 8 residual tidal constituent harmonic constants grid models involved in the computation.
>> Computation end time: 2026-06-11 08:12:53
```

8 residual ocean tidal constituent harmonic constants from difference between GOT4.8 and FES2004

Columns 2 and 3 of the record are agreed as the longitude and latitude

Save the results as | Import setting parameters | Start computation

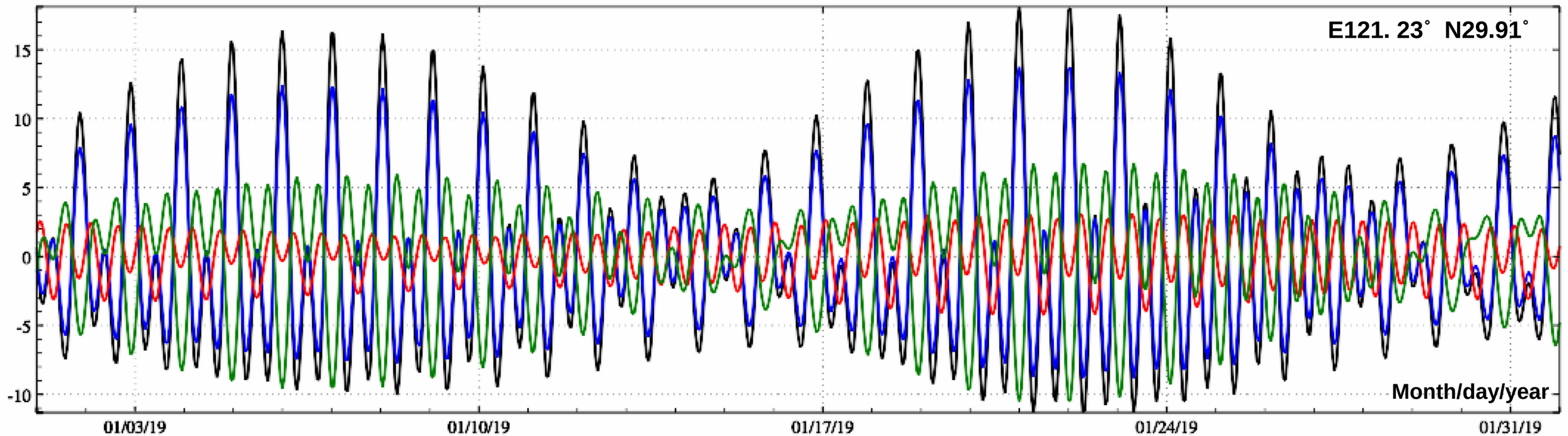
Display of the input-output file↓

Save data in the text box as

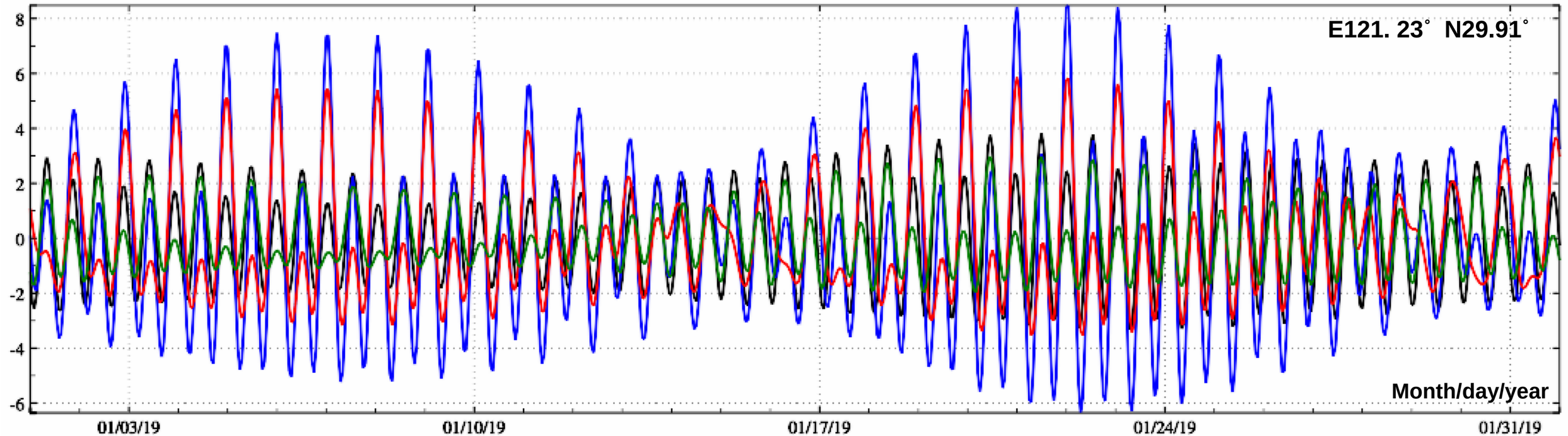
```
121.230000    29.910000   47.218  58484.000000
 201901010000 121.230000  29.910000 2.218   1.0864   0.8426   0.2789  -0.9590  0
 201901010100 121.230000  29.910000 2.218  -1.2644  -1.0431  -0.3716  -1.9073  -0
 201901010200 121.230000  29.910000 2.218  -3.0046  -2.4359  -0.8496  -2.3699  -1
 201901010300 121.230000  29.910000 2.218  -3.7807  -3.0520  -1.0574  -2.2214  -2
 201901010400 121.230000  29.910000 2.218  -3.4908  -2.8097  -0.9679  -1.4900  -2
 201901010500 121.230000  29.910000 2.218  -2.3067  -1.8476  -0.6301  -0.3505  -1
 201901010600 121.230000  29.910000 2.218  -0.6276  -0.4875  -0.1563   0.9193  -0
 201901010700 121.230000  29.910000 2.218   1.0228   0.8491   0.3073   2.0076   0
 201901010800 121.230000  29.910000 2.218   2.1328   1.7497   0.6179   2.6458   1
 201901010900 121.230000  29.910000 2.218   2.3361   1.9195   0.6740   2.6751   1
 201901011000 121.230000  29.910000 2.218   1.5110   1.2600   0.4424   2.0860   0
 201901011100 121.230000  29.910000 2.218  -0.1807  -0.0992  -0.0311   1.0200  -0
```

Residual Harmonic Constants: The difference between the observed harmonic constants and the values synthesized from a global tidal load spherical harmonic coefficient model.

By applying the Remove-Restore technique, the software refines the computation using Load Green's Function integration. Consequently, the program outputs represent solely the regional residuals of the tidal load effects.



The residual ocean tidal load effects (GOT4.8-FES2004): height anomaly (mm), ground gravity (μGal), radial displacement (mm), orthometric height (mm)



The residual ocean tidal load effects (GOT4.8-FES2004): ground tilt (S, mas), (W, mas), horizontal displacement (E, mm)), (N, mm)

Forecast of Various Tidal Effects on Various Surface Geodetic Elements

Solid Earth tide | Ocean tidal load | Atmosphere tidal load | Import parameters | Forcast | Follow example

Forecast of Various Tidal Effects on Various Surface Geodetic Elements

Numerical Forecast of Solid Earth Tidal Effects | Numerical Forecast of Ocean Tidal Load Effects | Numerical Forecast of Surface Atmosphere Tidal Load Effects

Location of surface point to be forecast

Longitude 121.240000°

Latitude 29.428100°

Height 17.830m



The selection of height type is critical for accurate computation:

- Solid Earth Tide: Utilize the Ellipsoidal Height.
- Ocean Tidal Load: Utilize the Normal Height or Orthometric Height.
- Atmosphere Tidal Load: Utilize the height relative to the local surface (set to zero in the program).

Input the forecast time 201607010930

Import setting parameters | Start to forcast...

Forecast with the given location and time

geoid or height anomaly (mm)	-237.159	ground gravity (μGal)	-95.705	gravity disturbance (μGal)	-108.813
horizontal displacement (E, mm)	20.079	ground tilt (S, mas)	4.222	vertical deflection (S, mas)	8.493
horizontal displacement (N, mm)	-16.345	ground tilt (W, mas)	-5.333	vertical deflection (W, mas)	-10.091
ground radial displacement (mm)	-119.083	radial gravity gradient (10μE)	67.971		
normal or orthometric height (mm)	117.948	horizontal gravity gradient (N, 10μE)	4.203	horizontal gravity gradient (W, 10μE)	-25.594

The spherical harmonic coefficient model of the ocean tidal load or surface atmosphere tidal load can be updated via the program [System Configs for Geophysical Models and Numerical Standards].

Forecast of Various Tidal Effects on Various Surface Geodetic Elements

Solid Earth tide | Ocean tidal load | Atmosphere tidal load | Import parameters | Forcast | Follow example

Forecast of Various Tidal Effects on Various Surface Geodetic Elements

Numerical Forecast of Solid Earth Tidal Effects | Numerical Forecast of Ocean Tidal Load Effects | Numerical Forecast of Surface Atmosphere Tidal Load Effects

Location of surface point to be forecast

Longitude 121.240000°

Latitude 29.428100°

Height 17.830m

Maximum truncated degree of model 360



The selection of height type is critical for accurate computation:
- Solid Earth Tide: Utilize the Ellipsoidal Height.
- Ocean Tidal Load: Utilize the Normal Height or Orthometric Height.
- Atmosphere Tidal Load: Utilize the height relative to the local surface (set to zero in the program).

Sea surface tidal height (cm) -77.433

Input the forecast time 201607010130

Import setting parameters | Start to forcast...

Forecast with the given location and time

geoid or height anomaly (mm)	-12.547	ground gravity (μGal)	-38.621	gravity disturbance (μGal)	-40.790
horizontal displacement (E, mm)	-10.338	ground tilt (S, mas)	-83.500	vertical deflection (S, mas)	-20.769
horizontal displacement (N, mm)	7.780	ground tilt (W, mas)	58.130	vertical deflection (W, mas)	16.004
ground radial displacement (mm)	17.526	radial gravity gradient (10μE)	-1622.769		
normal or orthometric height (mm)	30.073	horizontal gravity gradient (N, 10μE)	-1084.238	horizontal gravity gradient (W, 10μE)	-533.235

The spherical harmonic coefficient model of the ocean tidal load or surface atmosphere tidal load can be updated via the program [System Configs for Geophysical Models and Numerical Standards].

Forecast of Various Tidal Effects on Various Surface Geodetic Elements

Solid Earth tide | Ocean tidal load | Atmosphere tidal load | Import parameters | Forcast | Follow example

Forecast of Various Tidal Effects on Various Surface Geodetic Elements

Numerical Forecast of Solid Earth Tidal Effects | Numerical Forecast of Ocean Tidal Load Effects | Numerical Forecast of Surface Atmosphere Tidal Load Effects

Location of surface point to be forecast

Longitude 121.240000°

Latitude 29.428100°

Height 17.830m

Maximum truncated degree of model 360



The selection of height type is critical for accurate computation:
- Solid Earth Tide: Utilize the Ellipsoidal Height.
- Ocean Tidal Load: Utilize the Normal Height or Orthometric Height.
- Atmosphere Tidal Load: Utilize the height relative to the local surface (set to zero in the program).

Surface atmosphere (hPa/mbar) 10.055

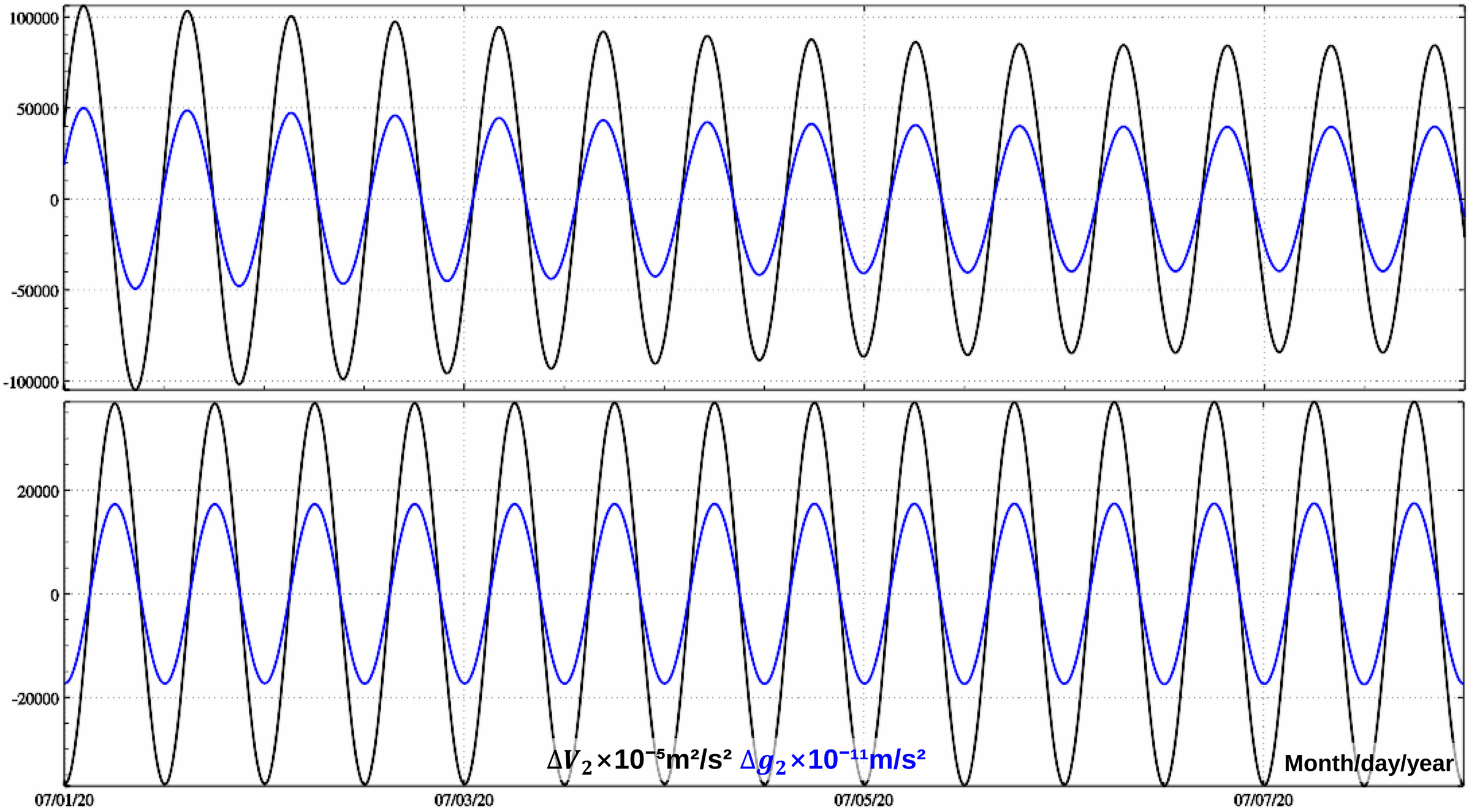
Input the forecast time 201607011105

Import setting parameters | Start to forcast...

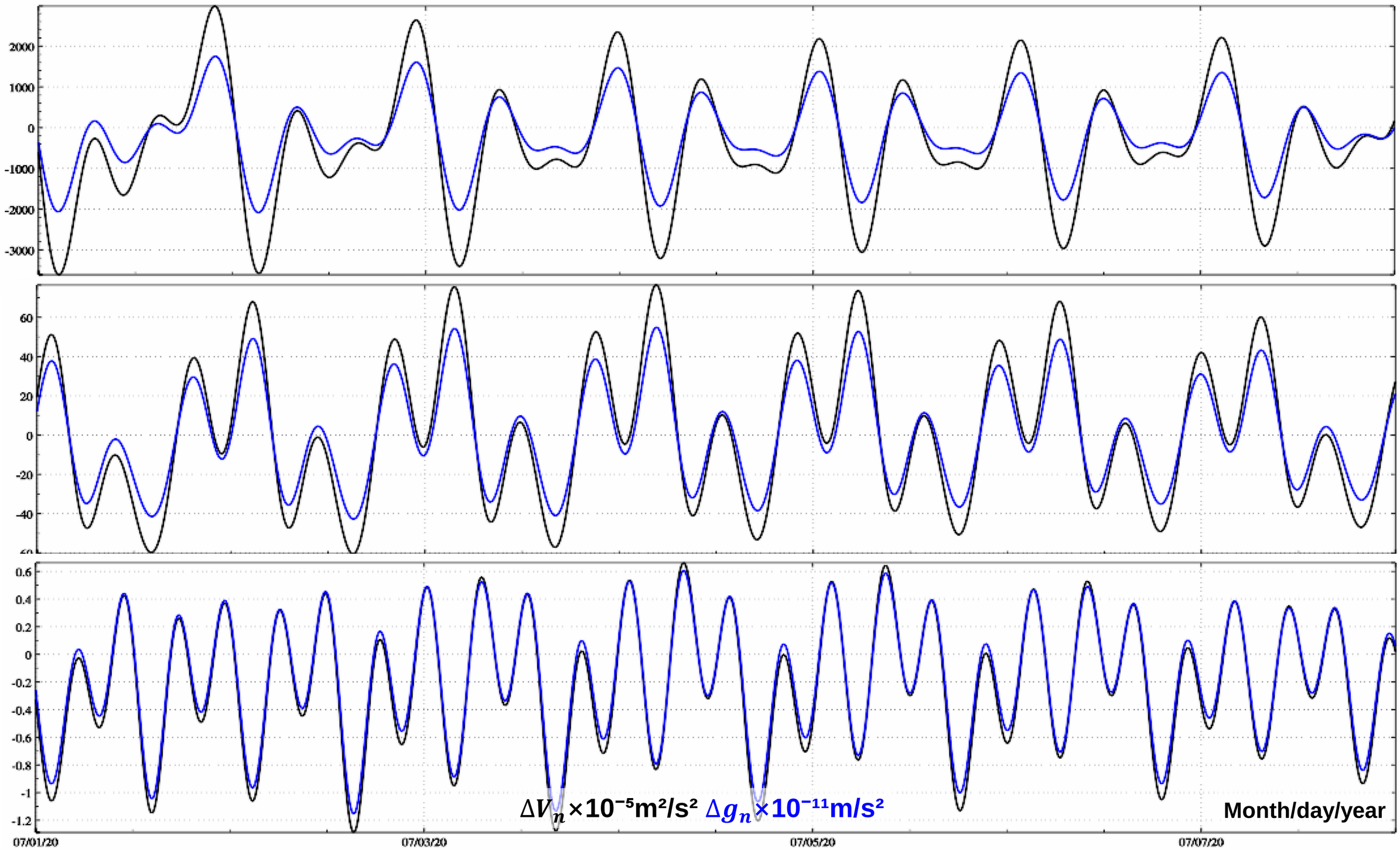
Forecast with the given location and time

geoid or height anomaly (mm)	4.406	ground gravity (μGal)	-5.437	gravity disturbance (μGal)	-4.602
horizontal displacement (E, mm)	-0.434	ground tilt (S, mas)	-0.673	vertical deflection (S, mas)	-0.284
horizontal displacement (N, mm)	0.518	ground tilt (W, mas)	0.665	vertical deflection (W, mas)	0.268
ground radial displacement (mm)	-5.949	radial gravity gradient (10μE)	-3.601		
normal or orthometric height (mm)	-10.356	horizontal gravity gradient (N, 10μE)	0.655	horizontal gravity gradient (W, 10μE)	0.594

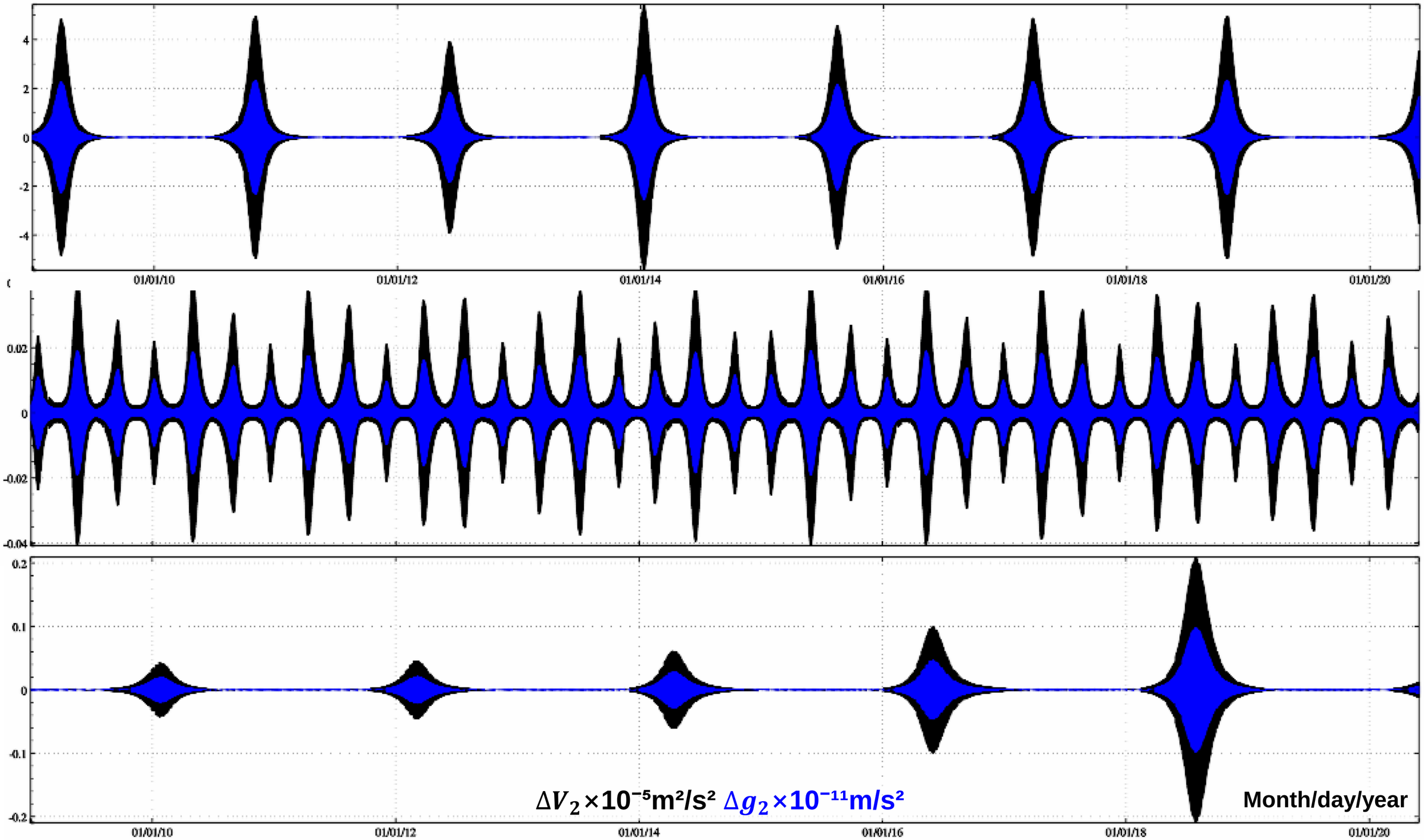
The spherical harmonic coefficient model of the ocean tidal load or surface atmosphere tidal load can be updated via the program [System Configs for Geophysical Models and Numerical Standards].



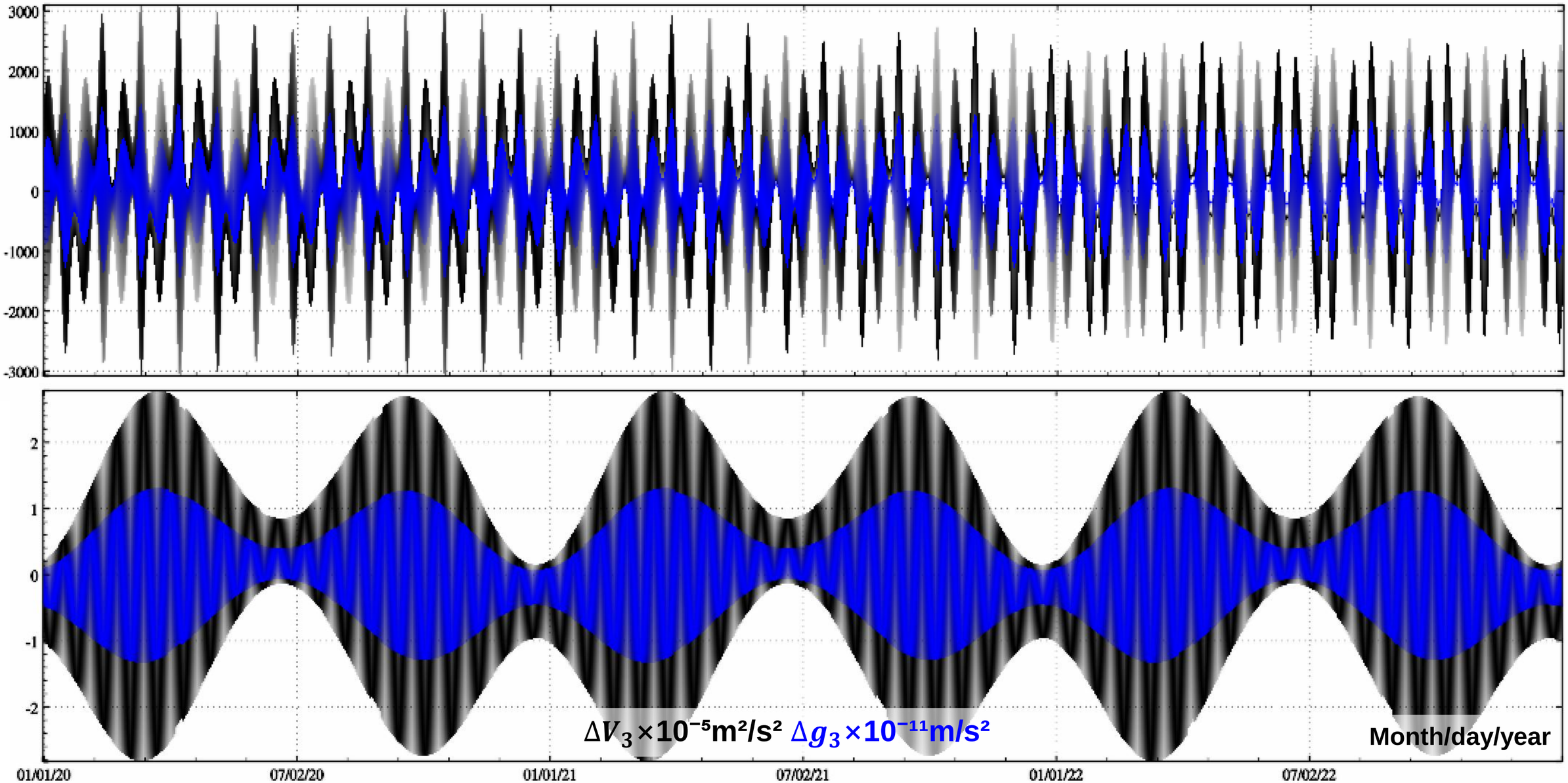
Degree-2 Earth's tidal potential (force) time series from Moon and Sun (7 days)



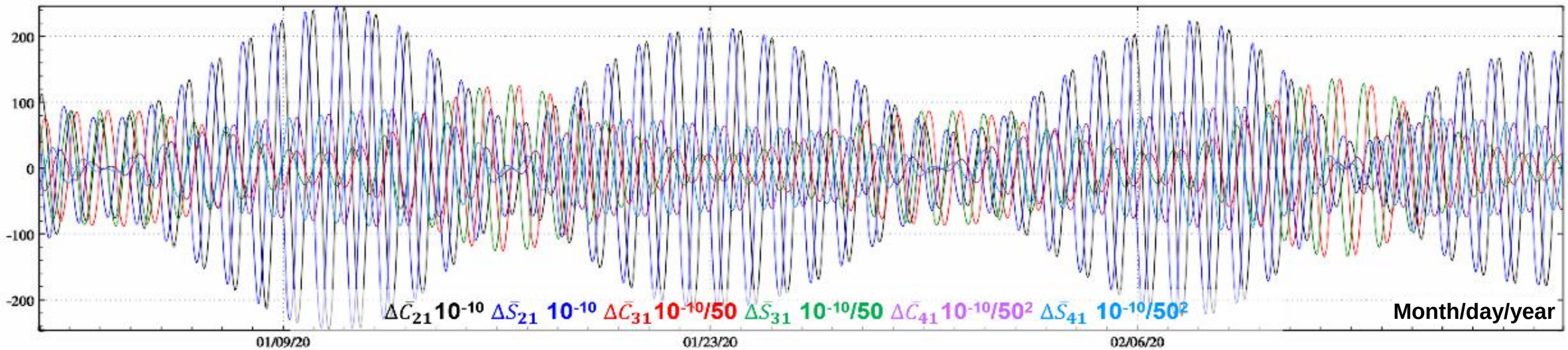
Degree 3, 4 and 5 Earth's tidal potential (force) time series from Moon (7 days)

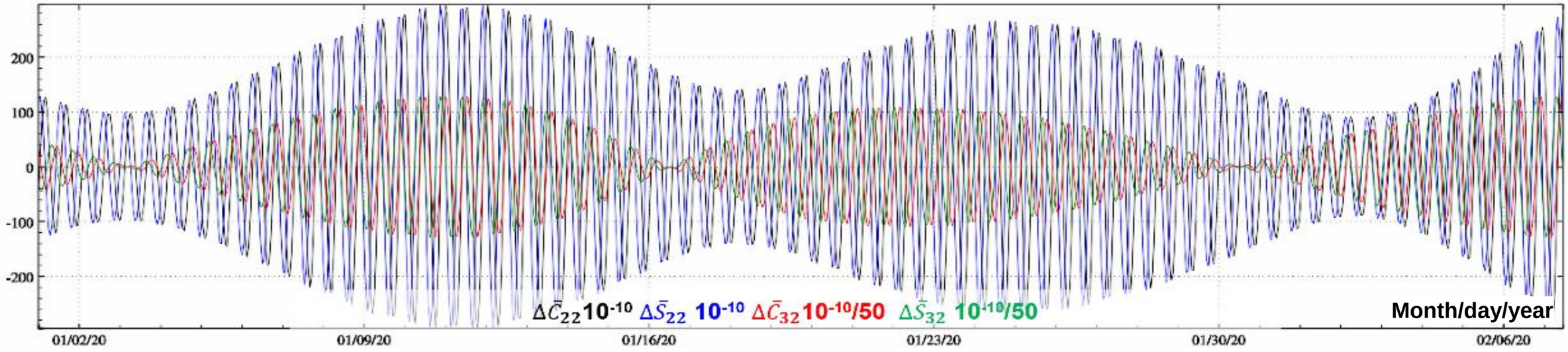


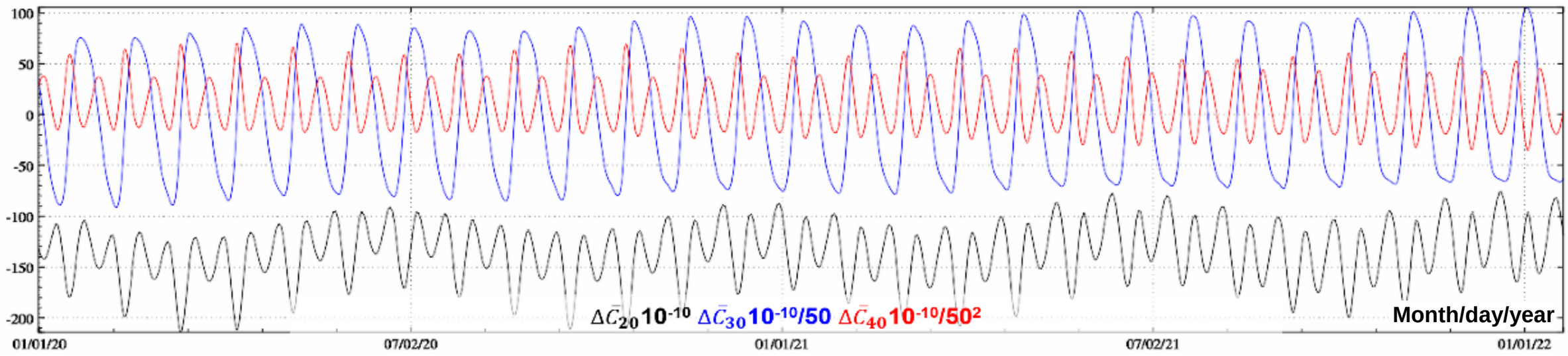
Degree-2 Earth's tidal potential (force) time series from Venus, Jupiter and Mars (12 years)

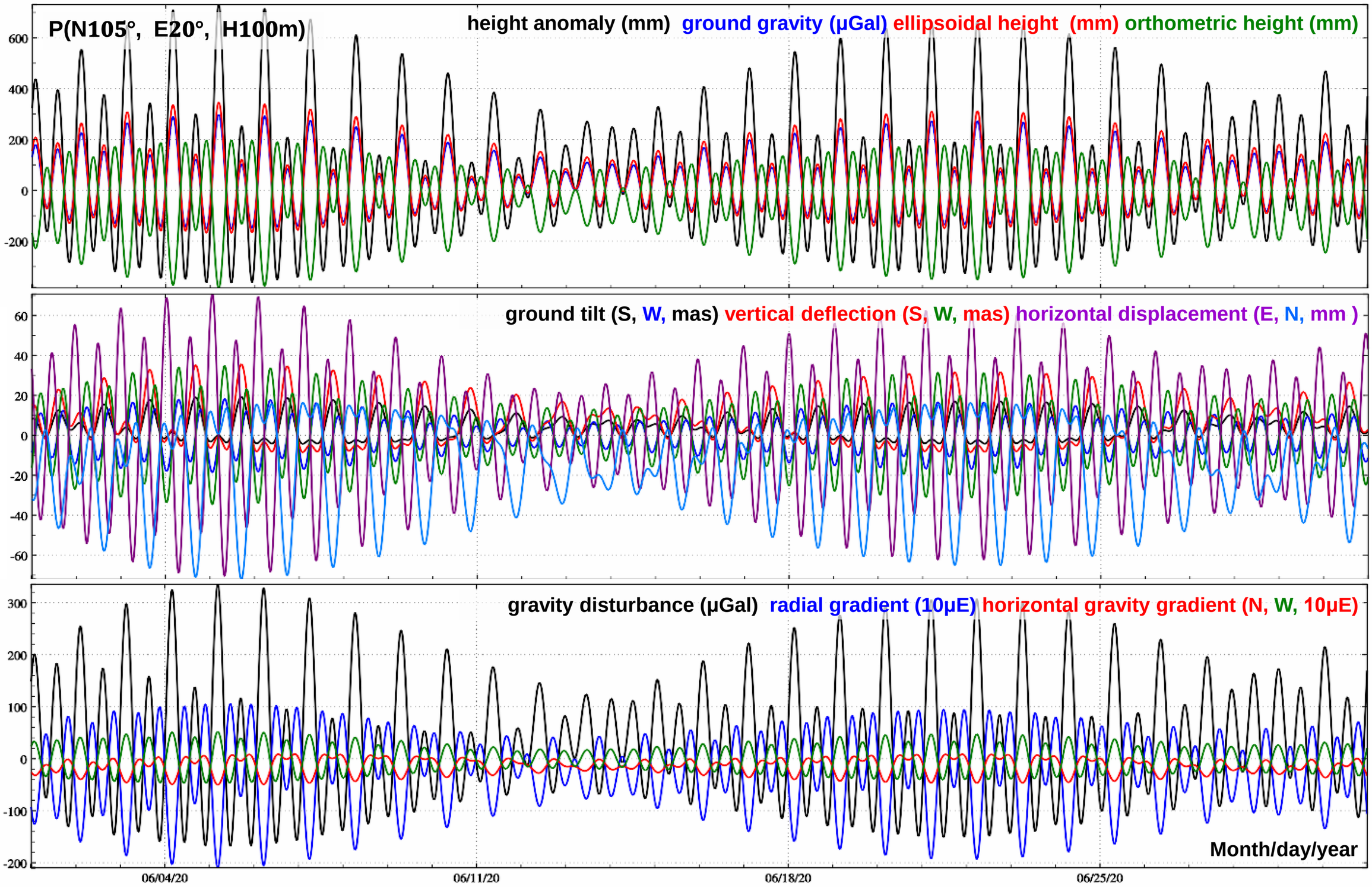


Degree 3 Earth's tidal potential (force) time series from Moon and Sun (2 years)

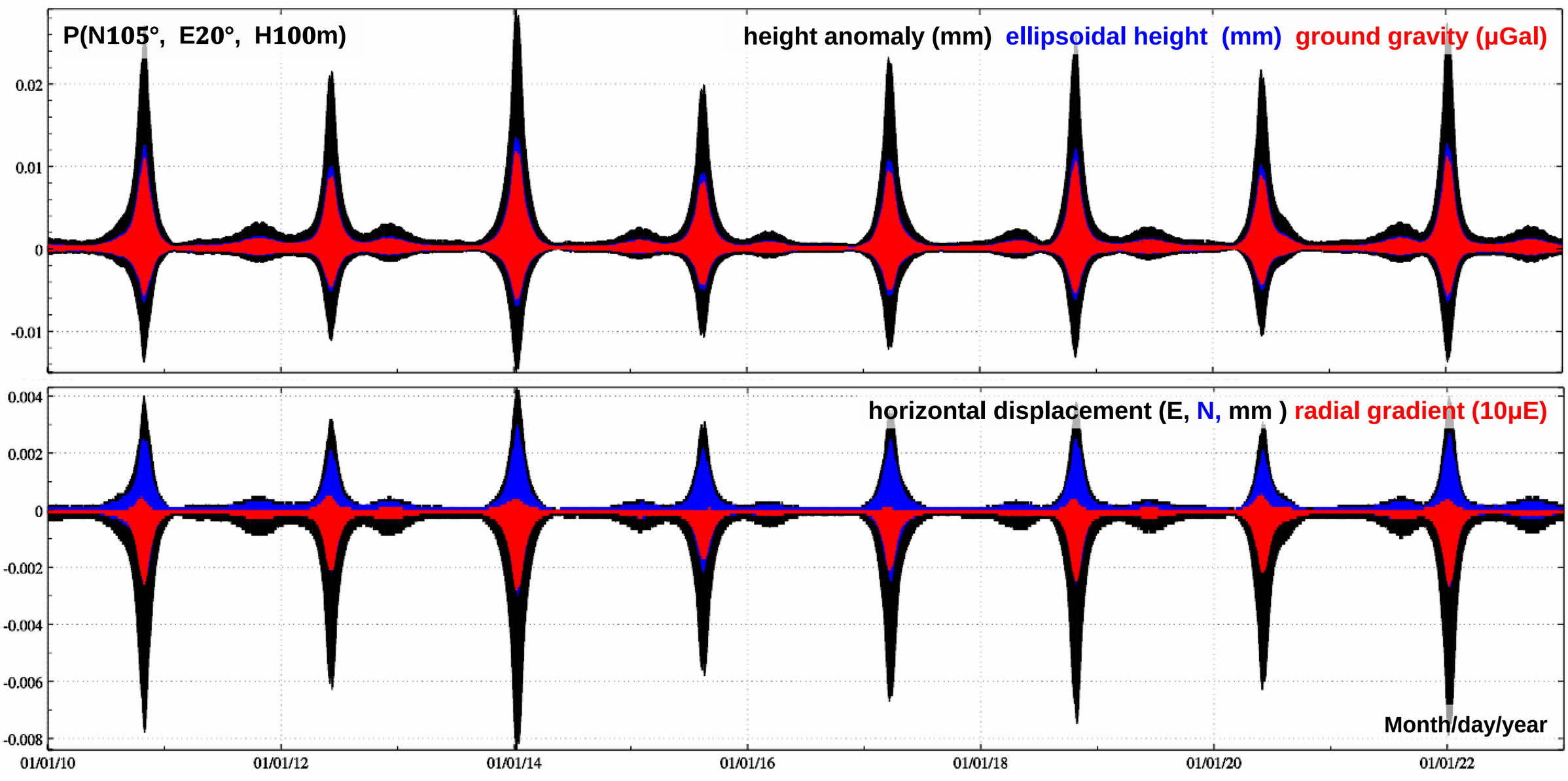

200
100
0
-100
-200
$\Delta\bar{C}_{21}$ 10^{-10} $\Delta\bar{S}_{21}$ 10^{-10} $\Delta\bar{C}_{31}$ 10^{-10}/50 $\Delta\bar{S}_{31}$ 10^{-10}/50 $\Delta\bar{C}_{41}$ 10^{-10}/50^2 $\Delta\bar{S}_{41}$ 10^{-10}/50^2
Month/day/year
01/09/20
01/23/20
02/06/20


200
100
0
-100
-200
$\Delta\bar{C}_{22}$ 10^{-10} $\Delta\bar{S}_{22}$ 10^{-10} $\Delta\bar{C}_{32}$ 10^{-10}/50 $\Delta\bar{S}_{32}$ 10^{-10}/50
Month/day/year
01/02/20
01/09/20
01/16/20
01/23/20
01/30/20
02/06/20

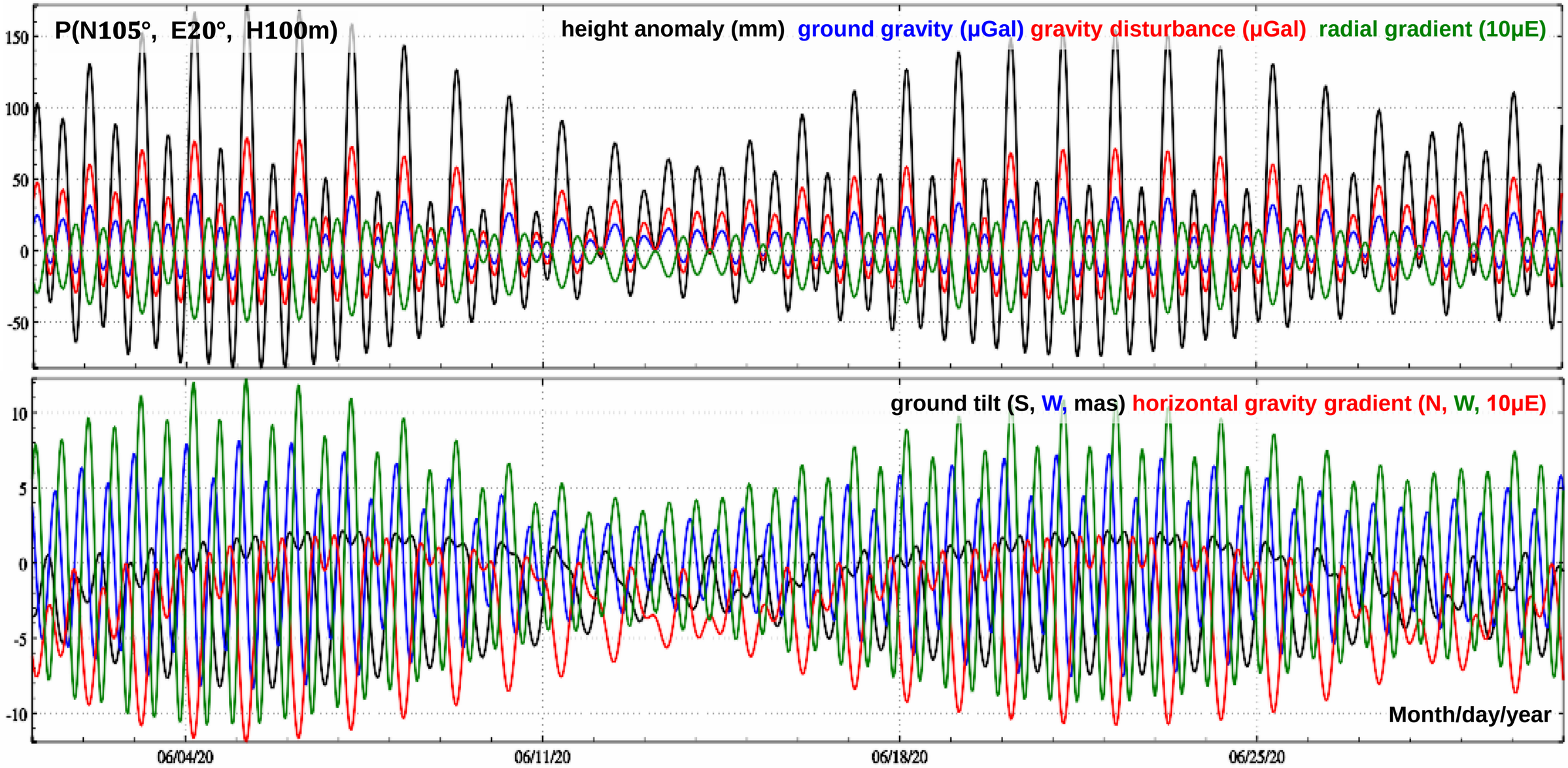

100
50
0
-50
-100
-150
-200
$\Delta\bar{C}_{20}$ 10^{-10} $\Delta\bar{C}_{30}$ 10^{-10}/50 $\Delta\bar{C}_{40}$ 10^{-10}/50^2
Month/day/year
01/01/20
07/02/20
01/01/21
07/02/21
01/01/22



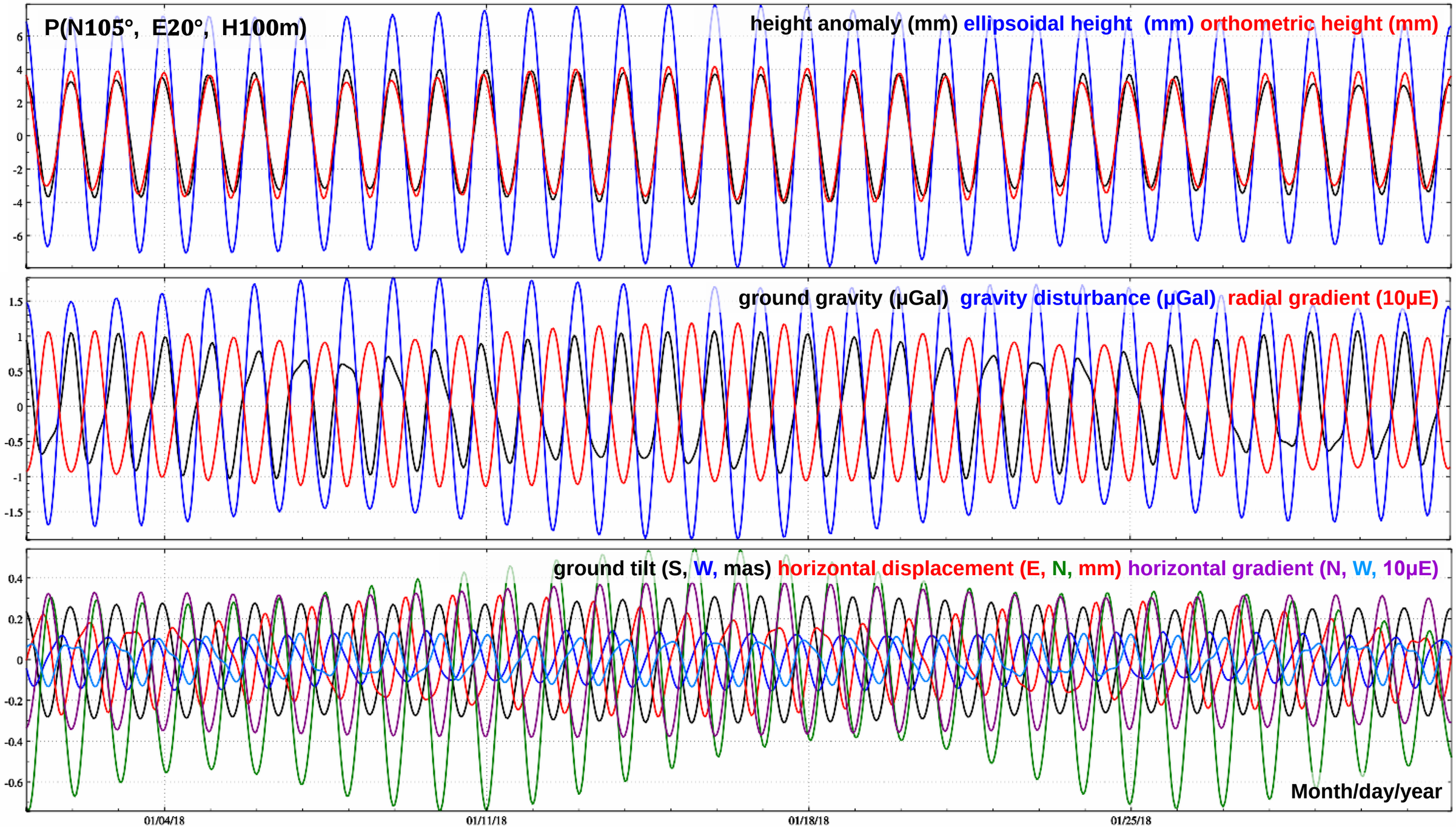
Solid Earth tidal effect time series on various geodetic elements



Solid tidal effect time series from the planets outside Earth



The indirect influence time series of tidal potential to geodetic elements



Contributions of potential Love number frequency dependent corrections

airptideS1_cs.dat | proS1_.ini | Airtdloadcs.dat | 0tideloadcs.dat

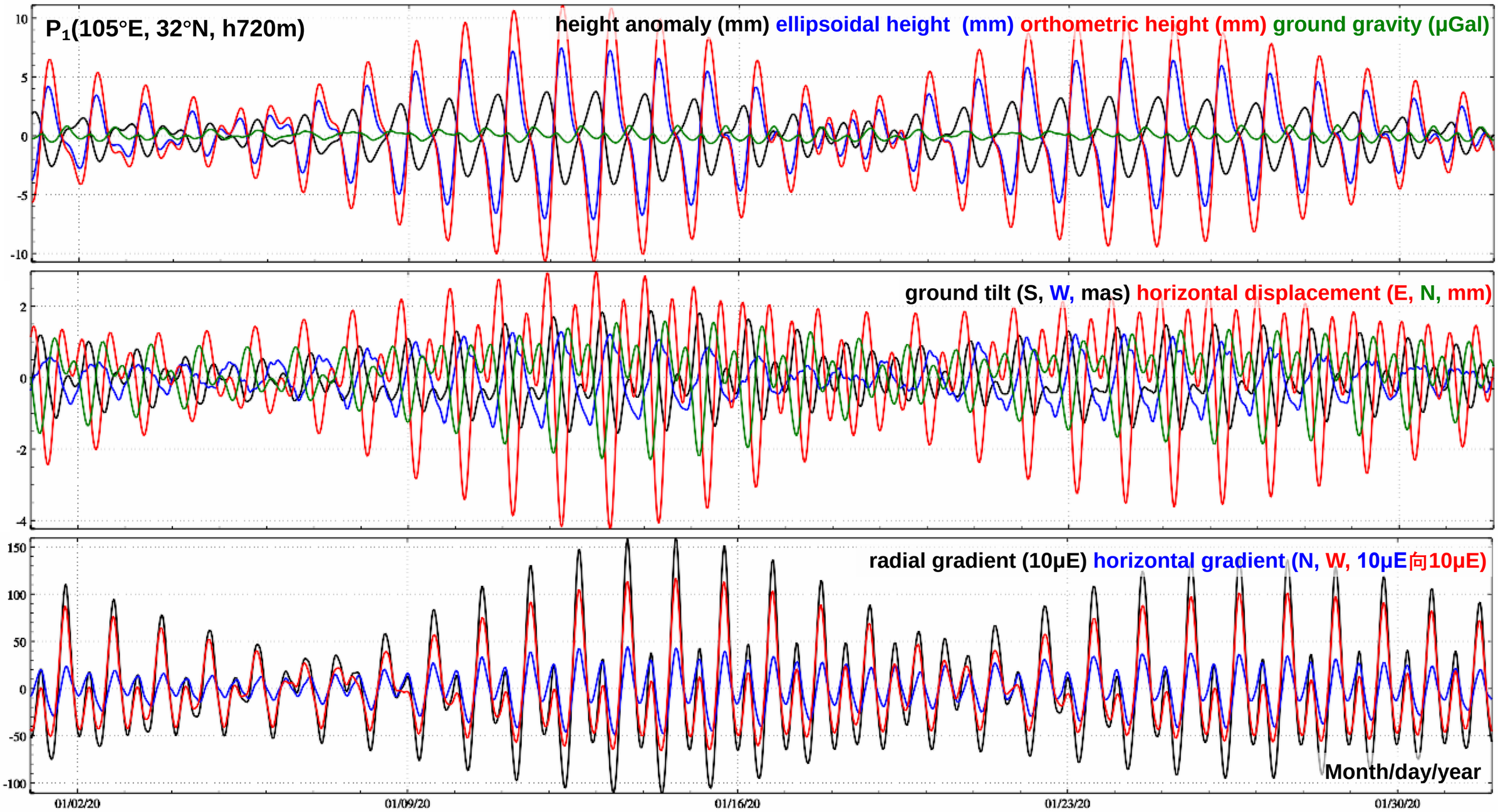
```
Ocean tidal height load normalized spherical harmonic coefficient model in cm.
Created by ETideLoad, ZHANG Chuanyin, Chinese Academy of Surveying and Mapping.
 Doodson name    n    m          Csin+          Ccos+          Csin-          Ccos-          C+        eps+          C-        eps-
 247.455  2N2    1    0     0.00458562     0.00231038     0.00458562     0.00231038   0.005135   63.2596   0.005135   63.2596
 247.455  2N2    1    1    -0.00773380     0.00473565     0.01063946    -0.00152991   0.009069  301.4805   0.010749   98.1828
 247.455  2N2    2    0     0.01415077    -0.00470716     0.01415077    -0.00470716   0.014913  108.3994   0.014913  108.3994
 247.455  2N2    2    1    -0.01749377     0.01964053    -0.02057617     0.01244109   0.026302  318.3086   0.024045  301.1587
 247.455  2N2    2    2    -0.05076973     0.15409810     0.03408330    -0.00708020   0.162246  341.7648   0.034811  101.7353
 247.455  2N2    3    0    -0.00345932    -0.05402235    -0.00345932    -0.05402235   0.054133  183.6639   0.054133  183.6639
 247.455  2N2    3    1     0.00459468     0.02860553     0.08674509     0.04125120   0.028972    9.1250   0.096054   64.5668
 247.455  2N2    3    2    -0.01359111    -0.04803085     0.00043095     0.01917460   0.049917  195.7997   0.019179    1.2875
 247.455  2N2    3    3     0.11576000     0.04745531     0.10043379    -0.03897379   0.125109   67.7090   0.107731  111.2090
 247.455  2N2    4    0    -0.04607076     0.02579335    -0.04607076     0.02579335   0.052800  299.2429   0.052800  299.2429
 247.455  2N2    4    1     0.03322584     0.01467790     0.01394749     0.02945707   0.036324   66.1660   0.032592   25.3369
 247.455  2N2    4    2     0.06616682    -0.16308472     0.08023800     0.03608357   0.175996  157.9166   0.087978   65.7862
 247.455  2N2    4    3    -0.04323293    -0.08712246    -0.08031745     0.08908738   0.097259  206.3921   0.119948  317.9635
 247.455  2N2    4    4    -0.07108370     0.11911427    -0.03283587     0.04029420   0.138712  329.1726   0.051979  320.8233
 247.455  2N2    5    0     0.00423674     0.05025371     0.00423674     0.05025371   0.050432    4.8190   0.050432    4.8190
```

Ocean tidal load spherical harmonic coefficient model FES2014b720cs.dat

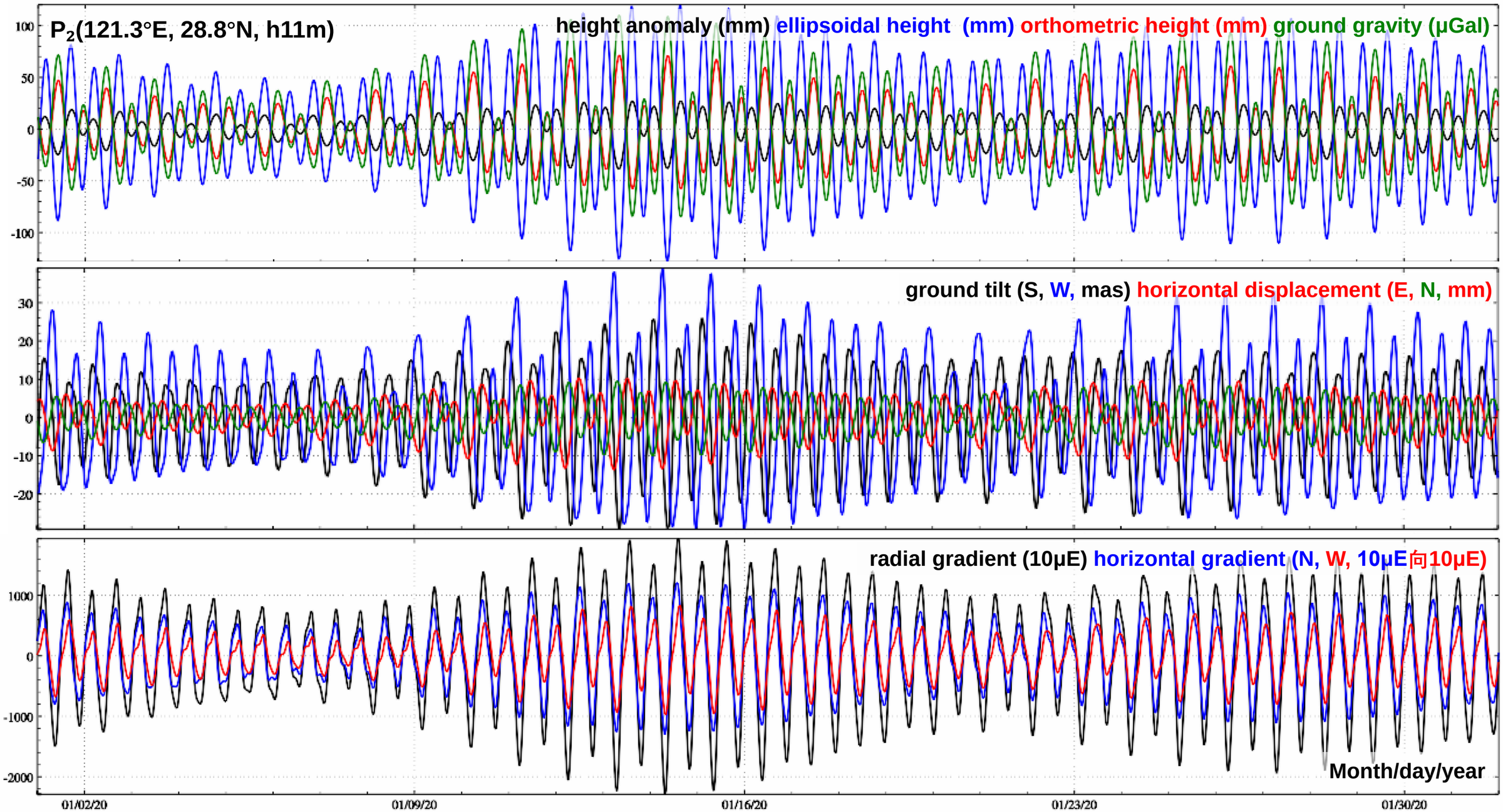
ECMWF2006.dat

```
Atmospheric tide normalized spherical harmonic coefficients model in hPa.
Created by ETideLoad4.0, ZHANG Chuanyin, Chinese academy of surveying and mapping.
 Doodson name    n    m          Csin+          Ccos+          Csin-          Ccos-          C+        eps+          C-        eps-
 164.556   S1    1    0    -0.01044031     0.00562801    -0.01044031     0.00562801   0.011861  298.3276   0.011861  298.3276
 164.556   S1    1    1    -0.02015273    -0.30983977    -0.02700767     0.03081953   0.310494  183.7214   0.040979  318.7714
 164.556   S1    2    0    -0.00879779     0.02710081    -0.00879779     0.02710081   0.028493  342.0149   0.028493  342.0149
 164.556   S1    2    1    -0.00268684    -0.06100327    -0.02133604     0.03900132   0.061062  182.5219   0.044456  331.3187
 164.556   S1    2    2     0.04746907    -0.07026009    -0.05105739    -0.01871012   0.084793  145.9563   0.054378  249.8745
 164.556   S1    3    0     0.02425656     0.01222288     0.02425656     0.01222288   0.027162   63.2565   0.027162   63.2565
 164.556   S1    3    1    -0.00066157     0.08663528     0.01518488     0.03226590   0.086638  359.5625   0.035660   25.2025
 164.556   S1    3    2     0.05673625    -0.01538495     0.00624773    -0.04261815   0.058785  105.1718   0.043074  171.6600
 164.556   S1    3    3     0.01548229     0.03548483    -0.06617883     0.00859431   0.038715   23.5720   0.066735  277.3993
 164.556   S1    4    0     0.01955708    -0.01828613     0.01955708    -0.01828613   0.026774  133.0765   0.026774  133.0765
 164.556   S1    4    1    -0.01459852     0.00147989     0.03554801    -0.00397062   0.014673  275.7885   0.035769   96.3734
 164.556   S1    4    2     0.01936298     0.02790702     0.01483771    -0.01816466   0.033967   34.7544   0.023454  140.7565
 164.556   S1    4    3     0.05871492     0.05584845     0.02091051    -0.06383148   0.081034   46.4333   0.067169  161.8618
 164.556   S1    4    4     0.05072226    -0.00992714    -0.02941680     0.00989714   0.051685  101.0737   0.031037  288.5953
 164.556   S1    5    0     0.00534727    -0.01557997     0.00534727    -0.01557997   0.016472  161.0570   0.016472  161.0570
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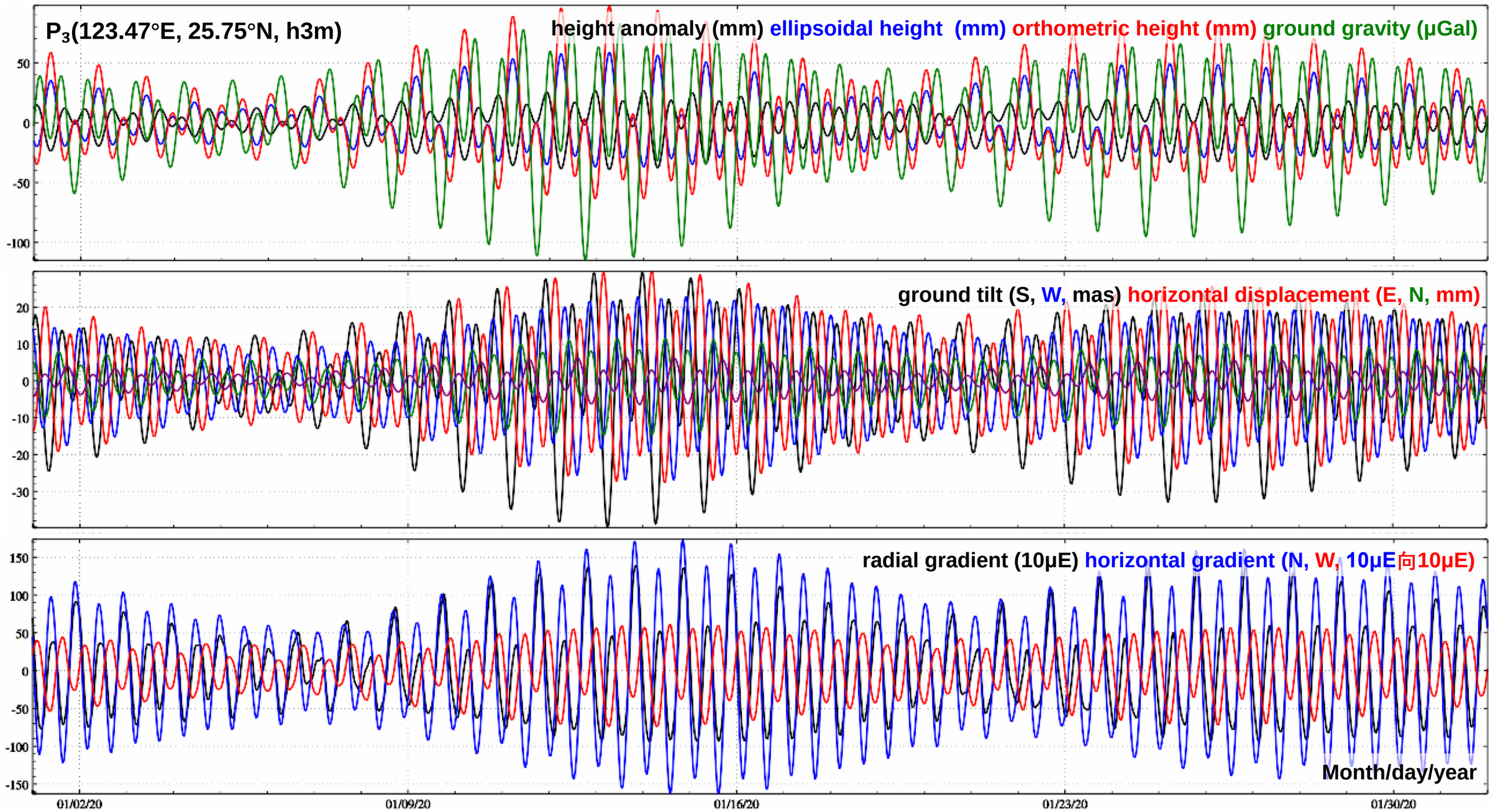
Atmosphere tidal load spherical harmonic coefficient model ECMF2006cs360.dat



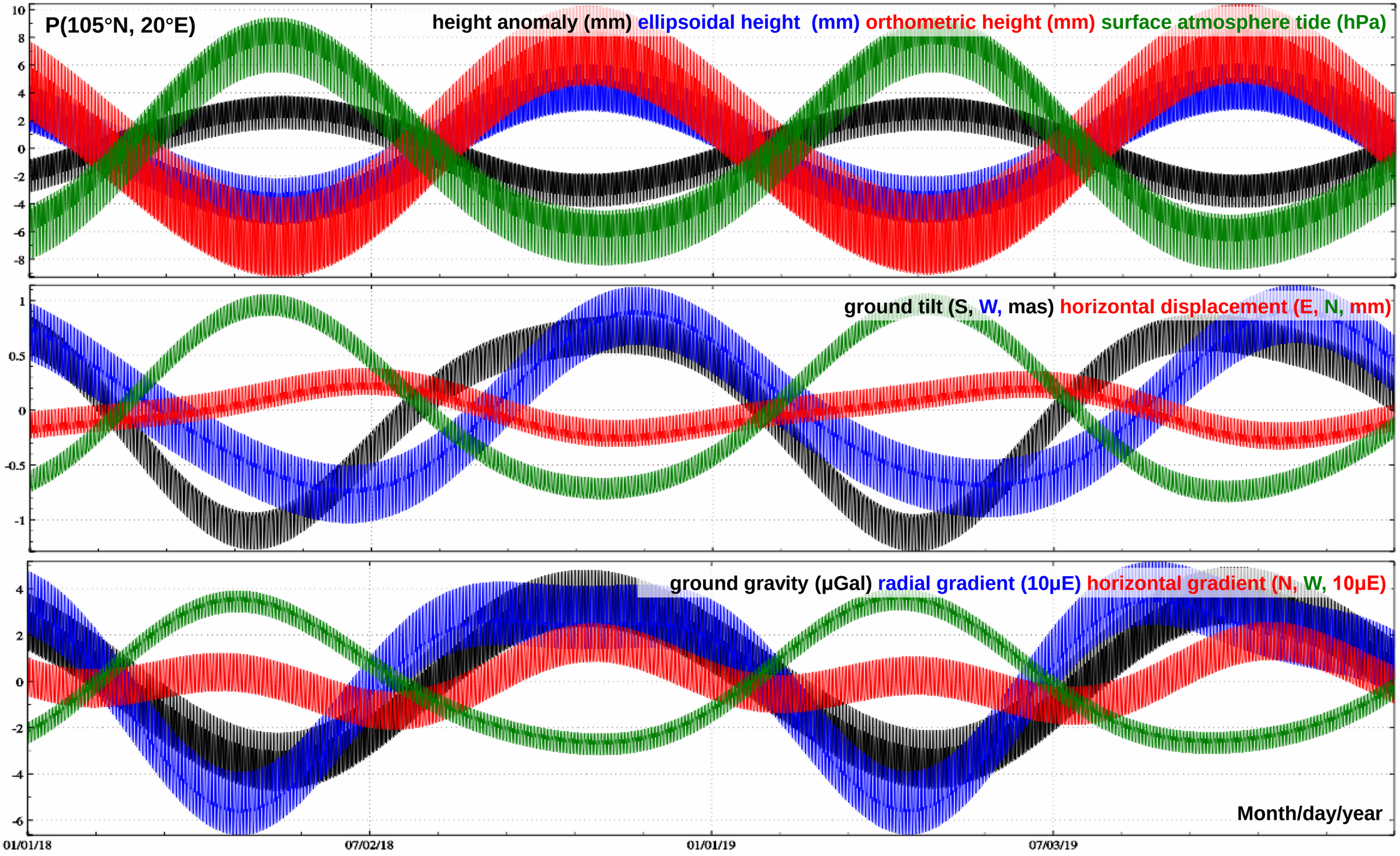
The ocean tidal load effect time series on various geodetic elements at P_1 point in the inland area 400km away from the coastline



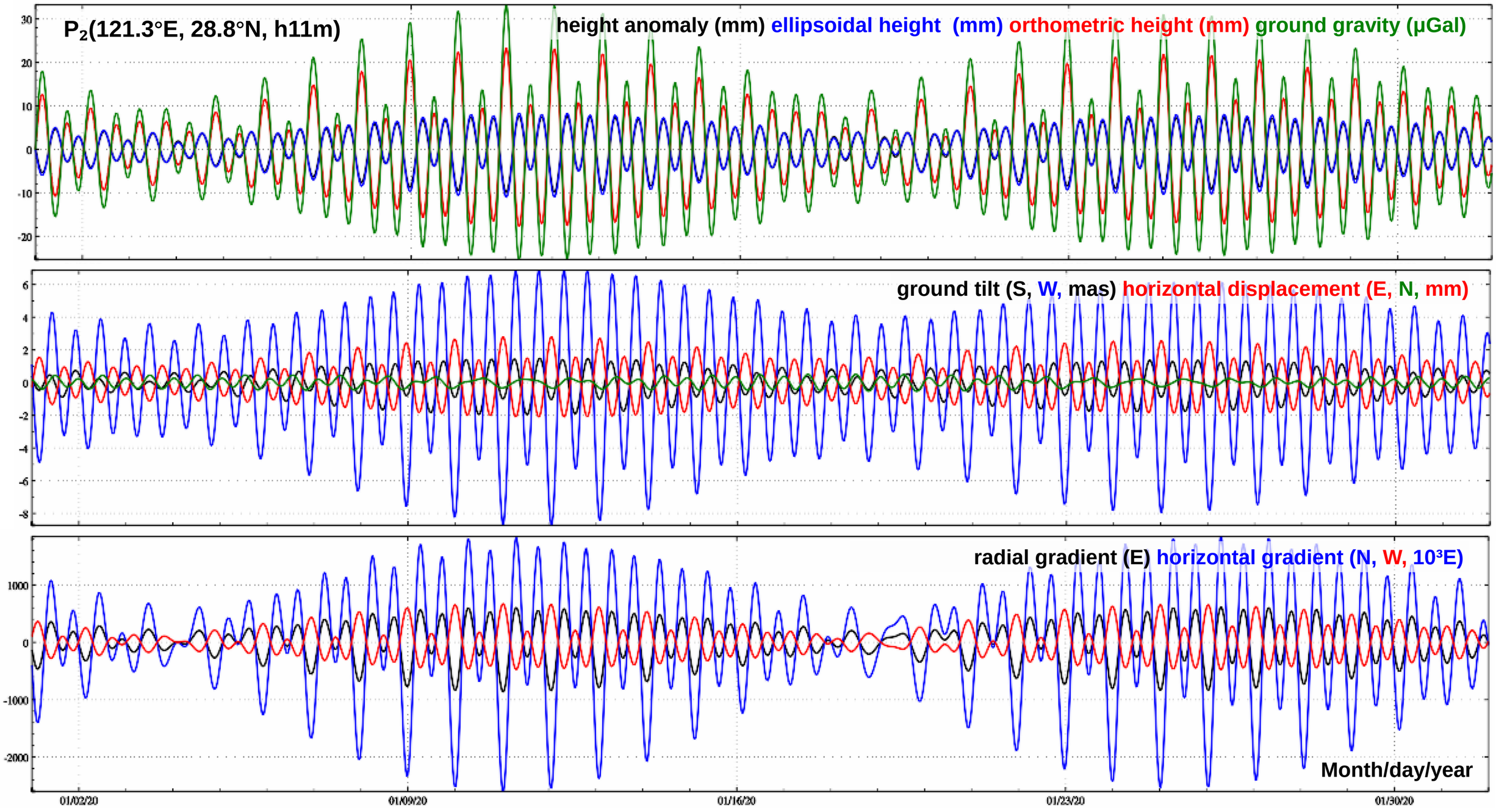
The ocean tidal load effect time series on various geodetic elements at P_2 point on the coastal zone



The ocean tidal load effect time series on various geodetic elements at P_3 point on offshore island 200km away from the coastline



The surface atmosphere tidal load effect time series on various geodetic elements



The residual time series of ocean tidal load effects (FES2014b720cs) on various geodetic elements at the P_2 in the coastal zone

The ocean tidal load effects on gravity gradient are dominant in the ultrashort wave parts, and the high-degree ocean tidal load spherical harmonic coefficient model FES2014b720cs cannot contain these ultrashort wave signals in coastal areas. The calculation results of the residual load effects on gravity gradient are divergent and not available using load Green's function integral.

P_3(123.47°E, 25.75°N, h3m)

height anomaly (mm) ellipsoidal height (mm) orthometric height (mm) ground gravity (μGal)

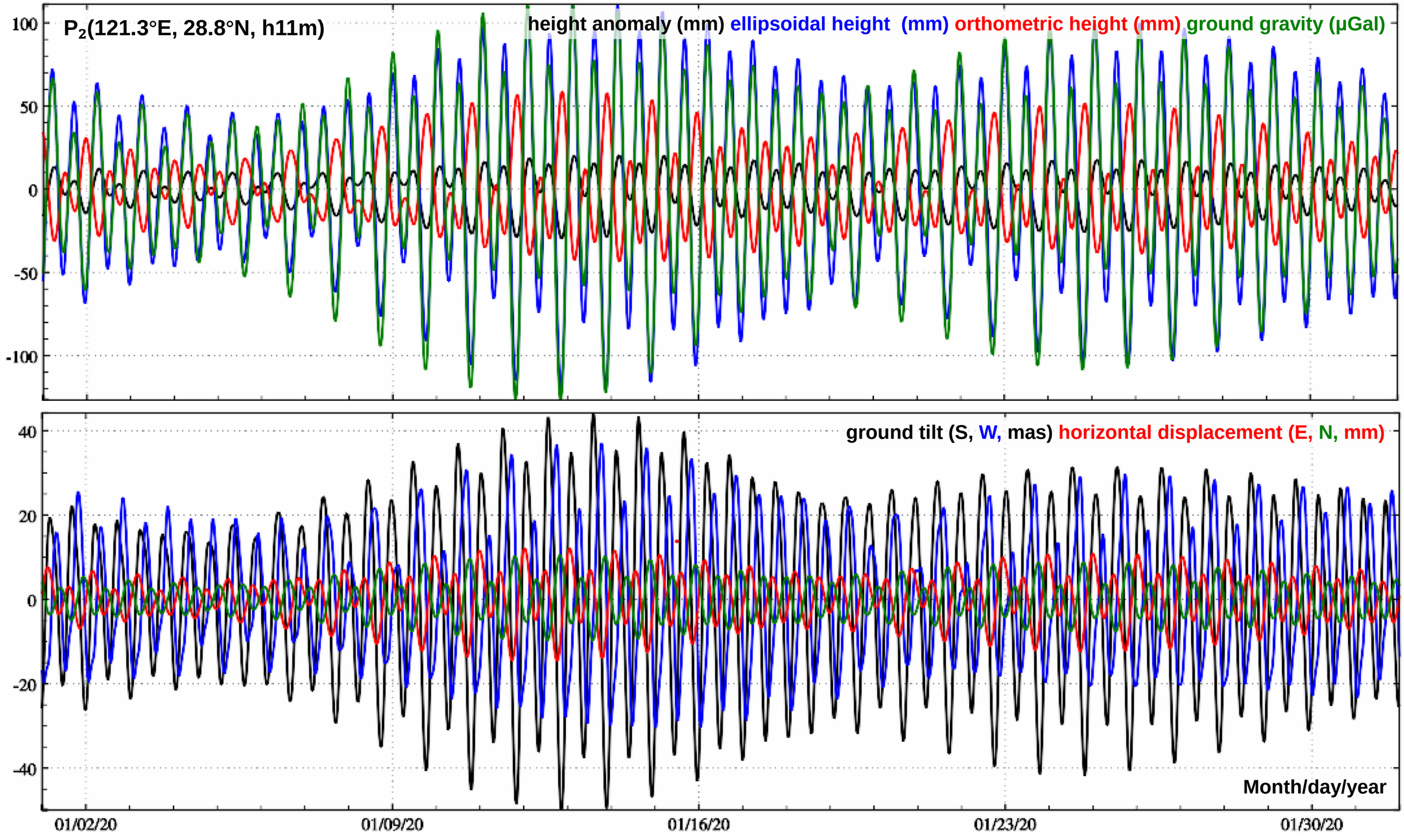
ground tilt (S, W, mas) horizontal displacement (E, N, mm)

radial gradient (mE) horizontal gradient (N, W, mE)

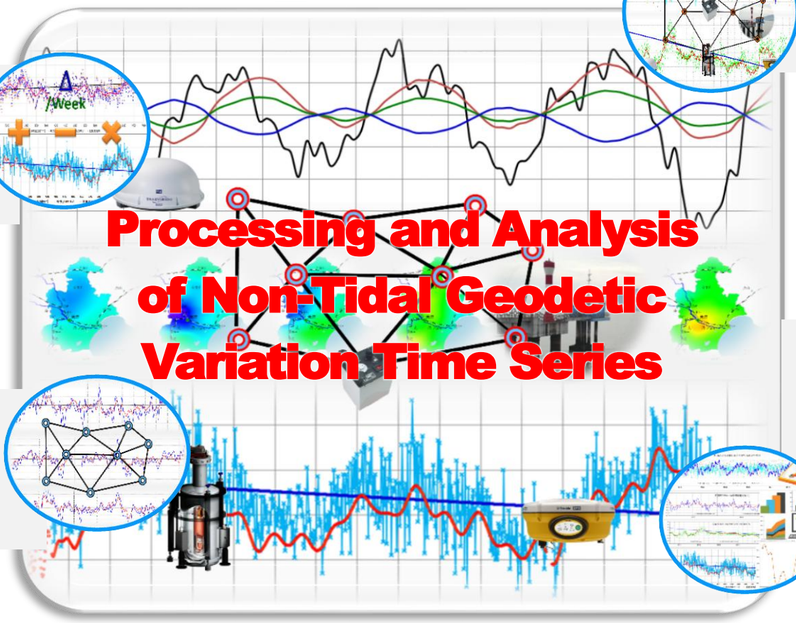
Month/day/year

01/02/20 01/09/20 01/16/20 01/23/20 01/30/20

The residual time series of ocean tidal load effects (FES2014b720cs) on various geodetic elements at the P_3 on the sea island 200km away from the coastline



The refine value time series of ocean tidal load effects on various geodetic elements at the P_2 in the coastal zone (FES2014b720cs model + load Green's integral of residual)



- Gross Error Detection and Separation on Variation Time Series
- Time Transformation between ETideLoad and MJD
- Unification of Reference Epoch for Specified Attribute Time Series
- Time Series Averaging According to Given Time Period

Separation and Processing for Irregular Geodetic Variation Time Series

Low-pass Filtering and Signal Reconstruction for Irregular Time Series

- Estimation of Low-pass Parameters and Linear Terms for Irregular Time Series
- Reconstruction of Low-pass Signals at All Sampling Epoch Times in Given Time Series
- Reconstruction of Low-pass Time Series According to Given Sampling Specifications

- Weighted Operation between Two Attribute Time Series
- Differencing Operation on Irregular Variation Time Series
- Integration Operation on Irregular Variation Time Series
- Construction of Time Series by Interpolation from Another Time Series

Weighted Operations, Differencing, Integration, and Interpolation on Variation Time Series

Normalized Extraction from Batch Geodetic Monitoring Network Time Series

- Normalized Extraction from Batch Geodetic Network Site Time Series
- Normalized Extraction from Batch CORS Network Baseline Time Series

- Gross Error Detection, Low-pass Filtering, and Reconstruction for Batch Time Series
- Batch Time Series Averaging and Record Format Time Series Construction

Processing and Analysis for Batch Geodetic Monitoring Network Time Series

Construction and Analysis of Record Time Series from Geodetic Network

- Construction of Record Time Series from Batch Time Series with Identical Specifications
- Interpolation Repair for Missing Samples in Record Time Series
- Time-space Statistics and Space-mean Separation for Record Time Series
- Removal of Some Sampling Attributes from Record Time Series File
- Removal or Restoration of Linear Variations from Record Time Series

- Reference Epoch Transformation for Grid Time Series
- Low-pass Filtering Operation on Grid Time Series
- Statistical Analysis on Variation (Vector) Grid Time Series
- Coordinate Form Transformation for Variation Vector Grid Time Series
- Removal and Restoration of Linear Variations for Grid Time Series

Processing and Analysis of Variation (Vector) Grid Time Series

Multi-form Spatiotemporal Interpolation from Grid Time Series

- Interpolation of Irregular Variation Time Series from Grid Time Series
- Interpolation of the Specified Record Time Series from Grid Time Series
- Interpolation at the Specified Location and Time from Grid Time Series
- Construction of Record Time Series by Spatiotemporal Interpolation
- Reconstruction of Grid Time Series According to Specified Spatiotemporal Resolution

Separation and Processing for Irregular Geodetic Variation Time Series

Gross Error Detection and Separation on Variation Time Series

Open file Save as Import parameters Start computation Save process Follow example

Gross Error Detection and Separation on Variation Time Series | Time Transformation between ETideLoad and MJD | Unification of Reference Epoch for Specified Attribute Time Series | Time Series Averaging According to Given Time Period

Open the ground variation time series file

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal numbe of the target time series: 2

Multiple numbers of the standard deviation: 3.0

Number of low-pass filtering parameters: 90

Save the results as

When the sampling epoch time is in ETideLoad format, the starting MJD0 is not necessary.

>> Program Process ** Operation Prompts

Save program process as

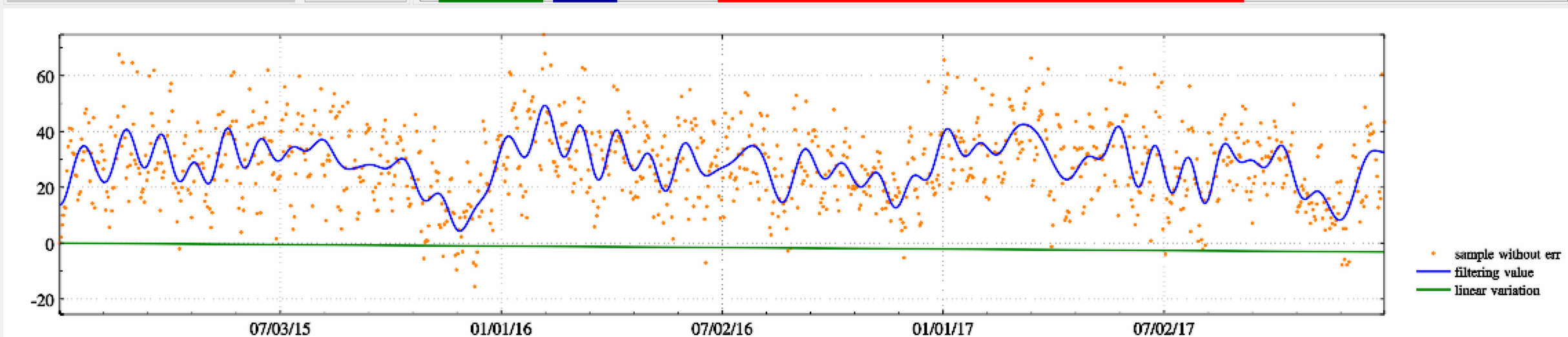
```
>> Select the computation function from the 4 control buttons on the top of the interface...
>> [Function] Utilizing a specified number of low-pass filtering parameters, this function constructs a low-pass filtering reference curve from the irregular time series using Continuous Fourier and Chebyshev Combined Basis Functions. It computes the residual time series (difference between sampling and reference values) and identifies gross errors where the residual exceeds a specified multiple of the standard deviation. The program performs 5 iterations of detection.
>> Open a ground variation time series file C:/ETideLoad4.5_win64en/examples/TmsrsErrorseppreproc/JHYW_U.txt.
  ** Set the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/TmsrsErrorseppreproc/ErrsepU.txt.
  ** Header: Original header appended with constant term and linear term (annual rate of variation, /a).
  ** Record: Original data appended with 5 attributes: Low-pass filtering value, Low-pass value (constant removed), Low-pass value (constant & linear term removed), Linear variation, and Residual value.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-11 11:13:26
  ** The mean, standard deviation, minimum and maximum of the residual time series, constant term and linear term (/a): -0.075, 11.750, -32.054, 34.511, 29.800, -1.0599
>> Complete the computation!
>> Computation end time: 2026-06-11 11:13:29
```

Display of the input-output file↓

Import setting parameters | Start computation

```
JHYW_U  120.0442179  29.16216832  109.8773  57023.500  29.8002  -1.0599
 2015010112   0.03   0.0   13.6839  -16.1162  -16.1162   0.0000  -13.6539
 2015010212   2.2    1.0   13.8213  -15.9789  -15.9760  -0.0029  -11.6213
 2015010312   6.51   2.0   14.2351  -15.5650  -15.5592  -0.0058   -7.7251
 2015010412   9.96   3.0   14.9137  -14.8865  -14.8778  -0.0087   -4.9537
 2015010512  12.85   4.0   15.8377  -13.9624  -13.9508  -0.0116   -2.9877
 2015010612  12.55   5.0   16.9812  -12.8189  -12.8044  -0.0145   -4.4312
```

Extract time series to be plot | Plot↓



Separation and Processing for Irregular Geodetic Variation Time Series

Unification of Reference Epoch for Specified Attribute Time Series

Open file Save as Import parameters Start computation Save process Follow example

Gross Error Detection and Separation on Variation Time Series | Time Transformation between ETideLoad and MJD | Unification of Reference Epoch for Specified Attribute Time Series | Time Series Averaging According to Given Time Period

Open the ground variation time series file

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal number of the first time series: 4

Column ordinal number of the last time series: 6

Enter the reference epoch time: 2016010112

Interpolation method: Gaussian function interp

Save the results as

When the sampling epoch time is in ETideLoad format, the starting MJD0 is not necessary.

Extract time series to be plot | Plot↓

>> Program Process ** Operation Prompts

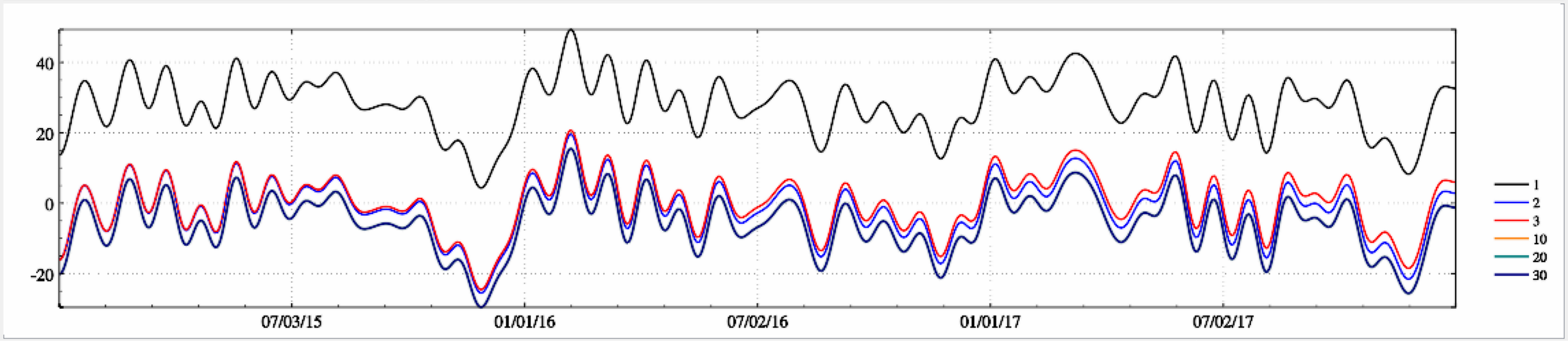
Save program process as

```
 ** The mean, standard deviation, minimum and maximum of the residual time series, constant term and linear term (/a): -0.075, 11.750, -32.054,
34.511, 29.800, -1.0599
>> Complete the computation!
>> Computation end time: 2026-06-11 11:13:29
>> [Function] Using Cubic Spline or Gaussian Function Interpolation, this function interpolates the sampling value at a given reference epoch time and
subtracts it from the time series to unify the datum. At the reference epoch time, the attribute value is zero.
 ** Constraint: The reference epoch must fall within the input time span (auto-adjusted if violated).
 ** Constraint: The number of attribute columns must not exceed 20.
>> Open a ground variation time series file C:/ETideLoad4.5_win64en/examples/TmsrsErrorseppreproc/ErrsepU.txt.
 ** Set the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting
parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/TmsrsErrorseppreproc/epochrst.txt.
 ** Original header appended with the reference epoch time and Original data appended with the unified attribute values.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-11 11:15:28
>> Complete the computation!
>> Computation end time: 2026-06-11 11:15:28
```

Display of the input-output file↓

Import setting parameters | Start computation

JHYW U	120.0442179	29.16216832	109.8773	57028.500	29.8002	-1.0599	2016010112			
2015010112	0.03	0.0	13.6839	-16.1162	-16.1162	0.0000	-13.6539	-20.1849	-20.1848	-21.2
2015010212	2.2	1.0	13.8213	-15.9789	-15.9760	-0.0029	-11.6213	-20.0475	-20.0475	-21.1
2015010312	6.51	2.0	14.2351	-15.5650	-15.5592	-0.0058	-7.7251	-19.6337	-19.6336	-20.(
2015010412	9.96	3.0	14.9137	-14.8865	-14.8778	-0.0087	-4.9537	-18.9551	-18.9551	-20.(
2015010512	12.85	4.0	15.8377	-13.9624	-13.9508	-0.0116	-2.9877	-18.0311	-18.0310	-19.(



Separation and Processing for Irregular Geodetic Variation Time Series

Unification of Reference Epoch for Specified Attribute Time Series

Open file Save as Import parameters Start computation Save process Follow example

Gross Error Detection and Separation on Variation Time Series | Time Transformation between ETideLoad and MJD | Unification of Reference Epoch for Specified Attribute Time Series | Time Series Averaging According to Given Time Period

Open the ground variation time series file

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal numbe of the target time series: 2

Select average period: One week

Save the results as

JHYW_U.txt

1	JHYW_U	120.0442179	29.16216832
2	2015010112	0.03	0.0
3	2015010212	2.2	1.0
4	2015010312	6.51	2.0
5	2015010412	9.96	3.0
6	2015010512	12.85	4.0
7	2015010612	12.55	5.0
8	2015010712	25.9	6.0
9	2015010812	34.52	7.0
10	2015010912	41.16	8.0
11	2015011012	36.64	9.0
12	2015011112	40.85	10.0

Extract time series to be plot | Plot↓

>> Program Process ** Operation Prompts

Save program process as

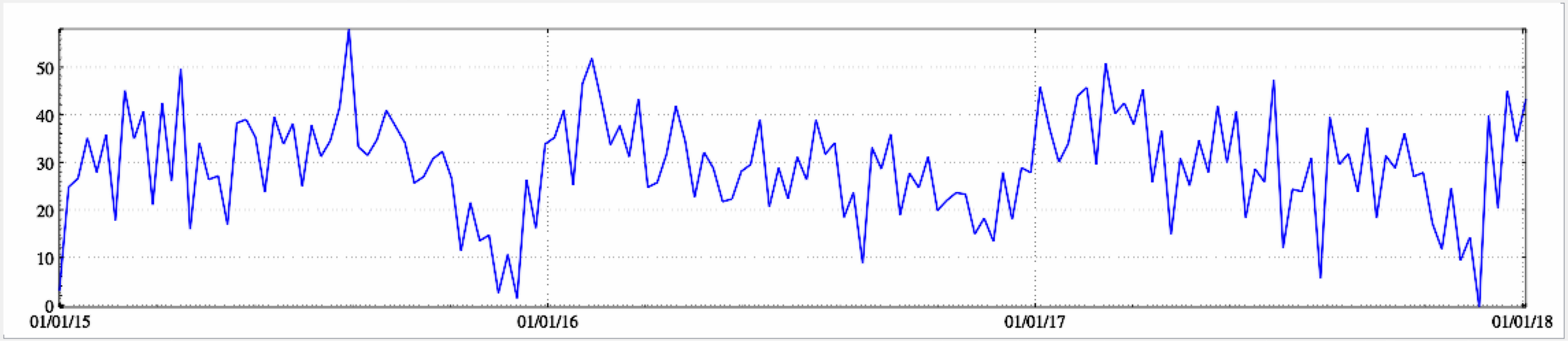
```
 ** Original header appended with the reference epoch time. and Original data appended with the unified attribute values.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-11 11:15:28
>> Complete the computation!
>> Computation end time: 2026-06-11 11:15:28
>> [Function] Calculates the mean value time series from regular or irregular data based on a specified attribute column and averaging period.
>> Open a ground variation time series file C:/ETideLoad4.5_win64en/examples/TmsrsErrorseppreproc/JHYW_U.txt.
 ** Set the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the results as C:/ETideLoad4.5_win64en/examples/TmsrsErrorseppreproc/averagerst.txt.
 ** Header: Original header appended with average mode (0=monthly,1=GPS weekly,2=given days).
 ** Record Format: Middle epoch time, average value, number of samples used.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-11 11:16:36
>> Complete the computation!
>> Computation end time: 2026-06-11 11:16:36
```

When the sampling epoch time is in ETideLoad format, the starting MJD0 is not necessary.

Display of the input-output file↓

Import setting parameters | Start computation

```
JHYW_U  120.0442179  29.16216832  109.8773   57023.500  1
     2014123112       2.9133     3
     2015010712      24.7971     7
     2015011412      26.6386     7
     2015012112      35.0757     7
     2015012812      27.9414     7
     2015020412      35.8143     7
```



Low-pass Filtering and Signal Reconstruction for Irregular Time Series

Estimation of Low-pass Parameters and Linear Terms for Irregular Time Series

Open file Save as Import parameters Start computation Save process Follow example

Estimation of Low-pass Parameters and Linear Terms for Irregular Time Series

Reconstruction of Low-pass Signals at All Sampling Epoch Times in Given Time Series

Reconstruction of Low-pass Time Series According to Given Sampling Specifications

Open the ground variation time series file

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal numbe of the target time series: 2

Number of parameters to be estimated: 120

When the sampling epoch time is in ETideLoad format, the starting MJD0 is not necessary.

Save the estimated parameters as

Extract time series to be plot Plot↓

>> Program Process ** Operation Prompts

Save program process as

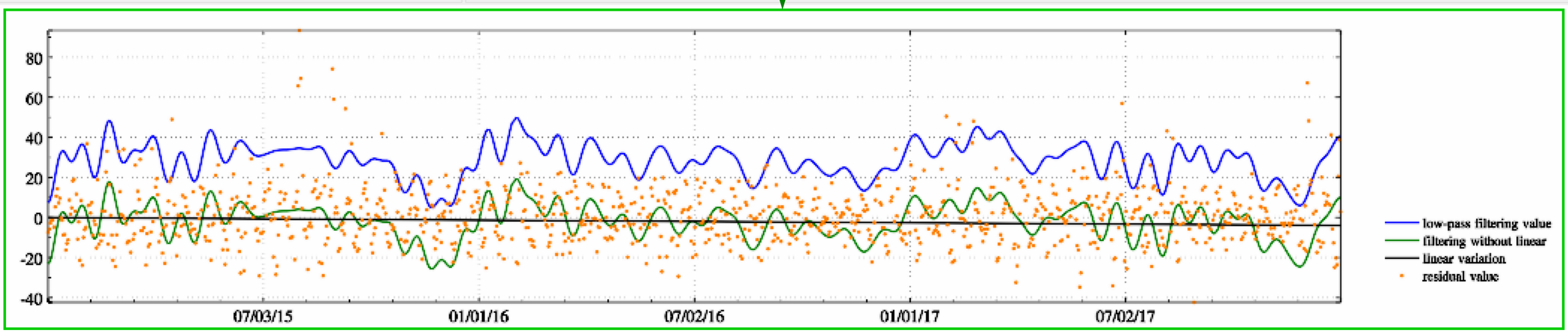
```
>> [Function] Using the continuous Chebyshev and triangular base function combination method, estimates the constant term, linear term (trend), and low-pass parameters for irregular time series.
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/Tmsrslowpfltrconstr/JHYW_U.txt.
  ** Set the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the estimated parameters as C:/ETideLoad4.5_win64en/examples/Tmsrslowpfltrconstr/filterpara.txt.
  ** Header: Original header + Constant term, Linear term (/a).
  ** Content: Sequential storage of all low-pass parameter values.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-11 16:03:09
>> Complete the computation!
>> Computation end time: 2026-06-11 16:03:11
>> The program automatically outputs the time series file C:/ETideLoad4.5_win64en/examples/Tmsrslowpfltrconstr/JHYW_U.rst.
>> Header: Original header + Constant term, Linear term (/a).
>> Record: Original data + 5 appended attributes (Low-pass value, Low-pass no-const, Low-pass no-const/linear, Linear variation,
```

Display of the input-output file↓

Import setting parameters

Start computation

```
JHYW_U  120.0442179  29.16216832  109.8773   57023.500     30.5261     -1.3239     120 57023.500000 58118.50
  3.05261276E+01 -1.94302375E-01 -2.26201904E-01  1.96251568E+00 -1.29977645E+00  2.68590446E+00 -1.16533816E
  6.13411905E-01  3.87968816E+00 -2.12537905E-01 -3.10662977E+00 -1.35173879E+00 -8.53528124E-01  6.92404155E
  2.23959995E-01 -2.74046116E+00  1.05795508E+00 -4.02928436E-01  1.35738370E+00 -1.41391576E+00 -1.34418092E
  2.10059292E+00 -5.44280127E-01  2.99786199E-01 -1.00506078E-01 -1.54069514E-01 -7.14182958E-01  2.70244088E
 -1.39891410E+00 -3.02051423E-01  7.24760530E-01  6.37516352E-01 -1.18167546E+00 -7.46668823E-01  9.36648734E
  1.03543665E+00 -4.61904150E-01 -4.57469731E-01 -4.70226878E-01  3.57170437E-01 -3.38258426E-01 -5.36832733E
```



Low-pass Filtering and Signal Reconstruction for Irregular Time Series

Reconstruction of Low-pass Signals at All Sampling Epoch Times in Given Time Series

Open file Save as Import parameters Start computation Save process Follow example

Estimation of Low-pass Parameters and Linear Terms for Irregular Time Series

Reconstruction of Low-pass Signals at All Sampling Epoch Times in Given Time Series

Reconstruction of Low-pass Time Series According to Given Sampling Specifications

Open the variation time series file to be reconstructed

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Number of parameters for reconstruction: 90

When the sampling epoch time is in ETideLoad format, the starting MJD0 is not necessary.

Save the result time series as

>> Program Process ** Operation Prompts

Save program process as

```
Residual).
>> [Function] Reconstructs the low-pass variation time series at the original sampling epochs based on a specified number of parameters.
  ** Constraint: The number must not exceed the estimated parameters (auto-adjusted if violated).
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/Tmsrslowpfltrconstr/JHYW_U.txt.
  ** Set the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmsrslowpfltrconstr/JHYWreconstr.txt.
  ** Header: Original header + Constant term, Linear term (/a).
  ** Record: Original data + 4 appended attributes (Low-pass value, Low-pass no-const, Low-pass no-const/linear, Linear variation).
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-11 16:31:35
>> Complete the computation!
>> Computation end time: 2026-06-11 16:31:35
```

Display of the input-output file↓

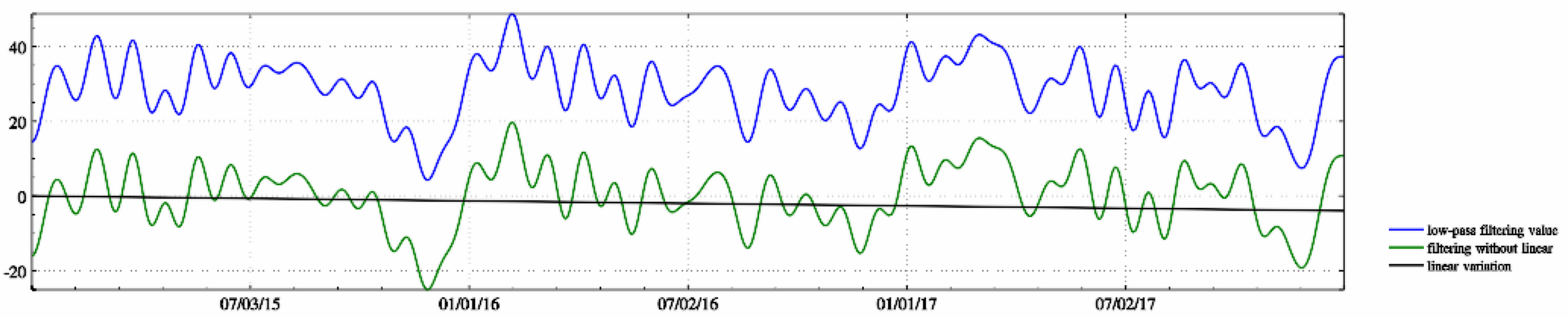
Import setting parameters

Start computation

```
JHYW_U  120.0442179  29.16216832  109.8773  57023.500  30.5261  -1.3239
 2015010112    0.03     0.0   14.48154  -16.0446  -16.0446   0.0000
 2015010212     2.2     1.0   14.60101  -15.9251  -15.9215  -0.0036
 2015010312    6.51     2.0   14.96346  -15.5627  -15.5554  -0.0072
 2015010412    9.96     3.0   15.55934  -14.9668  -14.9559  -0.0109
 2015010512   12.85     4.0   16.37307  -14.1531  -14.1386  -0.0145
 2015010612   12.55     5.0   17.38355  -13.1426  -13.1245  -0.0181
 2015010712    25.9     6.0   18.56482  -11.9613  -11.9396  -0.0217
```

Extract time series to be plot

Plot↓



Low-pass Filtering and Signal Reconstruction for Irregular Time Series

Reconstruction of Low-pass Time Series According to Given Sampling Specifications

Open file Save as Import parameters Start computation Save process Follow example

Estimation of Low-pass Parameters and Linear Terms for Irregular Time Series | Reconstruction of Low-pass Signals at All Sampling Epoch Times in Given Time Series | Reconstruction of Low-pass Time Series According to Given Sampling Specifications

Number of parameters for reconstruction: 90

Set the starting epoch time: 20150901

Set the ending epoch time: 20170630

Set the sampling internal: 12.000 h

Save the result time series as

>> Program Process ** Operation Prompts

Save program process as

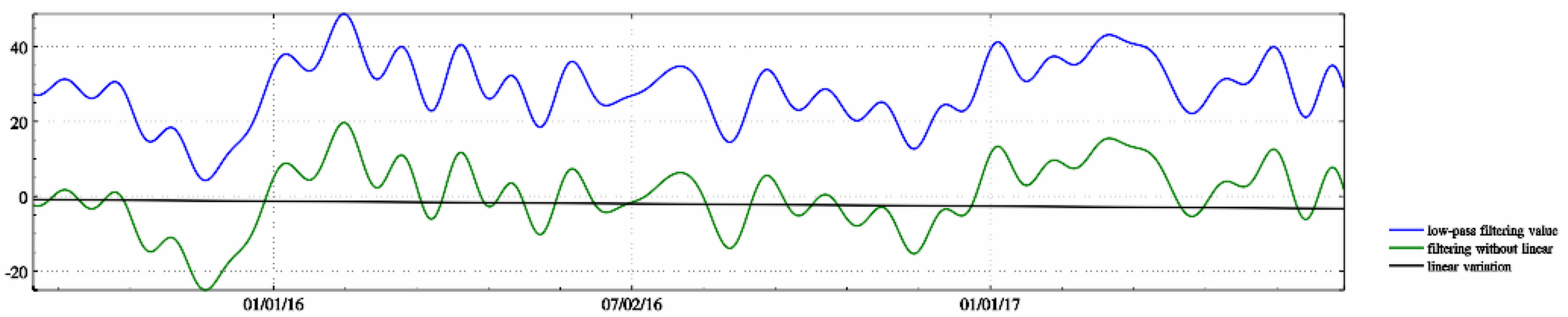
```
>> Computation start time：2026-06-11 16:31:35
>> Complete the computation!
>> Computation end time: 2026-06-11 16:31:35
>> [Function] Generates a reconstructed low-pass time series based on user-defined temporal specifications (start/end time, interval).
  ** The reconstruction interval should generally remain within the bounds of the original estimation time series (slight extrapolation permitted).
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmsrslowpfltrconstr/normreconstr.txt.
  ** Header: Derived from the low-pass parameter file header + Number of parameters, Starting MJD0, Ending MJD.
  ** Record: 5 attributes: Sampling Epoch Time, Low-pass Filtering Value, Low-pass Value (Constant Removed), Low-pass Value (Constant & Linear Term Removed), and Linear Variation.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-11 16:33:32
>> Complete the computation!
>> Computation end time: 2026-06-11 16:33:32
```

Display of the input-output file↓

Import setting parameters | Start computation

```
JHYW_U  120.0442179  29.16216832  109.8773   57023.500     30.5261     -1.3239     120 57023.500000 58118.500(
     2015090100     27.3023     -3.2238     -2.3448     -0.8790
     2015090112     27.1983     -3.3278     -2.4470     -0.8808
     2015090200     27.1188     -3.4074     -2.5247     -0.8826
     2015090212     27.0645     -3.4616     -2.5772     -0.8844
     2015090300     27.0360     -3.4901     -2.6039     -0.8862
     2015090312     27.0336     -3.4926     -2.6045     -0.8881
```

Extract time series to be plot | Plot↓



Weighted Operations, Differencing, Integration, and Interpolation on Variation Time Series

Weighted Operation between Two Attribute Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Weighted Operation between Two Attribute Time Series | Differencing Operation on Irregular Variation Time Series | Integration Operation on Irregular Variation Time Series | Construction of Time Series by Interpolation from Another Time Series

Open the ground variation time series file

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal number of the first attribute time series: 5

Weighted operation mode: plus +

Column ordinal number of the second attribute time series: 6

Weight of the first attribute time series: 1.0000

Weight of the second attribute time series: 1.0000

When the sampling epoch time is in ETideLoad format, the starting MJD0 is not necessary.

>> Program Process ** Operation Prompts

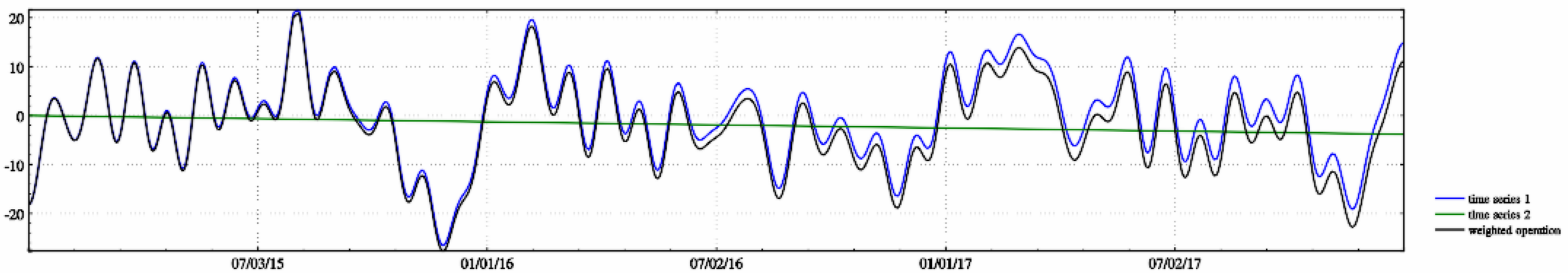
Save program process as

```
>> [Purpose] To perform direct mathematical operations on irregular geodetic variation time series, including weighted arithmetic operations, numerical differencing, numerical integration, and interpolation, based on user-specified methods.
>> Select the computation function from the 4 control buttons on the top of the interface...
>> [Function] Perform weighted addition, subtraction, or multiplication on two specified attribute time series within the irregular variation time series file.
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/TmsrsAddifferinterp/ErrsepU.txt.
  ** Set the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/TmsrsAddifferinterp/plusrst.txt.
  ** Record: The original input record is appended with a new column containing the calculated weighted operation results.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-12 10:05:56
>> Complete the computation!
>> Computation end time: 2026-06-12 10:05:56
```

Save the result time series as | Import setting parameters | Start computation

Extract time series to be plot | Plot↓

```
JHYW U  120.0442179  29.16216832  109.8773   57023.500
2015010112    0.03       0.0     -31.1716    -18.1077      0.0000    -13.0639    -18.1077
2015010212     2.2       1.0     -28.9982    -17.9572     -0.0035    -11.0409    -17.9607
2015010312    6.51       2.0     -24.6847    -17.5105     -0.0070     -7.1742    -17.5175
2015010412    9.96       3.0     -21.2312    -16.7818     -0.0104     -4.4494    -16.7922
2015010512   12.85       4.0     -18.3377    -15.7939     -0.0139     -2.5439    -15.8078
2015010612   12.55       5.0     -18.6342    -14.5776     -0.0174     -4.0566    -14.5950
2015010712    25.9       6.0      -5.2808    -13.1703     -0.0209      7.8896    -13.1912
2015010812   34.52       7.0       3.3427    -11.6143     -0.0244     14.9571    -11.6387
```



Weighted Operations, Differencing, Integration, and Interpolation on Variation Time Series

Differencing Operation on Irregular Variation Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Weighted Operation between Two Attribute Time Series | Differencing Operation on Irregular Variation Time Series | Integration Operation on Irregular Variation Time Series | Construction of Time Series by Interpolation from Another Time Series

Open the ground variation time series file

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal number of the time series to be differentiated: 5

ErrsepU.txt

1	JHYW_U	120.0442179	29.16216832	109.8773	57023.500	
2	2015010112	0.03	0.0	-31.1716	-18.1077	0.0000
3	2015010212	2.2	1.0	-28.9982	-17.9572	-0.0035
4	2015010312	6.51	2.0	-24.6847	-17.5105	-0.0070
5	2015010412	9.96	3.0	-21.2312	-16.7818	-0.0104
6	2015010512	12.85	4.0	-18.3377	-15.7939	-0.0139
7	2015010612	12.55	5.0	-18.6342	-14.5776	-0.0174
8	2015010712	25.9	6.0	-5.2808	-13.1703	-0.0209
9	2015010812	34.52	7.0	3.3427	-11.6143	-0.0244
10	2015010912	41.16	8.0	9.9862	-9.9554	-0.0278
11	2015011012	36.64	9.0	5.4697	-8.2409	-0.0313
12	2015011112	40.85	10.0	9.6832	-6.5180	-0.0348

When the sampling epoch time is in ETideLoad format, the starting MJD0 is not necessary.

Extract time series to be plot | Plot↓

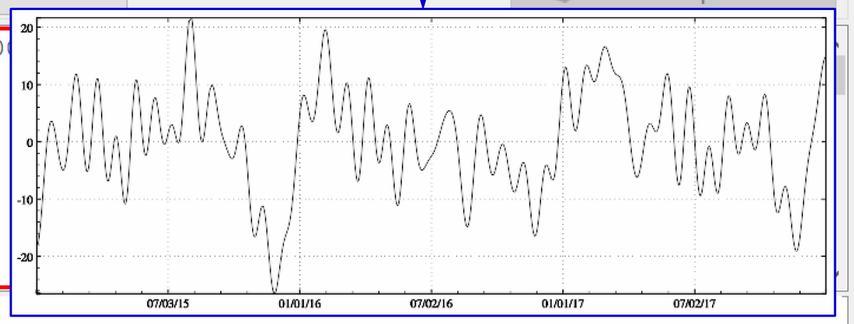
>> Program Process ** Operation Prompts

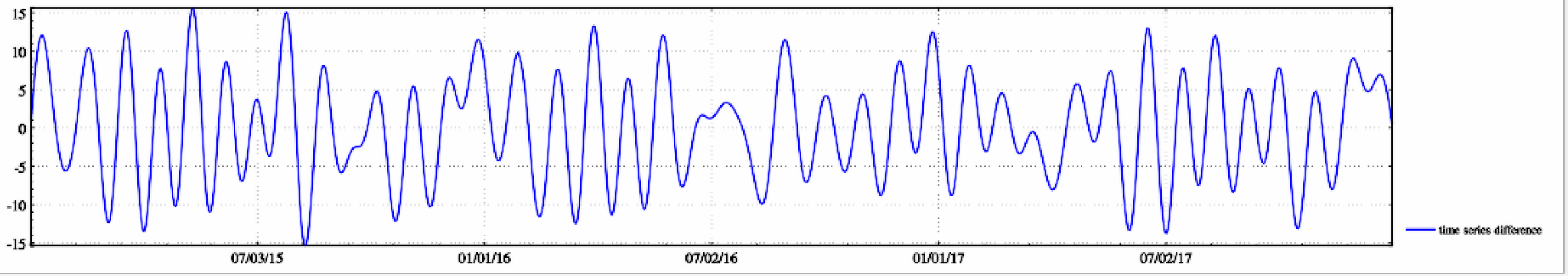
Save program process as

```
>> Computation start time：2026-06-12 10:05:56
>> Complete the computation!
>> Computation end time: 2026-06-12 10:05:56
>> [Function] Compute the finite difference (rate of change) for a specified irregular variation time series. The algorithm calculates the weekly variation rate (i.e., per week). The resulting epoch time for each difference is defined as the midpoint between the two adjacent sampling epochs.
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/TmsrsAddifferinterp/ErrsepU.txt.
  ** Set the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/TmsrsAddifferinterp/diffrst.txt.
  ** Header: Derived from the input file header.
  ** The output record consists of four attributes: Sampling Epoch Time (ETideLoad format), Number of Days relative to the First Sampling Epoch, Period of the Difference (Days), and Variation Rate (per week, /wk).
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-12 10:07:22
>> Complete the computation!
>> Computation end time: 2026-06-12 10:07:22
```

Save the result time series as | Import setting parameters | Start computation

```
JHYW_U  120.0442179  29.16216832  109.8773   57023.50
     2015010200      0.50000      1.00000      1.0535
     2015010300      1.50000      1.00000      3.1269
     2015010400      2.50000      1.00000      5.1009
     2015010500      3.50000      1.00000      6.9153
     2015010600      4.50000      1.00000      8.5141
     2015010700      5.50000      1.00000      9.8511
     2015010800      6.50000      1.00000     10.8920
     2015010900      7.50000      1.00000     11.6123
```





Weighted Operations, Differencing, Integration, and Interpolation on Variation Time Series

Integration Operation on Irregular Variation Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Weighted Operation between Two Attribute Time Series | Differencing Operation on Irregular Variation Time Series | Integration Operation on Irregular Variation Time Series | Construction of Time Series by Interpolation from Another Time Series

Open the ground variation time series file

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal number of the time series to be integrated: 4

When the sampling epoch time is in ETideLoad format, the starting MJD0 is not necessary.

>> Program Process ** Operation Prompts

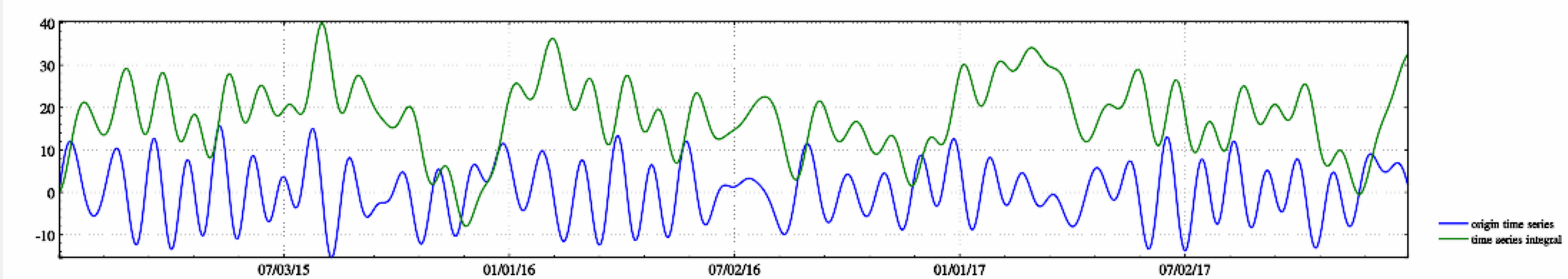
Save program process as

```
>> Complete the computation!
>> Computation end time: 2026-06-12 10:07:22
>> [Function] Perform numerical integration on a specified irregular variation time series by accumulating the weekly variation (dt = 7 days). The integrated value at the first epoch is set to zero. The weekly rate at the midpoint epoch is interpolated using the Gaussian Function Interpolation Method. The accumulated value at each step is calculated as the product of the weekly rate at the midpoint epoch and the sampling time interval (seven days).
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/TmsrsAddifferinterp/diffrst.txt.
  ** Set the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/TmsrsAddifferinterp/intgrst.txt.
  ** Header: Derived from the input time series file header.
  ** Record: The original input record is appended with a new column containing the integrated values.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-12 10:08:56
>> Complete the computation!
>> Computation end time: 2026-06-12 10:08:56
```

Save the result time series as | Import setting parameters | Start computation

```
JHYW U  120.0442179  29.16216832  109.8773   57023.500
     2015010200    0.50000    1.00000     1.0535     0.0000
     2015010300    1.50000    1.00000     3.1269     0.6064
     2015010400    2.50000    1.00000     5.1009     1.3467
     2015010500    3.50000    1.00000     6.9153     2.2454
     2015010600    4.50000    1.00000     8.5141     3.3168
     2015010700    5.50000    1.00000     9.8511     4.5586
     2015010800    6.50000    1.00000    10.8920     5.9508
     2015010900    7.50000    1.00000    11.6123     7.4602
```

Extract time series to be plot | Plot↓



Weighted Operations, Differencing, Integration, and Interpolation on Variation Time Series

Construction of Time Series by Interpolation from Another Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Weighted Operation between Two Attribute Time Series | Differencing Operation on Irregular Variation Time Series | Integration Operation on Irregular Variation Time Series | Construction of Time Series by Interpolation from Another Time Series

Open the ground variation time series file

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Open the variation time series file for interpolation

Set the file parameters

Column ordinal number of starting MJD0 in the header: 5

Column ordinal number of time in the record: 1

Column ordinal number of the time series to be interpolated: 4

Select interpolation mode: The cubic spline

>> Program Process ** Operation Prompts

Save program process as

```
>> Computation start time：2026-06-12 10:08:56
>> Complete the computation!
>> Computation end time: 2026-06-12 10:08:56
>> [Function] Interpolate sampling values from an irregular time series onto specified epochs using either Cubic Spline Interpolation or Gaussian Function Interpolation..
>> Open the ground variation time series file C:/ETideLoad4.5_win64en/examples/TmsrsAddifferinterp/ErrsepN.txt.
  ** Set the file format parameters according to the text box below. After giving the output file name, click the control button [Import setting parameters]...
>> Open the variation time series file for interpolation C:/ETideLoad4.5_win64en/examples/TmsrsAddifferinterp/ErrsepU.txt.
  ** Set the file format parameters according to the text box below...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/TmsrsAddifferinterp/intprst.txt.
  ** Header: Derived from the input time series file header.
  ** Record: The original input record is appended with a new column containing the interpolated sampling values.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-12 10:10:08
>> Complete the computation!
>> Computation end time: 2026-06-12 10:10:09
```

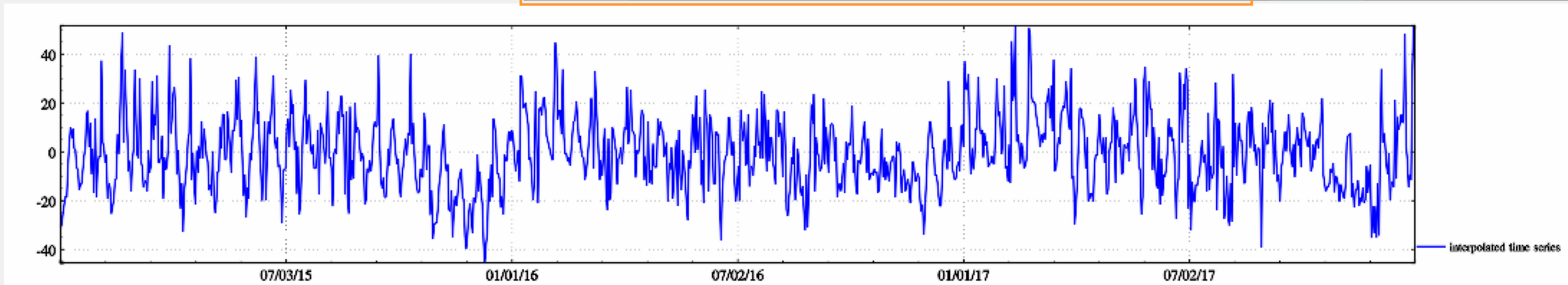
ErrsepU.txt

1	JHYW N	120.0442179	29.16216832	109.8773	57023.500	
2	2015010112	0.03	0.0	-31.1716	-18.1077	0.0000
3	2015010212	2.2	1.0	-28.9982	-17.9572	-0.0035
4	2015010312	6.51	2.0	-24.6847	-17.5105	-0.0070
5	2015010412	9.96	3.0	-21.2312	-16.7818	-0.0104
6	2015010512	12.85	4.0	-18.3377	-15.7939	-0.0139
7	2015010612	12.55	5.0	-18.6342	-14.5776	-0.0174
8	2015010712	25.9	6.0	-5.2808	-13.1703	-0.0209
9	2015010812	34.52	7.0	3.3427	-11.6143	-0.0244
10	2015010912	41.16	8.0	9.9862	-9.9554	-0.0278
11	2015011012	36.64	9.0	5.4697	-8.2409	-0.0313
12	2015011112	40.85	10.0	9.6832	-6.5180	-0.0348
13	2015011212	32.32	11.0	1.1567	-4.8320	-0.0383

Save the result time series as | Import setting parameters | Start computation

JHYW N	120.0442179	29.16216832	109.8773	57023.500			
2015010112	-0.42	0.0	-0.4177	2.9484	0.0000	-3.3661	-31.1716
2015010212	2.22	1.0	2.2519	2.8553	-0.0295	-0.6035	-28.9982
2015010312	4.8	2.0	4.8614	2.6179	-0.0591	2.2435	-24.6847
2015010412	2.69	3.0	2.7809	2.3324	-0.0886	0.4485	-21.2312
2015010512	4.56	4.0	4.6805	2.0810	-0.1181	2.5995	-18.3377
2015010612	4.35	5.0	4.5000	1.8664	-0.1477	2.6336	-18.6342
2015010712	-0.07	6.0	0.1095	1.5960	-0.1772	-1.4865	-5.2808
2015010812	-1.03	7.0	-0.8209	1.1332	-0.2067	-1.9542	3.3427

Extract time series to be plot | Plot↓



Normalized Extraction from Batch Geodetic Monitoring Network Time Series

Normalized Extraction from Batch Geodetic Network Site Time Series

Input folder Results folder Import parameters Start extracting Save process Follow example

Open any text file to be extracted in the folder

Set the wildcard of the batch file names

Ordinal number of first wildcard in file name: 1

Number of consecutive wildcards in file name: 4

Set parameters of the site location

Column ordinal number of the longtitude❶: 101

Latitude: 102 Height: 103

Set the extracting parameters

Number of rows of the input file header: 1

Column ordinal number of the sampling time in file record: 1

Column ordinal number of the master extracting time series in record: 2

Ratio to be multipied with the master time series: 1000.0000

Copy parameters for other time series❷: 401

Time format in the input file: Long integer in ETideLoad

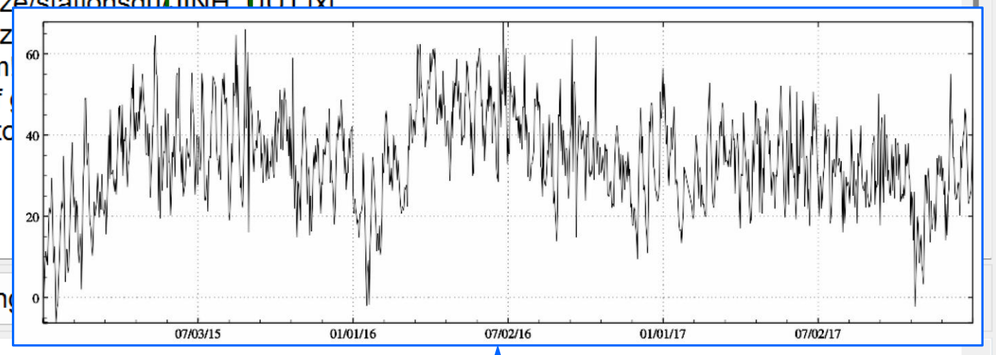
Normalized Extraction from Batch Geodetic Network Site Time Series

Normalized Extraction from Batch CORS Network Baseline Time Series

>> Program Process ** Operation Prompts

Save program process as

```
name with a consistent character count; and Output time series files will be saved to a user-specified directory.
>> Select a computation function from the two control buttons on the upper right of the interface...
>> [Function] Extract data from text files of batch geodetic network sites and generate corresponding time series files in the ETideLoad format..
>> Open any text file to be extracted in the folder C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/stationsqu/DONT_UUT.txt.
  ** Please carefully look at the source file information in the text box below, enter the parameters, select the output file folder, and then click the button [Import setting parameters] to import these parameters into the program...
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/stationrst.
  ** The geodetic site time series files searched by wildcard instantiation:
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/stationsqu/DONT_UUT.txt
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/stationsqu/FIDQ_UUT.txt
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/stationsqu/JHYW_UUT.txt
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/stationsqu/JINH_UUT.txt
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormaliz
>> Setting parameters have been imported into the program
>> Prepare for normalized extraction of batch time series of
  ** Click the control button [Start extracting], or the tool butto
>> Computation start time：2026-06-20 08:16:53
>> Complete to extract for the 5 site variation time series!
>> Computation end time: 2026-06-20 08:16:53
```



Set the folder to save results Import setting

```
121.0901 27.5005 85.999   57022   57023.50000000
 20150101120000.0  -32.369      0.00000000   -37.134
 20150102120000.0  -30.479      1.00000000   -28.017
 20150103120000.0  -23.879      2.00000000   -22.391
 20150104120000.0  -20.939      3.00000000   -19.136
 20150105120000.0  -23.109      4.00000000   -17.452
 20150106120000.0  -24.429      5.00000000   -16.777
 20150107120000.0  -16.689      6.00000000   -16.720
 20150108120000.0  -10.189      7.00000000   -17.019
 20150109120000.0  -21.929      8.00000000   -17.503
 20150110120000.0  -10.579      9.00000000   -18.061
 20150111120000.0   -2.839     10.00000000   -18.626
 20150112120000.0  -13.409     11.00000000   -19.159
 20150113120000.0  -23.759     12.00000000   -19.638
 20150114120000.0  -19.789     13.00000000   -20.051
```

The input text file to be extracted

DONT.txt

1	DONT	121.0901	27.5005	86.00	57023.500000	-32.3690
2	20150101120000	0.000000		0.0000	-37.1340
3	20150102120000	1.000000		1.8900	-28.0170
4	20150103120000	2.000000		8.4900	-22.3910
5	20150104120000	3.000000		11.4300	-19.1360
6	20150105120000	4.000000		9.2600	-17.4520
7	20150106120000	5.000000		7.9400	-16.7770
8	20150107120000	6.000000		15.6800	-16.7200
9	20150108120000	7.000000		22.1800	-17.0190
10	20150109120000	8.000000		20.5400	-17.5030
11	20150110120000	9.000000		21.7900	-18.0610
12	20150111120000	10.000000		18.9600	-18.6260
13	20150112120000	11.000000		18.9600	-19.1590
14	20150113120000	12.000000		8.6100	-19.6380
15	20150114120000	13.000000		12.5800	-20.0510
16	20150115120000	14.000000		6.6600	-20.3920

The output site time series file

Single Element (e.g., ❶101, 202): Represents the element at Row i and Column j (where 101 = 1st row, 1st column).

Column Range (e.g., ❷302): Indicates that the attribute time series starting from the 3rd column for a span of 2 consecutive columns will be saved. The program ignores column indices exceeding the source file's attribute range.

Normalized Extraction from Batch Geodetic Monitoring Network Time Series

Normalized Extraction from Batch CORS Network Baseline Time Series

Input folder | Results folder | Import parameters | Start extracting | Save process | Follow example

Open any text file to be extracted in the folder

Set the wildcard of the batch file names

Ordinal number of first wildcard in file name: 1

Number of consecutive wildcards in file name: 9

Location parameters of starting site for CORS basline

Column ordinal number of the longtitude❶: 101

Latitude: 102 Height: 103

Set the extracting parameters

Number of rows of the input file header: 2

Column ordinal number of the sampling time in file record: 2

Column ordinal number of the master extracting time series in record: 12

Ratio to be multipied with the master time series: 1000.0000

Copy parameters for other time series❷: 1401

Time format in the input file: MJD (GPS time)

Set time parameters about the MJD

There is no starting MJD0 in the input file

Enter the starting epoch time: 2015010112

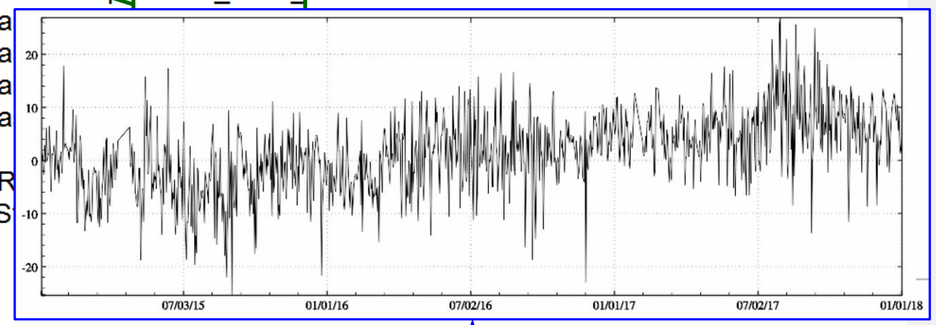
Normalized Extraction from Batch Geodetic Network Site Time Series

Normalized Extraction from Batch CORS Network Baseline Time Series

>> Program Process ** Operation Prompts

Save program process as

```
>> Open any text file to be extracted in the folder C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/baselinesqu/
CANN_DONT_Z.txt.
  ** Please carefully look at the source file information in the text box below, enter the parameters, select the output file folder, and then
click the button [Import setting parameters] to import these parameters into the program...
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/baselinerst.
  ** The CORS baseline time series files searched by wildcard instantiation:
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/baselinesqu/CANN_DONT_Z.txt
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/baselinesqu/CANN_FDIQ_Z.txt
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/baselinesqu/CANN_JHYW_Z.txt
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/baselinesqu/CANN_JINH_Z.txt
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/ba
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/ba
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/ba
    C:/ETideLoad4.5_win64en/examples/Tmsrsbatchnormalize/ba
>> Setting parameters have been imported into the program!
>> Prepare for normalized extraction of batch time series of COR
  ** Click the control button [Start extracting], or the tool button [S
>> Computation start time：2026-06-20 08:21:01
>> Complete to extract for the 8 CORS baseline time series!
>> Computation end time: 2026-06-20 08:21:11
```



The location parameters of the ending point of CORS basline

Column ordinal number of the longtitude❶: 201 Latitude: 202 Height: 204

Set the folder to save results | Import setting parameters | Start extracting

```
120.42470  27.52258 CANN_GPS
121.15027  27.83463 DONT_GPS
 DONT 001 N 34789.2465 +- 0.0024 E 71475.7299 +- 0.0026 U -454.3478 +- 0.0097 L 79493.8870 +- 0.0024 Correl.
 DONT 002 N 34789.2459 +- 0.0024 E 71475.7305 +- 0.0027 U -454.3463 +- 0.0099 L 79493.8873 +- 0.0025 Correl.
 DONT 003 N 34789.2457 +- 0.0025 E 71475.7296 +- 0.0028 U -454.3478 +- 0.0103 L 79493.8863 +- 0.0026 Correl.
 DONT 004 N 34789.2457 +- 0.0024 E 71475.7283 +- 0.0027 U -454.3504 +- 0.0102 L 79493.8852 +- 0.0025 Correl.
 DONT 005 N 34789.2468 +- 0.0025 E 71475.7312 +- 0.0028 U -454.3449 +- 0.0105 L 79493.8882 +- 0.0026 Correl.
 DONT 006 N 34789.2456 +- 0.0026 E 71475.7304 +- 0.0029 U -454.3482 +- 0.0108 L 79493.8871 +- 0.0027 Correl.
 DONT 007 N 34789.2464 +- 0.0025 E 71475.7309 +- 0.0027 U -454.3417 +- 0.0102 L 79493.8869 +- 0.0025 Correl.
 DONT 008 N 34789.2450 +- 0.0024 E 71475.7309 +- 0.0027 U -454.3479 +- 0.0101 L 79493.8873 +- 0.0025 Correl.
 DONT 009 N 34789.2463 +- 0.0026 E 71475.7305 +- 0.0028 U -454.3470 +- 0.0107 L 79493.8875 +- 0.0026 Correl.
```

The input text file to be extracted

CANN_DONT.txt

1	CANN_DONT	120.4247	27.5226	-1.00	121.1503	27.8346	0.00	57024.500000
2		2015010312	0.000000	0.0000	0.0097			
3		2015010412	1.000000	1.5000	0.0099			
4		2015010512	2.000000	0.0000	0.0103			
5		2015010612	3.000000	-2.6000	0.0102			
6		2015010712	4.000000	2.9000	0.0105			
7		2015010812	5.000000	-0.4000	0.0108			
8		2015010912	6.000000	6.1000	0.0102			
9		2015011012	7.000000	-0.1000	0.0101			
10		2015011112	8.000000	0.8000	0.0107			
11		2015011212	9.000000	1.5000	0.0125			
12		2015011312	10.000000	6.5000	0.0104			
13		2015011412	11.000000	1.0000	0.0116			
14		2015011512	12.000000	-5.9000	0.0123			
15		2015011612	13.000000	1.3000	0.0104			

The output baseline time series file

- Single Element (e.g., ❶101, 202): Represents the element at Row i and Column j (where 101 = 1st row, 1st column).
- Column Range (e.g., ❷302): Indicates that the attribute time series starting from the 3rd column for a span of 2 consecutive columns will be saved. The program ignores column indices exceeding the source file's attribute range.

Processing and Analysis for Batch Geodetic Monitoring Network Time Series

Gross Error Detection, Low-pass Filtering, and Reconstruction for Batch Time Series

Open folder | Results folder | Import parameters | Start processing | Save process | Follow example

Open any time series file to be processed in the folder

Set the wildcard of the batch file names

Ordinal number of first wildcard in file name: 1

Number of consecutive wildcards in file name: 9

Format parameters of the time series file

Column ordinal number of starting MJD0 in header: 5

Column ordinal number of sampling time in record: 1

Column ordinal number of the attribute time series to be processed in record: 3

Multiple of the standard deviation: 3.0

Number of the low-pass filtering parameters: 90

Gross Error Detection, Low-pass Filtering, and Reconstruction for Batch Time Series

Batch Time Series Averaging and Record-Format Time Series Construction

>> Program Process ** Operation Prompts

Save program process as

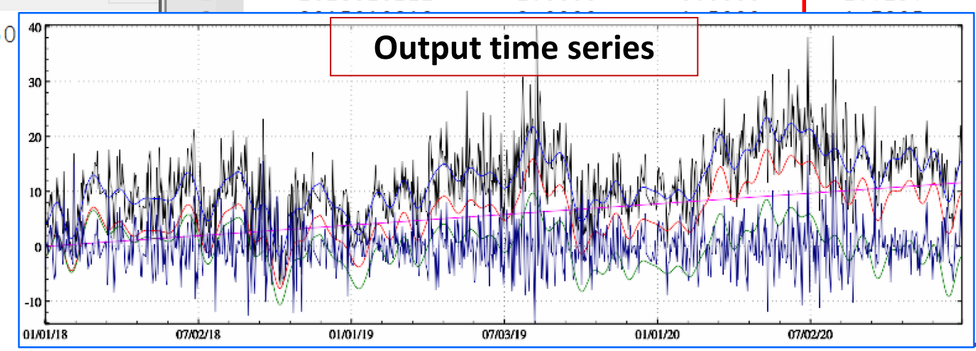
```
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/bslprorst.
 ** Header: Original header appended with Constant term and Linear term (annual variation rate, /a).
 ** Record: Original data appended with 5 attributes: Low-pass filtering value, Low-pass value (constant removed), Low-pass value (constant & linear removed), Linear variation, and Residual value.
 ** The time series files searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/baselinerst/CANN_DONT.txt
   C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/baselinerst/CANN_FDIQ.txt
   C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/baselinerst/CANN_JHYW.txt
   C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/baselinerst/CANN_JINH.txt
   C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/baselinerst/CANN_JINX.txt
   C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/baselinerst/CANN_JNJZ.txt
   C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/baselinerst/CANN_JSAN.txt
   C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/baselinerst/CANN_LHAI.txt
>> Setting parameters have been imported into the program!
>> Prepare for the gross error detection, low-pass filtering, and signal reconstructing...
 ** Click the control button [Start batch processing], or the tool button [Start processing]....
>> Computation start time：2026-06-20 09:48:06
>> Complete the gross error separation, low-pass filtering, and signal reconstructing for 8 time series!
>> Computation end time: 2026-06-20 09:48:15
 ** The program outputs the linear variation file TsqLinear#.txt, where # is the column ordinal number of the specified attribute time series in the source time series file.
 ** A header-less file storing statistical information for each processed series, including: Input file header, Number of filtering parameters, Annual variation rate (/a), Constant term, and Residual Standard Deviation.
```

Display of the input-output file↓

CANN_DONT 120.4247 27.5226 0.0 121.150

2015010212	1.0000	0.0000
2015010312	2.0000	1.5000
2015010412	3.0000	0.0000
2015010512	4.0000	-2.6000
2015010612	5.0000	2.9000
2015010712	6.0000	-0.4000
2015010812	7.0000	6.1000
2015010912	8.0000	-0.1000
2015011012	9.0000	0.8000
2015011112	10.0000	1.5000

Input time series



lvbCANN_DONT.txt

1	CANN_DONT	120.4247	27.5226	0.0	121.1503	27.8346	0.0	57023.5000	-5.5922	4.9225
2	2015010212	1.0000	0.0000		1.7297	7.3219	7.3219	0.0000	-1.7297	
						7.3127	7.2992	0.0135	-0.2205	
						7.2589	7.2319	0.0270	-1.6667	
						7.1636	7.1232	0.0404	-4.1714	
						7.0316	6.9777	0.0539	1.4606	
						6.8694	6.8020	0.0674	-1.6772	
						6.6847	6.6038	0.0809	5.0075	
						6.4864	6.3921	0.0943	-0.9942	
						6.2840	6.1762	0.1078	0.1082	
						6.0872	5.9659	0.1213	1.0050	
						5.9055	5.7707	0.1348	6.1867	
						5.7480	5.5997	0.1482	0.8442	
						5.6227	5.4609	0.1617	-5.9304	
						5.5363	5.3611	0.1752	1.3559	

After batch processing, the program plots and checks the processing quality for each time series. If necessary, users can invoke the standalone modules [Separation and Processing of Irregular Geodetic Variation Time Series] and [Low-pass Filtering and Signal Reconstruction for Irregular Time Series] for individual series refinement.

Processing and Analysis for Batch Geodetic Monitoring Network Time Series

Batch Time Series Averaging and Record-Format Time Series Construction

Open folder | Results folder | Import parameters | Start processing | Save process | Follow example

Open any time series file to be processed in the folder

Gross Error Detection, Low-pass Filtering, and Reconstruction for Batch Time Series

Batch Time Series Averaging and Record-Format Time Series Construction

Set the wildcard of the batch file names

Ordinal number of first wildcard in file name: 1

Number of consecutive wildcards in file name: 5

Format parameters of the time series file

Column ordinal number of starting MJD0 in header: 5

Column ordinal number of sampling time in record: 1

Column ordinal number of the attribute time series to be processed in record: 3

Select average period: One week

Type of the time series: The site variation time series

>> Program Process ** Operation Prompts

Save program process as

```
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YNMJ_U.txt
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YNRL_U.txt
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YNSD_U.txt
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YNTC_U.txt
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YNXP_U.txt
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YNYA_U.txt
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YNYL_U.txt
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YNYM_U.txt
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YNYS_U.txt
C:/ETideLoad4.5_win64en/examples/Tmsrsnetwkanalyspro/stationsrst/YSSK_U.txt
>> Setting parameters have been imported into the program!
>> Prepare for the Batch time series averaging and record-format time series construction...
  ** Click the control button [Start batch processing], or the tool button [Start processing]....
>> Computation start time：2026-06-20 09:50:29
>> Complete the averaging and record format time series construction for 16 time series!
>> Computation end time: 2026-06-20 09:50:30
  ** The program generates two specific files for record-format storage:
  ** (1) Average Value Record File (TsqavrRow#.txt): # is averaging mode.
  ** Header: Character count of name, Number of location attributes (M), Average Mode, Number of samples (N), N sampling epochs.
  ** Record: Name, M location info, N average values (default 9999).
  ** (2) Average Sample Count File
  ** Format identical to (1), but store
```

Set the folder to save results

Display of the input-output file↓

```
127.3745      36.3994        116.84          58119
    20180101                    0.5           0.00
    20180102                    1.5           4.99
    20180103                    2.5           4.24
    20180104                    3.5           3.44
    20180105                    4.5           7.01
    20180106                    5.5           8.05
    20180107                    6.5           9.49
    20180108                                  6.54
    20180109                    8.5           9.99
    20180110                    9.5           4.81
```

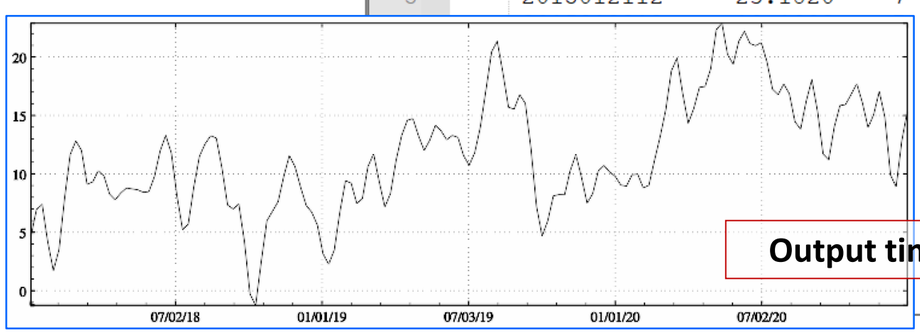
Input time series

avrDONT.txt

```
1  DONT   121.09010    27.50050    85.999     4.1458     -1.7406  1
2         2014123112   -23.4182    3
3         2015010712   -24.8598    7
4         2015011412   -26.2495    7
5         2015012112   -23.1820    7
```

the GPS weekly average

the middle epoch, average value, and number of the samples used to average



Output time series

After batch processing, the program plots and checks the processing quality for each time series. If necessary, users can invoke the standalone modules [Separation and Processing of Irregular Geodetic Variation Time Series] and [Low-pass Filtering and Signal Reconstruction for Irregular Time Series] for individual series refinement.

Construction and Analysis of Record Time Series from Geodetic Network

Construction of Record Time Series from Batch Time Series with Identical Specifications

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Construction of Record Time Series from Batch Time Series with Identical Specifications | Interpolation Repair for Missing Samples in Record Time Series | Time-space Statistics and Space-mean Separation for Record Time Series | Removal of Some Sampling Attributes from Record Time Series File | Removal or Restoration of Linear Variations from Record Time Series

Open any time series file in the folder

Ordinal Number of the first wildcard in the file name: 1

Number of consecutive wildcards in file name: 4

Site location parameters in header: 203

Column ordinal number of starting MJD0 in header: 5

Column ordinal number of sampling time in record: 1

Column ordinal number of the target attribute time series in record: 3

>> Program Process ** Operation Prompts

Save program process as

```
>> [Function] Construct a Record Time Series file from batch variation time series files with identical sampling specifications (same time span and interval) stored in a single directory.
  ** The program calculates the global maximum/minimum epoch times and the minimum sampling interval to establish a unified sampling specification. Missing values are flagged as 9999.000.
>> Open any time series file in the folder C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/DAEJ_U.txt
  ** Look at the input file information in the text box below, set the format parameters of the records time series file...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordrst.txt.
  ** Header: Number of characters in the time series name, number of location information columns, total number of samples, and all sampling epochs arranged chronologically.
  ** Record: Time series name, location information (3-4 attributes for sites, 6-8 for baselines/routes), and sequential sampling variations.
  ** Open any time series file in the folder
  ** The time series files searched by wildcard instantiation:
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/DAEJ_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/SCPZ_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/XIAG_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNGM_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNJD_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNLC_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNLJ_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNMJ_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNRL_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNSD_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNTC_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNXP_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNYA_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNYL_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNYM_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNYS_U.txt
     C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YSSK_U.txt
>> 17 time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
```

DAEJ_U.txt

1	DAEJ	127.3745	36.3994	116.84
2		20180101	0.5	0.00
3		20180102	1.5	4.99
4		20180103	2.5	4.24
5		20180104	3.5	3.44
6		20180105	4.5	7.01
7		20180106	5.5	8.05
8		20180107	6.5	9.49
9		20180108	7.5	6.54
10		20180109	8.5	9.99
11		20180110	9.5	4.81
12		20180111	10.5	2.28
13		20180112	11.5	1.55
14		20180113	12.5	2.58
15		20180114	13.5	7.46
16		20180115	14.5	12.58
17		20180116	15.5	9.82
18		20180117	16.5	6.86
19		20180118	17.5	9.51
20		20180119	18.5	6.38

Save the results as | Import setting parameters | Start computation

4	3	1095	2018010100	2018010200	2018010300	2018010400	2018010500	2018010600	2018010700	2018010800	2018010900	2018011
DAEJ	127.3745	36.3994	116.84	0.0000	4.9900	4.2400	3.4400	7.0100	8.0500	9.4900	6.54(
SCPZ	101.7439	26.5032	1167.55	0.0000	-3.9700	-9.2400	-14.8500	-4.0800	-3.8800	1.1400	3.79(
XIAG	100.2546	25.6081	1974.27	0.0000	8.6200	-3.6500	-3.9200	7.8100	-11.5100	-24.1600	3	3.69(
YNGM	99.3924	23.5460	1[illegible]	9.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9.00(
YNJD	100.8808	24.4371	1244.60	0.0000	-6.6700	-10.6000	-17.2800	-11.6100	-1.1200	9.0000	-7.34(
YNLC	100.0755	23.8678	1559.44	0.0000	-5.9500	-1.0000	-1.6300	-1.8100	-3.4400	4.0500	1.00(
YNLJ	100.0293	26.6956	3195.75	0.0000	-2.4000	-7.6800	-6.3000	2.0100	2.2000	7.1800	-0.01(
YNMJ	101.6748	23.4160	1281.64	0.0000	-0.6800	-4.6400	-8.8000	-3.5900	-8.5100	-12.4500	4.60(
YNRL	97.8453	24.0005	723.34	0.0000	-1.9200	1.0800	-6.2100	-4.6200	2.9900	1.3300	-0.22(
YNSD	99.1902	24.7128	1478.79	0.0000	-7.6300	-9.5800	-12.7500	-0.9200	-13.1100	-6.9300	0.42(

Output record time series

Record: the time series name, location, sampling variations arranged with sampling time.

A Record Time Series file represents the time evolution of a specific geodetic variation (monitoring element) across a network of sites. Each record corresponds to a specific geodetic object, such as a site's coordinate component, a GNSS baseline component, a gravity difference, a leveling route height difference, or an InSAR monitoring point.

Construction and Analysis of Record Time Series from Geodetic Network

Interpolation Repair for Missing Samples in Record Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Construction of Record Time Series from Batch Time Series with Identical Specifications | Interpolation Repair for Missing Samples in Record Time Series | Time-space Statistics and Space-mean Separation for Record Time Series | Removal of Some Sampling Attributes from Record Time Series File | Removal or Restoration of Linear Variations from Record Time Series

Open the record time series file

File parameters of the record time series

Column ordinal number of first epoch time in header: 4

Column ordinal number of the first variation in record: 5

Select interpolation mode: Gaussian function

>> Program Process ** Operation Prompts

Save program process as

```
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/SCPZ_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/XIAG_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNGM_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNJD_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNLC_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNLJ_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNMJ_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNRL_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNSD_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNTC_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNXP_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNYA_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNYL_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNYM_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YNYS_U.txt
C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/stationsrst/YSSK_U.txt
>> 17 time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-20 18:47:11
>> Complete the Computation!
>> Computation end time: 2026-06-20 18:47:14
>> [Function] Repair missing samples in the variation Record Time Series using Cubic Spline or Gaussian Function interpolation methods..
>> Open the record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecord999.txt
  ** Look at the input file information in the text box below, set the format parameters of the records time series file...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordinterp.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-20 18:49:29
>> Complete the Computation!
```

tmrecord999.txt

1	4	3	1095	2018010200	2018010300	2018010400	2018010500	2018010600	2018010700	2018010800	2018010900
2	DAEJ	127.3745	36.3994	116.84	0.0000	4.9900	4.2400	3.4400	7.0100	8.0500
3	SCPZ	101.7439	26.5032	1167.55	0.0000	-3.9700	-9.2400	9999.0000	-4.0800	-3.8800
4	XIAG	100.2546	25.6081	1974.27	0.0000	8.6200	-3.6500	-3.9200	9999.0000	-11.5100
5	YNJD	100.8808	24.4371	1244.60	0.0000	-6.6700	-19.6000	9999.0000	-11.6100	-1.1200
6	YNLC	100.0755	23.8678	1559.44	0.0000	-5.9500	-1.0000	-1.8300	9999.0000	-9.4400
7	YNLJ	100.0293	26.6956	3195.75	0.0000	-2.4000	-7.6800	-6.3000	2.0100	2.2000
8	YNMJ	101.6748	23.4160	1281.64	0.0000	-0.6800	-4.6400	-8.8000	-3.5900	-8.5100
9	YNRL	97.8453	24.0005	723.34	0.0000	-1.9200	1.0800	-6.2100	-4.6200	2.9900
10	YNSD	99.1902	24.7128	1478.79	0.0000	-7.6300	-9.5800	-12.7500	-0.9200	-13.1100
11	YNTC	98.4384	24.9546	1470.12	0.0000	-3.7500	-7.1800	-8.0300	1.1200	-3.4200
12	YNXP	101.9061	24.1024	1977.98	0.0000	6.6900	-0.0600	0.1100	3.3600	6.4500
13	YNYA	101.3274	25.7235	1846.15	0.0000	-2.6100	-9.5000	-8.4800	1.0400	0.6900
14	YNYL	99.3716	25.8847	1696.26	0.0000	-4.5400	-5.7000	9999.0000	2.1200	3.9600
15	YNYM	101.8609	25.6894	1077.79	0.0000	-0.6600	-0.9800	4.9900	13.4100	7.1600
16	YNYS	100.7539	26.6831	2143.89	0.0000	-2.6700	-7.8500	-7.1400	-6.4200	-7.7400
17	YSSK	142.7167	47.0297	91.29	0.0000	4.7500	4.0200	2.2100	4.6000	1.5000
18											

Input time series

Import setting parameters | Start computation

2018010500	2018010600	2018010700	2018010800	2018010900	2018011000	2018011
.0000	4.9900	4.2400	3.4400	7.0100	8.0500	9.4900
.0000	-3.9700	-9.2400	-5.5187	-4.0800	-3.8800	1.1400
.0000	8.6200	-3.6500	-3.9200	-10.2980	-11.5100	-24.1600
.0000	-6.6700	-19.6000	-10.7186	-11.6100	-1.1200	9.0000
.0000	-5.9500	-1.0000	-1.8300	-2.6473	-9.4400	4.0500
.0000	-2.4000	-7.6800	-6.3000	2.0100	2.2000	7.1800
.0000	-0.6800	-4.6400	-8.8000	-3.5900	-8.5100	-12.4500
.0000	-1.9200	1.0800	-6.2100	-4.6200	2.9900	1.3300
.0000	-7.6300	-9.5800	-12.7500	-0.9200	-13.1100	-6.9300
.0000	-3.7500	-7.1800	-8.0300	1.1200	-3.4200	0.3000

Output time series

A Record Time Series file represents the time evolution of a specific geodetic variation (monitoring element) across a network of sites. Each record corresponds to a specific geodetic object, such as a site's coordinate component, a GNSS baseline component, a gravity difference, a leveling route height difference, or an InSAR monitoring point.

Construction and Analysis of Record Time Series from Geodetic Network

Time-space Statistics and Space-mean Separation for Record Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Construction of Record Time Series from Batch Time Series with Identical Specifications | Interpolation Repair for Missing Samples in Record Time Series | Time-space Statistics and Space-mean Separation for Record Time Series | Removal of Some Sampling Attributes from Record Time Series File | Removal or Restoration of Linear Variations from Record Time Series

Open the record time series file

File parameters of the record time series

Column ordinal number of first epoch time in header: 4

Column ordinal number of the first variation in record: 5

- [x] Time-space mean separation of records time series
- [x] Converting records time series into site time series

Set the results time series folder

>> Program Process ** Operation Prompts

Save program process as

```
>> Computation end time: 2026-06-20 18:47:14
>> [Function] Repair missing samples in the variation Record Time Series using Cubic Spline or Gaussian Function interpolation methods..
>> Open the record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecord999.txt
  ** Look at the input file information in the text box below, set the format parameters of the records time series file...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordinterp.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-20 18:49:29
>> Complete the Computation!
>> Computation end time: 2026-06-20 18:49:31
>> [Function] Perform comprehensive spatiotemporal statistical analysis: Calculate temporal statistics (mean, std, min, max) for each individual record, spatial statistics(mean, std, min, max) across all sites at each sampling epoch, and global spatiotemporal statistics for the entire dataset.
>> Open the record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordrst.txt
  ** Look at the input file information in the text box below, set the format parameters of the records time series file...
>> Create or select the result files folder C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/removavrtmsqu.
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovavr.txt.
  ** Statistics Result File: Contains temporal statistics for each record (no header).
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-20 18:52:02
>> The program outputs the file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovaav.stm of spatial statistics time series into the current directory, whose sampling value are spatial statistics of the record time series.
  ** The file header: Epoch_statistics, spatial mean of longitudes, latitudes, and heights for all the points, the spatiotemporal mean, standard deviation, minimum and maximum of all sampling variations over the entire sampling time span. The record: The sampling epoch time, valid sampling variations number at the epoch time, spatial mean, standard deviation, minimum and maximum.
>> The program outputs the new record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovavr.spr into the current directory after removing the spatial average value from all the variations at each epoch time.
>> And outputs the new records time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovavr.tms after removing the time average value from the record time series of each variation.
>> Complete the Computation!
>> Computation end time: 2026-06-20 18:52:06
```

tmrecordrst.txt

1	4	3	1095	2018010100	2018010200	2018010300	2018010400
2	DAEJ	127.3745	36.3994	116.84	0.0000	4.9900
3	SCPZ	101.7439	26.5032	1167.55	0.0000	-3.9700
4	XIAG	100.2546	25.6081	1974.27	0.0000	8.6200
5	YNGM	99.3924	23.5460	1104.80	9999.0000	9999.0000
6	YNJD	100.8808	24.4371	1244.60	0.0000	-6.6700
7	YNLC	100.0755	23.8678	1559.44	0.0000	-5.9500
8	YNLJ	100.0293	26.6956	3195.75	0.0000	-2.4000
9	YNMJ	101.6748	23.4160	1281.64	0.0000	-0.6800
10	YNRL	97.8453	24.0005	723.34	0.0000	-1.9200
11	YNSD	99.1902	24.7128	1478.79	0.0000	-7.6300
12	YNTC	98.4384	24.9546	1470.12	0.0000	-3.7500
13	YNXP	101.9061	24.1024	1977.98	0.0000	6.6900
14	YNYA	101.3274	25.7235	1846.15	0.0000	-2.6100
15	YNYL	99.37				-4.5400
16	YNYM	101.8609	25.6894	1077.79	0.0000	-0.6600
17	YNYS	100.7539	26.6831	2143.89	0.0000	-2.6700
18	YSSK	142.7167	47.0297	91.29	0.0000	4.7500

Input record time series

tmrecordremovaav.stm | tmrecordremovavr.spr

1	4	3	1095	2018010100	2018010200	2018010300	2018010400	2018010500
2		DAEJ	127.3745	36.3994	116.84	-5.9818	1.1912
3		SCPZ	101.7439	26.5032	1167.55	-5.9818	-7.7688
4		XIAG	100.2546	25.6081	1974.27	-5.9818	4.8212
5		YNGM	99.3924	23.5460	1104.80	9999.0000	9999.0000
6		YNJD	100.8808	24.4371	1244.60	-5.9818	-10.4688
7		YNLC	100.0755	23.8678	1559.44	-5.9818	-9.7488
8		YNLJ	100.0293	26.6956	3195.75	-5.9818	-6.1988
9		YNMJ	101.6748	23.4160	1281.64	-5.9818	-4.4788
10		YNRL	97.8453	24.0005	723.34	-5.9818	-5.7188
11		YNSD	99.1902	24.7128	1478.79	-5.9818	-11.4288
12		YNTC	98.4384	24.9546	1470.12	-5.9818	-7.5488
13		YNXP	101.9061	24.1024	1977.98	-5.9818	2.8912
14		YNYA	101.3274	25.7235	1846.15	-5.9818	-6.4088
15		YNYL	99.3716	25.8847	1696.26	-5.9818	-8.3388
16		YNYM	101.8609	25.6894	1077.79	-5.9818	-4.4588
17		YNYS	100.7539	26.6831	2143.89	-5.9818	-6.4688
18		YSSK	142.7167	47.0297	91.29	-5.9818	0.9512

Save the results as | Import setting par

DAEJ	127.3745	36.3994	116.84	440.5116	2024.
SCPZ	101.7439	26.5032	1167.55	289.8710	1657.
XIAG	100.2546	25.6081	1974.27	288.3129	1629.
YNGM	99.3924	23.5460	1104.80	420.6608	1982.
YNJD	100.8808	24.4371	1244.60	472.3210	2105.
YNLC	100.0755	23.8678	1559.44	272.4826	1575.
YNLJ	100.0293	26.6956	3195.75	264.3826	1576.
YNMJ	101.6748	23.4160	1281.64	355.1048	1803.
YNRL	97.8453	24.0005	723.34	278.8997	1603.
YNSD	99.1902	24.7128	1478.79	229.0882	1462.
YNTC	98.4384	24.9546	1470.12	366.8519	1851.
YNXP	101.9061	24.1024	1977.98	275.1215	1575.

tmrecordremovaav.stm

1	Epoch_statistics	104.4021	27.0149	1420.6176	12.1306	12.3299
2	2018010100	17	5.9818	3.3237	0.0000	12.5800
3	2018010200	17	3.7988	3.9747	-1.7300	13.6600
4	2018010300	17	7.9376	4.4191	0.6400	17.0100
5	2018010400	15	12.1147	2.6635	7.4700	17.3700
6	2018010500	13	8.4977	4.3017	1.3200	17.6400
7	2018010600	17	9.6500	3.9586	4.4700	17.6100
8	2018010700	16	8.2194	3.0691	2.8100	13.4200
9	2018010800	15	8.1973	4.7083	1.8900	17.4500
10	2018010900	16	8.4606	4.3809	1.2800	17.9700
11	2018011000	16	10.9662	2.8911	4.1600	16.1700
12	2018011100	17	11.6124	5.7467	1.6200	21.2900
13	2018011200	16	5.2762	3.7404	-4.3700	10.9300
14	2018011300	16	11.3088	3.2544	7.2500	19.7200
15	2018011400	16	12.9363	3.6013	6.8000	21.1400
16	2018011500	15	8.0260	6.5740	-2.8000	19.9200
17	2018011600	15	7.6300	7.8795	-3.5900	23.2800
18	2018011700	15	-0.3780	4.8794	-7.0800	8.1800

A Record Time Series file represents the time evolution of a specific geodetic variation (monitoring element) across a network of sites. Each record corresponds to a specific geodetic object, such as a site's coordinate component, a GNSS baseline component, a gravity difference, a leveling route height difference, or an InSAR monitoring point.

Construction and Analysis of Record Time Series from Geodetic Network

Removal of Some Sampling Attributes from Record Time Series File

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Construction of Record Time Series from Batch Time Series with Identical Specifications | Interpolation Repair for Missing Samples in Record Time Series | Time-space Statistics and Space-mean Separation for Record Time Series | Removal of Some Sampling Attributes from Record Time Series File | Removal or Restoration of Linear Variations from Record Time Series

Open the record time series file

File parameters of the record time series

Column ordinal number of first epoch time in header: 4

Column ordinal number of the first variation in record: 5

Set the location parameters of the removal sampling variations: 1005

the 5 consecutive column sampling variations starting from the first sampling variation.

>> Program Process ** Operation Prompts

Save program process as

```
>> [Function] Perform comprehensive spatiotemporal statistical analysis: Calculate temporal statistics (mean, std, min, max) for each individual record, spatial statistics(mean, std, min, max) across all sites at each sampling epoch, and global spatiotemporal statistics for the entire dataset.
>> Open the record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordrst.txt
  ** Look at the input file information in the text box below, set the format parameters of the records time series file...
>> Create or select the result files folder C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/removavrtmsqu.
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovavr.txt.
  ** Statistics Result File: Contains temporal statistics for each record (no header).
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-20 18:52:02
>> The program outputs the file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovaav.stm of spatial statistics time series into the current directory, whose sampling value are spatial statistics of the record time series.
  ** The file header: Epoch_statistics, spatial mean of longitudes, latitudes, and heights for all the points, the spatiotemporal mean, standard deviation, minimum and maximum of all sampling variations over the entire sampling time span. The record: The sampling epoch time, valid sampling variations number at the epoch time, spatial mean, standard deviation, minimum and maximum.
>> The program outputs the new record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovavr.spr into the current directory after removing the spatial average value from all the variations at each epoch time.
>> And outputs the new records time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovavr.tms after removing the time average value from the record time series of each variation.
>> Complete the Computation!
>> Computation end time: 2026-06-20 18:52:06
>> [Function] Based on the specified linear term parameter (annual rate) and reference epoch (where linear variation is zero), calculate and remove or restore the linear trend from the Record Time Series.
>> Open the record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordrst.txt
  ** Look at the input file information in the text box below, set the format parameters of the records time series file...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremove.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-20 18:54:39
>> Complete the Computation!
>> Computation end time: 2026-06-20 18:54:41
```

Save the results as | Import setting parameters | Start computation

tmrecordrst.txt

1	4	3	1095	2018010100	2018010200	2018010300	2018010400	2018010500	2018010600	2018010700	2018010800	2018010900
2	DAEJ	127.3745	36.3994	116.84	0.0000	4.9900	4.2400	3.4400	7.0100	8.0500	9.4900	9999.0000
3	SCPZ	101.7439	26.5032	1167.55	0.0000	-3.9700	-9.2400	-14.8500	-4.0800	-3.8800	1.1400	1.0000
4	XIAG	100.2546	25.6081	1974.27	0.0000	8.6200	-3.6500	-3.9200	7.8100	-11.5100	-24.1600	-0.0100
5	YNGM	99.3924	23.5460	1104.80	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	4.6000
6	YNJD	100.8808	24.4371	1244.60	0.0000	-6.6700	-19.6000	-17.2800	-11.6100	-1.1200	9.0000	-0.2200
7	YNLC	100.0755	23.8678	1559.44	0.0000	-5.9500	-1.0000	-1.8300	-1.8100	-9.4400	4.0500	0.4200
8	YNLJ	100.0293	26.6956	3195.75	0.0000	-2.4000	-7.6800	-6.3000	2.0100	2.2000	7.1800	

Input time series

	4	3	1095	2018010600	2018010700	2018010800	2018010900	2018011000	2018011100	2018011200	2018011300
	DAEJ	127.3745	36.3994	116.84	8.0500	9.4900	6.5400	9.9900	4.8100	2.2800	1.5500
	SCPZ	101.7439	26.5032	1167.55	-3.8800	1.1400	3.7900	-0.9200	-4.6600	-3.6900	-1.0200
	XIAG	100.2546	25.6081	1974.27	-11.5100	-24.1600	33.6900	8.7100	4.3700	7.6100	3.7100
	YNGM	99.3924	23.5460	1104.80	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000
	YNJD	100.8808	24.4371	1244.60	-1.1200	9.0000	-0.2200	-0.6100	2.5500	1.6800	8.3800
	YNLC	100.0755	23.8678	1559.44	-9.4400	4.0500	0.4200	-2.8900	-1.9100	-1.7000	-2.2900

Output time series

A Record Time Series file represents the time evolution of a specific geodetic variation (monitoring element) across a network of sites. Each record corresponds to a specific geodetic object, such as a site's coordinate component, a GNSS baseline component, a gravity difference, a leveling route height difference, or an InSAR monitoring point.

Construction and Analysis of Record Time Series from Geodetic Network

Removal or Restoration of Linear Variations from Record Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Construction of Record Time Series from Batch Time Series with Identical Specifications | Interpolation Repair for Missing Samples in Record Time Series | Time-space Statistics and Space-mean Separation for Record Time Series | Removal of Some Sampling Attributes from Record Time Series File | Removal or Restoration of Linear Variations from Record Time Series

Open the record time series file

File parameters of the record time series

Column ordinal number of first epoch time in header: 4

Column ordinal number of the first variation in record: 5

Column ordinal number of the linear variations: 4

Reference epoch time for linear term: 2017010112

Select operation mode: Remove the linear term

>> Program Process ** Operation Prompts

Save program process as

```
>> The program outputs the file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovaav.stm of spatial statistics time series into the current directory, whose sampling value are spatial statistics of the record time series.
  ** The file header: Epoch_statistics, spatial mean of longitudes, latitudes, and heights for all the points, the spatiotemporal mean, standard deviation, minimum and maximum of all sampling variations over the entire sampling time span. The record: The sampling epoch time, valid sampling variations number at the epoch time, spatial mean, standard deviation, minimum and maximum.
>> The program outputs the new record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovavr.spr into the current directory after removing the spatial average value from all the variations at each epoch time.
>> And outputs the new records time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremovavr.tms after removing the time average value from the record time series of each variation.
>> Complete the Computation!
>> Computation end time: 2026-06-20 18:52:06
>> [Function] Based on the specified linear term parameter (annual rate) and reference epoch (where linear variation is zero), calculate and remove or restore the linear trend from the Record Time Series.
>> Open the record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordrst.txt
  ** Look at the input file information in the text box below, set the format parameters of the records time series file...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordremove.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-20 18:54:39
>> Complete the Computation!
>> Computation end time: 2026-06-20 18:54:41
>> [Function] Remove specified consecutive columns of sampling attributes from the records and their corresponding epoch times from the header.
>> Open the record time series file C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmrecordlv.txt
  ** Look at the input file information in the text box below, set the format parameters of the records time series file...
>> Save the result time series as C:/ETideLoad4.5_win64en/examples/Tmrecordanalysproc/tmremoveinear.txt.
  ** The output record time series file format is exactly the same as the input record time series file format.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-20 18:57:36
>> Complete the Computation!
>> Computation end time: 2026-06-20 18:57:38
```

tmrecordlv.txt

1	4	3	1095	2018063000	2018070100	2018070200	2018070300	2018070400
2	DAEJ	127.3745	36.3994	4.7696	5.0826	3.5536	4.1519	8.3240
3	SCPZ	101.7439	26.5032	7.7015	-1.4245	2.1780	3.5082	6.3966
4	XIAG	100.2546	25.6081	5.0237	13.8479	14.6566	13.1036	13.0978
5	YNGM	99.3924	23.5460	7.6243	16.2094	19.0862	17.9315	23.2126
6	YNJD	100.8808	24.4371	13.0188	-1.3550	-2.5375	-0.9368	1.9044
7	YNLC	100.0755	23.8678	14.2882	8.1647	11.4479	10.2314	13.6236
8	YNLJ	100.0293	26.6956	8.3327	8.2176	3.8888	0.7639	3.5360
9	YNMJ	101.6748	23.4160	8.6103	10.5328	10.5742	12.8304	18.2923
10	YNRL	97.8453	24.0005	10.7443	-0.3897	0.4476	-0.0877	6.6205
11	YNSD	99.1902	24.7128	10.7035	5.4884	-0.1311	-2.8601	2.7410
12	YNTC	98.4384	24.9546	8.9560	3.0966	-0.6202	1.2372	5.4233
13	YNXP	101.9061	24.1024	10.4522	15.1781	15.0918	19.1869	20.7027
14	YNYA	101.3274	25.7235	8.3122	9.1957	6.4313	5.0297	7.8634
15	YNYL	99.3716	25.8847	11.0056	4.5596	8.[illegible]	[illegible]	5.6103
16	YNYM	101.8609	25.6894	8.8854	12.9203	11.5722	13.6449	16.2924
17	YNYS	100.7539	26.6831	8.5892	1.6566	1.9025	1.5355	3.3891
18	YSSK	142.7167	47.0297	5.7404	7.8416	7.6066	8.1434	5.7709

Input time series

Import setting parameters

Start computation

2018063000	2018070100	2018070200	2018070300	2018070400	2018070500	2018070600	2018070700
4.7696	-2.0277	-3.5698	-2.9845	1.1745	3.1170	5.8186	3.8643
7.7015	-12.9056	-9.3242	-8.0151	-5.1477	-2.2000	-11.4150	-15.6776
5.0237	6.3588	7.1537	5.5870	5.5674	9.7302	6.8138	0.6063
7.6243	4.8434	7.6993	6.5238	11.7840	22.3225	18.8453	18.2138
13.0188	-20.7629	-21.9810	-20.4160	-17.6104	-17.8919	-17.7296	-19.6474
14.2882	-13.1356	-9.8915	-11.1471	-7.7940	-4.1248	-9.3985	-8.9925
8.3327	-4.2045	-8.5561	-11.7939	-8.9545	-4.1543	-4.6102	-9.4361
8.6103	-2.3031	-2.2853	-0.0526	5.3857	3.9008	-4.1102	-2.9588
10.7443	-16.4069	-15.5990	-16.1637	-9.4849	-2.6913	-10.3532	-12.3797
10.7035	-10.4679	-16.1168	-18.8751	-13.3033	-7.8846	-7.3920	-11.1529

Output time series

A Record Time Series file represents the time evolution of a specific geodetic variation (monitoring element) across a network of sites. Each record corresponds to a specific geodetic object, such as a site's coordinate component, a GNSS baseline component, a gravity difference, a leveling route height difference, or an InSAR monitoring point.

Processing and Analysis of Variation (Vector) Grid Time Series

Reference Epoch Transformation for Grid Time Series

Open folder Save as Import parameters Start computation Save process Follow example

Reference Epoch Transformation for Grid Time Series | Low-pass Filtering Operation on Grid Time Series | Statistical Analysis on Variation (Vector) Grid Time Series | Coordinate Form Transformation for Variation Vector Grid Time Series | Removal and Restoration of Linear Variations for Grid Time Series

Open any variation grid time series file

Set the wildcard of the grid file names

Oridnal Number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 8

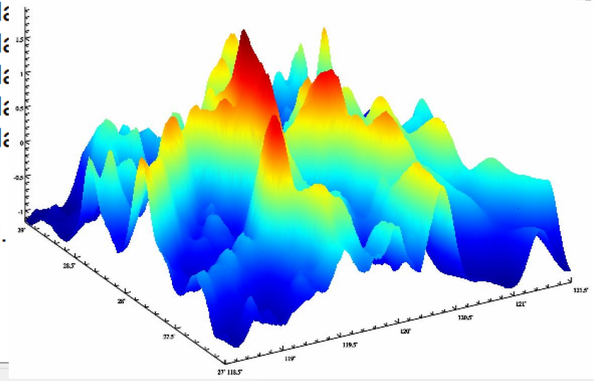
Process the vector grid time series

Open the variation grid file at the reference epoch

>> Program Process ** Operation Prompts

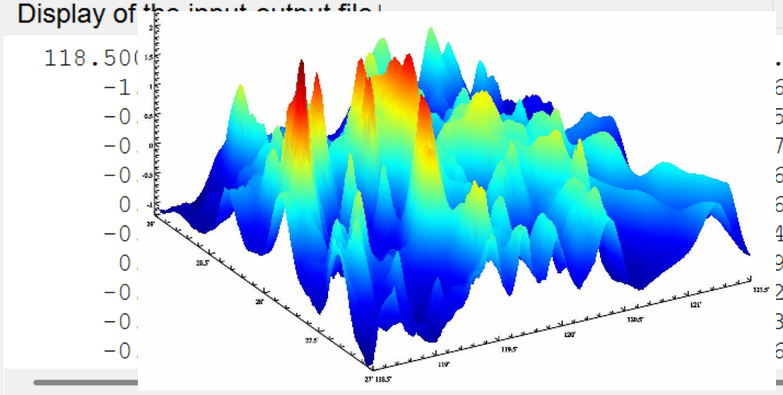
Save program process as

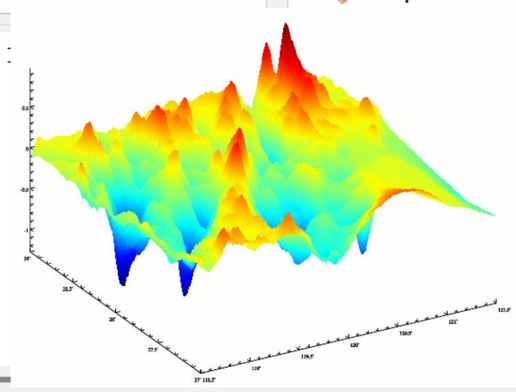
>> [Function] Unify the reference epoch by subtracting the variation grid values at a specified sampling time. After transformation, the grid values at the reference epoch are zero.
>> Open any variation grid time series file C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160101.dat.
>> Open the variation grid file at the reference epoch C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160101.dat.
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/epoch.
** The (vector) grid time series files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160101.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160131.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160301.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160331.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160501.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160531.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160701.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160801.da
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160831.da
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20161001.da
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20161031.da
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20161201.da
>> 12 grid time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation].
>> Computation start time：2026-06-21 09:20:53
>> Complete the unification of the reference epoch time for 12 grid time series!
>> Computation end time: 2026-06-21 09:20:54

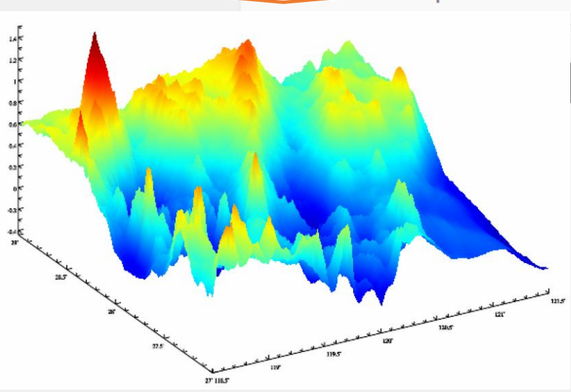


Set the folder to save results | Import setting parameters | computation

Display of the input-output file







A sequence of numerical grid model files representing a specific variation (or vector field). The seventh attribute in each grid file header is designated as the sampling epoch time.

Processing and Analysis of Variation (Vector) Grid Time Series

Low-pass Filtering Operation on Grid Time Series

Open folder Save as Import parameters Start computation Save process Follow example

Reference Epoch Transformation for Grid Time Series | Low-pass Filtering Operation on Grid Time Series | Statistical Analysis on Variation (Vector) Grid Time Series | Coordinate Form Transformation for Variation Vector Grid Time Series | Removal and Restoration of Linear Variations for Grid Time Series

Open any variation grid time series file

Set the wildcard of the grid file names

Oridnal Number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 8

Process the vector grid time series

Select low-pass filters: Moving average

Set the low-pass filter parameter (n): 5

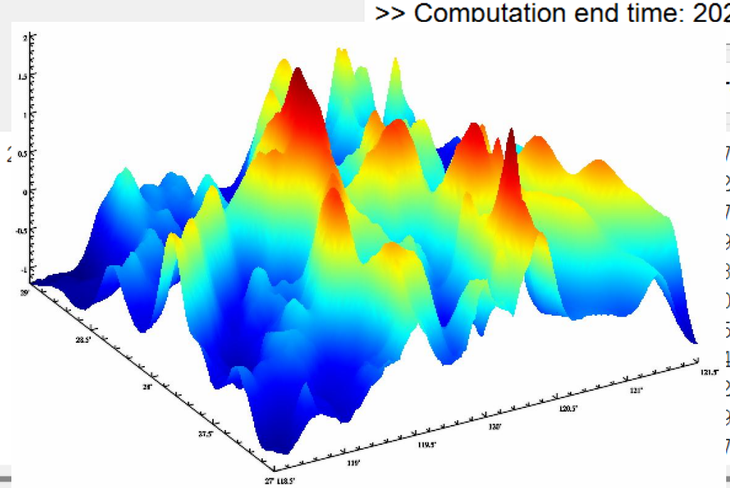
>> Program Process ** Operation Prompts

Save program process as

```
>> Complete the unification of the reference epoch time for 12 grid time series!
>> Computation end time: 2026-06-21 09:20:54
>> [Function] Apply low-pass filters (Moving Average, Gaussian, Exponential, Butterworth) to the grid time series. Grid specifications (extent and resolution) remain unchanged.
>> Open any variation grid time series file C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160101.dat.
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/flt.
 ** The (vector) grid time series files searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160101.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160131.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160301.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160331.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160501.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160531.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160701.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160801.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160831.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20161001.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20161031.dat
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20161201.dat
>> 12 grid time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-21 09:24:54
>> Complete the low-pass filtering for 12 grid time series!
>> Computation end time: 2026-06-21 09:24:54
```

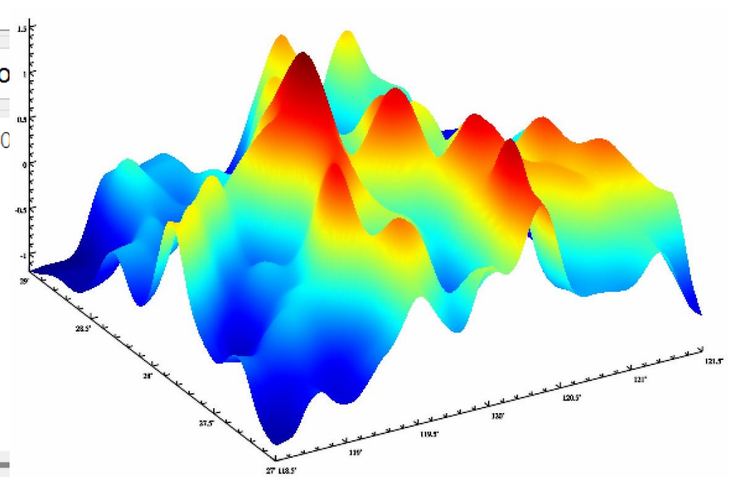
Display of the input-output file↓

```
118.500000  121.500000
    -1.1056     -0.8686
    -0.6595     -0.6895
    -0.9897     -0.9238
    -0.3572     -0.2164
     0.1404     -0.0935
    -0.0075     -0.2017
     0.0518     -0.0975
    -0.2898     -0.1284
    -0.5158     -0.6231
    -0.7686     -0.7346
```



esults Impo tart computation

```
/E-02          201601010
296              0735
716              7076
945              8820
373              0085
015              4547
580              3506
410             -.5882
205              .3802
907             -0.9221
716             -0.6566
                -0.0236
                -0.7196
                -0.5167
                 0.6472
                 0.6072
                 0.2126
                -0.5052
                 0.1002
                -0.8436
                -0.5584
```



A sequence of numerical grid model files representing a specific variation (or vector field). The seventh attribute in each grid file header is designated as the sampling epoch time.

Processing and Analysis of Variation (Vector) Grid Time Series

Statistical Analysis on Variation (Vector) Grid Time Series

Open folder Save as Import parameters Start computation Save process Follow example

Reference Epoch Transformation for Grid Time Series | Low-pass Filtering Operation on Grid Time Series | Statistical Analysis on Variation (Vector) Grid Time Series | Coordinate Form Transformation for Variation Vector Grid Time Series | Removal and Restoration of Linear Variations for Grid Time Series

Open any variation grid time series file

Set the wildcard of the grid file names

Oridnal Number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 8

Process the vector grid time series

>> Program Process ** Operation Prompts

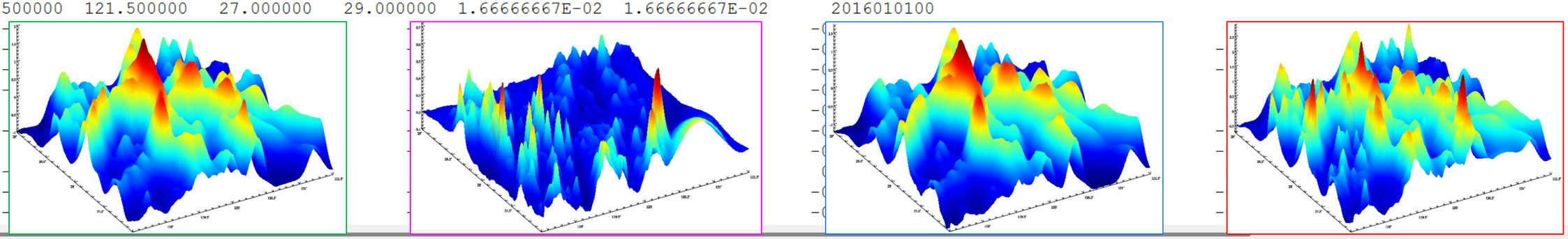
Save program process as

C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160131.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160301.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160331.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160501.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160531.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160701.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160801.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20160831.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20161001.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20161031.dat
C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmgrid/zwdx20161201.dat
>> 12 grid time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time: 2026-06-21 09:27:30
>> Complete the statistical analysis for 12 (vector) grid time series!
>> In the current folder, the program outputs spatial mean, standard deviation, minimum and maximum time series file gridstatmsqu.txt of the variation (vector) grid time series.
** The file header: tmgridstatitics, the grid center longitude, latitude, zero value. The record: the sampling epoch time of the variation (vector) grid time series, the spatial mean, standard deviation, minimum and maximum of the grid at sampling epoch time.
>> The program also outputs the time mean, standard deviation, minimum and maximum (vector) grid files gridtmavr.dat gridtmstd.dat, gridtminv.dat, and gridtmaxv.dat.
>> The overall space-time mean, standard deviation, minimum and maximum values of the variation (vector) grid time series are: 0.0247, 0.4276, -1.2081, and 2.8191.
>> Computation end time: 2026-06-21 09:27:30

Set the folder to save results | Import setting parameters | Start computation

Display of the input-output file↓

118.500000 121.500000 27.000000 29.000000 1.66666667E-02 1.66666667E-02 2016010100



A sequence of numerical grid model files representing a specific variation (or vector field). The seventh attribute in each grid file header is designated as the sampling epoch time.

Processing and Analysis of Variation (Vector) Grid Time Series

Coordinate Form Transformation for Variation Vector Grid Time Series

Open folder Save as Import parameters Start computation Save process Follow example

Reference Epoch Transformation for Grid Time Series | Low-pass Filtering Operation on Grid Time Series | Statistical Analysis on Variation (Vector) Grid Time Series | Coordinate Form Transformation for Variation Vector Grid Time Series | Removal and Restoration of Linear Variations for Grid Time Series

Open any vector grid time series file

>> Program Process ** Operation Prompts

Save program process as

Set the wildcard of the grid file names

Oridnal Number of the first wildcard in the file name: 8

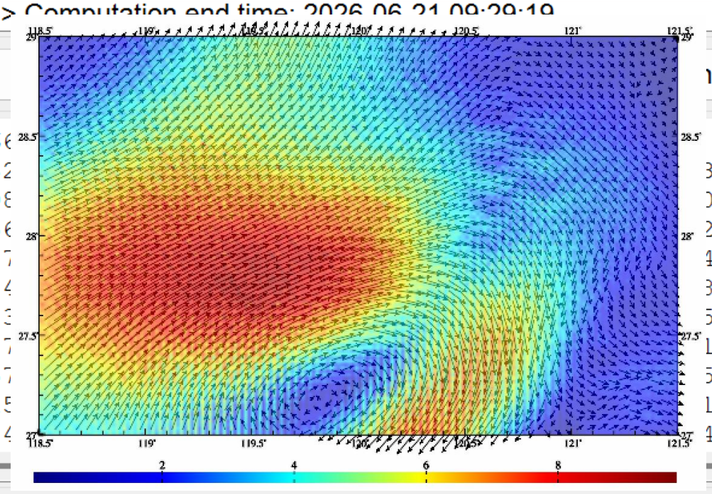
Number of consecutive wildcards in file name: 8

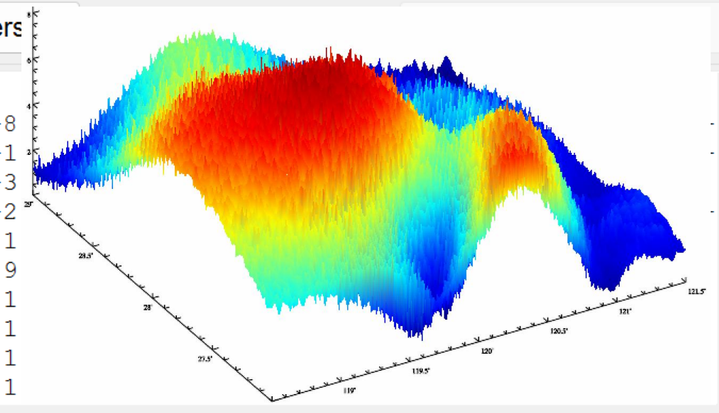
Vector transform mode: The plane rectangular

```
gridtmstd.dat, gridtminv.dat, and gridtmaxv.dat.
>> The overall space-time mean, standard deviation, minimum and maximum values of the variation (vector) grid time series are:
0.0247, 0.4276, -1.2081, and 2.8191.
>> Computation end time: 2026-06-21 09:27:30
>> [Function] Transform the vector representation in the grid between Polar Coordinates (r, α) and Plane Rectangular Coordinates
(E, N).
>> Open any vector grid time series file C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20150201.txt.
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/vconv.
 ** The (vector) grid time series files searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20150201.txt
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20150302.txt
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20150403.txt
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20150504.txt
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20150605.txt
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20150706.txt
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20150807.txt
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20150908.txt
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20151009.txt
   C:/ETideLoad4.5_win64en/examples/Tmgridanalysisproc/tmvgrd/cxpcbhl20151110.txt
>> 10 grid time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-21 09:29:18
>> Complete the coordinate form transformation for 10 vector grid time series!
>> Computation end time: 2026-06-21 09:29:19
```

Display of the input-output file↓

```
  118.500000  121.500000   27.000000   29.000000  1.66
-1.3621E+01 -8.9669E+00 -1.3249E+01 -8.4510E+00 -1.32
-7.1405E+00 -1.3074E+01 -6.6865E+00 -1.2434E+01 -5.98
-1.0886E+01 -3.2504E+00 -1.0236E+01 -2.3114E+00 -9.56
 2.5797E+00 -5.4586E+00  3.6631E+00 -4.1791E+00  4.77
 1.4446E-01  8.9566E+00  1.1454E+00  9.8749E+00  2.24
 1.3136E+01  6.1190E+00  1.3652E+01  7.1405E+00  1.43
 9.7614E+00  1.5272E+01  1.0102E+01  1.5829E+01  1.07
 1.5901E+01  1.1258E+01  1.5602E+01  1.1278E+01  1.57
 1.1402E+01  1.5798E+01  1.1629E+01  1.6107E+01  1.15
 1.4560E+01  1.0659E+01  1.4446E+01  1.0896E+01  1.44
```





A sequence of numerical grid model files representing a specific variation (or vector field). The seventh attribute in each grid file header is designated as the sampling epoch time.

Multi-form Spatiotemporal Interpolation from Grid Time Series

Interpolation of Irregular Variation Time Series from Grid Time Series

Open file Save as Import parameters Start computation Save process Follow example

Interpolation of Irregular Variation Time Series from Grid Time Series | Interpolation of the Specified Record Time Series from Grid Time Series | Interpolation at the Specified Location and Time from Grid Time Series | Construction of Record Time Series by Spatiotemporal Interpolation | Reconstruction of Grid Time Series According to Specified Spatiotemporal Resolution

Open any variation grid time series file

Set the wildcard of the grid file names

Ordinal Number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 8

Vector grids time series

Open ground variation time series file to be interpolated

Column ordinal number of the starting MJD0 in header: 4

Column ordinal number of the sampling time in record: 1

Spatial interpolation mode: Gaussian function

Temporal interpolation mode: Trigonometric function estimation

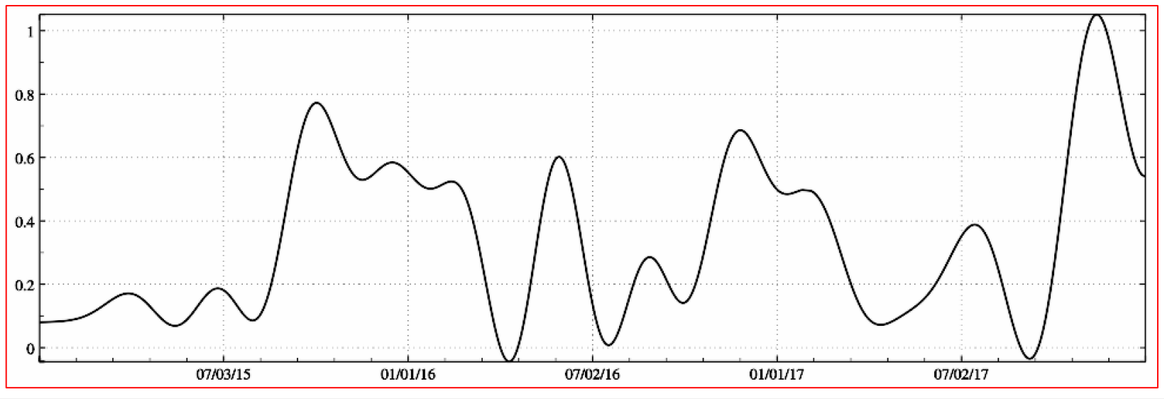
>> Program Process ** Operation Prompts

Save program process as

```
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160131.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160301.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160331.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160501.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160531.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160701.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160801.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160831.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161001.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161031.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161201.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170101.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170131.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170301.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170331.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170501.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170531.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170701.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170801.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170831.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171001.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171031.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171201.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171231.dat
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-21 10:46:38
>> Complete the computation! There are 37 grid time series files involved in the computation!
>> Computation end time: 2026-06-21 10:46:39
```

Save the results as | Import setting parameters | Start computation

```
DONT U  121.0901   27.5005    86.0
 20150101120000     -3.7134    -32.3690      0.0000     0.0785
 20150102120000     -2.8017    -30.4790      1.0000     0.0787
 20150103120000     -2.2391    -23.8790      2.0000     0.0790
 20150104120000     -1.9136    -20.9390      3.0000     0.0792
 20150105120000     -1.7452    -23.1090      4.0000     0.0795
 20150106120000     -1.6777    -24.4290      5.0000     0.0797
 20150107120000     -1.6720    -16.6890      6.0000     0.0800
 20150108120000     -1.7019    -10.1890      7.0000     0.0803
 20150109120000     -1.7503    -11.8290      8.0000     0.0805
 20150110120000     -1.8061    -10.5790      9.0000     0.0808
 20150111120000     -1.8626     -2.8390     10.0000     0.0811
 20150112120000     -1.9159    -13.4090     11.0000     0.0814
 20150113120000     -1.9638    -23.7590     12.0000     0.0818
 20150114120000     -2.0051    -19.7890     13.0000     0.0821
```



Interpolation points must lie within the grid extent. For noisy or gappy data, use Gaussian spatial interpolation and Trigonometric temporal interpolation.

Multi-form Spatiotemporal Interpolation from Grid Time Series

Interpolation of the Specified Record Time Series from Grid Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Interpolation of Irregular Variation Time Series from Grid Time Series | **Interpolation of the Specified Record Time Series from Grid Time Series** | Interpolation at the Specified Location and Time from Grid Time Series | Construction of Record Time Series by Spatiotemporal Interpolation | Reconstruction of Grid Time Series According to Specified Spatiotemporal Resolution

Open any variation grid time series file

Set the wildcard of the grid file names

Ordinal Number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 8

Open the record time series file

Column ordinal number of first sampling epoch in header: 4

Column ordinal number of first sampling variation in record: 5

Spatial interpolation mode: Gaussian function

Temporal interpolation mode: Trigonometric function estimation

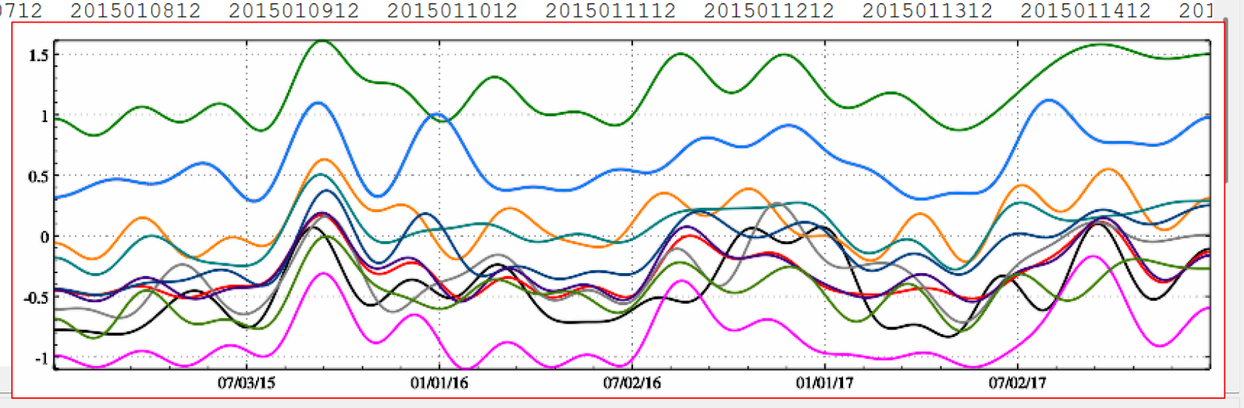
>> Program Process ** Operation Prompts

Save program process as

```
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160131.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160301.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160331.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160501.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160531.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160701.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160801.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160831.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161001.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161031.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161201.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170101.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170131.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170301.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170331.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170501.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170531.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170701.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170801.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170831.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171001.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171031.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171201.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171231.dat
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-21 10:48:54
>> Complete the computation! There are 37 grid time series files involved in the computation!
>> Computation end time: 2026-06-21 10:48:57
```

Save the results as | Import setting parameters | Start computation

4	3	1096	2015010112	2015010212	2015010312	2015010412	2015010512	2015010612	2015010712	2015010812	2015010912	2015011012	2015011112	2015011212	2015011312	2015011412	201
FDIQ			120.1226	27.2007	50.54	-0.7763	-0.7760	-0.7758	-0.7757								
JINH			119.3833	29.1304	1191.60	NaN	NaN	NaN	NaN								
JINX			119.2245	29.0415	84.79	-0.4520	-0.4520	-0.4520	-0.4521								
JNJZ			119.3815	27.5835	286.78	0.9431	0.9433	0.9431	0.9427								
JSAN			119.5546	28.2741	71.54	0.3361	0.3364	0.3369	0.3375								
LISH			119.5546	28.2741	71.54	0.3361	0.3364	0.3369	0.3375								
LONQ			119.0759	28.0451	233.28	-0.0762	-0.0761	-0.0764	-0.0769								
LUOY			119.4218	27.3309	552.52	-0.2036	-0.2035	-0.2036	-0.2040								
PCHQ			118.2644	28.1005	405.43	NaN	NaN	NaN	NaN								
PCJM			118.2644	28.1005	405.43	NaN	NaN	NaN	NaN								
QIYU			119.0445	27.3717	412.75	-0.6142	-0.6138	-0.6134	-0.6130								
QNYN			118.5750	27.3657	429.39	-0.4498	-0.4494	-0.4492	-0.4490								
QUZH			118.5327	28.5937	90.79	-1.0038	-1.0037	-1.0037	-1.0040								



Interpolation points must lie within the grid extent. For noisy or gappy data, use Gaussian spatial interpolation and Trigonometric temporal interpolation.

Multi-form Spatiotemporal Interpolation from Grid Time Series

Interpolation at the Specified Location and Time from Grid Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Interpolation of Irregular Variation Time Series from Grid Time Series | Interpolation of the Specified Record Time Series from Grid Time Series | **Interpolation at the Specified Location and Time from Grid Time Series** | Construction of Record Time Series by Spatiotemporal Interpolation | Reconstruction of Grid Time Series According to Specified Spatiotemporal Resolution

Open any variation grid time series file

Set the wildcard of the grid file names

Ordinal Number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 8

Open the calculated point file with the location and time

Row numbers occupied by the file header: 1

Column ordinal number of the sampling time in record: 6

Spatial interpolation mode: Gaussian function

Temporal interpolation mode: Trigonometric function estimation

>> Program Process ** Operation Prompts

Save program process as

```
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160131.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160301.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160331.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160501.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160531.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160701.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160801.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160831.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161001.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161031.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161201.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170101.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170131.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170301.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170331.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170501.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170531.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170701.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170801.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170831.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171001.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171031.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171201.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171231.dat
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-21 10:51:24
>> Complete the computation! There are 37 grid time series files involved in the computation!
>> Computation end time: 2026-06-21 10:51:24
```

Save the results as | Import setting parameters | Start computation

FDIQ	120.1226	27.2007	50.54	90	2015010705	
JINH	119.3833	29.1304	1191.60	90	2015010705	NaN
JINX	119.2245	29.0415	84.79	90	2015010705	-0.4527
JNJZ	119.3815	27.5835	286.78	90	2015010705	0.9394
JSAN	119.5546	28.2741	71.54	90	2015010705	0.3405
LISH	119.5546	28.2741	71.54	90	2015010705	0.3405
LONQ	119.0759	28.0451	233.28	90	2015010705	-0.0790
LUOY	119.4218	27.3309	552.52	90	2015010705	-0.2069
PCJM	118.2644	28.1005	405.43	90	2015010705	NaN
QIYU	119.0445	27.3717	412.75	90	2015010705	-0.6132
QNYN	118.5750	27.3657	429.39	90	2015010705	-0.4497
QUZH	118.5327	28.5937	90.79	90	2015010705	-1.0064
QZLY	119.1109	29.0201	73.91	90	2015010705	-0.4615
SHNQ	119.3010	27.2727	827.01	90	2015010705	-0.7148
SNYN	119.3033	28.2716	182.77	90	2015010705	0.4074

Interpolation points must lie within the grid extent. For noisy or gappy data, use Gaussian spatial interpolation and Trigonometric temporal interpolation.

Multi-form Spatiotemporal Interpolation from Grid Time Series

Construction of Record Time Series by Spatiotemporal Interpolation

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Interpolation of Irregular Variation Time Series from Grid Time Series | Interpolation of the Specified Record Time Series from Grid Time Series | Interpolation at the Specified Location and Time from Grid Time Series | **Construction of Record Time Series by Spatiotemporal Interpolation** | Reconstruction of Grid Time Series According to Specified Spatiotemporal Resolution

Open any variation grid time series file

Set the wildcard of the grid file names

Ordinal Number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 8

Open the discrete point file to be interpolated

Spatial interpolation mode: Gaussian function

Temporal interpolation mode: Trigonometric function estimation

Number of rows of the file header: 0

Start time for the target time series: 20150112

End time for the target time series: 20171215

Sampling internal for the target time series: 7.000 day

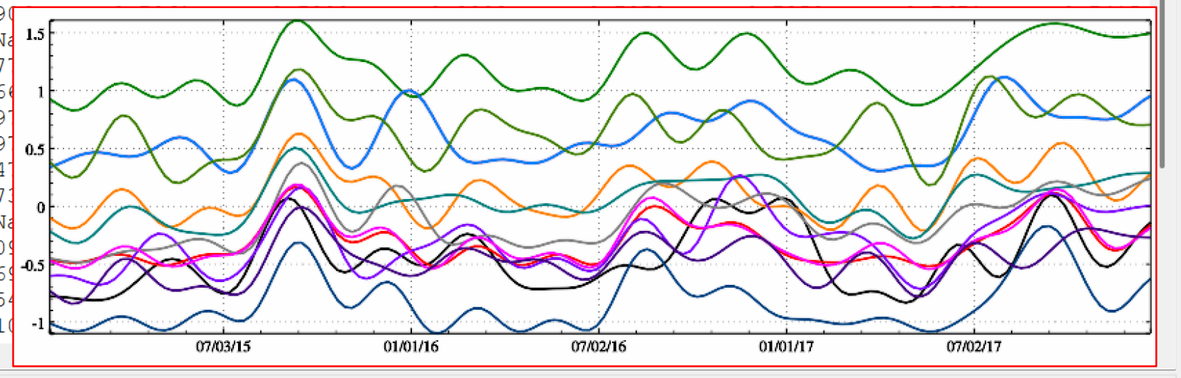
>> Program Process ** Operation Prompts

Save program process as

```
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160131.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160301.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160331.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160501.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160531.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160701.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160801.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160831.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161001.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161031.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161201.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170101.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170131.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170301.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170331.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170501.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170531.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170701.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170801.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20170831.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171001.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171031.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171201.dat
C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20171231.dat
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-21 10:54:00
>> Complete the computation! There are 37 grid time series files involved in the computation!
>> Computation end time: 2026-06-21 10:54:00
```

Save the results as | Import setting parameters | Start computation

	154	2015011200	2015011900	2015012600	2015020200	2015020900	2015021600	2015022300	2015030200	2015030900	2015031600	2015032300	2015033000	2015040600	2015041300	201504200
FDIQ	120.1226	27.2007	50.54	90	2015010705	-0.7764	-0.7797	-0.7847	-0.79							
JINH	119.3833	29.1304	1191.60	90	2015010705	NaN	NaN	NaN	Na							
JINX	119.2245	29.0415	84.79	90	2015010705	-0.4561	-0.4637	-0.4719	-0.47							
JNJZ	119.3815	27.5835	286.78	90	2015010705	0.9292	0.9070	0.8831	0.86							
JSAN	119.5546	28.2741	71.54	90	2015010705	0.3469	0.3605	0.3779	0.39							
LISH	119.5546	28.2741	71.54	90	2015010705	0.3469	0.3605	0.3779	0.39							
LONQ	119.0759	28.0451	233.28	90	2015010705	-0.0894	-0.1113	-0.1338	-0.14							
LUOY	119.4218	27.3309	552.52	90	2015010705	-0.2158	-0.2356	-0.2574	-0.27							
PCJM	118.2644	28.1005	405.43	90	2015010705	NaN	NaN	NaN	Na							
QIYU	119.0445	27.3717	412.75	90	2015010705	-0.6105	-0.6070	-0.6062	-0.60							
QNYN	118.5750	27.3657	429.39	90	2015010705	-0.4515	-0.4570	-0.4638	-0.46							
QUZH	118.5327	28.5937	90.79	90	2015010705	-1.0126	-1.0265	-1.0422	-1.05							
QZLY	119.1109	29.0201	73.91	90	2015010705	-0.4682	-0.4829	-0.4988	-0.51							



Interpolation points must lie within the grid extent. For noisy or gappy data, use Gaussian spatial interpolation and Trigonometric temporal interpolation.

Multi-form Spatiotemporal Interpolation from Grid Time Series

Reconstruction of Grid Time Series According to Specified Spatiotemporal Resolution

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Interpolation of Irregular Variation Time Series from Grid Time Series | Interpolation of the Specified Record Time Series from Grid Time Series | Interpolation at the Specified Location and Time from Grid Time Series | Construction of Record Time Series by Spatiotemporal Interpolation | **Reconstruction of Grid Time Series According to Specified Spatiotemporal Resolution**

Open any variation grid time series file

Set the wildcard of the grid file names

Ordinal Number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 8

Vector grids time series — spatial resolution: 2.500′

Spatial interpolation mode: Gaussian function

Temporal interpolation mode: Trigonometric function estimation

Start time for the target time series: 20150112

End time for the target time series: 20171215

Sampling internal for the target time series: 7.000 day

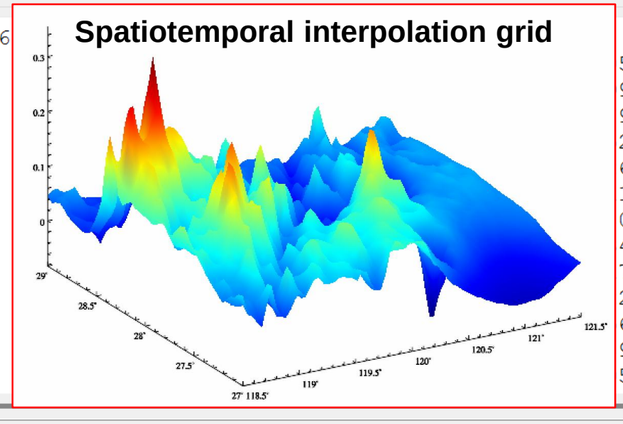
>> Program Process ** Operation Prompts

Save program process as

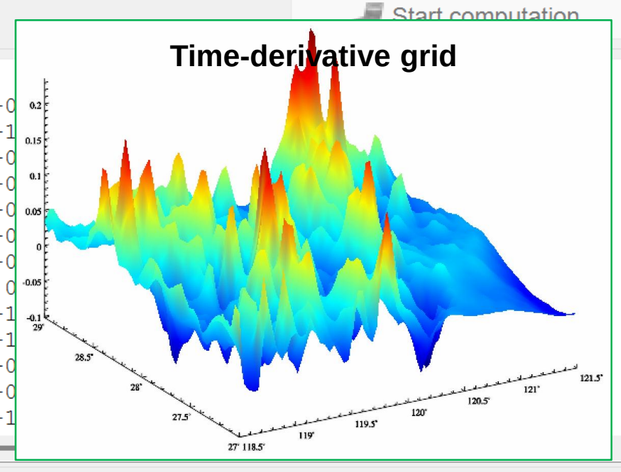
```
>> Computation end time: 2026-06-21 10:54:00
>> [Function] Construct a Record Time Series for specified location points (from a discrete point file) using the defined sampling time specifications.
>> Open any variation grid time series file C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150101.dat.
>> Create or select the result files folder C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/intpgridtm.
>> The program output the variation (vector) grid time series files grdtmsp*.dat and their time-derivative (vector) grid time series files grdtmdf.dat (per week, /wk).
 ** The grid time series files searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150101.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150131.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150301.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150331.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150501.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150531.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150701.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150801.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20150831.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20151001.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20151031.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20151201.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160101.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160131.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160301.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160331.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160501.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160531.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160701.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160801.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20160831.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161001.dat
   C:/ETideLoad4.5_win64en/examples/Tmgrdinterpolation/tmgrid/zwdx20161031.dat
```

Set the result files folder | Import setting parameters | Start computation

```
 118.50000000  121.50000000   27.00000000   29.00000000  1.66666666
    -1.0362       -1.0442       -1.0488       -1.0508      -1.0510
    -0.8437       -0.8347       -0.8359       -0.8482      -0.8734
    -1.0294       -1.0180       -0.9994       -0.9775      -0.9464
    -0.5674       -0.5563       -0.5524       -0.5527      -0.5566
    -0.1703       -0.1497       -0.1468       -0.1651      -0.1887
    -0.2312       -0.2352       -0.2440       -0.2505      -0.2519
    -0.0523       -0.1336       -0.2491       -0.3552      -0.4857
    -0.4004       -0.2344       -0.0988        0.0626       0.1736
    -0.5907       -0.7157       -0.8504       -0.9387      -1.0283
    -1.2061       -1.2098       -1.2133       -1.2155      -1.2181
    -1.1262       -1.0909       -1.0366       -0.9828      -0.9059
    -0.3301       -0.3822       -0.4405       -0.5253      -0.5996
    -1.0504       -1.0572       -1.0607       -1.0631      -1.0627
```

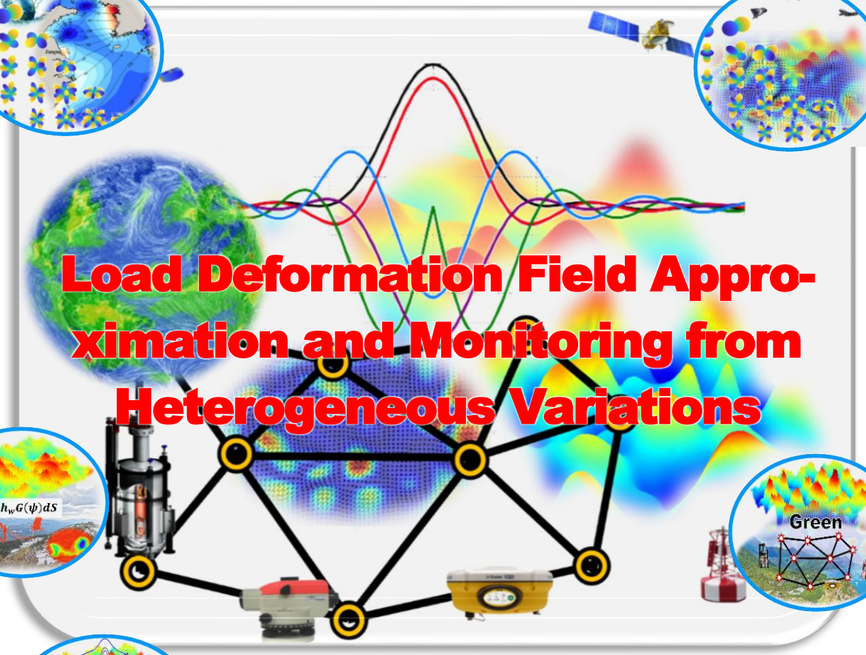



```
    504       -1.0292       -0
    984       -1.0123       -1
    911       -0.7547       -0
    228       -0.4859       -0
    658       -0.2733       -0
    180       -0.0530       -0
    068       -0.8285       -0
    466        0.2841        0
    749       -1.1815       -1
    206       -1.2174       -1
    685       -0.4948       -0
    912       -0.9369       -0
    563       -1.0348       -1
```



Interpolation points must lie within the grid extent. For noisy or gappy data, use Gaussian spatial interpolation and Trigonometric temporal interpolation.

Load Deformation Field Approximation and Monitoring from Heterogeneous Variations



- Spherical Harmonic Analysis on Global Surface Load Time Series
  - Construction of Global Surface Data Grid in Spherical Coordinates
  - Spherical Harmonic Analysis on Global Surface Atmosphere Variations
  - Spherical Harmonic Analysis on Global Surface Atmosphere Variations
  - Spherical Harmonic Analysis on Global Sea Level Variations
- Spherical Harmonic Analysis of Tidal Harmonic Constants and Construction of Tidal Load Model
  - Construction of Tidal Harmonic Constant Grid in Spherical Coordinates
  - Spherical Harmonic Analysis on Surface Atmosphere Tidal Harmonic Constants
  - Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants
- Computation of Load Model Values via Spherical Harmonic Synthesis
  - Computation of Surface Load Equivalent Water Height Model Values
  - Computation of Tidal Constituent Harmonic Constant Model Values
  - Computation of Load Equivalent Water Height Model Value Time Series
- Computation of Load Deformation Field via Spherical Harmonic Synthesis
  - Computation of Various Load Effects via Spherical Harmonic Synthesis
  - Computation of Various Load Effects for Earth Satellites or External to the Solid Earth
  - Computation of Load Effect Time Series via Spherical Harmonic Synthesis
- Regional Refinement of Load Deformation Field via Green's Integration
  - Computation of Regional Residual Surface Load Effects via Green's Integration
  - Computation of Lakes, Glaciers, and Snow Load Effects via Green's Integration
  - Computation of Regional Load Effect Time Series via Green's Integration
- Load Deformation Field Recovery from Heterogeneous Variations via Green's Integral Constraint
  - Load Deformation Field Estimation from Heterogeneous Variations via Green's Integral Constraint
  - Approximation of EWH variation and Load Effects from Variation Time Series by Green's integral constraints
- Regional Approximation of Load Deformation Field Using SRBFs
  - Approximation of Residual Loads and Synthesis of Residual Load Effects Using SRBFs
  - Approximation of Residual Surface Load and Load Effect Time Series Using SRBFs
- Geodynamic Calculation on Geodetic Field Grid Time Series
  - Time Difference Operation on Variation (Vector) Grid Time Series
  - Horizontal Gradient Calculation on Batch Variation Grids
  - Inner Product Operation on Two Groups of Vector Grid Time Series
- SRBF Approximation of Terrestrial Water Variations and Load Effects from Heterogeneous Variations
  - SRBF Approximation of Terrestrial Water Variations and Load Effects from Heterogeneous Variations
  - SRBF Approximation of EWH Variation and Load Effects from Heterogeneous Variation Time Series

- Appoximation Processes of High-Resolution Regional Load Deformation Field Time Series using SRBFs
- Collaborative Monitoring Process of Groundwater Variations and Load Deformation Field with SRBFs

Spherical Harmonic Analysis on Global Surface Load Time Series

Construction of global surface data grid in spherical coordinates

Open file Save as Import parameters Start computation Save process Follow example

Construction of Global Surface Data Grid in Spherical Coordinates | Spherical Harmonic Analysis on Global Surface Atmosphere Variations | Spherical Harmonic Analysis on Global Terrestrial water Variations | Spherical Harmonic Analysis on Global Sea Level Variations

Open any global surface discrete point data file | Save program process as | Load Spherical Harmonic Analysis and Synthesis of Load Effects

Set the wildcards of the file names

Ordinal number of first wildcard in the file name: 1

Number of consecutive wildcards in file name: 9

The discrete point file format

Number of rows of the file header: 1

Column ordinal number of target atrribute in record: 4

Target grid resolution: 30.0 '

>> [Purpose] To construct a normalized surface load Spherical Harmonic (SH) coefficient model from global grid data (e.g., atmosphere, terrestrial water, sea level). This model facilitates the computation of non-tidal load effects on geodetic elements via spherical harmonic synthesis.
>> Select the computation function from the 4 control buttons on the top of the interface...
>> [Function] Generate a spherical coordinate grid model from global discrete point data using the simple average method. If no valid discrete points exist within a grid cell, the cell value is set to zero.
>> Open any global surface discrete point data file C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/gridate/landwater.txt.
** The window below only shows no more than 3000 rows of data in the file!
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/gridate.
** The discrete point data files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/gridate/landwater.txt
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/gridate/sealvlchg.txt
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time: 2026-06-22 11:34:57
>> Computation end time: 2026-06-22 11:35:22

Set the result file folder | Import setting parameters | Start computation

```
0.00000000  360.00000000  -90.00000000  90.00000000  0.250000  0.250000 2018011512
         1    0.1250000  -89.8750000       0.000
         2    0.3750000  -89.8750000       0.000
         3    0.6250000  -89.8750000       0.000
         4    0.8750000  -89.8750000       0.000
         5    1.1250000  -89.8750000       0.000
         6    1.3750000  -89.8750000       0.000
         7    1.6250000  -89.8750000       0.000
         8    1.8750000  -89.8750000       0.000
         9    2.1250000  -89.8750000       0.000
        10    2.3750000  -89.8750000       0.000
        11    2.6250000  -89.8750000       0.000
```

Local Disk (C:) › ETideLoad4.5_win64en › examples › Loadspharmonanalys › gridrst

名称	修改日期	类型	大小
sphlandwater.dat	2022/12/26 12:54	DAT 文件	2,557 KB
sphsealvlchg.dat	2022/12/26 12:55	DAT 文件	2,557 KB

The maximum degree n of the load spherical harmonic coefficient model corresponds to the number of grid cells in the latitude direction. For instance, a 0.25° × 0.25° grid resolution corresponds to n = 720.

Spherical Harmonic Analysis on Global Surface Load Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Construction of Global Surface Data Grid in Spherical Coordinates | Spherical Harmonic Analysis on Global Surface Atmosphere Variations | Spherical Harmonic Analysis on Global Terrestrial water Variations | Spherical Harmonic Analysis on Global Sea Level Variations

Open any surface atmosphere spherical coordinate grid file

Save program process as

Load Spherical Harmonic Analysis and Synthesis of Load Effects

Set the wildcards of the file names

Ordinal number of first wildcard in the file name: 7

Number of consecutive wildcards in file name: 10

Set termination condition of the iteration

Residual standard deviation threshold (a): 1.0 ‰

Termination condition of residual decrease (b): 1.0 ‰

The surface harmonic functions in the spherical harmonic coefficient model are defined on the spherical surface whose radius is equal to the equatorial radius a of the Earth.

```
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020102112.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020102812.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020110412.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020111112.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg20201118
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg202
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg202
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg202
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg202
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-22 11:37:34
>> Complete the spherical harmonic analysis for 157 surface atmosphere variation grids!
  ** The program outputs Atmosphere Load SH Model (airpress***cs.dat), Iteration Statistics (pro***.ini), and Residual Grids (rnt***.dat) *** is the instance of the given wildcards.
  ** The file header of the airpress***cs.dat: Geocentric Gravitational Constant GM (×10¹⁴ m³/s²), Equatorial Radius a (m), Zero-degree term aΔC₀₀ (hPa), Relative ErrorΘ (%).
  ** The program also outputs COM variation Time Series (geocenterairpr.txt) induced by atmosphere vaiations: Epoch time (Decimal Year), ΔXcm (mm), ΔYcm (mm), ΔZcm (mm)), Date (long integer agreed by ETideLoad).
>> Computation end time: 2026-06-22 12:04:06
```

Set the result file folder | Import setting parameters | Start computation

airpress2018010312cs.dat | pro2018010312.ini

1	0	0.7495	6.4294	-26.2276	24.8602
2	1	-0.0001	1.0126	-4.5367	4.0258
3	2	0.0000	0.2271	-3.2268	2.2565
4	3	0.0000	0.1235	-2.1964	1.7883
5	4	0.0000	0.0982	-1.5286	1.3247
6	5	0.0000	0.0869	-1.3249	1.1328
7	6	0.0000	0.0805	-1.2698	1.1281
8	7	0.0000	0.0765	-1.2514	1.1263
9	8	0.0000	0.0738	-1.2512	1.1252
10	9	0.0000	0.0720	-1.2512	1.1244
11	10	0.0000	0.0706	-1.2514	1.1238
12	11	0.0000	0.0696	-1.2517	1.1234
13	12	0.0000	0.0688	-1.2519	1.1231

number of iterations, mean, SD, minimun

	0.000000	360.000000	-90.000000	90.000000	1.00000000	1.00000000	2018010312.
				621	7.0751	7.0883	7.1017
				621	7.2770	7.2929	7.3093
				766	7.6052	7.6344	7.6643
				281	8.0552	8.0802	8.1046
				160	8.3240	8.3305	8.3367
				525	8.3497	8.3515	8.3529
				028	8.3000	8.3015	8.3029
				006	8.3015	8.3025	8.3034
				031	8.3024	8.3030	8.3041
				413	8.3489	8.3565	8.3635

180-degree load spherical harmonic coefficient model

airpress2018010312cs.dat

1	3.986004418	6378137.00	-0.1761	1.061
2	1	0	5.442500620464125E-11	0.0000000000000000E+00
3	1	1	3.600943486139815E-10	-6.362567431307765E-10
4	2	0	7.861363013559757 7E-10	0.0000000000000000E+00
5	2	1	1.741191733531681 9E-09	6.311530368772120 7E-10
6	2	2	9.723215485868468 0E-10	7.918069545671124 6E-10
7	3	0	2.4931	0.0000000000000000E+00
8	3	1	-2.491719033229163 7E-10	7.965273935430935 2E-10
9	3	2	-2.213861554159197 0E-09	-1.312324414648704 2E-09
10	3	3	1.024101244521990 0E-09	-1.360073339024647 3E-10
11	4	0	1.771069910559289 7E-09	0.0000000000000000E+00
12	4	1	-7.464574801162861 5E-10	-3.514837530015004 0E-10
13	4	2	-2.979137085618405 5E-09	9.485485551364782 6E-10
14	4	3	1.452476918898930 9E-09	7.635436042690920 1E-10
15	4	4	5.797405388969434 2E-10	8.463530013639974 9E-11

$GM(\times 10^{14} m^3/s^2)$ a(m) zero-degree term (hPa/mbar), relative erro(%)

the scale parameter

The maximum degree n of the load spherical harmonic coefficient model corresponds to the number of grid cells in the latitude direction. For instance, a 0.25° × 0.25° grid resolution corresponds to n = 720.

Spherical Harmonic Analysis on Global Surface Load Time Series

Spherical Harmonic Analysis on Global Terrestrial water Variations

Open file Save as Import parameters Start computation Save process Follow example

Construction of Global Surface Data Grid in Spherical Coordinates | Spherical Harmonic Analysis on Global Surface Atmosphere Variations | Spherical Harmonic Analysis on Global Terrestrial water Variations | Spherical Harmonic Analysis on Global Sea Level Variations

Open any land water variation spherical coordinate grid file

Set the wildcards of the file names

Ordinal number of first wildcard in the file name: 7

Number of consecutive wildcards in file name: 10

Set termination condition of the iteration

Residual standard deviation threshold (a): 1.0 ‰

Termination condition of residual decrease (b): 1.0 ‰

Open the land-sea terrain spherical coordinate grid file

The surface harmonic functions in the spherical harmonic coefficient model are defined on the spherical surface whose radius is equal to the equatorial radius a of the Earth.

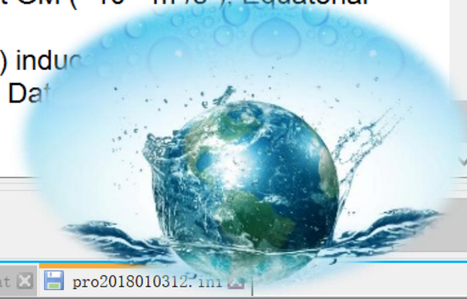
Save program process as

Load Spherical Harmonic Analysis and Synthesis of Load Effects

```
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020072212.dat
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020072912.dat
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020080512.dat
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020081212.dat
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020081912.dat
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020082612.dat
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020090212.dat
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020090912.dat
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020091612.dat
   C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/landw60m/grdchg2020092312.dat
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-22 12:06:26
>> Complete the spherical harmonic analysis for 143 land water variation grids!
  ** The program outputs Terrestrial Water Load SH Model (lndwater***cs.dat) Iteration Statistics (pro***.ini), and
Residual Grids (rnt***.dat) *** is the instance of the given wildcards.
  ** The file header of the lndwater***cs.dat: Geocentric Gravitational Constant GM (×10¹⁴ m³/s²), Equatorial
Radius a (m), Zero-degree term aΔC₀₀ (hPa), Relative ErrorΘ (%).
  ** The program also outputs COM variation Time Series (geocenterlandw.txt) induc
vaiations: Epoch time (Decimal Year), ΔXcm (mm), ΔYcm (mm), ΔZcm (mm)), Dat
ETideLoad).
>> Computation end time: 2026-06-22 12:37:40
```

Set the result file folder

Import setting parameters



lndwater2018010312cs.dat

1	3.986004418	6378137.00	0.3233	6.980
2	1	0	5.4161495494517116E-10	0.0000000000000000E+00
3	1	1	1.4985750154536610E-10	2.7205544947240000E-11
4	2	0	5.6467115175068137E-10	0.0000000000000000E+00
5	2	1	4.5844404050751017E-11	2.0240200564244726E-11
6	2	2	8.1098570416071924E-11	1.5085062944512367E-10
7	3	0	6.6147679187737971E-10	0.0000000000000000E+00
8	3	1	2.0986907160162932E-10	2.2122230227494451E-10
9	3	2	2.5993285450561679E-11	2.5858637236562612E-10
10	3	3	1.5662015629820256E-12	3.1453510330532493E-10
11	4	0	-2.1426804285782660E-11	0.0000000000000000E+00
12	4	1	3.9997109881976516E-10	3.8079722829269770E-10
13	4	2	7.2734785934906625E-11	3.7420446091482942E-10
14	4	3	3.0098589960811890E-11	7.6495297040055588E-11
15	4	4	-1.7097207839997709E-10	2.1562251557914367E-10

$GM(\times 10^{14} m^3/s^2)$ a(m) zero-degree term (cm), relative erro(%)

the scale parameter

	2.500000000E-01	2.500000000E-01			
.0000	2774.0000	2774.0000	2774.0000	27	
.0000	2774.0000	2774.0000	2774.0000	27	
.0000	2774.0000	2774.0000	2774.0000	27	
.0000	2774.0000	2774.0000	2774.0000	27	
.0000	2794.0000	2794.0000	2794.0000	27	
.0000	2794.0000	2794.0000	2794.0000	27	
.0000	2794.0000	2794.0000	2794.0000	27	
.0000	2794.0000	2794.0000	2794.0000	27	
.0000	2794.0000	2794.0000	2794.0000	27	
.0000	2794.0000	2794.0000	2794.0000	27	

lndwater2018010312cs.dat | pro2018010312.ini

0	1.3801	3.9806	-18.6738	16.7511
1	0.1031	0.9422	-5.7645	7.8790
2	0.0417	0.4895	-4.7948	6.8285
3	0.0260	0.3601	-4.3988	6.3837
4	0.0209	0.3156	-4.4585	6.2287
5	0.0188	0.2980	-4.5210	5.9999
6	0.0176	0.2900	-4.5657	5.7698
7	0.0169	0.2857	-4.5930	5.5886
8	0.0164	0.2832	-4.6083	5.5846
9	0.0161	0.2816	-4.6163	5.5847
10	0.0159	0.2805	-4.6202	5.5857
11	0.0157	0.2797	-4.6221	5.5866
12	0.0156	0.2791	-4.6229	5.5872
13	0.0156	0.2786	-4.6233	5.5875
14	0.0155	0.2783	-4.6235	5.5877
15	0.0155	0.2778	-4.6235	5.5877

number of iterations, mean, SD, minimum, maximun

The maximum degree n of the load spherical harmonic coefficient model corresponds to the number of grid cells in the latitude direction. For instance, a 0.25° × 0.25° grid resolution corresponds to n = 720.

Spherical Harmonic Analysis on Global Surface Load Time Series

Spherical Harmonic Analysis on Global Sea Level Variations

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Construction of Global Surface Data Grid in Spherical Coordinates | Spherical Harmonic Analysis on Global Surface Atmosphere Variations | Spherical Harmonic Analysis on Global Terrestrial water Variations | Spherical Harmonic Analysis on Global Sea Level Variations

Open any sea level variation spherical coordinate grid file

Set the wildcards of the file names

Ordinal number of first wildcard in the file name: 7

Number of consecutive wildcards in file name: 10

Set termination condition of the iteration

Residual standard deviation threshold (a): 1.0 ‰

Termination condition of residual decrease (b): 1.0 ‰

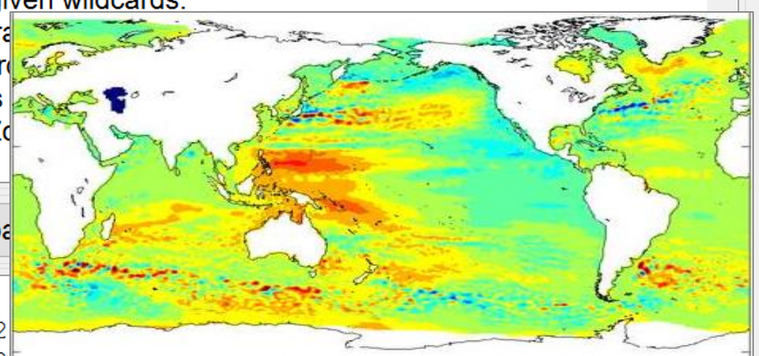
Open the land-sea terrain spherical coordinate grid file

Save program process as

Load Spherical Harmonic Analysis and Synthesis of Load Effects

```
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020102112.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020102812.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020110412.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020111112.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020111812.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020112512.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020120212.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020120912.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020121612.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020122312.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/seal60m/grdchg2020122912.dat
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-22 12:54:39
>> Complete the spherical harmonic analysis for 157 sea level variation grids!
 ** The program outputs Sea Level Variation Load SH Mode (seachg***cs.dat), Iteration Statistics (pro***.ini),
and Residual Grids (rnt***.dat) *** is the instance of the given wildcards.
 ** The file header of the seachg***cs.dat: Geocentric Gra
Radius a (m), Zero-degree term aΔC₀₀ (hPa), Relative Err
 ** The program also outputs COM variation Time Series
Epoch time (Decimal Year), ΔXcm (mm), ΔYcm (mm), ΔZc
>> Computation end time: 2026-06-22 13:42:40
```

The surface harmonic functions in the spherical harmonic coefficient model are defined on the spherical surface whose radius is equal to the equatorial radius a of the Earth.



Set the result file folder | Import setting pa

sealevel2018010312cs.dat

1		3.986004418	6378137.00	0.1482	12.259
2	1	0	-7.1099714241030070E-10	0.0000000000000000E+00	
3	1	1	1.4067052467886149E-11	-7.5907650586142063E-10	
4	2	0	1.6751189679450448E-10	0.0000000000000000E+00	
5	2	1	1.0298691240132240E-10	-4.8354027549818012E-10	
6	2	2	6.4627313483801362E-10	-1.0376661124700542E-09	
7	3	0	-2.4310321497109673E-10	0.0000000000000000E+00	
8	3	1	1.0753767348058446E-09	-3.6443245955988522E-10	
9	3	2	4.0530961810871272E-10	9.1666926888445966E-11	
10	3	3	-1.1197190742285947E-10	-4.8811906702259529E-10	
11	4	0	-8.4235286957811616E-11	0.0000000000000000E+00	
12	4	1	-5.1282309415176720E-11	2.5307177529937340E-10	
13	4	2	-3.4627064648576430E-10	7.1811239570472555E-10	
14	4	3	-1.5836119076575140E-10	-1.4013498597540113E-10	
15	4	4	2.0672494020177201E-10	2.3876308632158088E-10	

$GM(\times 10^{14} m^3/s^2)$ a(m) zero-degree term (cm), relative erro(%)

the scale parameter

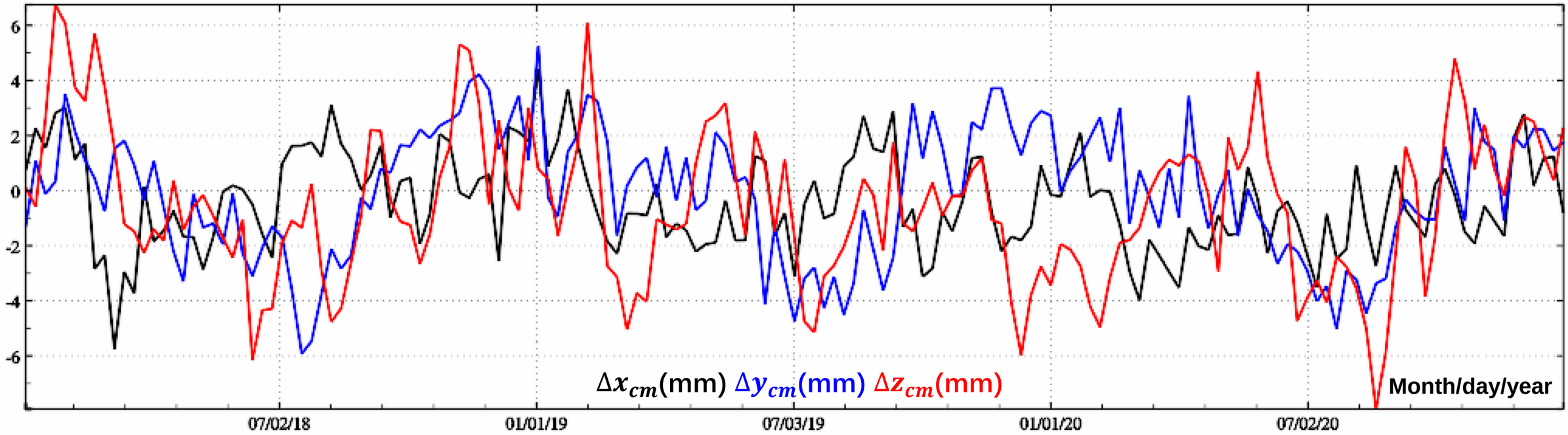
1		2.500000000E-01	2.500000000E-01		
2	.0000	2774.0000	2774.0000	2774.0000	2
3	.0000	2774.0000	2774.0000	2774.0000	27
4	.0000	2774.0000	2774.0000	2774.0000	27
5	.0000	2774.0000	2774.0000	2774.0000	27
6	.0000	2774.0000	2774.0000	2774.0000	27
7	.0000	2794.0000	2794.0000	2794.0000	27
8	.0000	2794.0000	2794.0000	2794.0000	27
9	.0000	2794.0000	2794.0000	2794.0000	27
10	.0000	2794.0000	2794.0000	2794.0000	27
11	.0000	2794.0000	2794.0000	2794.0000	27
12	.0000	2794.0000	2794.0000	2794.0000	27

sealevel2018010312cs.dat | pro2018010312. ini

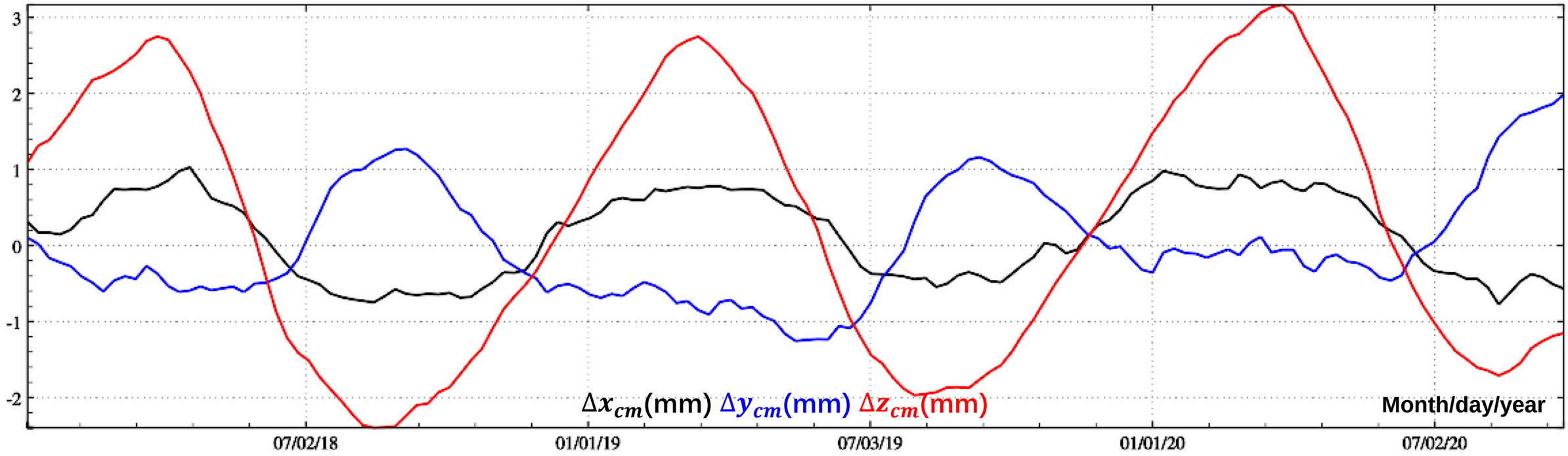
1	0	0.2248	6.0022	-72.5365	62.0915
2	1	0.0437	3.0110	-41.6793	39.1393
3	2	0.0098	2.0946	-29.0016	34.5860
4	3	0.0047	1.6552	-21.2292	31.1485
5	4	0.0040	1.3967	-15.6018	28.7731
6	5	0.0034	1.2288	-15.6526	27.1106
7	6	0.0028	1.1125	-16.6297	25.8610
8	7	0.0022	1.0285	-17.1866	24.8697
9	8	0.0017	0.9659	-17.4713	24.0634
10	9	0.0013	0.9180	-17.5730	23.4037
11	10	0.0010	0.8808	-17.5508	22.8553
12	11	0.0007	0.8514	-17.4465	22.4287

number of iterations, mean, SD, minimum, maximun

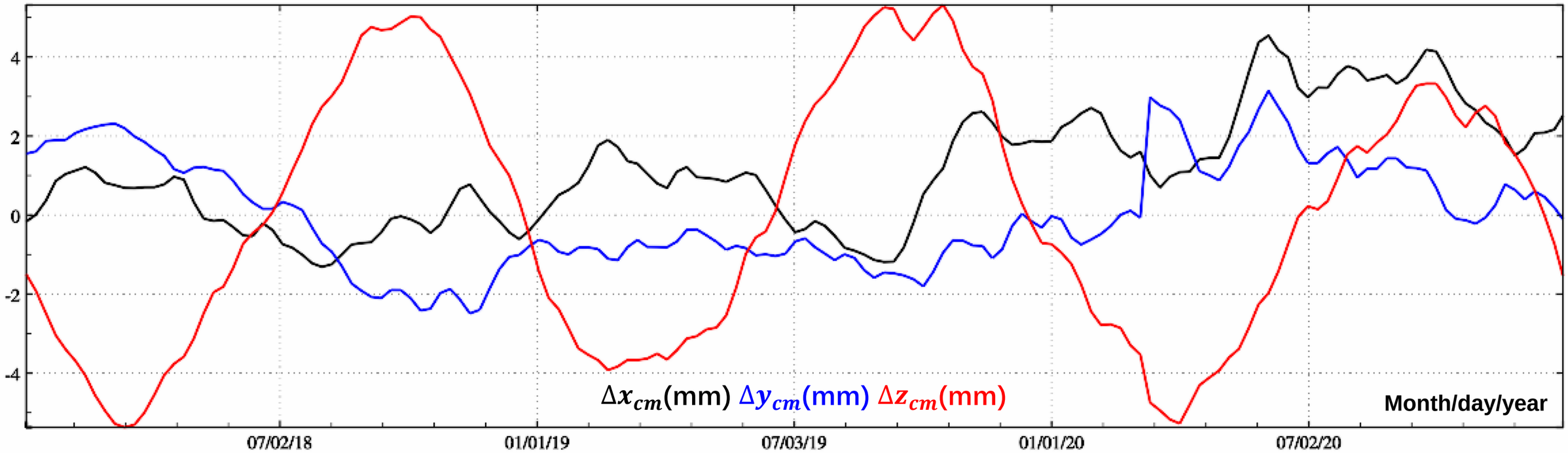
The maximum degree n of the load spherical harmonic coefficient model corresponds to the number of grid cells in the latitude direction. For instance, a 0.25° × 0.25° grid resolution corresponds to n = 720.



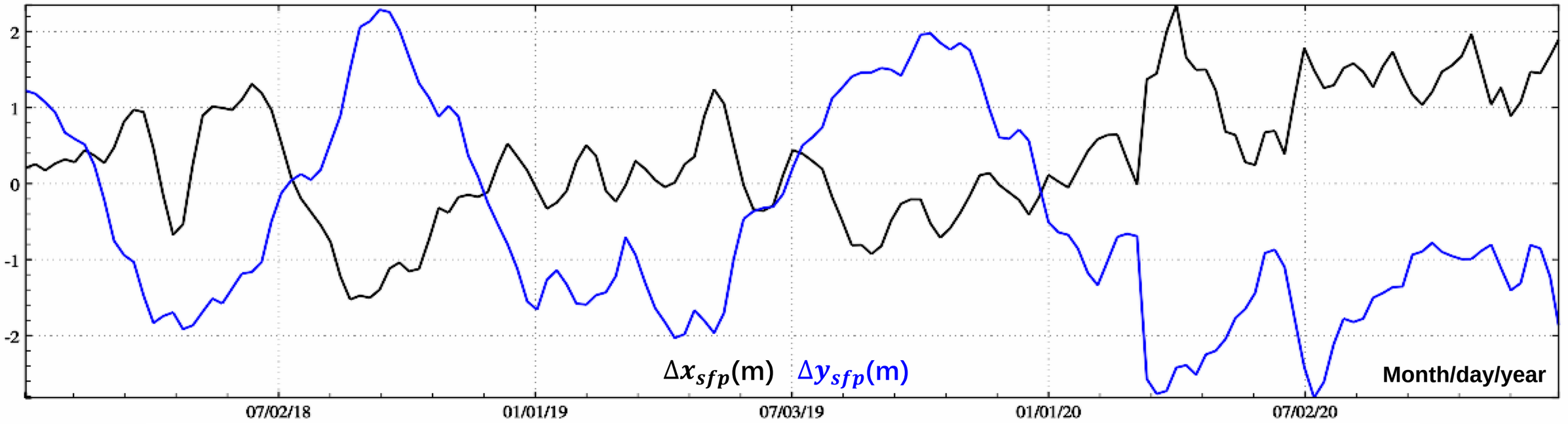
The surface atmosphere load effect time series (mm) on Earth's center of mass (COM)



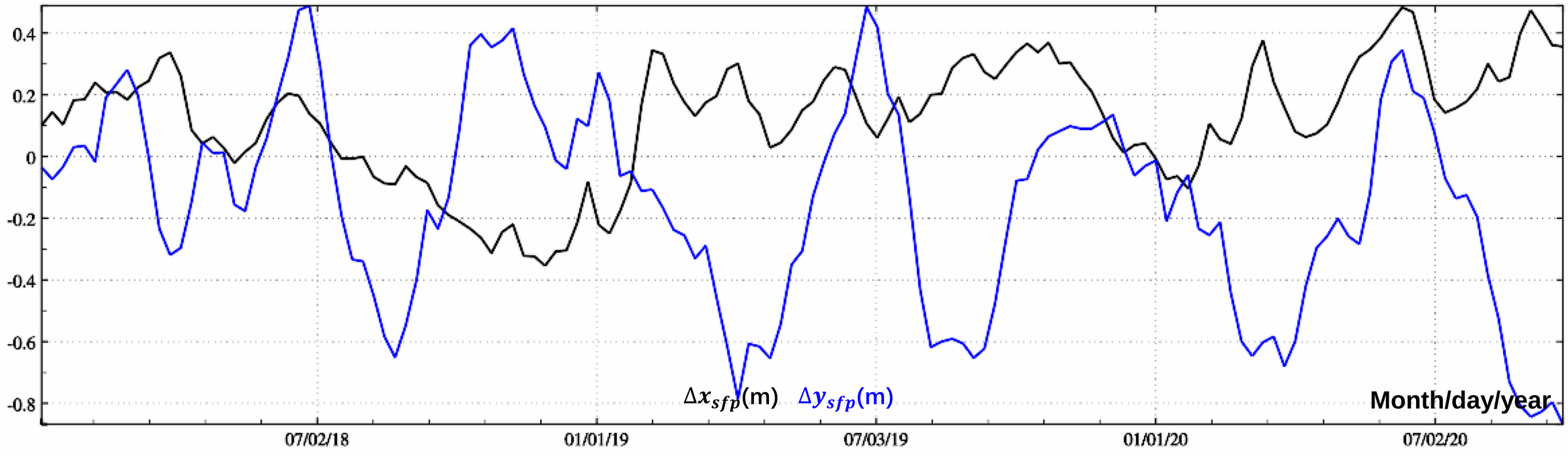
The global land water variation load effect time series (mm) on Earth's center of mass (COM)



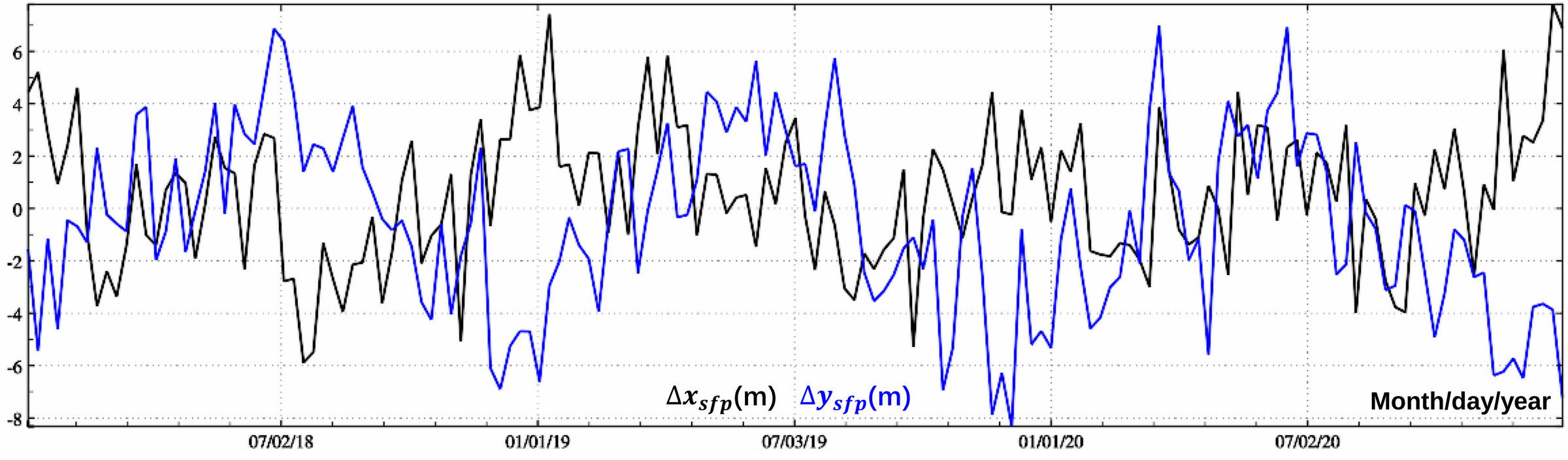
The global sea level variation load effect time series (mm) on Earth's center of mass (COM) variations



The global sea level variation load effect time series (m) on Earth's figure pole in ITRS



The global land water variation load effect time series (m) on Earth's figure pole in ITRS



The surface atmosphere variation load effect time series (m) on Earth's figure pole in ITRS

Spherical Harmonic Analysis of Tidal Harmonic Constants and Construction of Tidal Load Model

Construction of Tidal Harmonic Constant Grid in Spherical Coordinates

Open file Save as Import parameters Start computation Save process Follow example

Construction of Tidal Harmonic Constant Grid in Spherical Coordinates | Spherical Harmonic Analysis on Surface Atmosphere Tidal Harmonic Constants | Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants | Algorithm formulas

Open any discrete tidal constituent harmonic constant file

Set the wildcard of the file names

Ordinal number of the first wildcard in the file name: 1

Number of consecutive wildcards in file name: 3

Number of rows of the file header: 1

Column ordinal number of the component 1 of harmonic parameters in the record: 4

Column ordinal number of the component 2 of harmonic parameters in the record: 5

Spatial resolution of the target grid: 30.0 '

The form of harmonic parameters: amplitude, argument

Column ordinal number of the tide constituent name in the file header: 1

Column ordinal number of the Doodson constant in the file header: 2

>> Program Process ** Operation Prompts

Save program process as

```
  ** The degree number maxn of the tidal load spherical harmonic coefficient model corresponds to the number of harmonic constant spherical coordinate cell-grids in the latitude direction. For example, a 0.25° × 0.25° tidal harmonic constant spherical coordinate grid corresponds to maxn = 720.
>> Select the computation function from the 3 control buttons on the top of the interface...
>> [Function] o generate a spherical coordinate grid model of tidal constituent harmonic constant vectors (In-Phase and Out-of-Phase amplitudes) from discrete point data using the simple average method.
  ** Input File Header Requirement: The program requires at least one header row containing the Tidal Constituent Name and its Doodson Constant.
  ** Doodson Constant: A unique integer identifier (e.g., for the M₂ tide) used to identify the tidal type and frequency. Note: The Doodson constant must be correct.
>> Open any discrete tidal constituent harmonic constant file C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate/S1_airp.txt.
  ** The window below only shows no more than 3000 rows of data in the file!
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate.
  ** The discrete tidal constituent harmonic constant files searched by wildcard instantiation:
    C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate/S1_airp.txt
    C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate/S2_airp.txt
    C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate/Sa_airp.txt
    C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate/Ssa_airp.txt
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-22 15:20:52
>> Complete the spherical coordinate griding for 4 discrete tidal constituent harmonic constant files!
  ** The program outputs the spherical coordinate grid files sph***.dat of the tidal constituent harmonic constants into the output folder. *** is the tidal constituent's name.
>> Computation end time: 2026-06-22 15:21:56
```

Set the result file folder | Import setting parameters | Start computation

```
S1 164556 Hcosg Hsing in hPa
       1    0.000000  -90.000000    0.05396    0.16694
       2    0.250000  -90.000000    0.05396    0.16694
       3    0.500000  -90.000000    0.05396    0.16694
       4    0.750000  -90.000000    0.05396    0.16694
       5    1.000000  -90.000000    0.05396    0.16694
       6    1.250000  -90.000000    0.05396    0.16694
       7    1.500000  -90.000000    0.05396    0.16694
       8    1.750000  -90.000000    0.05396    0.16694
       9    2.000000  -90.000000    0.05396    0.16694
      10    2.250000  -90.000000    0.05396    0.16694
      11    2.500000  -90.000000    0.05396    0.16694
```

examples › Loadtidespharmsynth › gridrst

名称	修改日期
sphS1_.dat	2022/1/11 10:30
sphS2_.dat	2022/1/11 10:31
sphSa_.dat	2022/1/11 10:31
sphSsa.dat	2022/1/11 10:31

The units for the tidal constituent harmonic constants are identical to those of the derived tidal load spherical harmonic coefficients: Surface Atmosphere: hPa or mbar; and Ocean Tides: cm.

Spherical Harmonic Analysis of Tidal Harmonic Constants and Construction of Tidal Load Model

Spherical Harmonic Analysis on Surface Atmosphere Tidal Harmonic Constants

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Construction of Tidal Harmonic Constant Grid in Spherical Coordinates | Spherical Harmonic Analysis on Surface Atmosphere Tidal Harmonic Constants | Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants | Algorithm formulas

Open any tidal constituent harmonic constant grid file

Set the wildcard of the file names

Ordinal number of the first wildcard in the file name: 4

Number of consecutive wildcards in file name: 3

Column ordinal number of the tide constituent name in the file header: 8

Column ordinal number of the Doodson constant in the file header: 7

Set termination condition of the iteration

Residual standard deviation threshold (a): 1.0 ‰

Termination condition of residual decrease (b): 1.0 ‰

>> Program Process ** Operation Prompts

Save program process as

```
 ** The program outputs the spherical coordinate grid files sph***.dat of the tidal constituent harmonic constants into the output folder. *** is the tidal constituent's name.
>> Computation end time: 2026-06-22 15:21:56
>> [Function] To transform the surface atmosphere tidal constituent harmonic constant sph
into a surface atmosphere tidal load spherical harmonic coefficient model (units: hPa/mbar)
spherical harmonic analysis.
>> Open any tidal constituent harmonic constant grid file C:/ETideLoad4.5_win64en/examp
sphS1_.dat.
 ** The window below only shows no more than 3000 rows of data in the file!
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Loadtidespha
 ** The tidal constituent harmonic constant grid files searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate/sphS1_.dat
   C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate/sphS2_.dat
   C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate/sphSa_.dat
   C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/sphgridate/sphSsa.dat
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-22 15:24:14
>> Complete the spherical harmonic analysis for 4 surface atmosphere tidal constituent harmonic constant grids!
 ** The program outputs the surface atmosphere tidal load spherical harmonic coefficient model file Airtdloadcs.dat, all the tidal constituent spherical harmonic coefficient model files airptide***cs.dat, iteration process statistics files pro***.ini and residual harmonic constant grid files rnt***.dat into the output folder, *** is the tidal constituent's name.
 ** The program also outputs the first-degree atmosphere tidal load spherical harmonic coefficient file AtideOne.dat to the current directory. Header: Geocentric Gravitational Constant GM (×10¹⁴ m³/s²), Equatorial Radius a (m); and Records (Row 4+): Doodson Constant, Constituent Name, C₁₀⁺ (In-Phase), C₁₀⁻ (Out-of-Phase), C₁₁⁺, C₁₁⁻, S₁₁⁺, S₁₁⁻.
>> Computation end time: 2026-06-22 15:45:54
```

pharmsynth › airptidecs

名称	修改日期
airptideS1_cs.dat	2022/1/11 10:40
airptideS2_cs.dat	2022/1/11 10:44
airptideSa_cs.dat	2022/1/11 10:47
airptideSsacs.dat	2022/1/11 10:49
Airtdloadcs.dat	2022/1/11 10:49
proS1_.ini	2022/1/11 10:40
proS2_.ini	2022/1/11 10:44
proSa_.ini	2022/1/11 10:47
proSsa.ini	2022/1/11 10:49
rntS1_.dat	2022/1/11 10:40
rntS2_.dat	2022/1/11 10:44

Output files

Set the result file folder | Imp

Degree 360 tidal load spherical harmonic coefficient model

0.0	360.0	-90.0	90.0	0.50000000	0.50000000	164556	S1		
0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	
0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	
0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	
0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	
0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	
0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	
0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	
0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	
0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	
0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	

The units for the tidal constituent harmonic constants are identical to those of the derived tidal load spherical harmo

proS1_.ini | airptideS1_cs.dat

```
1  in-phase amplitude spherical harmonic coefficients model
2   3.986004418    6378137.00        0.1756    2.893
3        1      0 -3.2737818185410342E-09  0.0000000000000000E+00
4        1      1 -2.5[illegible]E-09 -1.[illegible]E-08
5        2      0 -2.7587345611526482E-09  0.0000000000000000E+00
6        2      1 -3.7664414786858797E-09 -1.5679278417046221E-08
7        2      2 -5.6259795454790081E-10 -8.0822938426465110E-09
8        3      0  7.6061597145007028E-09  0.0000000000000000E+00
9        3      1  2.2[illegible]2140809E-09  8.5243342871089541E-09
10       3      2  9.8749805288913024E-09  4.2697746192343320E-09
11       3      3 -7.9484869809999550E-09  4.2160451922288746E-09
12       4      0  6.1325368377539217E-09  0.0000000000000000E+00
13       4      1  3.2845793001559087E-09  8.5456114914643217E-10
14       4      2  5.3621764434892774E-09  7.2233754311287918E-09
15       4      3  1.2484120370871218E-08  1.8764089211095401E-08
16       4      4  3.3403899087229966E-09 -3.1081614168687751E-09
17       5      0  1.6767502798578674E-09  0.0000000000000000E+00
18       5      1 -2.3752174015164590E-09  6.3407664854698723E-09
19       5      2 -5.0350543830721095E-09 -5.7620363858752100E-12
20       5      3  5.1976501472008727E-09  1.1153184597367160E-08
```

$GM(10^{14}m^3/s^2)$ a(m) zero-degree term (hPa/mbar), relative erro(%)

the scale parameter

airptideS1_cs.dat | proS1_.ini | Airtdloadcs.dat

```
Surface atmospheric tidal load normalized spherical harmonic coefficient model in hPa or mbar.
Created by ETideLoad, ZHANG Chuanyin, Chinese Academy of Surveying and Mapping.
 Doodson name     n     m          Csin+          Ccos+          Csin-          Ccos-          C+       eps+          C-       eps-
 164.556   S1     1     0    -0.01044593     0.00562824    -0.01044593     0.00562824    0.011866  298.3157    0.011866  298.3157
 164.556   S1     1     1    -0.02016686    -0.30983778    -0.02700702     0.03082551    0.310493  183.7240    0.040983  318.7776
 164.556   S1     2     0    -0.00880807     0.02708492    -0.00880807     0.02708492    0.028481  341.9854    0.028481  341.9854
 164.556   S1     2     1    -0.00267857    -0.06099820    -0.02133360     0.03899757    0.061057  182.5144    0.044451  331.3192
 164.556   S1     2     2     0.04746516    -0.07024418    -0.05104501    -0.01871795    0.084777  145.9525    0.054369  249.8623
 164.556   S1     3     0     0.02424426     0.01222005     0.02424426     0.01222005    0.027150   63.2501    0.027150   63.2501
 164.556   S1     3     1    -0.00065416     0.08663644     0.01517276     0.03225602    0.086639  359.5674    0.035646   25.1916
 164.556   S1     3     2     0.05672425    -0.01538354     0.00625213    -0.04261689    0.058773  105.1736    0.043073  171.6539
 164.556   S1     3     3     0.01546691     0.03548381    -0.06617256     0.00859525    0.038708   23.5517    0.066728  277.4008
 164.556   S1     4     0     0.01956420    -0.01827060     0.01956420    -0.01827060    0.026769  133.0418    0.026769  133.0418
 164.556   S1     4     1    -0.01459744     0.00148107     0.03555613    -0.00398511    0.014672  275.7935    0.035779   96.3950
 164.556   S1     4     2     0.01934232     0.02790035     0.01483035    -0.01817240    0.033949   34.7322    0.023456  140.7824
 164.556   S1     4     3     0.05868605     0.05584202     0.02090025    -0.06381922    0.081009   46.4225    0.067154  161.8668
 164.556   S1     4     4     0.05071872    -0.00993816    -0.02940598     0.00988633    0.051683  101.0865    0.031023  288.5827
 164.556   S1     5     0     0.00535373    -0.01557249     0.00535373    -0.01557249    0.016467  161.0273    0.016467  161.0273
 164.556   S1     5     1    -0.01117229     0.00673870    -0.00397207    -0.03368705    0.013047  301.0968    0.033920  186.7247
 164.556   S1     5     2     0.01540811     0.05344217     0.01772763    -0.01768282    0.055619   16.0830    0.025039  134.9275
 164.556   S1     5     3    -0.02915700     0.01752056     0.01896564     0.02778884    0.034155  238.5496    0.028100   42.2838
 164.556   S1     5     4     0.06196212    -0.00041678    -0.00316231     0.00014887    0.061964   90.3854    0.003166  272.6952
 164.556   S1     5     5    -0.01902007    -0.00031063    -0.01902007    -0.00031063    0.019023  269.0643    0.019023  269.0643
 164.556   S1     6     0     0.01292417     0.05007315    -0.01614491    -0.03693554    0.051714   14.4725    0.040310  203.6106
 164.556   S1     6     1    -0.02124270     0.00967981    -0.00563026     0.00828166    0.023344  294.4977    0.010014  325.7903
 164.556   S1     6     2     0.00000000     0.00000000     0.00000000     0.00000000    0.000000    0.0000    0.000000    0.0000
```

Atmosphere tidal load spherical harmonic coefficient model ECMWF2006cs360.dat constructed by ETideload4.5

airptideS1_cs.dat | proS1_.ini | Airtdloadcs.dat | Otideloadcs.dat | AirtdOne.dat

```
  3.986004418    6378137.00
name Doodson          C10+           C10-           C11+           C11-           S11+           S11-
  S1 164.556 -0.32755435E-08  0.17648553E-08 -0.73961840E-08 -0.43745105E-07 -0.53411096E-07 -0.10724379E-08
  S2 273.555 -0.63049967E-09  0.13744707E-08  0.80115817E-10  0.52363295E-08  0.33900139E-08 -0.10865938E-08
  Sa  56.565  0.82105514E-07 -0.16159915E-06 -0.35243498E-07 -0.82919083E-08  0.35037721E-07 -0.12165101E-06
 Ssa  57.555  0.65256321E-08  0.64837464E-07 -0.35845502E-07 -0.25039833E-07  0.12771654E-07  0.24911463E-07
```

First-degree atmosphere tidal load spherical harmonic coefficient file from ECMWF2006cs360.dat. Which could be employed to forecast of atmosphere tidal load effects on Earth's center of mass (COM) or COM variation effect on all geodetic elements due to surface atmosphere tide.

Spherical Harmonic Analysis of Tidal Harmonic Constants and Construction of Tidal Load Model

Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Construction of Tidal Harmonic Constant Grid in Spherical Coordinates | Spherical Harmonic Analysis on Surface Atmosphere Tidal Harmonic Constants | Spherical Harmonic Analysis on Ocean Tidal Constituent Harmonic Constants | Algorithm formulas

Open any tidal constituent harmonic constant grid file

Set the wildcard of the file names

Ordinal number of the first wildcard in the file name: 4

Number of consecutive wildcards in file name: 4

Column ordinal number of the tide constituent name in the file header: 8

Column ordinal number of the Doodson constant in the file header: 7

Set termination condition of the iteration

Residual standard deviation threshold (a): 1.0 ‰

Termination condition of residual decrease (b): 1.0 ‰

Open the land-sea terrain spherical coordinate grid file

>> Program Process ** Operation Prompts

Save program process as

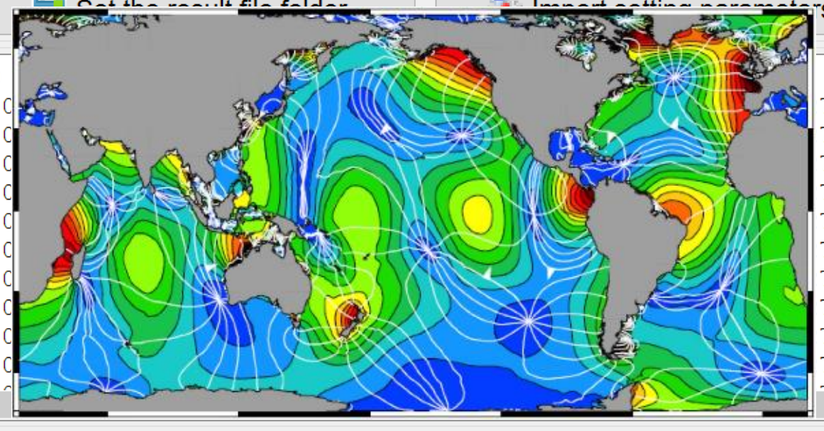
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAAs2.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAAs4.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAAsa.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAAt2.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAmn4.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAms4.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAmsf.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAmtm.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAmu2.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAnu2.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAssa.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/spheps2.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphlam2.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphmks2.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphmsqm.dat
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-22 15:55:19
>>Complete the spherical harmonic analysis for 34 ocean tidal constituent harmonic constant grids!
** The program outputs the ocean tidal load spherical harmonic coefficient model file Otideloadcs.dat, all the tidal constituent spherical harmonic coefficient model files Otidetide***cs.dat, iteration process statistics file pro***.ini and residual harmonic constant grid file rnt***.dat into the output folder, *** is the tidal constituent's name.
** The program also outputs the first-degree ocean tidal load spherical harmonic coefficient file OtideOne.dat to the current directory. Header: Geocentric Gravitational Constant GM (×10¹⁴ m³/s²), Equatorial Radius a (m); and Records (Row 4+): Doodson Constant, Constituent Name, C_{10}^{+} (In-Phase), C_{10}^{-} (Out-of-Phase), C_{11}^{+}, C_{11}^{-}, S_{11}^{+}, S_{11}^{-}.
>> Computation end time: 2026-06-22 16:27:29

oceantideAAm2cs.dat | proAAm2.ini

```
in-phase amplitude spherical harmonic coefficients model
 3.986004418    6378137.00          0.1742   16.593
      1      0  4.4085955207264692E-08  0.0000000000000000E+00
      2      0  6.5725321907033189E-09  0.0000000000000000E+00
      2      1 -1.8692151140697192E-07 -1.5099193342176944E-07
      2      2 -4.2883633592280017E-07  5.5470270050811761E-07
      3      0  1.7475107844400720E-07  0.0000000000000000E+00
      3      1  1.2[illegible]49883E-07 -2.6089831232089852E-07
      3      2 -4.9250213524868856E-08 -2.4846879781068044E-07
      3      3  8.0449640224242131E-07  3.9758095836942275E-07
      4      0 -2.2682335734447000E-07  0.0000000000000000E+00
      4      1  1.3715974585179605E-07  6.5462420096423725E-08
      4      2  5.6729562392776139E-07 -7.9749298897800718E-07
      4      3 -5.7287720643753832E-07 -7.4217107021983083E-07
      4      4 -7.6789761138093624E-07  5.6224223764210645E-07
      5      0 -1.5887618918450042E-07  0.0000000000000000E+00
      5      1 -5.5606626280901892E-07  2.5928786409610682E-07
      5      2 -6.7325675390925060E-07  4.6715642647917952E-07
      5      3 -2.6396483930740691E-07  2.7714000718129907E-07
```

$GM(10^{14}m^3/s^2)$ a(m) zero-degree term (cm), relative erro(%)

the scale parameter



名称	修改日期	大小
Otideloadcs.dat	2022/1/24 20:08	67,264 KB
oceantidemsqmcs.dat	2022/1/24 20:08	1,995 KB
promsqm.ini	2022/1/24 20:08	3 KB
rntmsqm.dat	2022/1/24 20:08	1,536 KB
oceantidemks2cs.dat	2022/1/24 20:08	1,995 KB
promks2.ini	2022/1/24 20:08	5 KB
rntmks2.dat	2022/1/24 20:08	1,536 KB
oceantidelam2cs.dat	2022/1/24 20:07	1,995 KB
prolam2.ini	2022/1/24 20:07	4 KB
rntlam2.dat	2022/1/24 20:07	1,536 KB
oceantideeps2cs.dat	2022/1/24 20:06	1,995 KB
proeps2.ini	2022/1/24 20:06	4 KB
rnteps2.dat	2022/1/24 20:06	1,536 KB
oceantideAssacs.dat	2022/1/24 20:05	1,995 KB
rntAssa.dat	2022/1/24 20:05	1,536 KB
proAssa.ini	2022/1/24 20:05	3 KB

Output files

The units for the tidal constituent harmonic constants are identical to those of the derived tidal load spherical harmonic coefficients: Surface Atmos

Loadfmcmsfptm.txt | Otideloadcs.dat

Ocean tidal height load normalized spherical harmonic coefficient model in cm.
Created by ETideLoad, ZHANG Chuanyin, Chinese Academy of Surveying and Mapping.

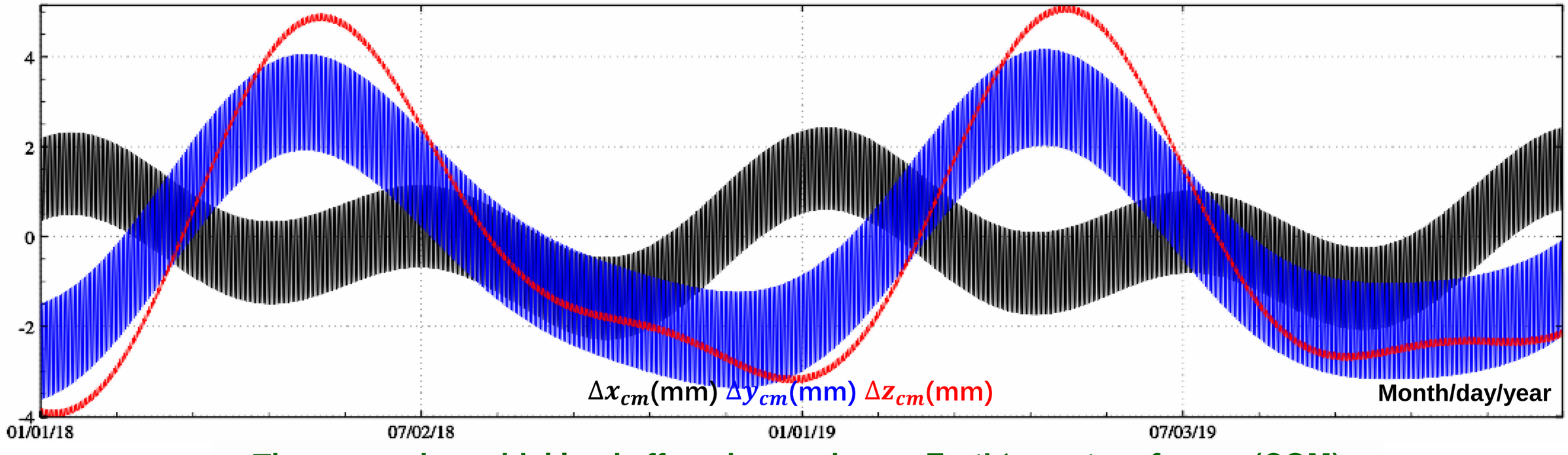
Doodson	name	n	m	Csin+	Ccos+	Csin-	Ccos-	C+	eps+	C-	eps-
247.455	2N2	1	0	0.00458562	0.00231038	0.00458562	0.00231038	0.005135	63.2596	0.005135	63.2596
247.455	2N2	1	1	-0.00773380	0.00473565	0.01063946	-0.00152991	0.009069	301.4805	0.010749	98.1828
247.455	2N2	2	0	0.01415077	-0.00470716	0.01415077	-0.00470716	0.014913	108.3994	0.014913	108.3994
247.455	2N2	2	1	-0.01749377	0.01964053	-0.02057617	0.01244109	0.026302	318.3086	0.024045	301.1587
247.455	2N2	2	2	-0.05076973	0.15409810	0.03408330	-0.00708020	0.162246	341.7648	0.034811	101.7353
247.455	2N2	3	0	-0.00345932	-0.05402235	-0.00345932	-0.05402235	0.054133	183.6639	0.054133	183.6639
247.455	2N2	3	1	0.00459468	0.02860553	0.08674509	0.04125120	0.028972	9.1250	0.096054	64.5668
247.455	2N2	3	2	-0.01359111	-0.04803085	0.00043095	0.01917460	0.049917	195.7997	0.019179	1.2875
247.455	2N2	3	3	0.11576000	0.04745531	0.10043379	-0.03897379	0.125109	67.7090	0.107731	111.2090
247.455	2N2	4	0	-0.04607076	0.02579335	-0.04607076	0.02579335	0.052800	299.2429	0.052800	299.2429
247.455	2N2	4	1	0.03322584	0.01467790	0.01394749	0.02945707	0.036324	66.1660	0.032592	25.3369
247.455	2N2	4	2	0.06616682	-0.16308472	0.08023800	0.03608357	0.175996	157.9166	0.087978	65.7862
247.455	2N2	4	3	-0.04323293	-0.08712246	-0.08031745	0.08908738	0.097259	206.3921	0.119948	317.9635
247.455	2N2	4	4	-0.07108370	0.11911427	-0.03283587	0.04029420	0.138712	329.1726	0.051979	320.8233
247.455	2N2	5	0	0.00423674	0.05025371	0.00423674	0.05025371	0.050432	4.8190	0.050432	4.8190
247.455	2N2	5	1	-0.06599377	0.02863740	-0.06611923	-0.08775797	0.071939	293.4580	0.109878	216.9954
247.455	2N2	5	2	0.03191636	0.09160043	-0.13292118	0.09809027	0.097002	19.2099	0.157262	308.5896
247.455	2N2	5	3	-0.04622566	0.00329631	0.03229552	0.02551165	0.100381	332.6324	0.039828	234.1757
247.455	2N2	5	4	0.12978448	0.00840802	0.08015548	0.01845451	0.130889	91.5042	0.082186	282.7617
247.455	2N2	5	5	0.07170340	0.02947675	0.04405895	-0.06476786	0.077526	67.6528	0.095534	152.5364
247.455	2N2	6	0	0.03947937	-0.02794239	0.03947937	-0.02794239	0.048367	125.2898	0.048367	125.2898
247.455	2N2	6	1	-0.03340601	-0.04901155	0.00654233	-0.02479353	0.059314	214.2781	0.025642	165.2182
247.455	2N2	6	2	0.01502432	0.05093430	-0.00472606	-0.04361353	0.053104	16.4347	0.043869	186.1846
247.455	2N2	6	3	0.00272363	0.04846491	-0.00102382	0.02626808	0.048541	3.2165	0.026288	357.7680
247.455	2N2	6	4	0.05940714	-0.01371178	0.06957119	0.00812134	0.060969	102.9969	0.070044	83.3418
247.455	2N2	6	5	-0.06310363	-0.02281638	0.02184442	0.02667029	0.067102	250.1215	0.034474	39.3193
247.455	2N2	6	6	0.06505389	0.01875362	0.05082476	0.11432385	0.067703	73.9189	0.125112	23.9684
247.455	2N2	7	0	0.03231974	0.00130979	0.03231974	0.00130979	0.032346	87.6793	0.032346	87.6793
247.455	2N2	7	1	0.01740544	-0.02827998	0.01240391	0.00333515	0.033207	148.3890	0.012844	74.9503
247.455	2N2	7	2	-0.05289712	0.01334177	0.03482823	-0.08565262	0.054554	284.1559	0.092463	157.8723
247.455	2N2	7	3	-0.04490640	0.03300070	-0.01170604	0.00335994	0.055728	306.3113	0.012179	286.0149
247.455	2N2	7	4	0.02847534	-0.01480133	-0.04298436	-0.00624406	0.032092	117.4652	0.043436	261.7348
247.455	2N2	7	5	0.03444464	-0.04692621	-0.05161881	0.01841567	0.058211	143.7207	0.054805	289.6345
247.455	2N2	7	6	0.03370577	-0.00688833	-0.04456603	-0.02386590	0.034402	101.5503	0.050554	241.8302
247.455	2N2	7	7	0.03170557	-0.04712240	0.03534061	0.04767806	0.056796	146.0660	0.059348	36.5471
247.455	2N2	8	0	0.00128965	0.01929829	0.00128965	0.01929829	0.019341	3.8232	0.019341	3.8232
247.455	2N2	8	1	0.02942979	-0.03337153	0.00149069	-0.01387328	0.044495	138.5915	0.013953	173.8671

Ocean tidal load spherical harmonic coefficient model
FES2014b360cs.dat constructed by ETideload4.5

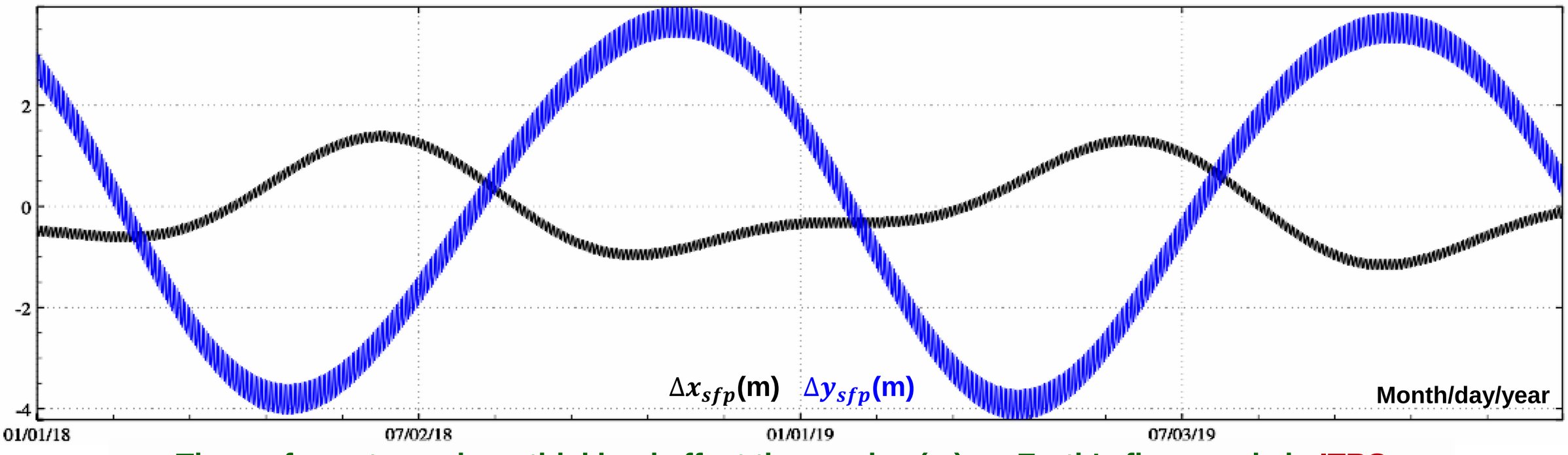
oceantideA2n2cs.dat | proA2n2.ini | OtideOne.dat

```
 3.986004418   6378137.00
name Doodson          C10+          C10-          C11+          C11-          S11+          S11-
 2N2 247.455  0.14379190E-08  0.72446933E-09  0.45556662E-09  0.50261431E-09  0.98234968E-09  0.28806626E-08
  J1 175.455  0.22805765E-08 -0.14599680E-07  0.11146859E-07  0.31354016E-08  0.49073923E-08  0.50239288E-08
  K1 165.555  0.65903198E-07 -0.23618735E-06  0.15240517E-06  0.54510351E-07  0.57951321E-07  0.91115166E-07
  K2 275.555  0.58820344E-08  0.78223673E-09  0.82634785E-08  0.17098158E-07  0.28274727E-08  0.95641986E-09
  L2 265.455  0.99527541E-09  0.43369491E-10  0.27208849E-08  0.18838893E-08 -0.93316186E-09 -0.31242492E-09
  M2 255.555  0.64086749E-07  0.33741274E-07  0.82092113E-07  0.76976307E-08 -0.39331272E-07  0.74234937E-07
  M3 355.555  0.51159035E-10  0.26216133E-10  0.20622631E-10 -0.16737336E-10 -0.74054752E-10 -0.32502465E-10
  M4 455.555 -0.12877739E-09 -0.82078020E-09  0.21241775E-09  0.89312487E-09 -0.11238411E-09 -0.11882183E-08
  M6 655.555  0.18174228E-08  0.30921490E-09  0.36600543E-09  0.36841599E-09 -0.72147727E-09 -0.13743491E-09
  M8 855.555 -0.59854172E-10 -0.29503418E-11  0.41858427E-10  0.58809710E-10 -0.34465624E-10  0.81925459E-11
  Mf  75.555  0.23994538E-07  0.23160661E-08  0.14961765E-07 -0.19050356E-07  0.57231952E-08 -0.38155669E-08
  Mm  65.455  0.12211587E-07 -0.10619733E-08 -0.13680094E-08 -0.93454574E-08  0.34149364E-08 -0.61740212E-09
  N2 245.655  0.16604395E-07  0.24692742E-08  0.10060051E-07  0.75631673E-09 -0.49125733E-09  0.20845840E-07
  N4 435.755 -0.11170849E-09 -0.41029169E-10  0.37178942E-10 -0.10703469E-09 -0.53442667E-10 -0.19926918E-10
  O1 145.555  0.23239277E-07 -0.16830188E-06  0.86481239E-07  0.11802879E-07  0.58555768E-07  0.34726677E-07
  P1 163.555  0.16600813E-07  0.74602430E-07  0.48235157E-07  0.14146460E-07  0.16884105E-07  0.27004988E-07
  Q1 135.655  0.40244812E-08 -0.29117940E-07  0.15908436E-07  0.77164577E-09  0.12770867E-07  0.14909422E-08
  R2 273.555  0.22430236E-07  0.94564697E-08  0.30377828E-07  0.49137638E-07 -0.61338730E-08  0.76805145E-08
  S1 164.556 -0.40129653E-08  0.48653114E-08 -0.48716881E-08  0.11419251E-07  0.74509139E-08 -0.34899535E-09
  S2 273.555  0.22430236E-07  0.94564697E-08  0.30377828E-07  0.49137638E-07 -0.61338730E-08  0.76805145E-08
  S4 491.555  0.32089047E-09  0.14407638E-09  0.12925319E-11  0.14038268E-09  0.10308541E-09  0.11742749E-09
  Sa  56.554  0.21793187E-09  0.12972260E-09  0.71714382E-10  0.49927099E-10 -0.42733149E-10 -0.53422994E-10
  T2 272.556  0.13719484E-08  0.73425584E-09  0.20944307E-08  0.29614380E-08  0.13767437E-09  0.10318216E-08
 MN4 445.655 -0.70793273E-09 -0.76823301E-10  0.24279253E-09 -0.66374018E-09 -0.14062685E-09  0.16716883E-09
 MS4 473.555  0.32582237E-09 -0.10684852E-08  0.10873236E-08  0.38092589E-09 -0.40703836E-09 -0.28009461E-09
 Msf  73.555  0.52032006E-09  0.12958178E-08  0.20898774E-09  0.69234415E-09  0.16108594E-08  0.36734674E-09
 Mtm  85.455  0.38057222E-08  0.89028662E-09  0.47545363E-08 -0.16109463E-08  0.13034435E-08  0.46197838E-10
 mu2 237.555  0.27230195E-08 -0.54548861E-09  0.80856645E-09  0.28475772E-08  0.30945151E-08  0.39961507E-08
 nu2 245.655  0.31512988E-08  0.13274377E-08  0.16643629E-08  0.77176190E-09 -0.34369557E-09  0.49489633E-08
 Ssa  57.555  0.85592993E-08 -0.21041028E-09 -0.85777470E-08 -0.10849053E-08  0.38854237E-09 -0.73333943E-09
eps2 227.655  0.15232320E-08 -0.54284574E-09  0.18709319E-08 -0.17678032E-09  0.14037532E-08 -0.64291979E-09
lam2 263.655  0.77975910E-09 -0.46145888E-09  0.29230225E-08 -0.81098933E-09 -0.68691816E-09 -0.10714953E-08
MKS2 257.555 -0.76338045E-11 -0.81694611E-10  0.81955321E-10  0.53313693E-09  0.52931064E-09  0.23733568E-09
Msqm  93.555  0.17382639E-09 -0.21085098E-11  0.98864729E-10  0.18391545E-09 -0.15315104E-09 -0.66456652E-11
```

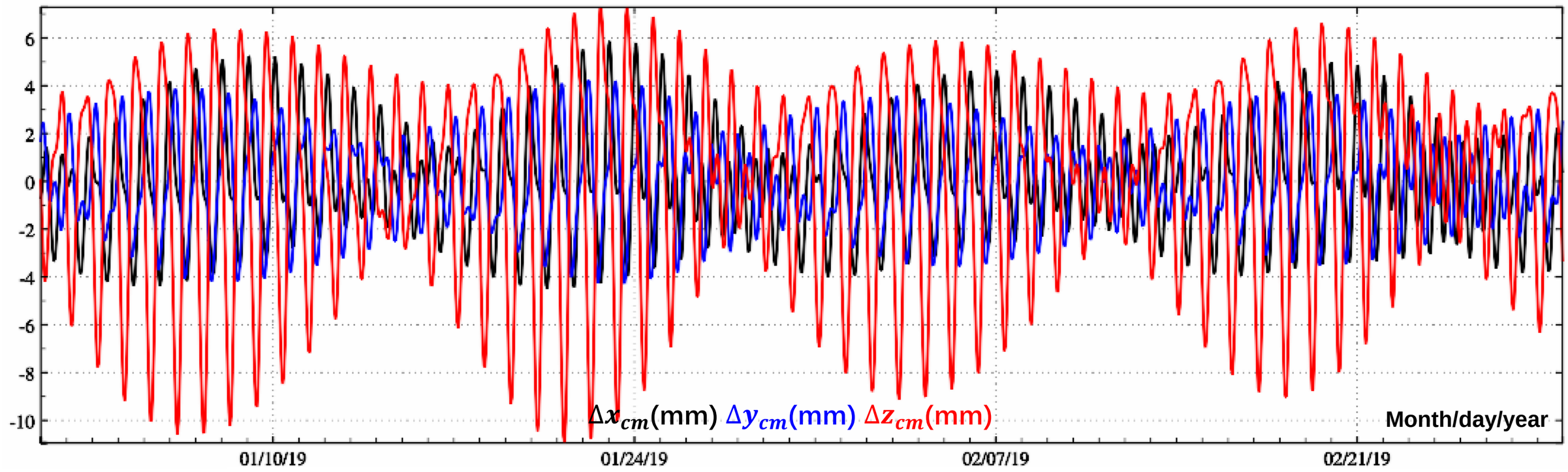
First-degree ocean tidal load spherical harmonic coefficient file from FES2014b360cs.dat. Which could be employed to forecast of ocean tidal load effects on Earth's center of mass (COM) or COM variation effect on all geodetic elements due to ocean tide.



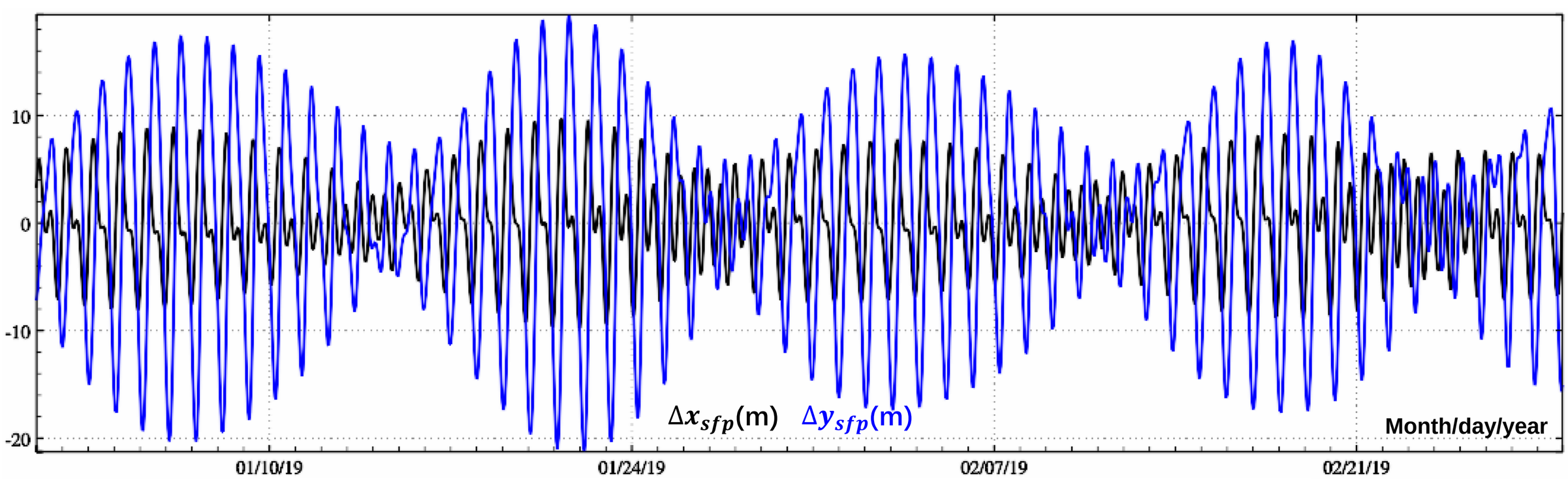
The atmosphere tidal load effect time series on Earth‘s center of mass (COM)



The surface atmosphere tidal load effect time series (m) on Earth's figure pole in ITRS



The ocean tidal load effect time series (mm) on Earth's center of mass (COM)



The ocean tidal load effect time series (m) on Earth's figure pole in ITRS

Computation of Load Model Values via Spherical Harmonic Synthesis

Computation of Various Load Effects via Spherical Harmonic Synthesis

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Surface Load Equivalent Water Height Model Values

Computation of Tidal Constituent Harmonic Constant Model Values

Computation of Load Equivalent Water Height Model Value Time Series

Select the calculation point file format

The discrete computation point file

Open the surface computation point file

Number of rows of the file header 1

Open surface load harmonic coefficient model file

Type of surface load: Surface atmosphere (hPa/mbar)

Maximum truncated degree of the coefficients model: 180

>> Program Process ** Operation Prompts

Save program process as

```
>> [Purpose] To compute the model values of tidal harmonic constants or non-tidal surface loads via Spherical Harmonic
Synthesis (SHS) from the provided tidal load or surface non-tidal load spherical harmonic coefficient models.
>> Select the computation function from the 3 control buttons on the top of the interface...
>> [Function] To compute the surface atmosphere (hPa/mbar), terrestrial equivalent water height (cm), or sea level variation
(cm) at specified locations from the normalized spherical harmonic coefficient model (unit: m) via Spherical Harmonic
Synthesis (SHS).
>> Open the surface computation point file C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/calcpnt.txt.
  ** Look at the file information in the window below and set the row number of the file header...
>> Open surface load harmonic coefficient model file C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/
airpress2016020312cs.dat.
  ** The window below only shows no more than 3000 rows of data in the file!
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/airpmdlrst.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-23 14:11:19
>> Complete the computation!
>> Computation end time: 2026-06-23 14:11:28
```

Save the results as | Import setting parameters | Start computation

```
point records
      1   104.041667   25.041667   0.000      5.1460
      2   104.125000   25.041667   0.000      5.3954
      3   104.208333   25.041667   0.000      5.6511
      4   104.291667   25.041667   0.000      5.9115
      5   104.375000   25.041667   0.000      6.1746
      6   104.458333   25.041667   0.000      6.4384
      7   104.541667   25.041667   0.000      6.7009
      8   104.625000   25.041667   0.000      6.9603
      9   104.708333   25.041667   0.000      7.2146
     10   104.791667   25.041667   0.000      7.4619
     11   104.875000   25.041667   0.000      7.7006
     12   104.958333   25.041667   0.000      7.9290
     13   105.041667   25.041667   0.000      8.1458
```

airpress2016020312cs.dat

```
1  3.986004418    6378137.00      -0.0970    0.940
2  1  0  1.8412756758963265E-10  0.0000000000000000E+00
3  2  0 -4.8416548561273103E-10  0.0000000000000000E+00
4  2  0 -8.3041237127846868E-10  0.0000000000000000E+00
5  2  1  3.0042214596809370E-10  1.4178812767271399E-09
6  2  2 -1.0298699208011155E-09  3.9778819980241900E-11
7  3  0 -2.2852824251273103E-09  0.0000000000000000E+00
8  3  1  8.2395160100381500E-10  2.5989454828063558E-10
9  3  2 -3.5135784095054722E-10 -9.8307496726666295E-10
10 3  3  6.7975067084791942E-10 -1.5506806360999531E-10
11 4  0 -1.3500990624598282E-09  0.0000000000000000E+00
12 4  1 -2.6751068548153390E-09 -1.8704081553144181E-09
13 4  2 -2.1920121450288522E-09 -5.9632881355913724E-10
14 4  3  9.2399791292550230E-10 -1.3797018418177622E-10
15 4  4 -4.6878373744373565E-10  6.9608812443930559E-11
16 5  0  2.9811603734448944E-09  0.0000000000000000E+00
17 5  1 -6.5942693396055756E-10  5.0634794014008111E-10
```

$GM(10^{14}m^3/s^2)$ a(m) zero-degree term (hPa/mbar), relative erro(%)

the scale parameter

This module supports the Remove-Restore technique. It can be employed for: Regional tidal load effect refinement using a tidal load spherical harmonic coefficient model as the reference tidal field; and Regional load deformation field refinement using a surface load spherical harmonic model as the reference load field.

Due to spectral leakage and aliasing inherent in high-degree spherical harmonic synthesis: Computed values for Sea Level Variation and Ocean Tidal Harmonic Constants may be non-zero in coastal land areas; and Computed values for Terrestrial Equivalent Water Height may be non-zero in coastal sea areas.

Computation of Load Model Values via Spherical Harmonic Synthesis

Computation of Tidal Constituent Harmonic Constant Model Values

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Surface Load Equivalent Water Height Model Values

Computation of Tidal Constituent Harmonic Constant Model Values

Computation of Load Equivalent Water Height Model Value Time Series

Open the surface computation point file

Number of rows of the file header: 1

Open tidal load harmonic coefficient model file

Maximum truncated degree of the coefficients model: 180

>> Program Process ** Operation Prompts

Save program process as

```
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-23 14:11:19
>> Complete the computation!
>> Computation end time: 2026-06-23 14:11:28
>> [Function] To calculate the harmonic constant model values (units: hPa or cm) for all tidal constituents contained in a tidal load spherical harmonic coefficient model at specified locations, using the normalized spherical harmonic coefficient model.
>> Open the surface computation point file C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/calcpnt.txt.
  ** Look at the file information in the window below and set the row number of the file header...
>> Open tidal load harmonic coefficient model file C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/Airtdloadcs.dat.
  ** The window below only shows no more than 3000 rows of data in the file!
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/airptiderst.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-23 14:13:18
>> Complete the computation of the harmonic constant model values for 4 tidal constituents!
>> Computation end time: 2026-06-23 14:14:13
```

Save the results as | Import setting parameters | Start computation

airptiderst.txt

```
point records    S1 164556    S2 273555    Sa  56565    Ssa  57555
      1  104.041667  25.041667  0.000   -1.776    1.309    0.240    1.303   -0.514   -5.819    0.317    1.364
      2  104.125000  25.041667  0.000   -1.755    1.300    0.240    1.304   -0.459   -5.935    0.298    1.347
      3  104.208333  25.041667  0.000   -1.737    1.289    0.239    1.304   -0.401   -6.054    0.278    1.330
      4  104.291667  25.041667  0.000   -1.720    1.274    0.238    1.305   -0.338   -6.176    0.257    1.312
      5  104.375000  25.041667  0.000   -1.706    1.257    0.235    1.306   -0.272   -6.300    0.235    1.295
      6  104.458333  25.041667  0.000   -1.694    1.238    0.232    1.307   -0.204   -6.425    0.214    1.278
      7  104.541667  25.041667  0.000   -1.685    1.217    0.227    1.308   -0.133   -6.549    0.193    1.262
      8  104.625000  25.041667  0.000   -1.679    1.194    0.222    1.310   -0.061   -6.673    0.171    1.246
      9  104.708333  25.041667  0.000   -1.675    1.170    0.216    1.311    0.013   -6.794    0.151    1.230
     10  104.791667  25.041667  0.000   -1.674    1.146    0.210    1.312    0.087   -6.913    0.131    1.216
     11  104.875000  25.041667  0.000   -1.675    1.121    0.203    1.313    0.161   -7.027    0.112    1.202
     12  104.958333  25.041667  0.000   -1.679    1.096    0.196    1.315    0.235   -7.137    0.094    1.190
     13  105.041667  25.041667  0.000   -1.684    1.071    0.188    1.316    0.308   -7.241    0.077    1.178
```

This module supports the Remove-Restore technique. It can be employed for: Regional tidal load effect refinement using a tidal load spherical harmonic coefficient model as the reference tidal field; and Regional load deformation field refinement using a surface load spherical harmonic model as the reference load field.

Due to spectral leakage and aliasing inherent in high-degree spherical harmonic synthesis: Computed values for Sea Level Variation and Ocean Tidal Harmonic Constants may be non-zero in coastal land areas; and Computed values for Terrestrial Equivalent Water Height may be non-zero in coastal sea areas.

Computation of Load Model Values via Spherical Harmonic Synthesis

Computation of Load Equivalent Water Height Model Value Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Surface Load Equivalent Water Height Model Values

Computation of Tidal Constituent Harmonic Constant Model Values

Computation of Load Equivalent Water Height Model Value Time Series

Select the calculation point file format

The discrete computation point file

Open the surface computation point file

Number of rows of the file header 1

Open any load harmonic coefficient model file

Set the wildcard of the file names

Ordinal number of the first wildcard in the file name 5

Number of consecutive wildcards in file name 10

Type of surface load Land water EWH (cm)

Maximum truncated degree of the coefficients model 180

>> Program Process ** Operation Prompts

Save program process as

```
   C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/landwcstm/swsc2018011012.coe
   C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/landwcstm/swsc2018011712.coe
   C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/landwcstm/swsc2018012412.coe
   C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/landwcstm/swsc2018013112.coe
   C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/landwcstm/swsc2018020712.coe
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
  ** The computation process needs to wait... During the computation period, you can open the output file C:/
ETideLoad4.5_win64en/examples/Loadspharmsynthesis/lndwmdlrst.txt, to look at the computation progress!
  ** The last column attribute of each output file header is the instance of the wildcards of the file name of surface load
harmonic coefficient model file, which represents the sampling epoch time of the output file.
>> Computation start time：2026-06-23 14:16:58
>> Complete the computation of the load EWH model values of 6 sampling epoch time!
>> Output Internal Test File (Loadfmcmsfptm.txt) to the current directory.
  ** Header: The first row is the file header.
  ** Records: Starting from the second row, each record stores the sampling epoch time, 8 columns of surface load effects
on the first and second degree normalized geopotential coefficients ΔC10, ΔC11, ΔS11, ΔC20, ΔC21, ΔS21, ΔC22, ΔS22 (×10⁻¹⁰), 3
columns of surface load effects on Earth's center of mass Δxcm, Δycm, Δzcm (units: mm), and 2 columns of surface load
effects on Earth's figure pole Δxsfp, Δysfp (in ITRS, m).
>> Computation end time: 2026-06-23 14:18:11
```

Save the results as | Import setting parameters | Start computation

point records	2018010312	2018011012	2018011712	2018012412	2018013112	2018020712		
1	104.041667	25.041667	0.000	-0.3446	-0.2313	-1.0282	-2.1012	-3.1517	-3.5899
2	104.125000	25.041667	0.000	-0.4105	-0.2578	-1.0650	-2.1316	-3.1786	-3.6312
3	104.208333	25.041667	0.000	-0.4723	-0.2826	-1.1008	-2.1612	-3.2043	-3.6732
4	104.291667	25.041667	0.000	-0.5303	-0.3064	-1.1360	-2.1905	-3.2293	-3.7161
5	104.375000	25.041667	0.000	-0.5849	-0.3304	-1.1717	-2.2202	-3.2540	-3.7600
6	104.458333	25.041667	0.000	-0.6371	-0.3562	-1.2089	-2.2513	-3.2793	-3.8055
7	104.541667	25.041667	0.000	-0.6883	-0.3854	-1.2490	-2.2850	-3.3065	-3.8532
8	104.625000	25.041667	0.000	-0.7400	-0.4199	-1.2938	-2.3227	-3.3366	-3.9039
9	104.708333	25.041667	0.000	-0.7939	-0.4616	-1.3446	-2.3657	-3.3710	-3.9586
10	104.791667	25.041667	0.000	-0.8518	-0.5122	-1.4031	-2.4153	-3.4110	-4.0179
11	104.875000	25.041667	0.000	-0.9154	-0.5731	-1.4706	-2.4727	-3.4576	-4.0827
12	104.958333	25.041667	0.000	-0.9861	-0.6457	-1.5481	-2.5388	-3.5118	-4.1536
13	105.041667	25.041667	0.000	-1.0653	-0.7306	-1.6363	-2.6142	-3.5741	-4.2307

This module supports the Remove-Restore technique. It can be employed for: Regional tidal load effect refinement using a tidal load spherical harmonic coefficient model as the reference tidal field; and Regional load deformation field refinement using a surface load spherical harmonic model as the reference load field.

Due to spectral leakage and aliasing inherent in high-degree spherical harmonic synthesis: Computed values for Sea Level Variation and Ocean Tidal Harmonic Constants may be non-zero in coastal land areas; and Computed values for Terrestrial Equivalent Water Height may be non-zero in coastal sea areas.

Computation of Load Deformation Field via Spherical Harmonic Synthesis

Computation of Various Load Effects via Spherical Harmonic Synthesis

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Various Load Effects via Spherical Harmonic Synthesis | Computation of Various Load Effects for Earth Satellites or External to the Solid Earth | Computation of Load Effect Time Series via Spherical Harmonic Synthesis | Global Load Spherical Harmonic Analysis and Synthesis of Load Effects

Select the computation point file format

The discrete computation point file

Open the space computation point file

Number of rows of the file header 1

Column ordinal number of the height in record 4

Open surface load harmonic coefficient model file

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [ ] ground normal or orthometric height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)

The type of surface load: Land water EWH

Save program process as

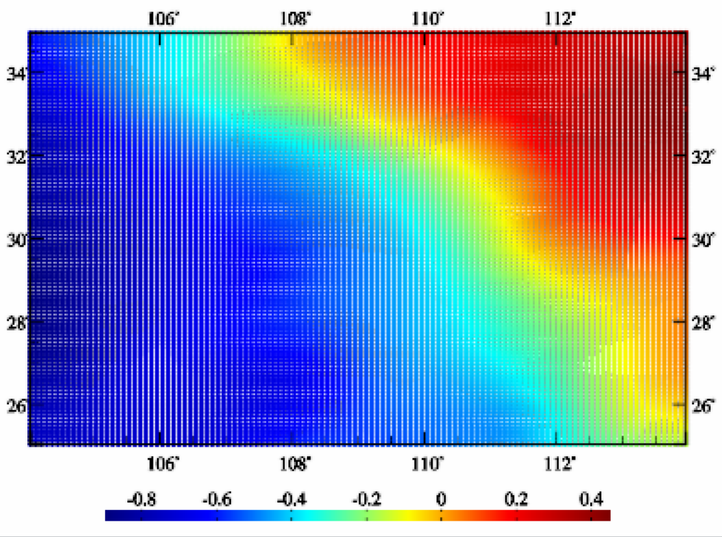
```
Atmosphere or Terrestrial Water Variation loads, the height of the computation point refers to the height relative to the Earth's surface.
>> Select the computation function from the 3 control buttons on the top of the interface...
>> [Function] This function computes the non-tidal load effects on a comprehensive set of geodetic elements from the input surface atmosphere, terrestrial water, or sea
level variation load spherical harmonic coefficient model (m) via spherical harmonic synthesis. The target elements include: Geoid or height anomaly (mm), ground gravity
(μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, mas), vertical deflection (SW, to the south and to the west, mas), horizontal displacement
(EN, to the east and to the north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity
gradient (NW, 10μE).
>> Open the space computation point file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/calcpnt.txt.
  ** Look at the file information in the window below and set the row number of the file header...
>> Open surface load harmonic coefficient model file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/landwcs/swsc2018011012.coe.
  ** The window below only shows no more than 3000 rows of data in the file!
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/loaddfmrst.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-23 16:28:57
>> Complete the computation of the model values of load effects!
>> Computation end time: 2026-06-23 16:30:57
```

Minimum starting degree of the coefficient model 1 | Maximum truncated degree 360

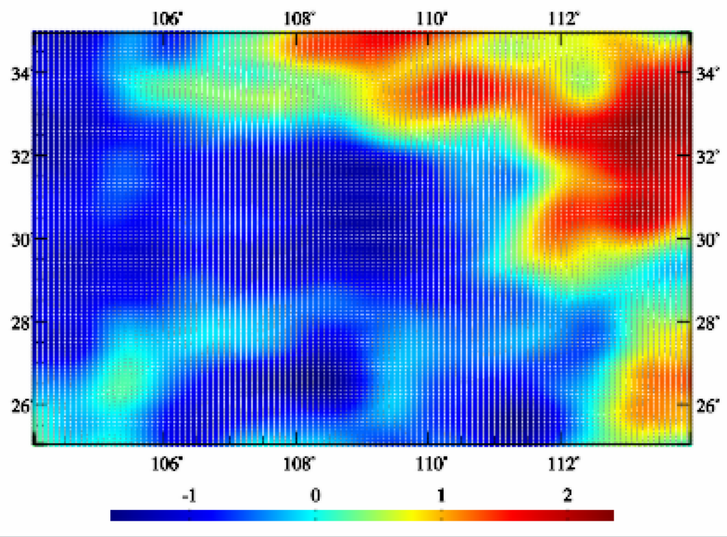
Save the results as | Import setting parameters | Start computation

```
104.0 114.0 25.0 35.0 0.08333333 0.08333333
      1  104.041667  25.041667  0.000    -0.7492     0.3235     1.4184
      2  104.125000  25.041667  0.000    -0.7479     0.2727     1.4232
      3  104.208333  25.041667  0.000    -0.7470     0.2064     1.4295
      4  104.291667  25.041667  0.000    -0.7464     0.1325     1.4368
      5  104.375000  25.041667  0.000    -0.7458     0.0603     1.4441
      6  104.458333  25.041667  0.000    -0.7451    -0.0016     1.4507
      7  104.541667  25.041667  0.000    -0.7440    -0.0463     1.4561
      8  104.625000  25.041667  0.000    -0.7426    -0.0699     1.4598
      9  104.708333  25.041667  0.000    -0.7408    -0.0718     1.4618
     10  104.791667  25.041667  0.000    -0.7386    -0.0553     1.4623
     11  104.875000  25.041667  0.000    -0.7361    -0.0262     1.4619
```

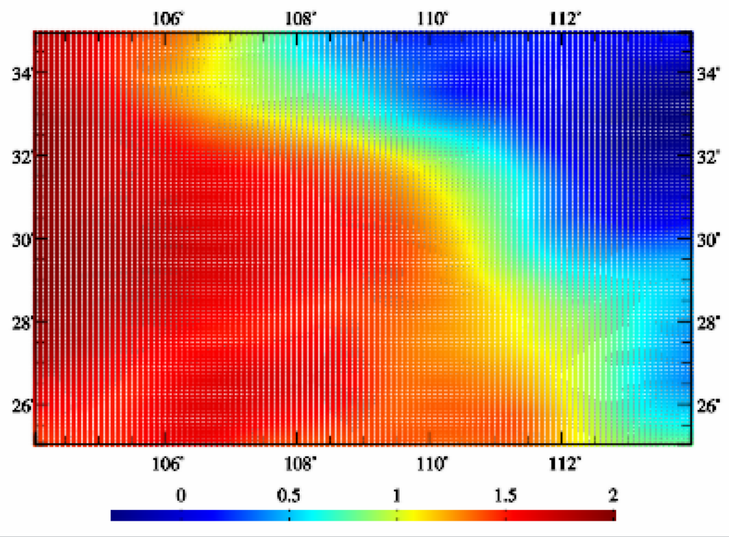
Extract deformation field to be plot | Plot↓



geoid / height anomaly (mm)



ground gravity (μGal)



radial displacement (mm)

Computation of Load Deformation Field via Spherical Harmonic Synthesis

Computation of Various Load Effects via Spherical Harmonic Synthesis

Computation of Various Load Effects via Spherical Harmonic Synthesis | Computation of Various Load Effects for Earth Satellites or External to the Solid Earth | Computation of Load Effect Time Series via Spherical Harmonic Synthesis | Global Load Spherical Harmonic Analysis and Synthesis of Load Effects

Select the computation point file format

The computation surface height grid file

Open the computation surface height grid file

Open surface load harmonic coefficient model file

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [ ] ground normal or orthometric height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)

The type of surface load: Surface atmosphere

Save program process as

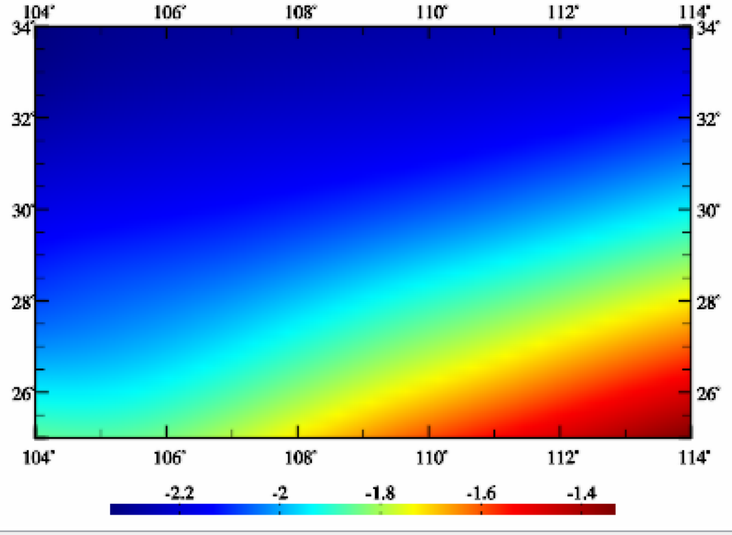
```
>> Computation start time：2026-06-23 16:28:57
>> Complete the computation of the model values of load effects!
>> Computation end time: 2026-06-23 16:30:57
>> [Function] This function computes the non-tidal load effects on a comprehensive set of geodetic elements from the input surface atmosphere, terrestrial water, or sea level variation load spherical harmonic coefficient model (m) via spherical harmonic synthesis. The target elements include: Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, mas), vertical deflection (SW, to the south and to the west, mas), horizontal displacement (EN, to the east and to the north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (10μE), or horizontal gravity gradient (NW, 10μE).
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/zero15m.dat.
>> Open surface load harmonic coefficient model file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/airwhCS20170315.txt.
  ** The window below only shows no more than 3000 rows of data in the file!
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/loadfmdlgrd.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-23 16:33:51
>> Complete the computation of the model values of load effects!
>> Computation end time: 2026-06-23 16:34:10
```

Minimum starting degree of the coefficient model: 1 | Maximum truncated degree: 360

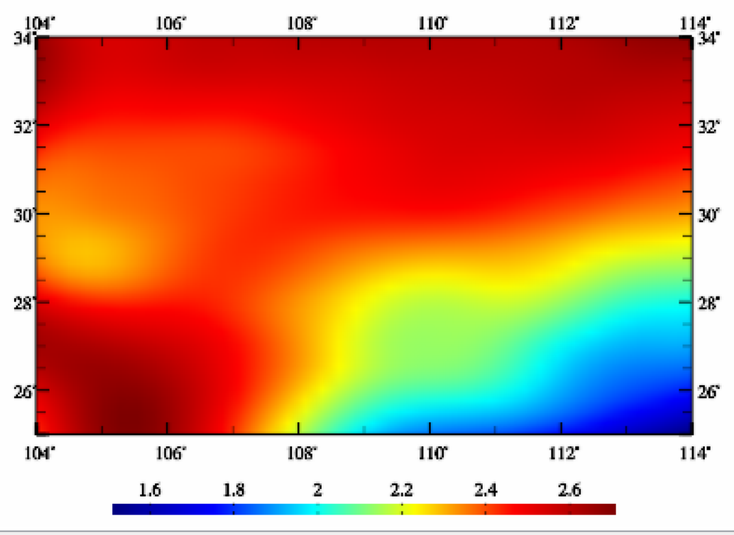
Save the results as | Import setting parameters | Start computation

```
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/loadfmdlgrd.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/loadfmdlgrd.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/loadfmdlgrd.dpr
```

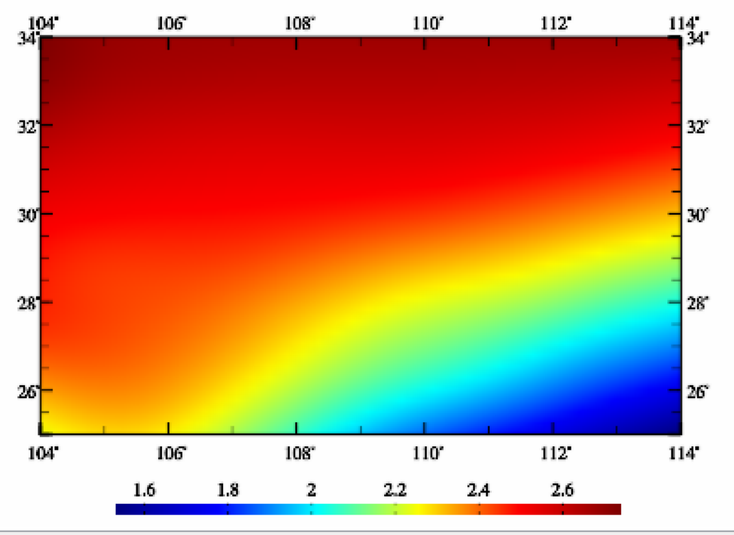
Extract deformation field to be plot | Plot↓



geoid / height anomaly (mm)



ground gravity (μGal)



radial displacement (mm)

Computation of Load Deformation Field via Spherical Harmonic Synthesis

Computation of Various Load Effects for Earth Satellites or External to the Solid Earth

Computation of Various Load Effects via Spherical Harmonic Synthesis | Computation of Various Load Effects for Earth Satellites or External to the Solid Earth | Computation of Load Effect Time Series via Spherical Harmonic Synthesis | Global Load Spherical Harmonic Analysis and Synthesis of Load Effects

Select the computation point file format: The discrete computation point file

Open the space computation point file

Number of rows of the file header: 1

Column ordinal number of the height in record: 4

Open surface load harmonic coefficients model file

Select the type of effects

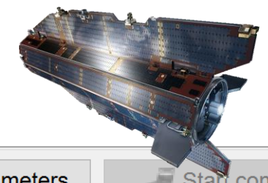
- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [ ] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [x] gravity gradient (ENU, 10μE)

The type of surface load: Sea level variation

Save program process as

```
>> Computation start time：2026-06-23 16:33:51
>> Complete the computation of the model values of load effects!
>> Computation end time: 2026-06-23 16:34:10
>> [Function] This function computes the non-tidal load effects on the geopotential (0.1m²/s²), gravity (μGal), or gravity gradient (10μE) at points located in space external to the solid Earth (e.g., ocean space, near-Earth space, or satellite altitudes) external to the solid Earth from the input surface atmosphere, terrestrial water, or sea level variation load spherical harmonic coefficient model (m) via spherical harmonic synthesis..
  ** Here the space point external to the solid Earth generally refers to the point that is not fixed with the solid Earth in ocean space, near-Earth space, or satellite altitude.
>> Open the space computation point file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/outpnt.txt.
  ** Look at the file information in the window below and set the row number of the file header...
>> Open surface load harmonic coefficient model file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealevel2018010312cs.dat.
  ** The window below only shows no more than 3000 rows of data in the file!
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/outdfmrst.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-23 16:38:59
>> Complete the computation of the model values of load effects!
>> Computation end time: 2026-06-23 16:40:37
```

GOCE satellite altitude

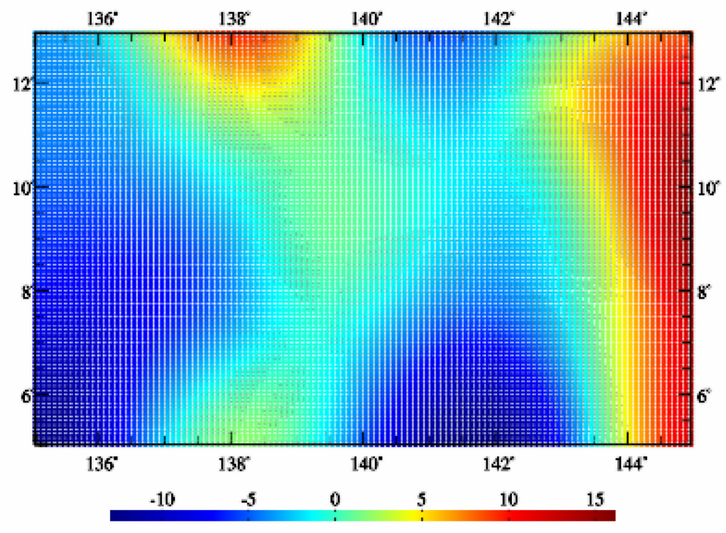


Minimum starting degree of the coefficient model: 1 — Maximum truncated degree: 360

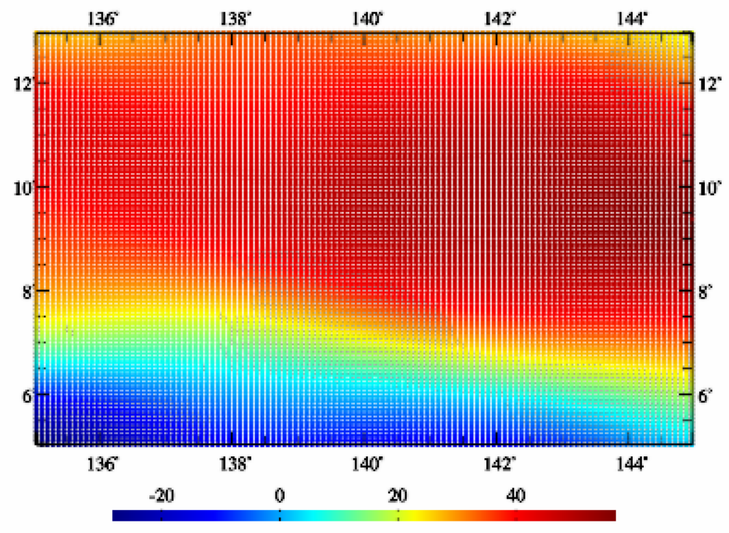
Save the results as | Import setting parameters | Start computation

1	135.041667	5.041667	240000.000				
2	135.125000	5.041667	240000.000	0.5445	-12.7285	-28.4375	-41.9023
3	135.208333	5.041667	240000.000	0.5514	-12.6973	-27.9109	-41.3091
4	135.291667	5.041667	240000.000	0.5584	-12.6025	-27.3734	-40.6392
5	135.375000	5.041667	240000.000	0.5654	-12.4454	-26.8260	-39.8946
6	135.458333	5.041667	240000.000	0.5727	-12.2278	-26.2698	-39.0785
7	135.541667	5.041667	240000.000	0.5800	-11.9521	-25.7057	-38.1944
8	135.625000	5.041667	240000.000	0.5874	-11.6215	-25.1351	-37.2466
9	135.708333	5.041667	240000.000	0.5949	-11.2394	-24.5590	-36.2400
10	135.791667	5.041667	240000.000	0.6026	-10.8098	-23.9789	-35.1800
11	135.875000	5.041667	240000.000	0.6103	-10.3371	-23.3961	-34.0726
12	135.958333	5.041667	240000.000	0.6181	-9.8259	-22.8120	-32.9238

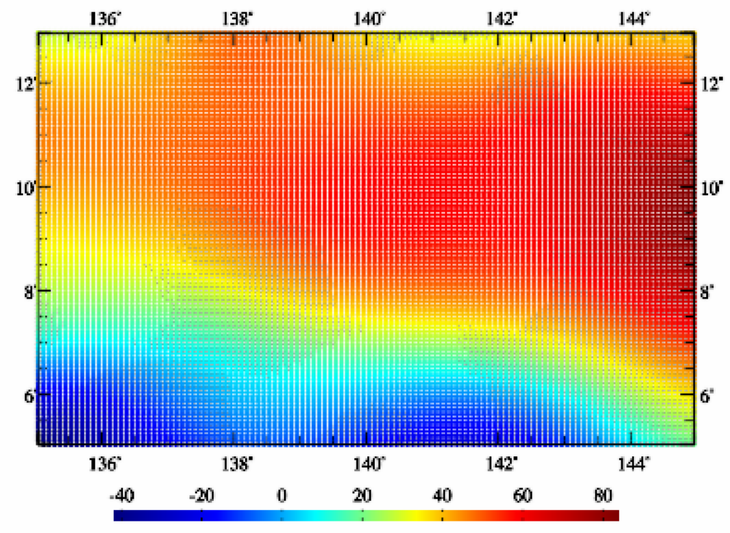
Extract deformation field to be plot | Plot↓



gravity gradient (E, 10μE)



gravity gradient (N, 10μE)



gravity gradient (U, 10μE)

Computation of Load Deformation Field via Spherical Harmonic Synthesis

Computation of Various Load Effects for Earth Satellites or External to the Solid Earth

Computation of Various Load Effects via Spherical Harmonic Synthesis | Computation of Various Load Effects for Earth Satellites or External to the Solid Earth | Computation of Load Effect Time Series via Spherical Harmonic Synthesis | Global Load Spherical Harmonic Analysis and Synthesis of Load Effects

Select the computation point file format

The discrete computation point file

Open the space computation point file

Number of rows of the file header: 0

Column ordinal number of the height in record: 4

Open surface load harmonic coefficients model file

Select the type of effects

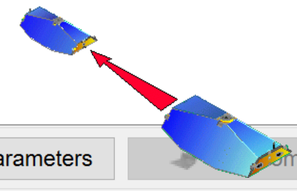
- [x] geopotential (0.1m²/s²)
- [ ] gravity vector (XYZ, μGal)
- [x] gravity vector (ENU, μGal)
- [ ] gravity gradient (XYZ, 10μE)
- [ ] gravity gradient (ENU, 10μE)

The type of surface load: Sea level variation

Save program process as

```
>> Computation start time：2026-06-23 16:38:59
>> Complete the computation of the model values of load effects!
>> Computation end time: 2026-06-23 16:40:37
>> [Function] This function computes the non-tidal load effects on the geopotential (0.1m²/s²), gravity (μGal), or gravity gradient (10μE) at points located in space external to the solid Earth (e.g., ocean space, near-Earth space, or satellite altitudes) external to the solid Earth from the input surface atmosphere, terrestrial water, or sea level variation load spherical harmonic coefficient model (m) via spherical harmonic synthesis..
  ** Here the space point external to the solid Earth generally refers to the point that is not fixed with the solid Earth in ocean space, near-Earth space, or satellite altitude.
>> Open the space computation point file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/satpnt.txt.
  ** Look at the file information in the window below and set the row number of the file header...
>> Open surface load harmonic coefficient model file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealevel2018010312cs.dat.
  ** The window below only shows no more than 3000 rows of data in the file!
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/satdfmrst.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-23 16:42:50
>> Complete the computation of the model values of load effects!
>> Computation end time: 2026-06-23 16:44:28
```

GRACE satellite altitude

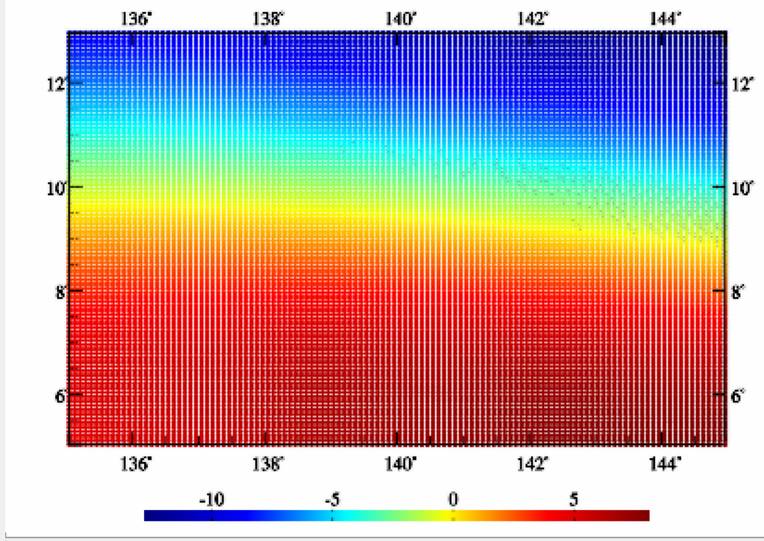


Minimum starting degree of the coefficient model: 1 — Maximum truncated degree: 360

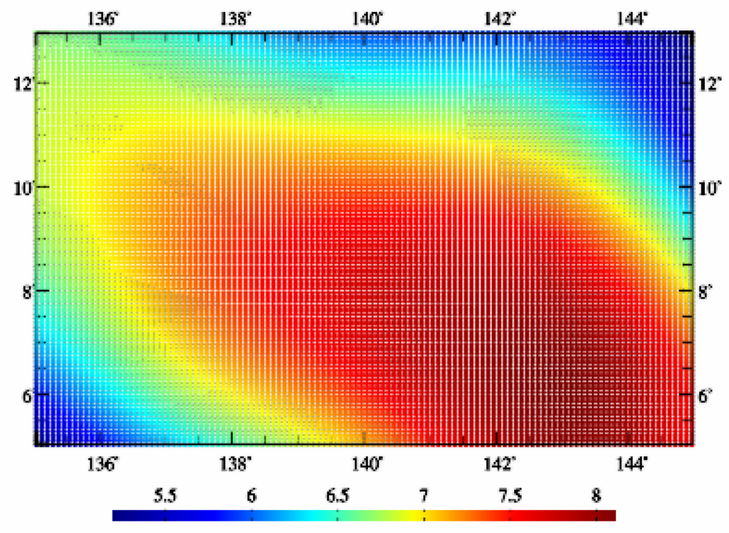
Save the results as | Import setting parameters | Start computation

1	135.041667	5.041667	450000.000	0.5600	4.5071	5.2700	-0.7925
2	135.125000	5.041667	450000.000	0.5653	4.5585	5.3123	-0.8456
3	135.208333	5.041667	450000.000	0.5705	4.6095	5.3547	-0.9002
4	135.291667	5.041667	450000.000	0.5759	4.6601	5.3973	-0.9562
5	135.375000	5.041667	450000.000	0.5812	4.7103	5.4399	-1.0137
6	135.458333	5.041667	450000.000	0.5866	4.7601	5.4825	-1.0726
7	135.541667	5.041667	450000.000	0.5921	4.8096	5.5250	-1.1329
8	135.625000	5.041667	450000.000	0.5976	4.8587	5.5672	-1.1946
9	135.708333	5.041667	450000.000	0.6031	4.9074	5.6092	-1.2577
10	135.791667	5.041667	450000.000	0.6087	4.9559	5.6509	-1.3221
11	135.875000	5.041667	450000.000	0.6143	5.0040	5.6922	-1.3878
12	135.958333	5.041667	450000.000	0.6199	5.0518	5.7331	-1.4547

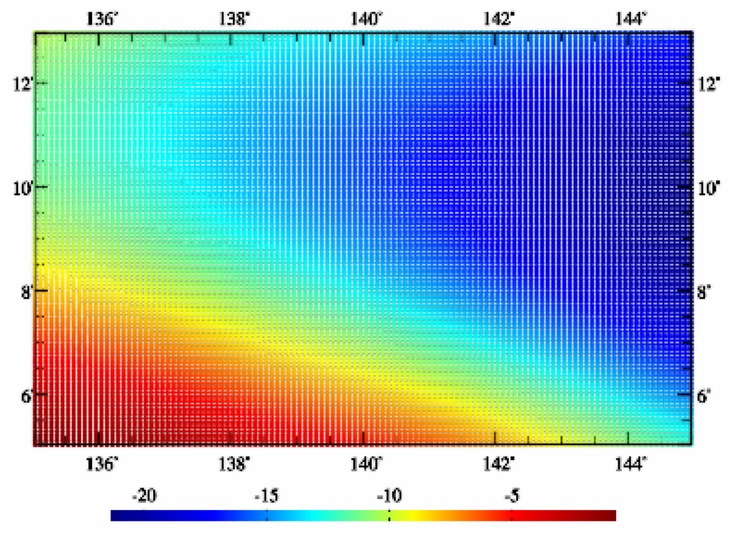
Extract deformation field to be plot | Plot↓



gravity vector (E, μGal)



gravity vector (N, μGal)



gravity vector (U, μGal)

Computation of Load Deformation Field via Spherical Harmonic Synthesis

Computation of Load Effect Time Series via Spherical Harmonic Synthesis

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Various Load Effects via Spherical Harmonic Synthesis

Computation of Various Load Effects for Earth Satellites or External to the Solid Earth

Computation of Load Effect Time Series via Spherical Harmonic Synthesis

Global Load Spherical Harmonic Analysis and Synthesis of Load Effects

Select the computation point file format

The computation surface height grid file

Open the land surface height grid file

Open any load harmonic coefficient model file

Set the wildcard of the file names

Ordinal number of first wildcard in file name: 9

Number of consecutive wildcards in file name: 10

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [ ] ground normal or orthometric height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)

The type of surface load: Sea level variation

Save program process as

```
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019060512cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019061212cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019061912cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019062612cs.dat
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
 ** The computation process needs to wait... During the computation period, you can open the output files folder C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/
seaload,to look at the computation progress!!
 ** The last column attribute of each output file header is the instance of the wildcards of the file name of the model time series, which represents the sampling epoch time of
the output file.
>> Computation start time：2026-06-23 16:49:33
>> Complete the computation of the model values for 26 load deformation field!
 ** Output Internal Test File (Loadfmcmsfptm.txt) to the current directory.
 ** Header: The first row is the file header.
 ** Records: Starting from the second row, each record stores the sampling epoch time, 8 columns of surface load effects on the first and second degree normalized
geopotential coefficients ΔC10, ΔC11, ΔS11, ΔC20, ΔC21, ΔS21, ΔC22, ΔS22 (×10⁻¹⁰), 3 columns of surface load effects on Earth's center of mass Δxcm, Δycm, Δzcm (units: mm),
and 2 columns of surface load effects on Earth's figure pole Δxsfp, Δysfp (in ITRS, m).
>> Computation end time: 2026-06-23 16:50:53
```

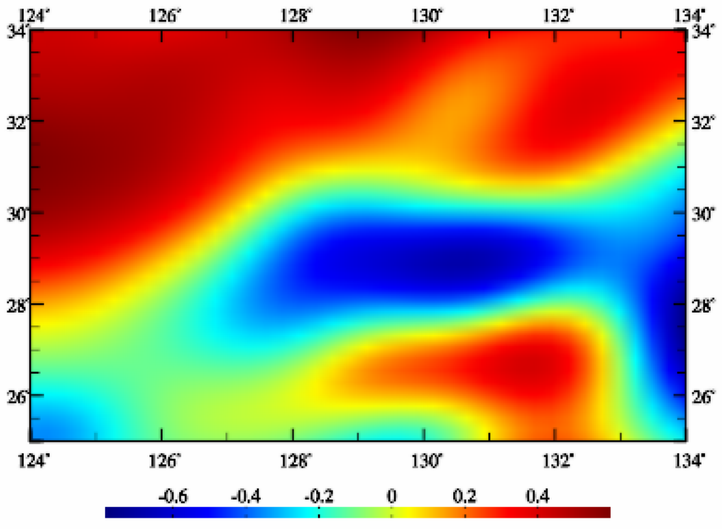
Minimum starting degree of the coefficient model: 1

Maximum truncated degree: 180

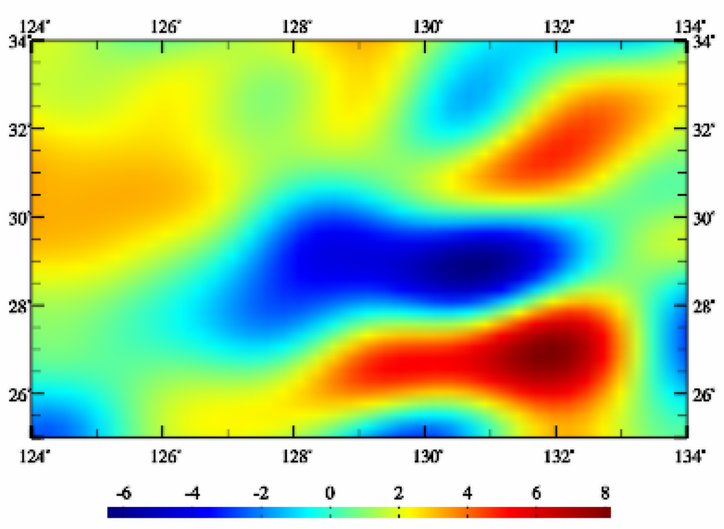
Set the result folder | Import setting parameters | Start computation

```
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019010212.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019010212.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019010212.dpr
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019010912.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019010912.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019010912.dpr
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019011612.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019011612.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019011612.dpr
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019012312.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019012312.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload/loadfmdl2019012312.dpr
```

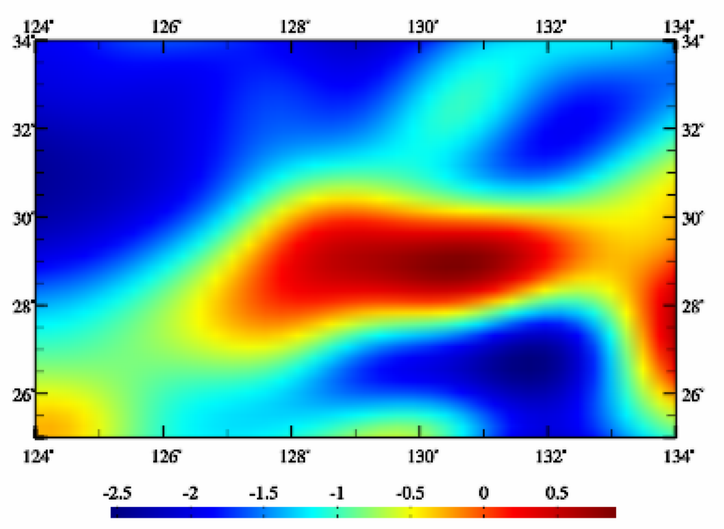
Extract deformation field to be plot | Plot↓



geoid / height anomaly (mm)



ground gravity (μGal)



radial displacement (mm)

Computation of Load Deformation Field via Spherical Harmonic Synthesis

Computation of Load Effect Time Series via Spherical Harmonic Synthesis

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Various Load Effects via Spherical Harmonic Synthesis

Computation of Various Load Effects for Earth Satellites or External to the Solid Earth

Computation of Load Effect Time Series via Spherical Harmonic Synthesis

Global Load Spherical Harmonic Analysis and Synthesis of Load Effects

Select the computation point file format

The computation surface height grid file

Open the land surface height grid file

Open any load harmonic coefficient model file

Set the wildcard of the file names

Ordinal number of first wildcard in file name: 5

Number of consecutive wildcards in file name: 10

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [ ] ground normal or orthometric height (mm)
- [ ] radial gravity gradient (10μE)
- [ ] horizontal gravity gradient (NW, 10μE)

The type of surface load: Land water EWH

Save program process as

```
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/landwcs/swsc2018011712.coe
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/landwcs/swsc2018012412.coe
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/landwcs/swsc2018013112.coe
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/landwcs/swsc2018020712.coe
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
 ** The computation process needs to wait... During the computation period, you can open the output files folder C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl,to look at the computation progress!!
 ** The last column attribute of each output file header is the instance of the wildcards of the file name of the model time series, which represents the sampling epoch time of the output file.
>> Computation start time：2026-06-23 16:57:56
>> Complete the computation of the model values for 6 load deformation field!
 ** Output Internal Test File (Loadfmcmsfptm.txt) to the current directory.
 ** Header: The first row is the file header.
 ** Records: Starting from the second row, each record stores the sampling epoch time, 8 columns of surface load effects on the first and second degree normalized geopotential coefficients ΔC10, ΔC11, ΔS11, ΔC20, ΔC21, ΔS21, ΔC22, ΔS22 (×10⁻¹⁰), 3 columns of surface load effects on Earth's center of mass Δxcm, Δycm, Δzcm (units: mm), and 2 columns of surface load effects on Earth's figure pole Δxsfp, Δysfp (in ITRS, m).
>> Computation end time: 2026-06-23 16:58:27
```

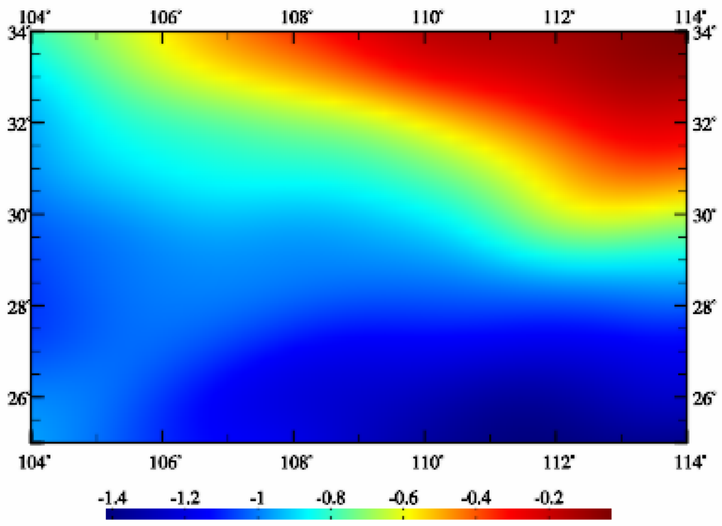
Minimum starting degree of the coefficient model: 1

Maximum truncated degree: 180

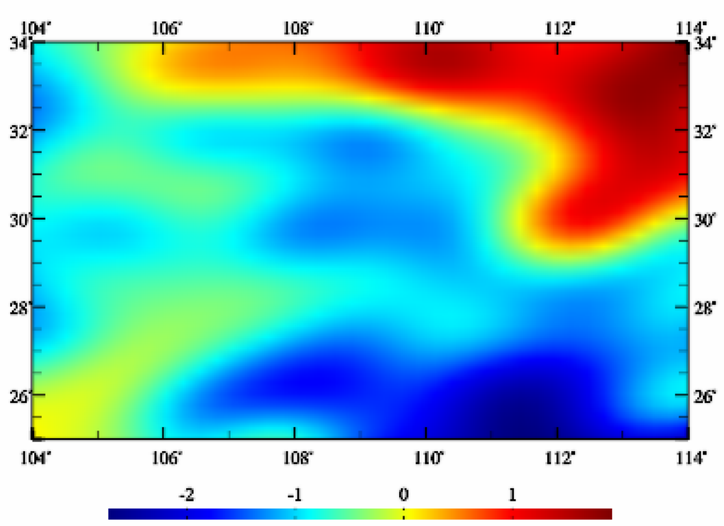
Set the result folder | Import setting parameters | Start computation

```
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018010312.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018010312.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018010312.dpr
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018011012.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018011012.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018011012.dpr
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018011712.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018011712.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018011712.dpr
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018012412.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018012412.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl/loadfmdl2018012412.dpr
```

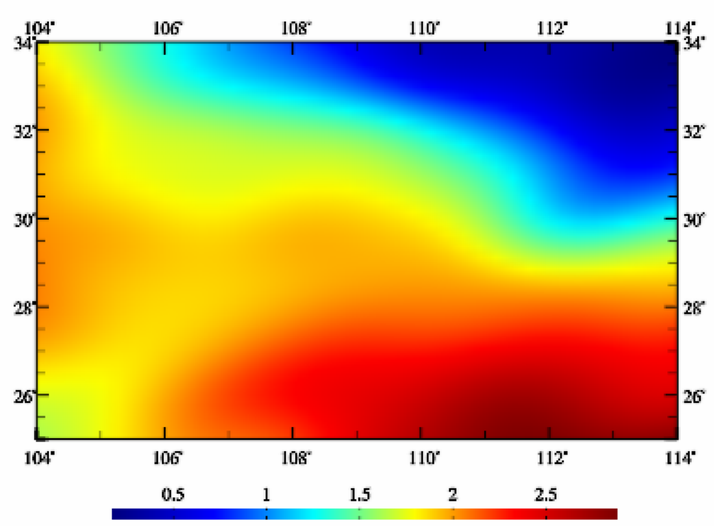
Extract deformation field to be plot | Plot↓



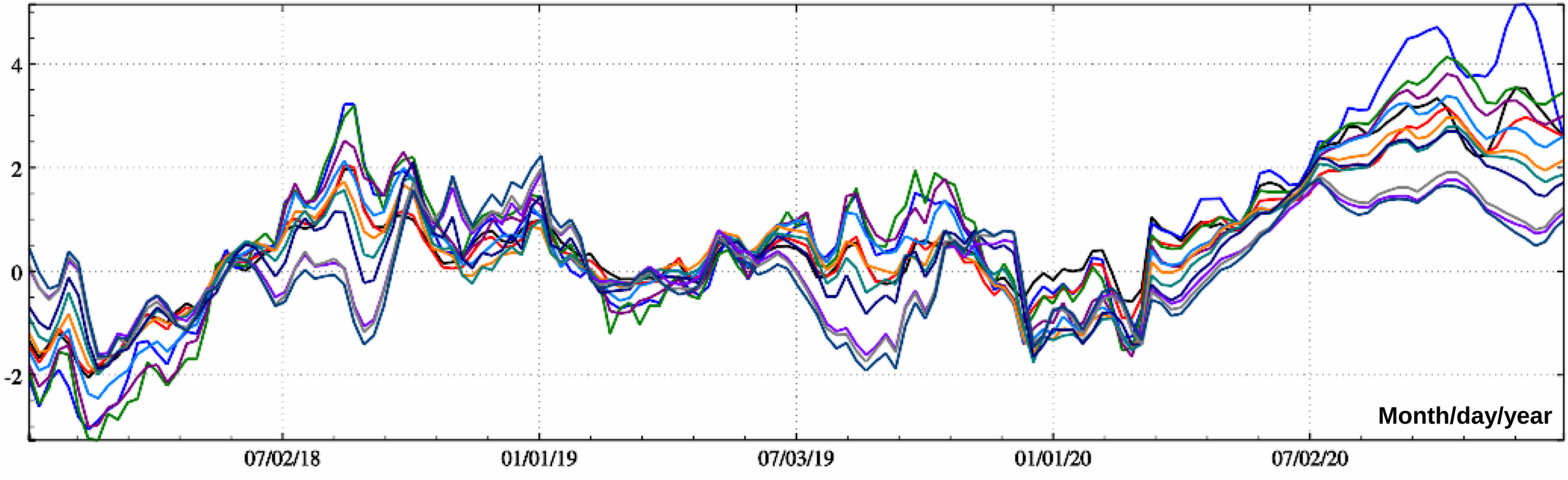
geoid / height anomaly (mm)



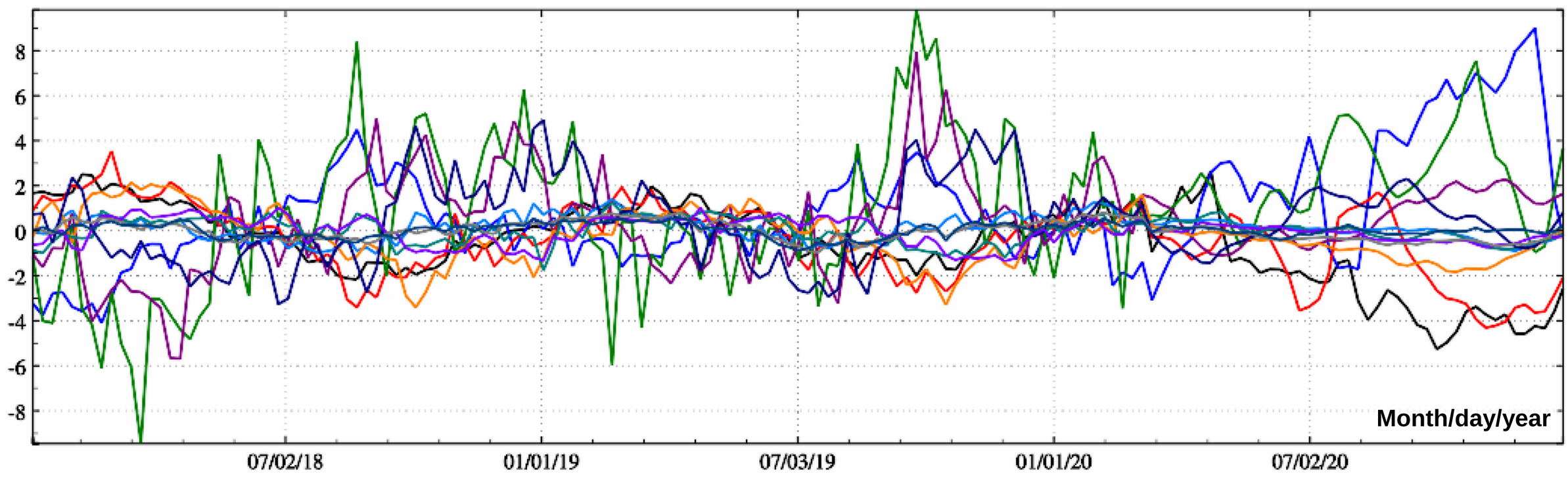
ground gravity (μGal)



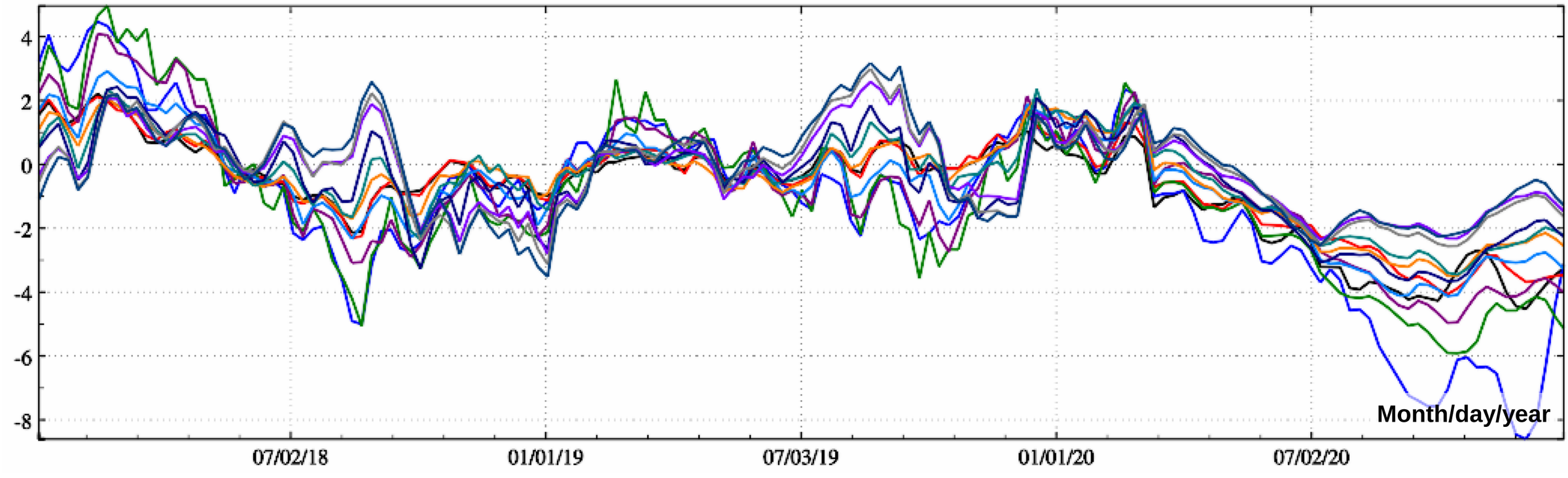
radial displacement (mm)



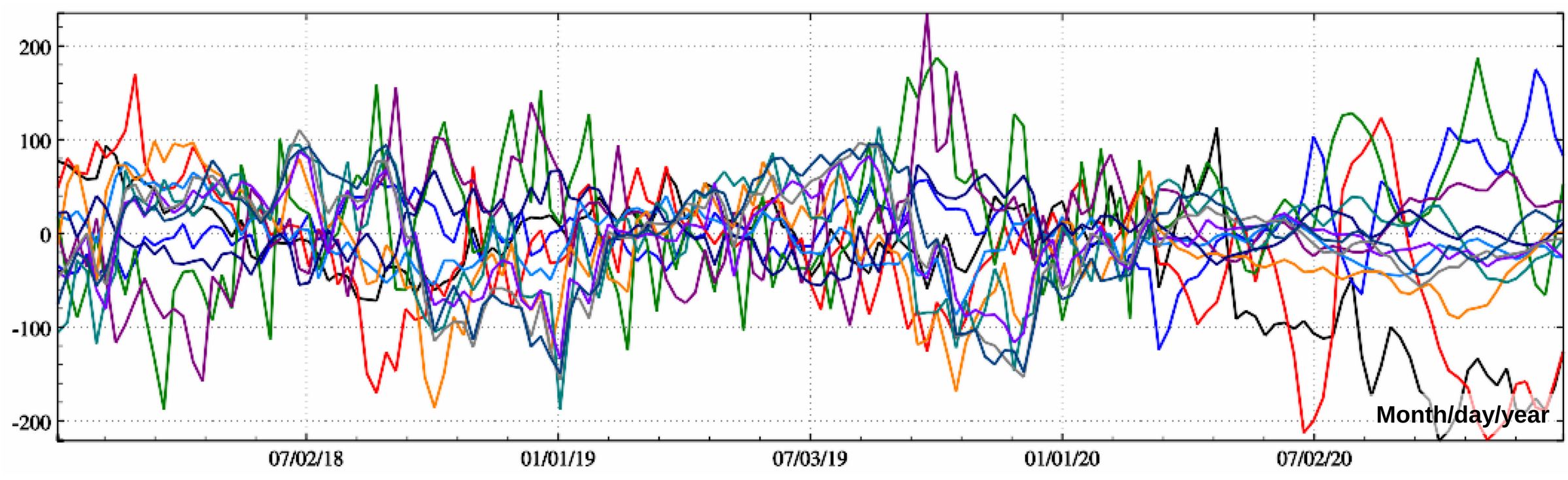
Sea level variation load effect weekly time series on the geoid (mm) at 12 tide gauges along Chinese coast



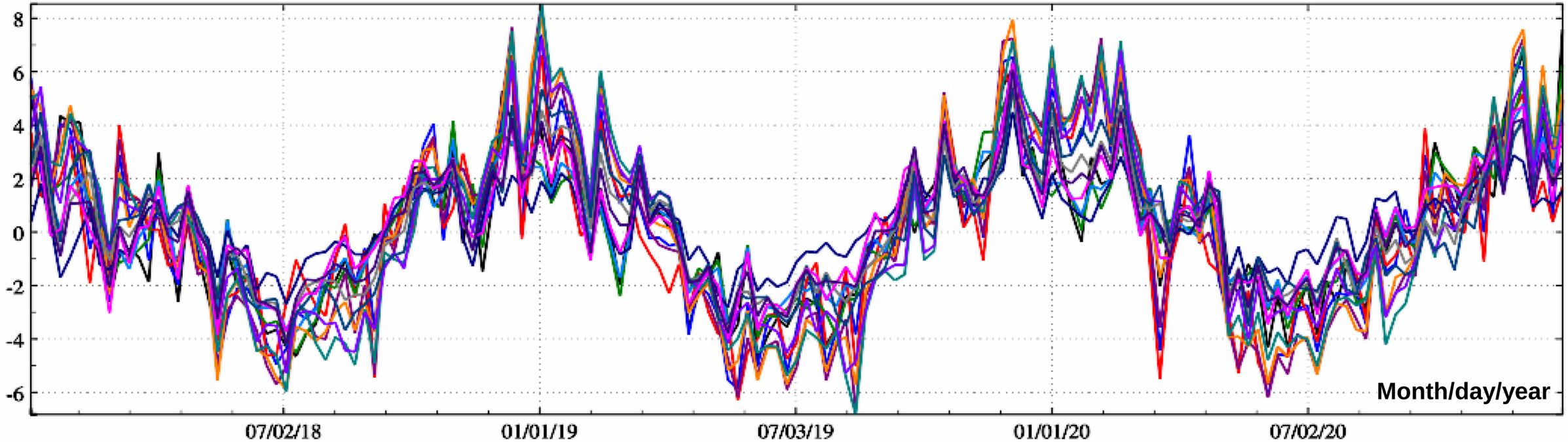
Sea level variation load effect weekly time series on the ground gravity (μGal) at 12 tide gauges along Chinese coast



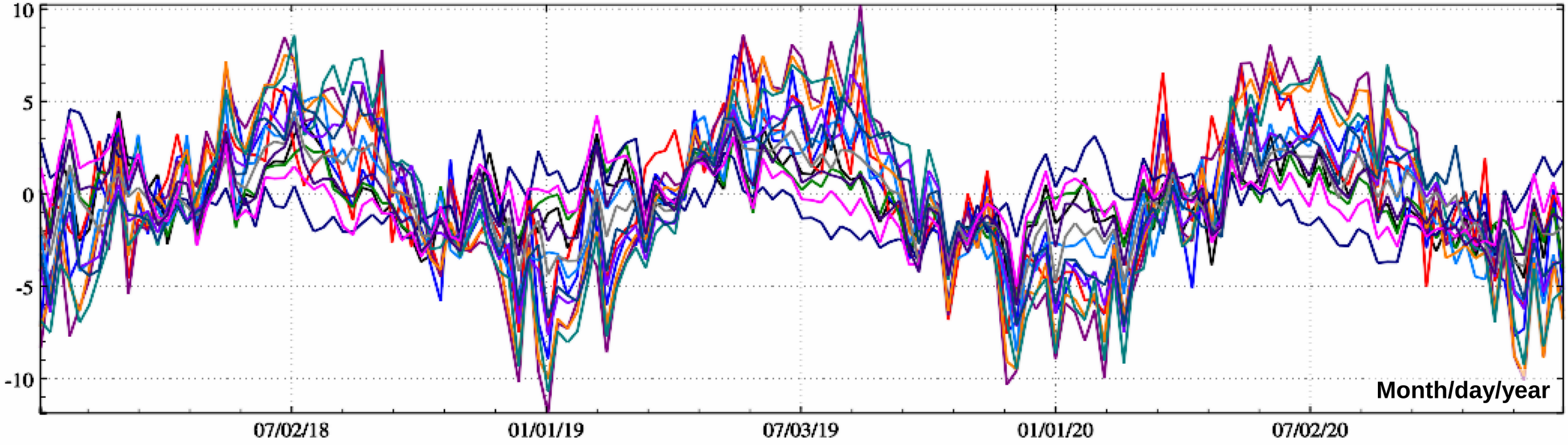
Sea level variation load effect weekly time series on the ellipsoidal height (mm) at 12 tide gauges along Chinese coast



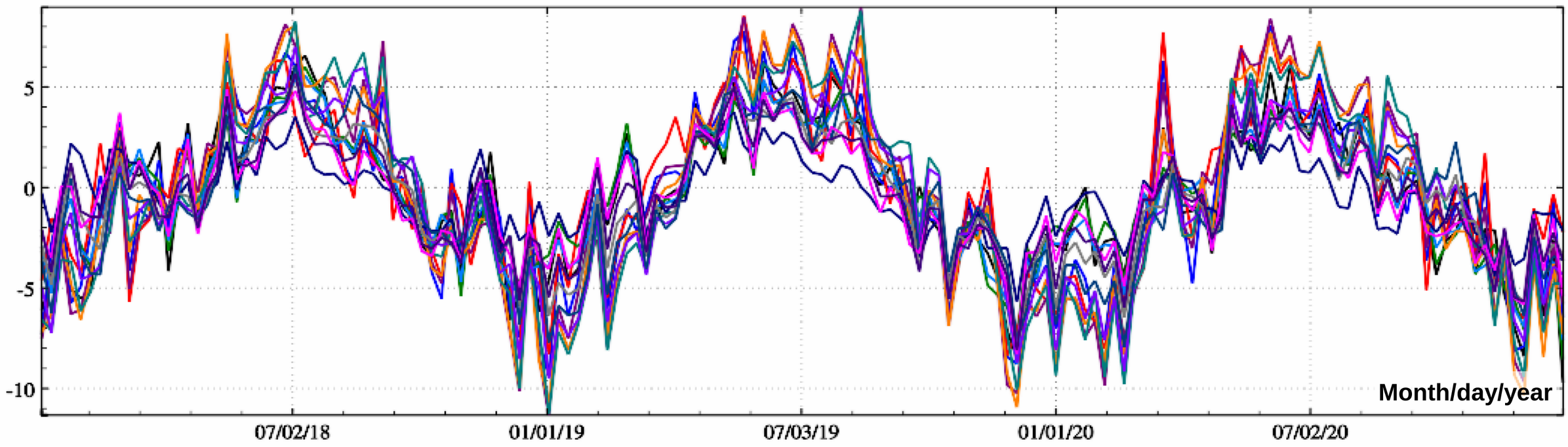
Sea level variation load effect weekly time series on the radial gradient (10μE) at 12 tide gauges along Chinese coast



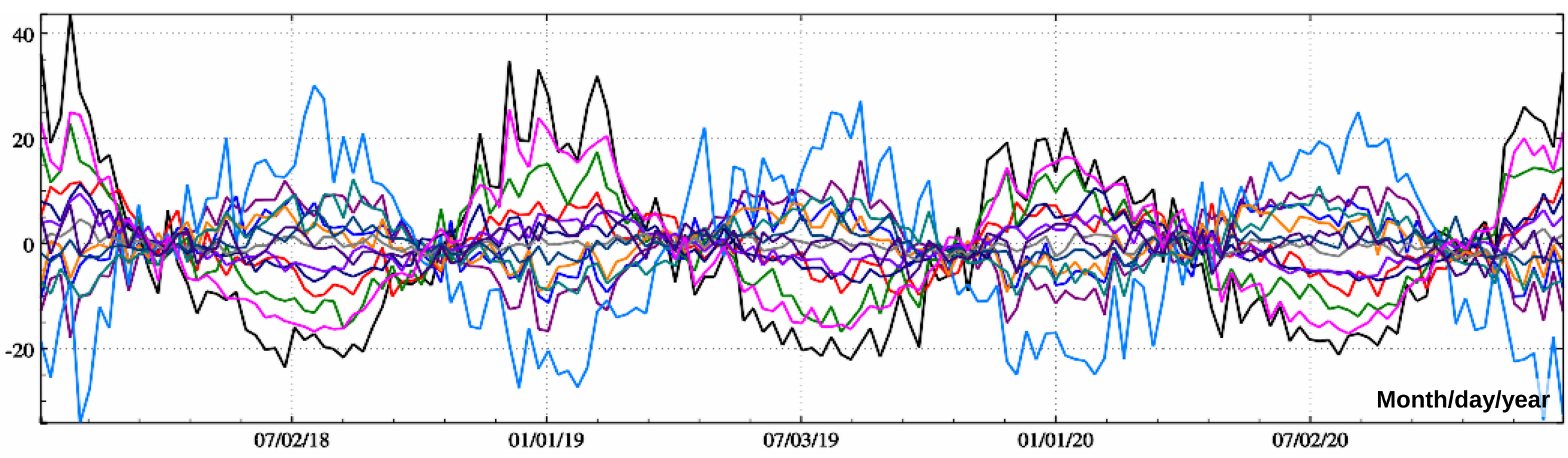
Surface atmosphere variation load effect weekly time series on the geoid (mm) at 14 CORS stations in mainland China



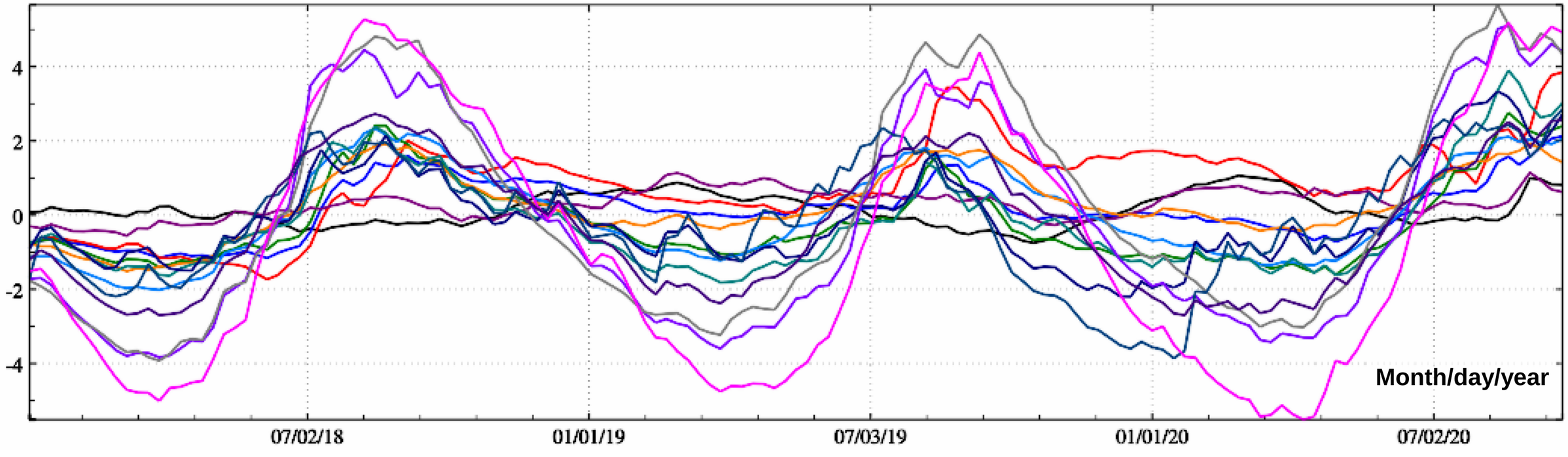
Surface atmosphere variation load effect weekly time series on the ground gravity (μGal) at 14 CORS stations in mainland China



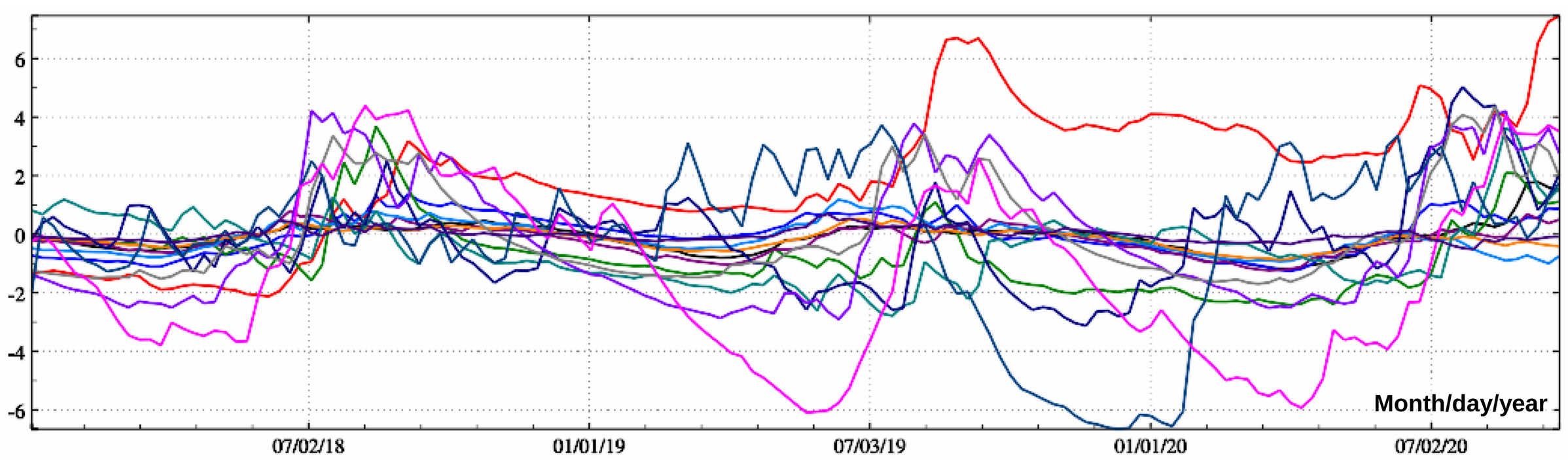
Surface atmosphere variation load effect weekly time series on the ellipsoidal height (mm) at 14 CORS stations in mainland China



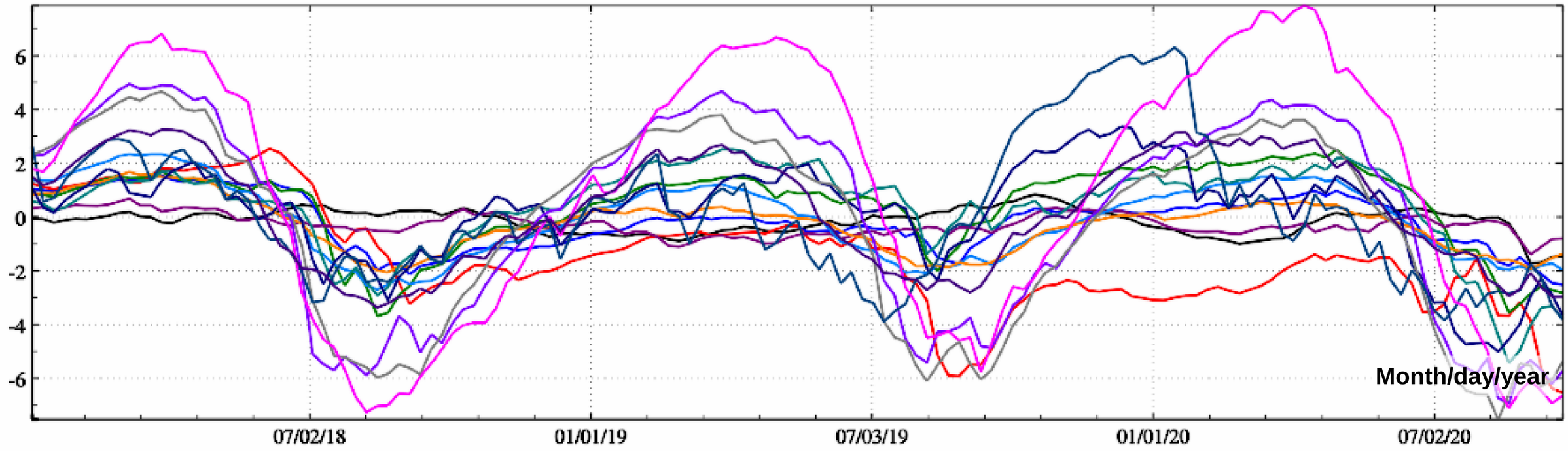
Surface atmosphere variation load effect weekly time series on the radial gradient (10μE) at 14 CORS stations in mainland China



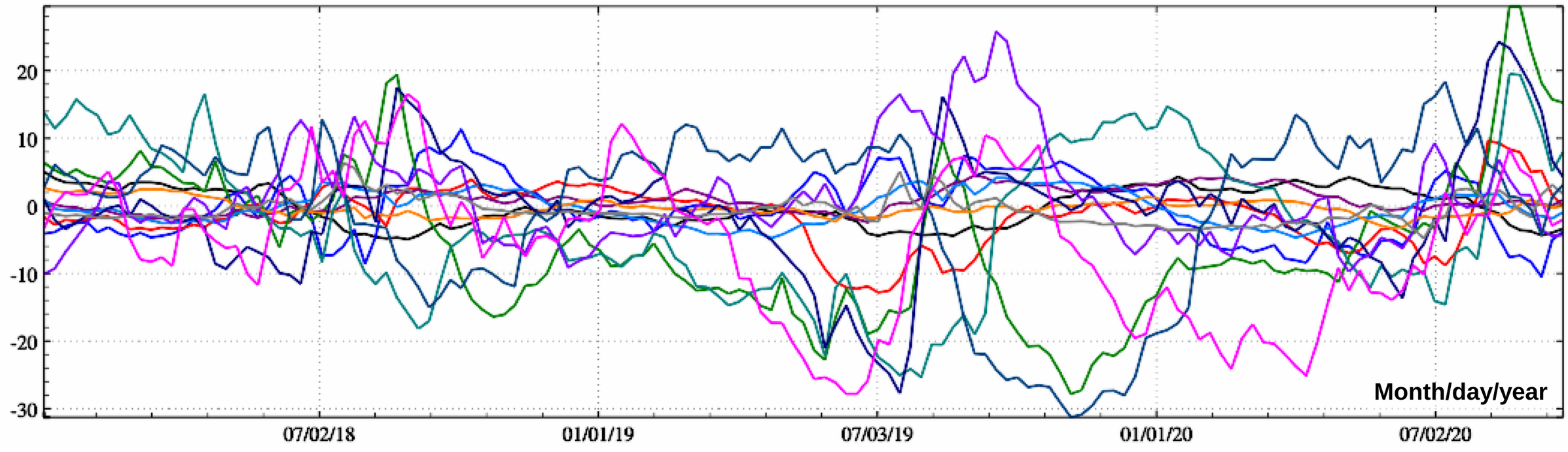
Global land water variation load effect weekly time series on the geoid (mm) at 14 CORS stations in mainland China



Global land water variation load effect weekly time series on the ground gravity (μGal) at 14 CORS stations in mainland China



Global land water variation load effect weekly time series on the ellipsoidal height (mm) at 14 CORS stations in mainland China



Global land water variation load effect weekly time series on the radial gradient (10μE) at 14 CORS stations in mainland China

Regional Refinement of Load Deformation Field via Green's Integration

Computation of Regional Residual Surface Load Effects via Green's Integration

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Regional Residual Surface Load Effects via Green's Integration | Computation of Lakes, Glaciers, and Snow Load Effects via Green's Integration | Computation of Regional Load Effect Time Series via Green's Integration | Algorithm formulas

Select the computation point file format

The discrete computlation point file

Open the space computation point file

Number of rows of the file header 1

Column ordinal number of height in record 4

Open the residual equivalent water height variation grid file

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [ ] ground normal or orthometric height (mm)
- [ ] radial gravity gradient (mE)
- [ ] horizontal gravity gradient (NW, mE)

Extract the effects to be plot | Plot↓

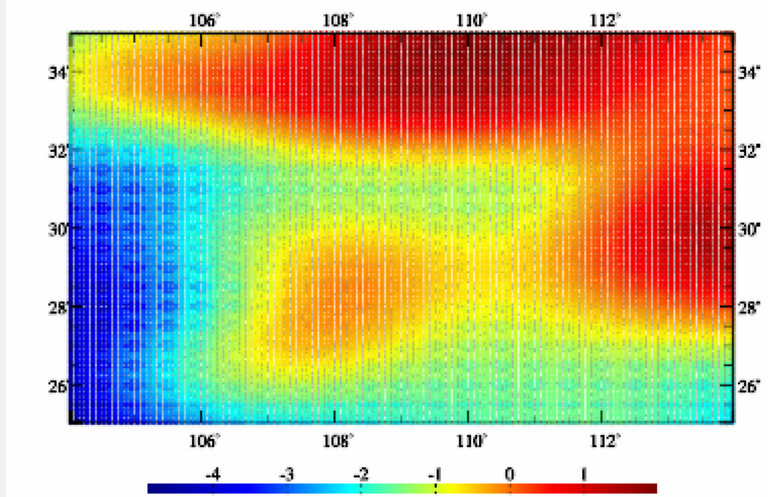
The type of surface load: Surface atmosphere

Save program process as

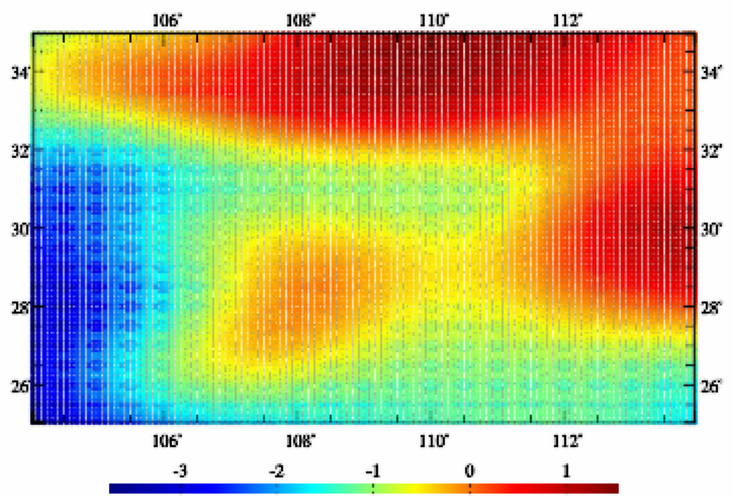
```
grid (represented as Equivalent Water Height, EWH) from which the global reference model has been removed. This process refines the regional load deformation field and temporal gravity field.
  ** Note on Computation Point Height: For Sea Level Variation loads, use Normal or Orthometric Height; and For Surface Atmosphere or Terrestrial Water Variation loads, use height relative to the Earth's surface.
>> Select the computation function from the 3 control buttons on the top of the interface...
>> [Function] From the Regional Residual Equivalent Water Height (EWH) Variation Grid (cm), this function computes the residual load effects on Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, mas), vertical deflection (SW, to the south and to the west, mas), horizontal displacement (EN, to the east and to the north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (mE), or horizontal gravity gradient (NW, mE) via load Green's function integration.
>> Open the space computation point file C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/calcpnt.txt.
  ** Look at the file information in the window below and set the row number of the file header...
>> Open the residual equivalent water height variation grid file C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEP2018041112.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmrst.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-24 09:58:31
>> Complete the refinement computation!
>> Computation end time: 2026-06-24 09:58:54
```

Green's integral radius 200km | Save the results as | Import setting parameters | Start computation

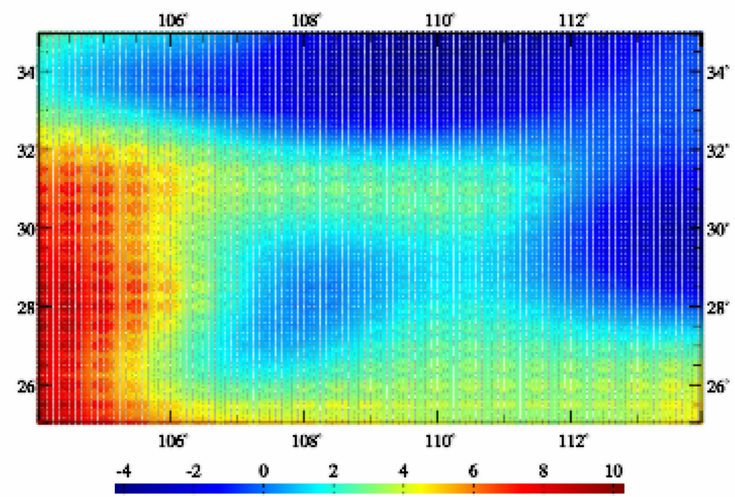
```
104.0 114.0 25.0 35.0 0.08333333 0.08333333
      1  104.041667  25.041667  0.000    -4.8869    -3.7365    10.3277
      2  104.125000  25.041667  0.000    -4.8332    -3.7064    10.2616
      3  104.208333  25.041667  0.000    -4.1772    -3.2158     8.7561
      4  104.291667  25.041667  0.000    -4.0208    -3.1012     8.4475
      5  104.375000  25.041667  0.000    -4.5213    -3.4739     9.6114
      6  104.458333  25.041667  0.000    -4.3950    -3.3692     9.2881
      7  104.541667  25.041667  0.000    -4.3121    -3.2968     9.0991
```



geoid / height anomaly (mm)



ground gravity (μGal)



radial displacement (mm)

Regional Refinement of Load Deformation Field via Green's Integration

Computation of Regional Residual Surface Load Effects via Green's Integration

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Regional Residual Surface Load Effects via Green's Integration | Computation of Lakes, Glaciers, and Snow Load Effects via Green's Integration | Computation of Regional Load Effect Time Series via Green's Integration | Algorithm formulas

Select the computation point file format

The computation surface height grid file

Open the land surface height grid file

Open the residual equivalent water height variation grid file

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (mE)
- [ ] horizontal gravity gradient (NW, mE)

The type of surface load: Surface atmosphere

Save program process as

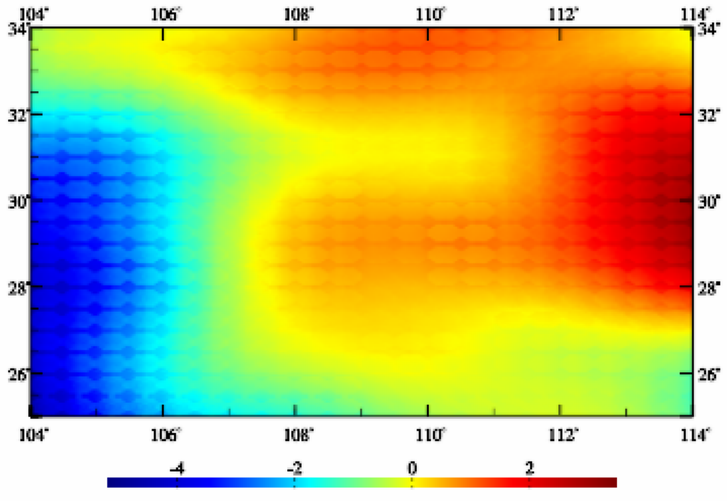
```
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmrst.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-24 09:58:31
>> Complete the refinement computation!
>> Computation end time: 2026-06-24 09:58:54
>> [Function] From the Regional Residual Equivalent Water Height (EWH) Variation Grid (cm), this function computes the residual load effects on Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, mas), vertical deflection (SW, to the south and to the west, mas), horizontal displacement (EN, to the east and to the north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (mE), or horizontal gravity gradient (NW, mE) via load Green's function integration.
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/zero3m.dat.
>> Open the residual equivalent water height variation grid file C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEP2018042512.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-24 10:01:17
>> Complete the refinement computation!
>> Computation end time: 2026-06-24 10:01:20
```

Green's integral radius: 200km

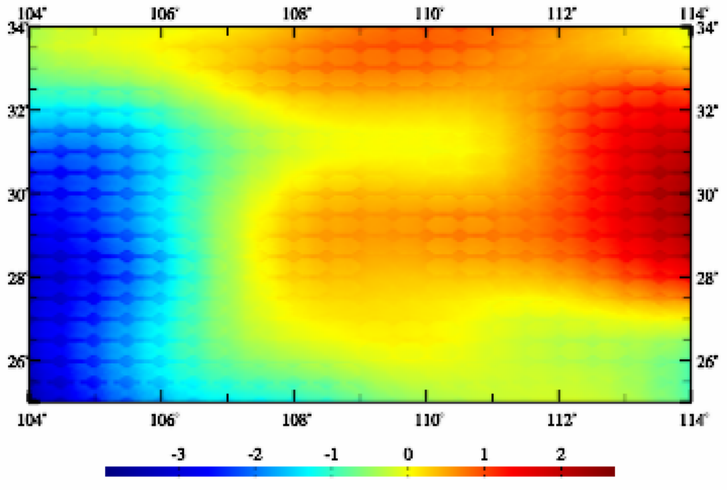
Save the results as | Import setting parameters | Start computation

```
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.ksi
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.gra
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.dpr
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.nmh
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.grr
```

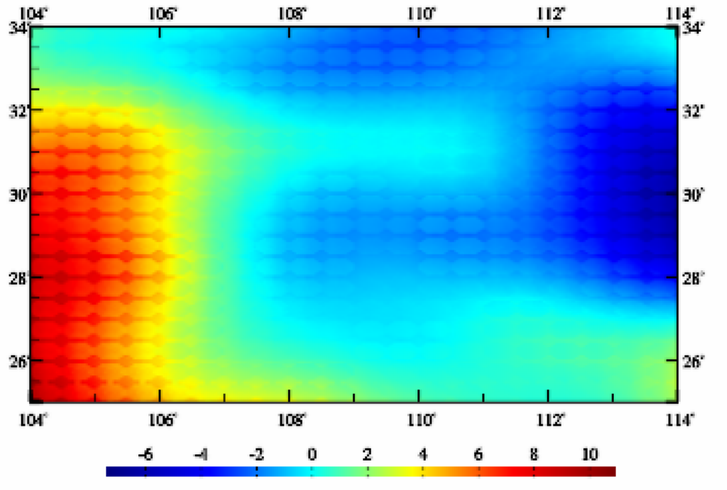
Extract the effects to be plot | Plot↓



geoid / height anomaly (mm)



ground gravity (μGal)



radial displacement (mm)

Regional Refinement of Load Deformation Field via Green's Integration

Computation of Lakes, Glaciers, and Snow Load Effects via Green's Integration

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Regional Residual Surface Load Effects via Green's Integration | Computation of Lakes, Glaciers, and Snow Load Effects via Green's Integration | Computation of Regional Load Effect Time Series via Green's Integration | Algorithm formulas

Select the computation point file format

The discrete computlation point file

Open the space computation point file

Number of rows of the file header 1

Column ordinal number of height in record 4

Open water-body equivalent water height variation grid file

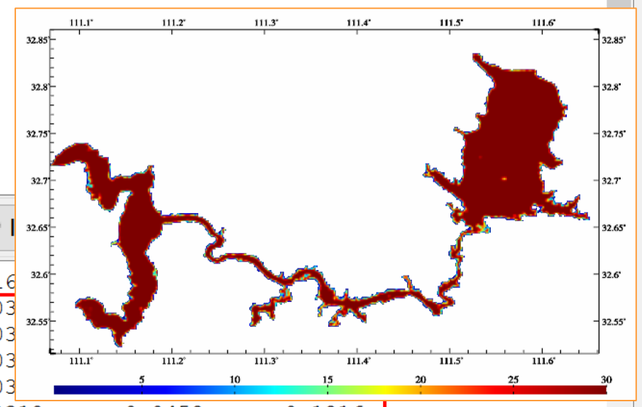
Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (mE)
- [ ] horizontal gravity gradient (NW, mE)

Extract the effects to be plot | Plot↓

Save program process as

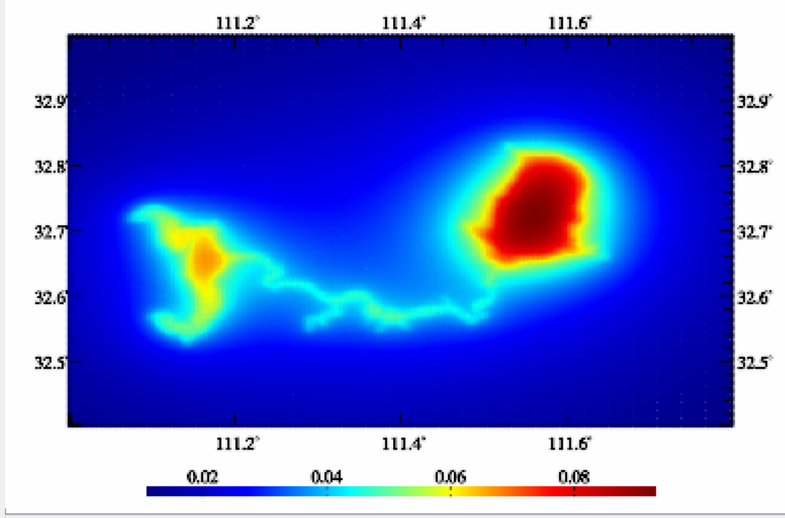
```
>> Complete the refinement computation!
>> Computation end time: 2026-06-24 10:01:20
>> [Function] This function computes the load effects of inland water bodies (rivers, lakes, reservoirs), glaciers, and snow-covered mountains on Geoid or
height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, mas), vertical deflection (SW, to the
south and to the west, mas), horizontal displacement (EN, to the east and to the north, mm), ground radial displacement (mm), ground normal or
orthometric height (mm), radial gravity gradient (mE), or horizontal gravity gradient (NW, mE) via load Green's function integration. The input is the Load
Equivalent Water Height (EWH) Variation Grid (cm) specific to these hydrological features.
  ** The height in the computation point file refers to the height of the computation point relative to the water/ice surface.
  ** The EWH grids of multiple water bodies at the same epoch can be merged directly to compute the total load effect via a single integration.
>> Open the space computation point file C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/lakecalcpnt.txt.
  ** Look at the file information in the window below and set the row number of the file header...
>> Open water-body equivalent water height variation grid file C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/lakechgcm.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/lakedfmrst.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-24 10:04:17
>> Complete the refinement computation!
>> Computation end time: 2026-06-24 10:12:29
```



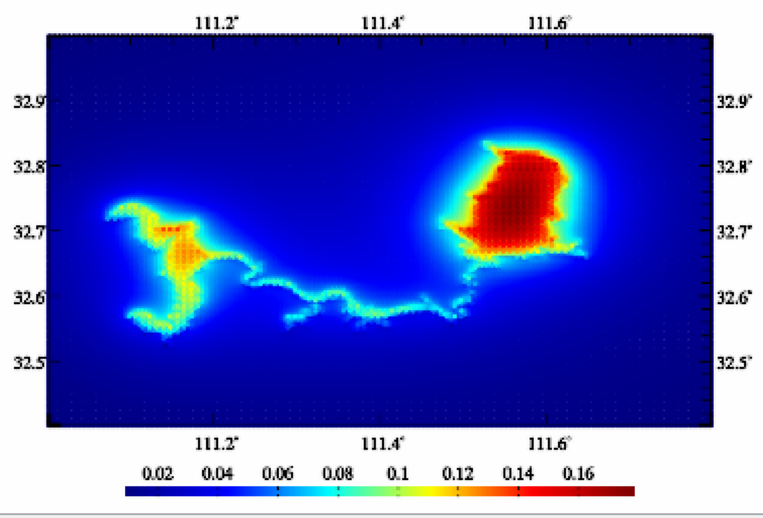
Green's integral radius 200km

Save the results as

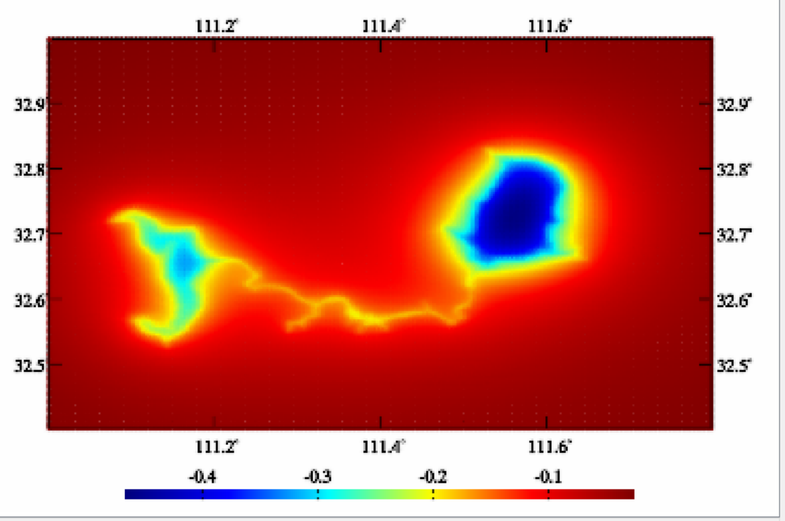
111.00000000	111.80000000	32.40000000	33.00000000	0.00416667	0.00416			
1	111.0020833	32.4020833	0.000	0.0130	0.0102	-0.03		
2	111.0062500	32.4020833	0.000	0.0131	0.0102	-0.03		
3	111.0104167	32.4020833	0.000	0.0132	0.0103	-0.03		
4	111.0145833	32.4020833	0.000	0.0133	0.0104	-0.03		
5	111.0187500	32.4020833	0.000	0.0134	0.0104	-0.0318	-0.0452	-0.1216
6	111.0229167	32.4020833	0.000	0.0134	0.0105	-0.0321	-0.0456	-0.1245
7	111.0270833	32.4020833	0.000	0.0135	0.0106	-0.0324	-0.0459	-0.1273



geoid / height anomaly (mm)



ground gravity (μGal)



radial displacement (mm)

Regional Refinement of Load Deformation Field via Green's Integration

Computation of Lakes, Glaciers, and Snow Load Effects via Green's Integration

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Regional Residual Surface Load Effects via Green's Integration

Computation of Lakes, Glaciers, and Snow Load Effects via Green's Integration

Computation of Regional Load Effect Time Series via Green's Integration

Algorithm formulas

Select the computation point file format

The computation surface height grid file

Open the land surface height grid file

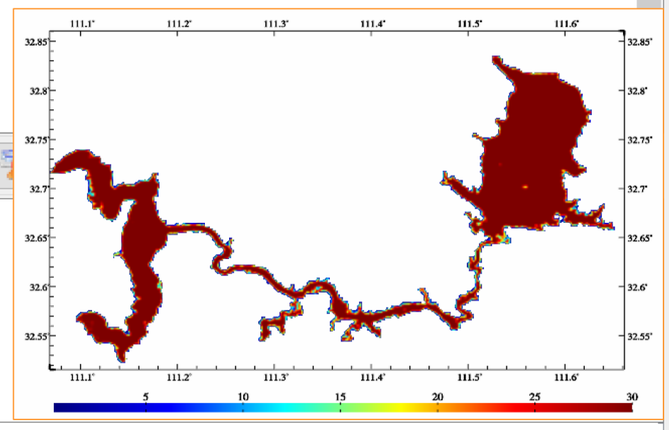
Open water-body equivalent water height variation grid file

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (mE)
- [ ] horizontal gravity gradient (NW, mE)

Save program process as

```
>> Computation start time：2026-06-24 10:04:17
>> Complete the refinement computation!
>> Computation end time: 2026-06-24 10:12:29
>> [Function] This function computes the load effects of inland water bodies (rivers, lakes, reservoirs), glaciers, and snow-covered mountains on Geoid or height anomaly (mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, mas), vertical deflection (SW, to the south and to the west, mas), horizontal displacement (EN, to the east and to the north, mm), ground radial displacement (mm), ground normal or orthometric height (mm), radial gravity gradient (mE), or horizontal gravity gradient (NW, mE) via load Green's function integration. The input is the Load Equivalent Water Height (EWH) Variation Grid (cm) specific to these hydrological features.
  ** The height in the computation point file refers to the height of the computation point relative to the water/ice surface.
  ** The EWH grids of multiple water bodies at the same epoch can be merged directly to compute the total load effect via a single integration.
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/lakecalcpnt.dat.
>> Open water-body equivalent water height variation grid file C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/lakechgcm.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-24 10:16:38
>> Complete the refinement computation!
>> Computation end time: 2026-06-24 10:23:51
```



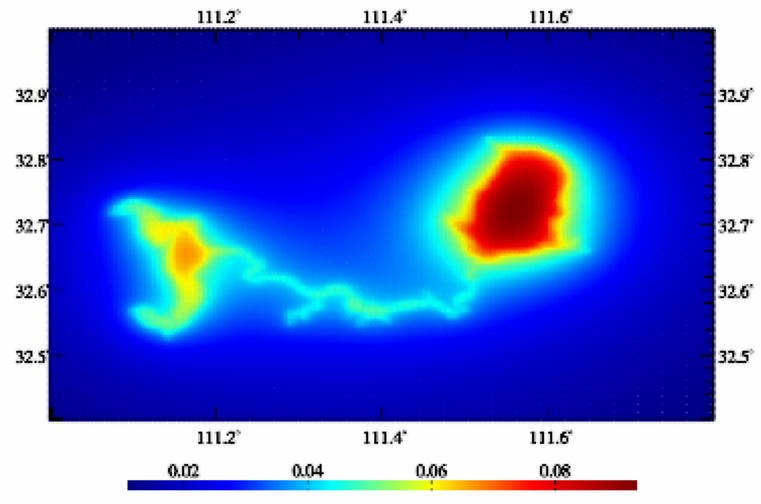
Green's integral radius 200km

Save the results as

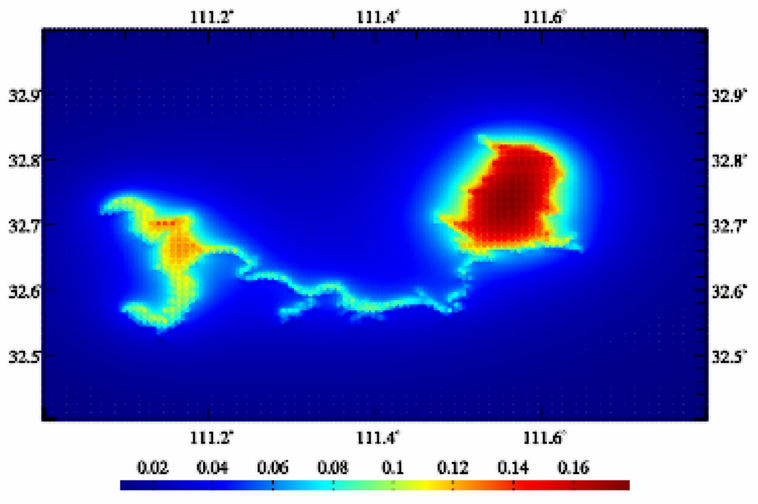
```
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.ksi
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.gra
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.dpr
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.nmh
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/rntdfmgrd.grr
```

Extract the effects to be plot

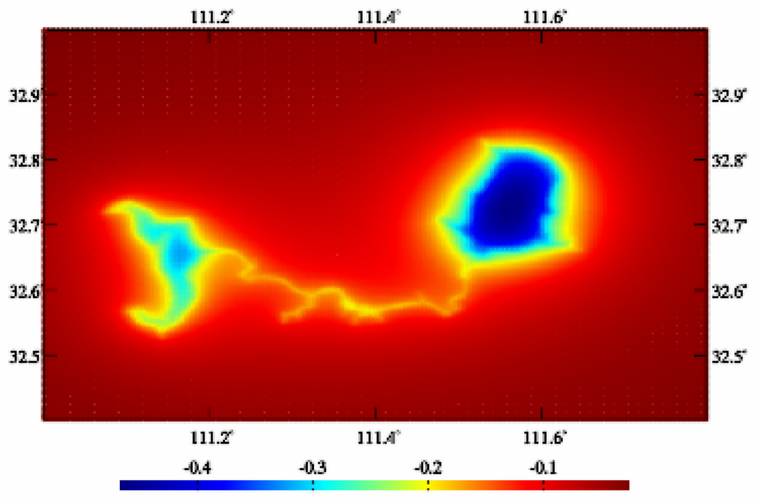
Plot↓



geoid / height anomaly (mm)



ground gravity (μGal)



radial displacement (mm)

Regional Refinement of Load Deformation Field via Green's Integration

Computation of Regional Load Effect Time Series via Green's Integration

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Regional Residual Surface Load Effects via Green's Integration

Computation of Lakes, Glaciers, and Snow Load Effects via Green's Integration

Computation of Regional Load Effect Time Series via Green's Integration

Algorithm formulas

Select the computation point file format

The discrete computlation point file

Open the surface computation point file

Number of rows of the file header 1

Column ordinal number of height in record 4

Open any residual equivalent water height variation grid file

Set the wildcard of the file names

Ordinal number of first wildcard in file name 8

Number of consecutive wildcards in file name 10

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (mE)
- [x] horizontal gravity gradient (NW, mE)

Extract the effects to be plot

Plot↓

The type of surface load: Land water EWH

Save program process as

```
 ** The program outputs  the residual load effect record time series files rntGreen***.txt. Each output file header is identical to the input file. One or several columns of the selected surface load effects are appended to the input file record as the output file record.
    *** represents the wildcards of the variation grid time series file names, whose instance identifies the sampling epoch time of the load effects.
 ** The load EWH variation grid files searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEF2018041112.dat
   C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEF2018041812.dat
   C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEF2018042512.dat
   C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEF2018050212.dat
>> 4 equivalent water height variation grid time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
 ** The computation process requires time.... During this period, you can open the output file directory C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms,to look at the computation progress!!
 ** The last attribute of each output file header is the instance of the wildcards of the residual EWH grid time series file name, which represents the sampling epoch time of the output file.
>> Computation start time：2026-06-24 10:34:13
>> Complete the refinement computation of 4 load deformation field!
>> Computation end time: 2026-06-24 10:34:22
```

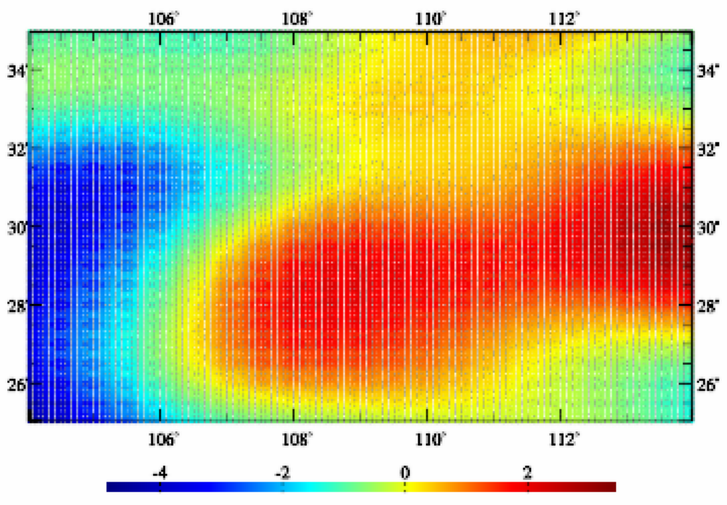
Green's integral radius 200km

Set the results folder

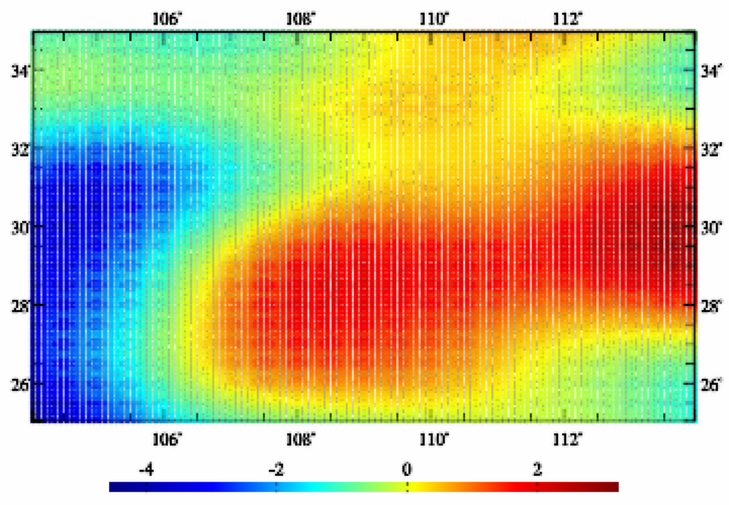
Import setting parameters

Start computation

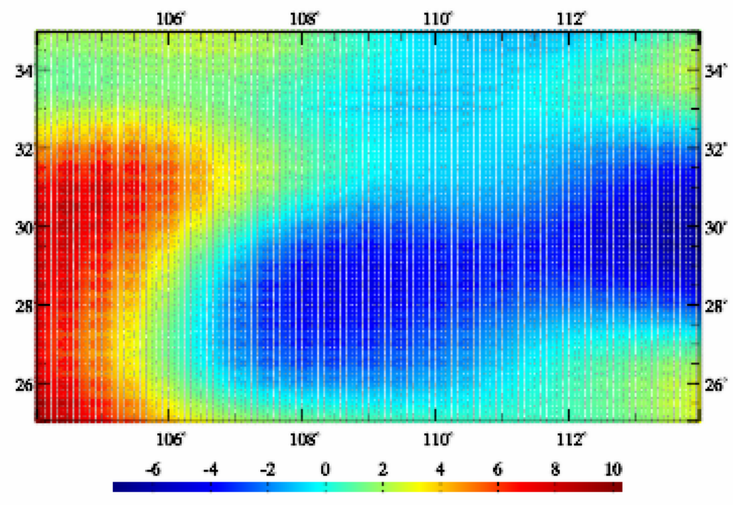
```
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041112.txt
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041812.txt
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018042512.txt
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018050212.txt
```



geoid / height anomaly (mm)



ground gravity (μGal)



radial displacement (mm)

Regional Refinement of Load Deformation Field via Green's Integration

Computation of Regional Load Effect Time Series via Green's Integration

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Computation of Regional Residual Surface Load Effects via Green's Integration

Computation of Lakes, Glaciers, and Snow Load Effects via Green's Integration

Computation of Regional Load Effect Time Series via Green's Integration

Algorithm formulas

Select the computation point file format

The computation surface height grid file

Open the land surface height grid file

Open any residual equivalent water height variation grid file

Set the wildcard of the file names

Ordinal number of first wildcard in file name: 8

Number of consecutive wildcards in file name: 10

Select the type of effects

- [x] geoid or height anomaly (mm)
- [x] ground gravity (μGal)
- [ ] gravity disturbance (μGal)
- [ ] ground tilt (SW, mas)
- [ ] vertical deflection (SW, mas)
- [ ] horizontal displacement (EN, mm)
- [x] ground radial displacement (mm)
- [x] ground normal or orthometric height (mm)
- [x] radial gravity gradient (mE)
- [x] horizontal gravity gradient (NW, mE)

Extract the effects to be plot

Plot↓

The type of surface load: Land water EWH

Save program process as

```
respectively, representing the grid file of load effects on the height anomaly, ground gravity, gravity disturbance, ground tilt, vertical deflection, horizontal
displacement, radial displacement, normal or orthometric height, radial gravity gradient, or horizontal gravity gradient.
    *** represents the wildcards of the variation grid time series file names, whose instance identifies the sampling epoch time of the load effects.
 ** The load EWH variation grid files searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEF2018041112.dat
   C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEF2018041812.dat
   C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEF2018042512.dat
   C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/swscSEF2018050212.dat
>> 4 equivalent water height variation grid time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
 ** The computation process requires time.... During this period, you can open the output file directory C:/ETideLoad4.5_win64en/examples/
Loadfmrntgreenintg/loadtms,to look at the computation progress!!
 ** The last attribute of each output file header is the instance of the wildcards of the residual EWH grid time series file name, which represents the
sampling epoch time of the output file.
>> Computation start time：2026-06-24 10:44:14
>> Complete the refinement computation of 4 load deformation field!
>> Computation end time: 2026-06-24 10:44:26
```

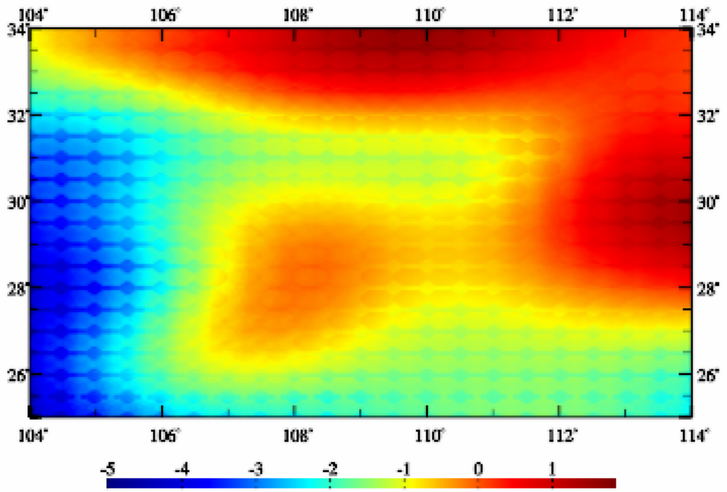
Green's integral radius: 200km

Set the results folder

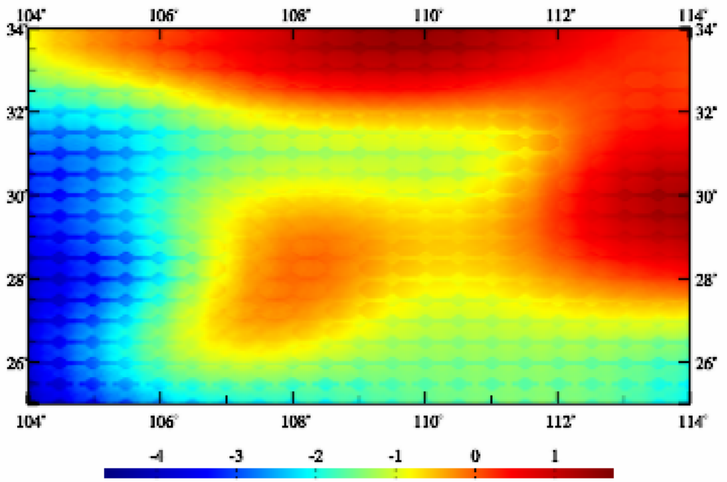
Import setting parameters

Start computation

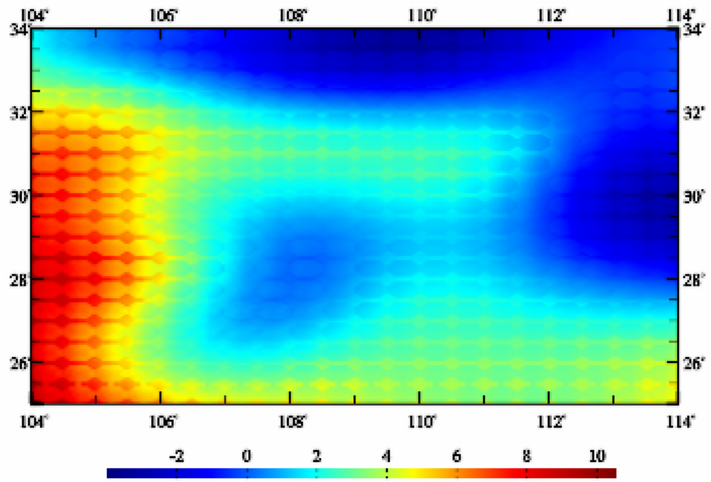
```
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041112.ksi
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041112.gra
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041112.dpr
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041112.nmh
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041112.grr
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041112.hgd
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041812.ksi
C:/ETideLoad4.5_win64en/examples/Loadfmrntgreenintg/loadtms/rntGreen2018041812.gra
```



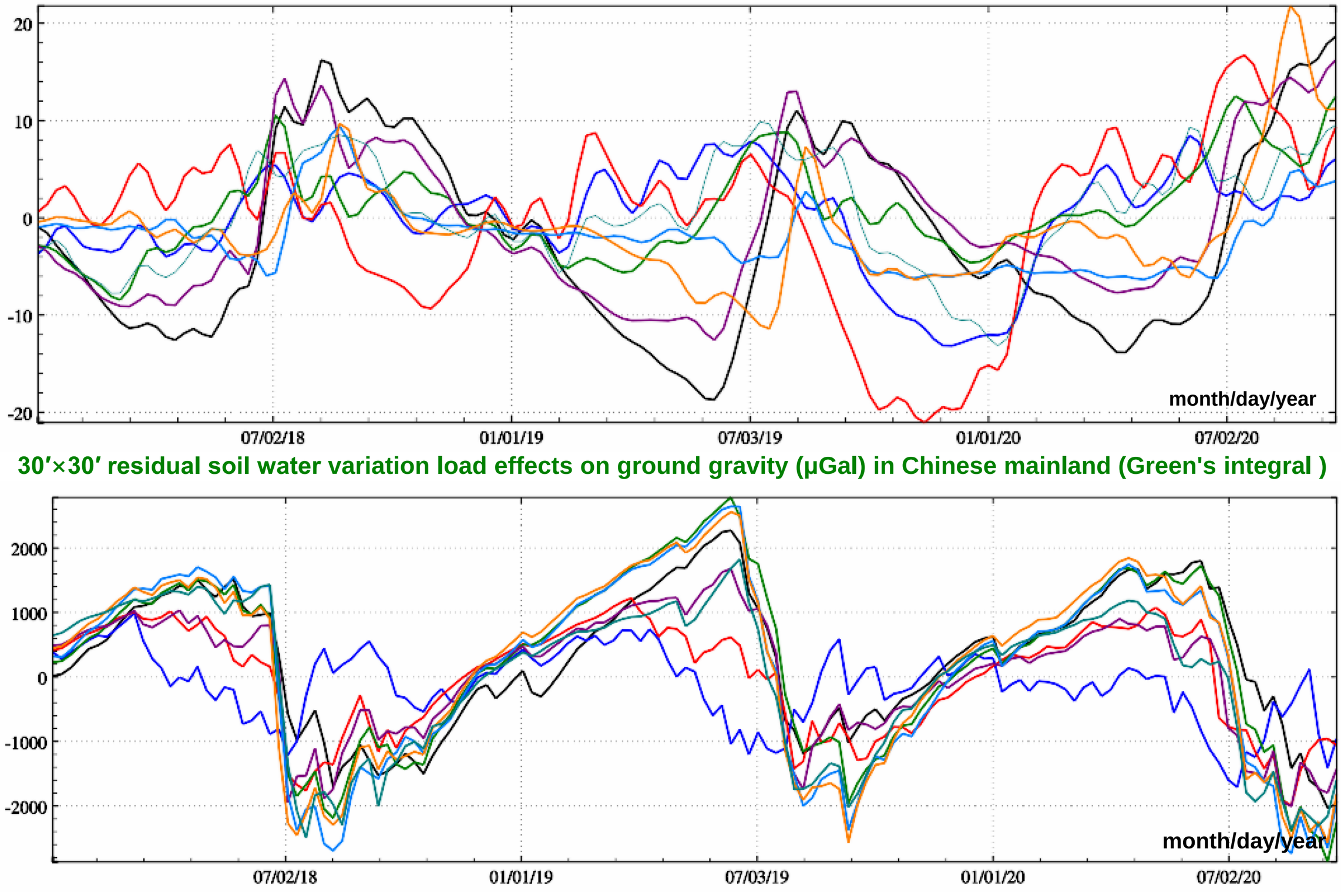
geoid / height anomaly (mm)



ground gravity (μGal)

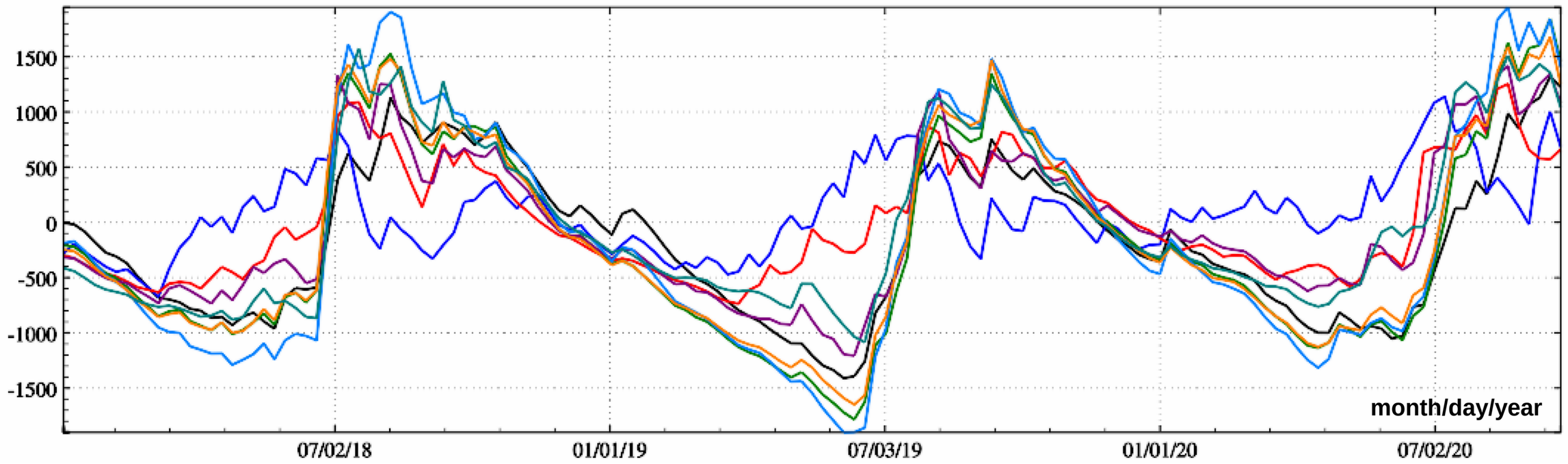


radial displacement (mm)

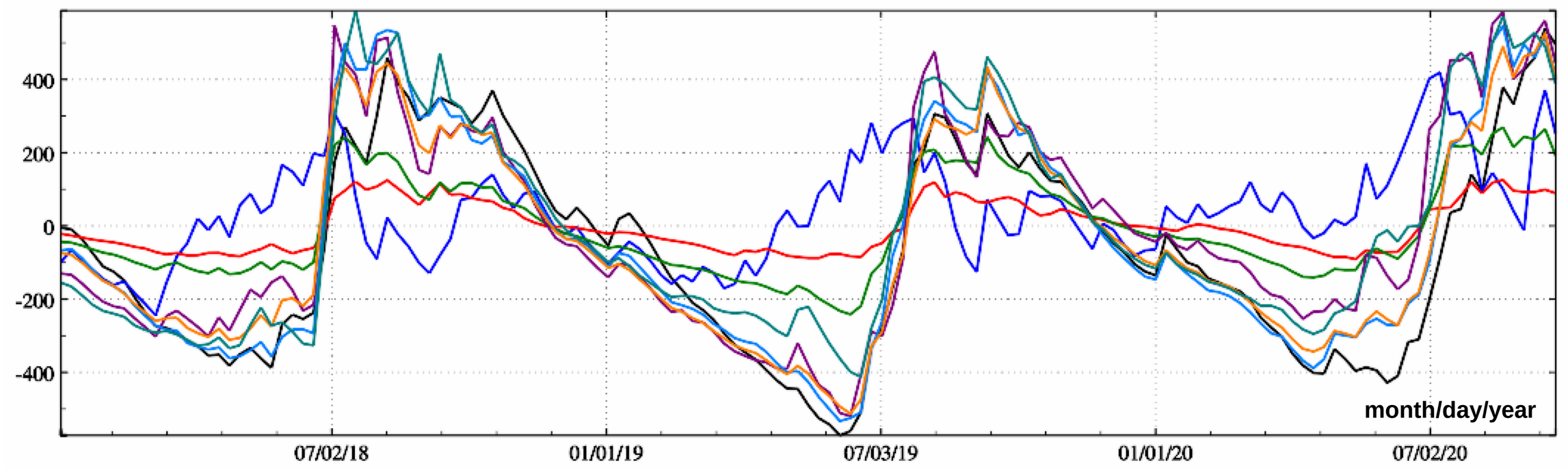


30′×30′ residual soil water variation load effects on ground gravity (μGal) in Chinese mainland (Green's integral)

30′×30′ residual soil water variation load effects on radial gradient (mE) in Chinese mainland (Green's integral)



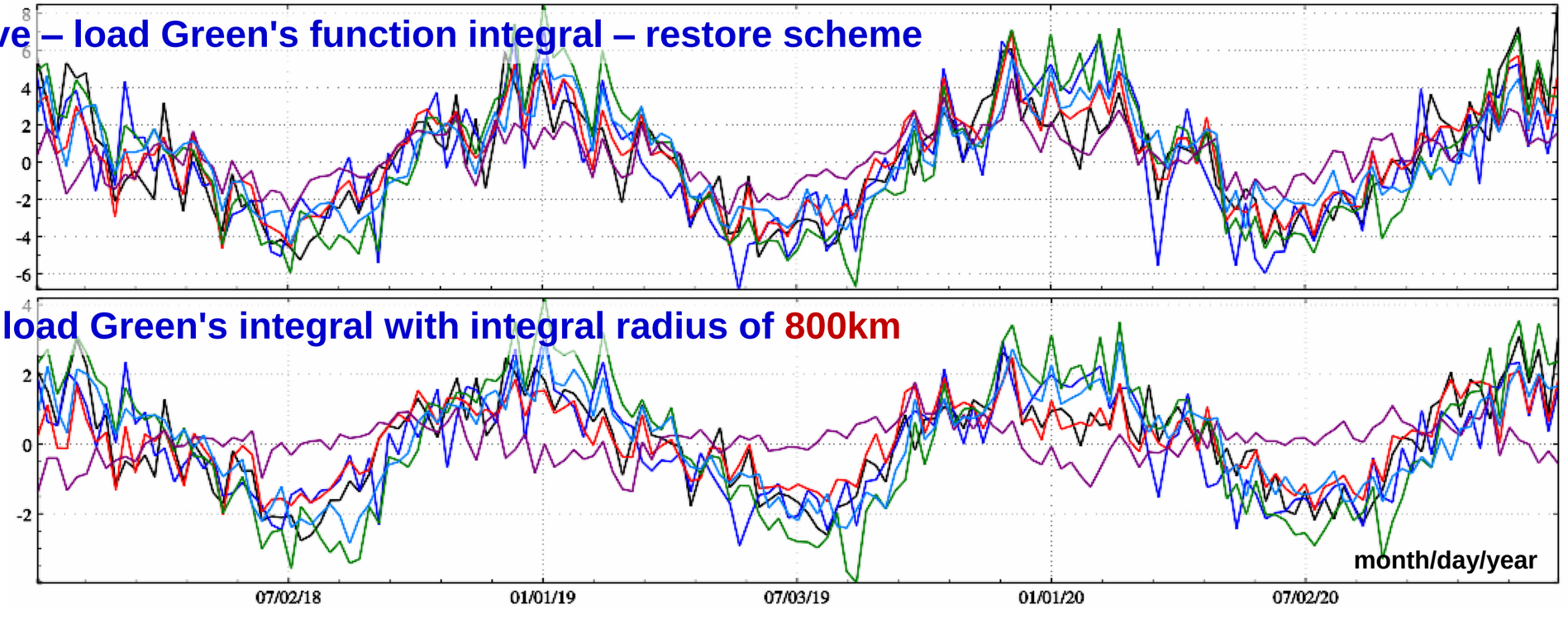
30′×30′ residual soil water variation load effects on horizontal gradient (N, mE) in Chinese mainland (Green's integral)



30′×30′ residual soil water variation load effects on horizontal gradient (W, mE) in Chinese mainland (Green's integral)

Remove – load Green's function integral – restore scheme

Direct load Green's integral with integral radius of 800km

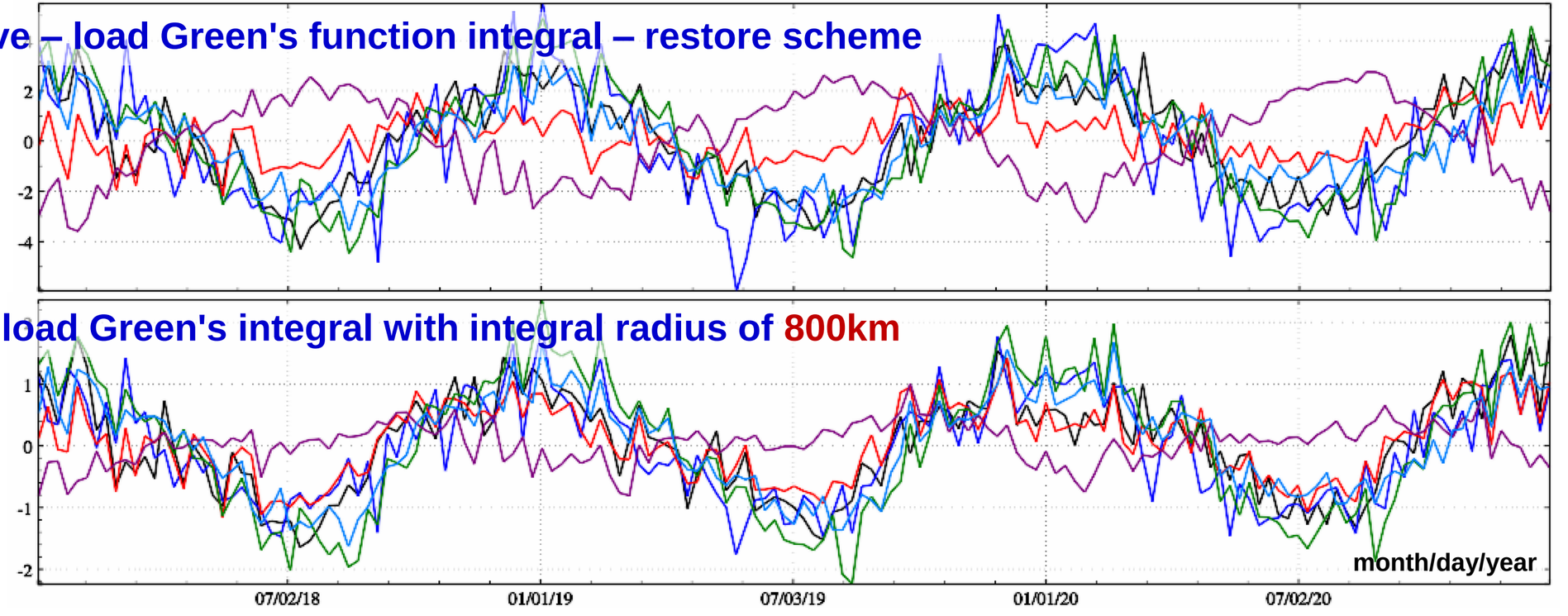




Surface atmosphere load effect time series on geoid (mm) at 6 CORS stations in mainland China using two scheme

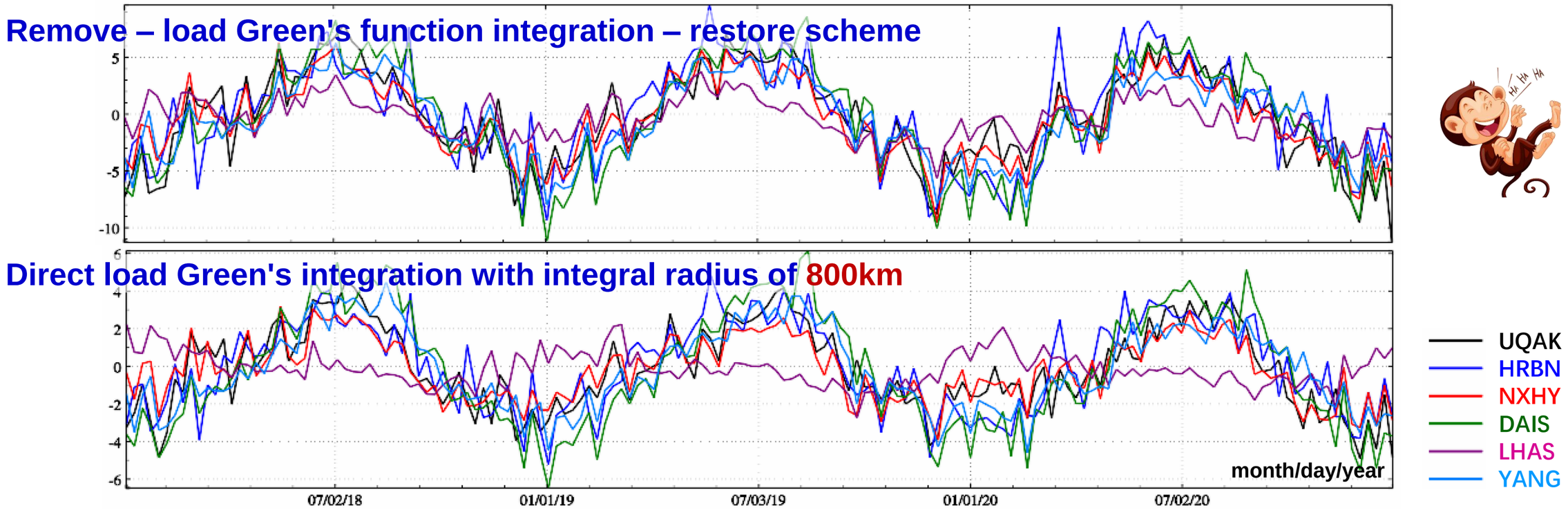
Remove – load Green's function integral – restore scheme

Direct load Green's integral with integral radius of 800km

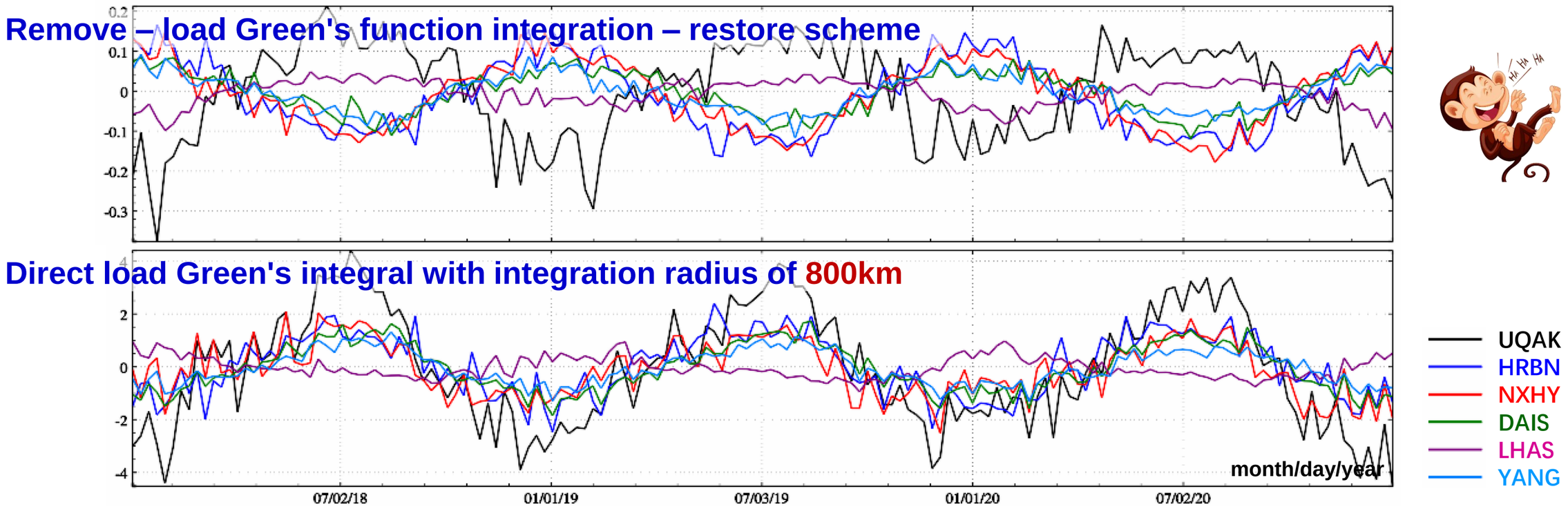




Surface atmosphere load effect time series on ground gravity (mGal) at 6 CORS stations in mainland China using two scheme



Surface atmosphere load effect time series on ellipsoidal height (mm) at 6 CORS stations in mainland China using two scheme



Surface atmosphere load effect time series on radial gravity gradient (mE) at 6 CORS stations in mainland China using two scheme

Regional Approximation of Load Deformation Field Using SRBFs

Approximation of Residual Loads and Synthesis of Residual Load Effects Using SRBFs

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Approximation of Residual Loads and Synthesis of Residual Load Effects Using SRBFs

Approximation of Residual Surface Load and Load Effect Time Series Using SRBFs

Regional Surface Load SRBF Approximation and Load effect SRBF Synthesis

Select the computation point file format

The discrete computation point file

Open the space computation point file

Number of rows of the file header 1

Column ordinal number of height in record 4

Open the residual equivalent water height variation grid file

Parameters of the first SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	15
maximum degree	900
burial depth of Bjerhammar sphere	5.0km
action distance of SBRF center	150km
Reuter network level Q	1800

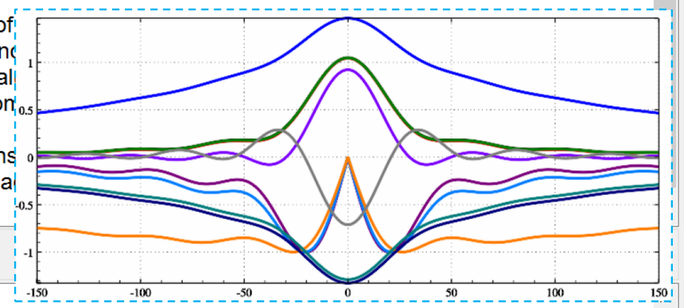
Parameters of cumulative SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	45
maximum degree	1800
burial depth of Bjerhammar sphere	10.0km
action distance of SBRF center	90km
Reuter network level Q	1800

Solution of normal equation: LU triangular decompo | Cumulative SRBF approach times: 1

Save program process as

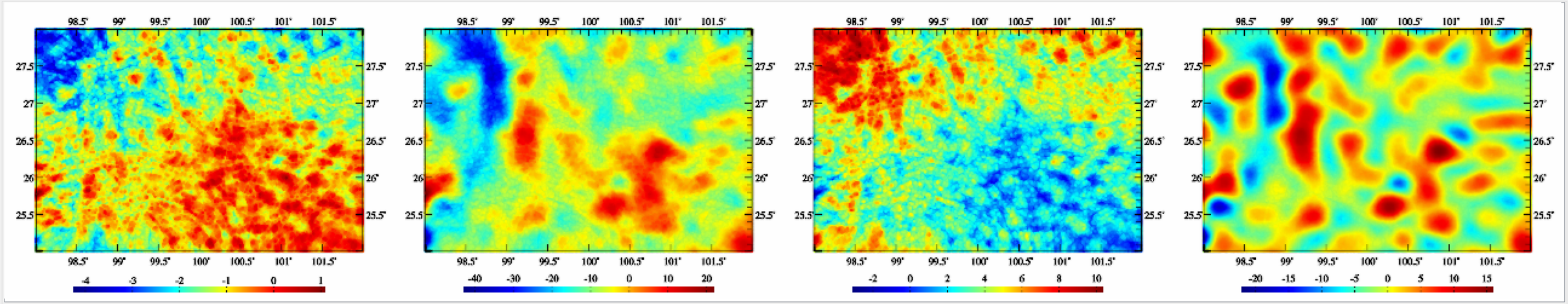
```
>> Save the results as C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfm.txt.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-24 15:49:02
>> Complete the computation for approximation of residual load and synthesis of residual load effects!
 The source EWH observations (cm): Mean  -22.9259  standard deviation  22.8930  minimum  -146.8799  maximum   87.2602.
 The 0th iterated residual EWH (cm): Mean   0.0052  standard deviation   4.4537  minimum   -37.6941  maximum   25.5549.
 The 1th iterated residual EWH (cm): Mean   0.0025  standard deviation   3.5260  minimum   -28.3254  maximum   22.1524.
>> Computation end time: 2026-06-24 15:56:05
>> The program also outputs the SRBF spatial curve file *spc.rbf and spectral curve file *dgr.rbf for 11 kinds of
 ** *spc.rbf file header format: SRBF type (0 = radial multipole kernel function, 1 = Poisson wavelet kernel func
Legendre expansion, buried depth (km). The record format: Spherical distance (km), the normalized SRBF val
gravity, gravity disturbance, ground tilt, vertical deflection, horizontal displacement, radial displacement, orthon
variations.
 ** The file header of * dgr.rbf is the same as * spc.rbf. The record format:Degree n of SRBF Legendre expans
load EWH, height anomaly, ground gravity, gravity disturbance, ground tilt, vertical deflection, horizontal displa
gradient, and horizontal gradient variations.
```



Save the results as

```
98.000  102.000  25.0000  28.000  0.01666667  0.01666667
      1   98.008333   25.008333        0.000     -50.5230    -1.5456    -20.2522    -20.9465     0.0110     -0.0079     0.0015     -0.001
      2   98.025000   25.008333        0.000     -45.9740    -1.3242    -18.4557    -19.0682     0.0092     -0.0089     0.0011     -0.001
      3   98.041667   25.008333        0.000     -42.7539    -1.2380    -17.1549    -17.7312     0.0078     -0.0095     0.0009     -0.001
      4   98.058333   25.008333        0.000     -42.9815    -1.4841    -17.1478    -17.8004     0.0080     -0.0104     0.0011     -0.001
      5   98.075000   25.008333        0.000     -37.7942    -1.2010    -15.1123    -15.6618     0.0061     -0.0108     0.0008     -0.001
      6   98.091667   25.008333        0.000     -37.0927    -1.3542    -14.7584    -15.3525     0.0055     -0.0113     0.0008     -0.002
      7   98.108333   25.008333        0.000     -36.7076    -1.5304    -14.5265    -15.1730     0.0036     -0.0116     0.0005     -0.002
      8   98.125000   25.008333        0.000     -35.1771    -1.5832    -13.8705    -14.5278     0.0022     -0.0112     0.0002     -0.002
```

Extract the effects to be plot | Plot↓



geoid / height anomaly (mm) | ground gravity (μGal) | radial displacement (mm) | radial gradient (mE)

The optimization principles for these parameters aim to ensure that the estimated load EWH variations and load effects in space are continuous and differentiable, while minimizing the standard deviation and driving the residual statistical mean toward zero for residual EWH variations.

Regional Approximation of Load Deformation Field Using SRBFs

Approximation of Residual Loads and Synthesis of Residual Load Effects Using SRBFs

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Approximation of Residual Loads and Synthesis of Residual Load Effects Using SRBFs

Approximation of Residual Surface Load and Load Effect Time Series Using SRBFs

Regional Surface Load SRBF Approximation and Load effect SRBF Synthesis

Select the computation point file format

The computation surface grid file

Open the computation surface height grid file

Open the residual equivalent water height variation grid file

Parameters of the first SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	15
maximum degree	900
burial depth of Bjerhammar sphere	5.0km
action distance of SBRF center	150km
Reuter network level Q	1800

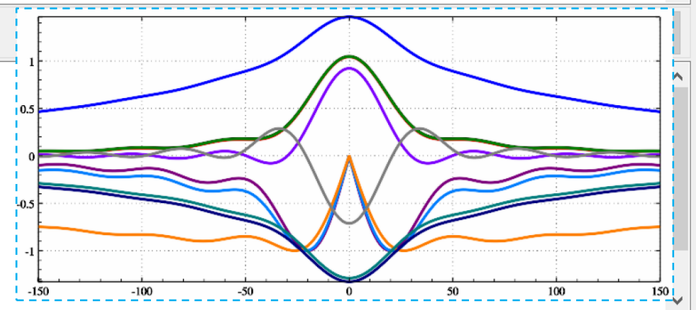
Parameters of cumulative SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	45
maximum degree	1800
burial depth of Bjerhammar sphere	10.0km
action distance of SBRF center	90km
Reuter network level Q	1800

Solution of normal equation: LU triangular decompo | Cumulative SRBF approach times: 1

Save program process as

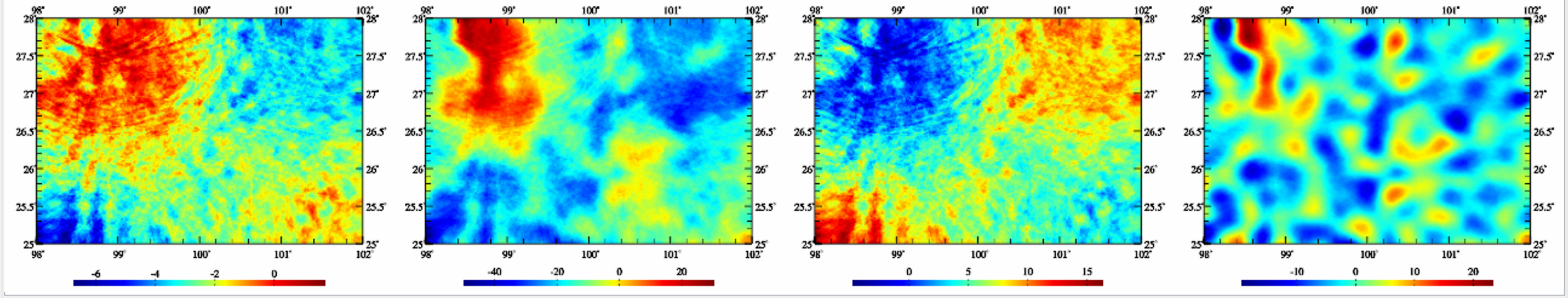
```
>> Save the results as C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.txt.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-24 15:59:10
>> Complete the computation for approximation of residual load and synthesis of residual load effects!
   The source EWH observations (cm): Mean  -40.4567  standard deviation  31.3639  minimum  -191.3139  maximum   75.7880.
   The 0th iterated residual EWH (cm): Mean   0.0087  standard deviation   5.5002  minimum   -43.6331  maximum   39.0007.
   The 1th iterated residual EWH (cm): Mean   0.0011  standard deviation   4.5873  minimum   -40.7119  maximum   30.1390.
>> Computation end time: 2026-06-24 16:04:47
>> The program also outputs the SRBF spatial curve file *spc.rbf and spectral curve file *dgr.rbf for 11 kinds of geodetic variations into the current directory.
 ** *spc.rbf file header format: SRBF type (0 = radial multipole kernel function, 1 = Poisson wavelet kernel function), order of SRBF, minimum and maximum degree of SRBF Legendre expansion, buried depth (km). The record format: Spherical distance (km), the normalized SRBF values derived from the load EWH, height anomaly, ground gravity, gravity disturbance, ground tilt, vertical deflection, horizontal displacement, radial displacement, orthometric height, radial gravity gradient, and horizontal gradient variations.
 ** The file header of * dgr.rbf is the same as * spc.rbf. The record format:Degree n of SRBF Legendre expansion, the degree-n normalized SRBF values derived from the load EWH, height anomaly, ground gravity, gravity disturbance, ground tilt, vertical deflection, horizontal displacement, radial displacement, orthometric height, radial gravity gradient, and horizontal gradient variations.
```



Save the results as

```
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.ewh
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.ksi
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.gra
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.rga
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.dft
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.vdf
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.dph
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.dpr
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.nmh
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmgrd.grr
```

Extract the effects to be plot | Plot↓



geoid / height anomaly (mm) | ground gravity (μGal) | radial displacement (mm) | radial gradient (mE)

The optimization principles for these parameters aim to ensure that the estimated load EWH variations and load effects in space are continuous and differentiable, while minimizing the standard deviation and driving the residual statistical mean toward zero for residual EWH variations.

Regional Approximation of Load Deformation Field Using SRBFs

Approximation of Residual Surface Load and Load Effect Time Series Using SRBFs

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Approximation of Residual Loads and Synthesis of Residual Load Effects Using SRBFs

Approximation of Residual Surface Load and Load Effect Time Series Using SRBFs

Regional Surface Load SRBF Approximation and Load effect SRBF Synthesis

Select the computation point file format

The discrete computation point file

Open the surface computation point file

Number of rows of the file header 1

Column ordinal number of height in record 4

Open any residual equivalent water height variation grid file

Ordinal number of first wildcard in file name 8

Number of consecutive wildcards in file name 8

Parameters of the first SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	15
maximum degree	900
burial depth of Bjerhammar sphere	5.0km
action distance of SBRF center	150km
Reuter network level Q	1800

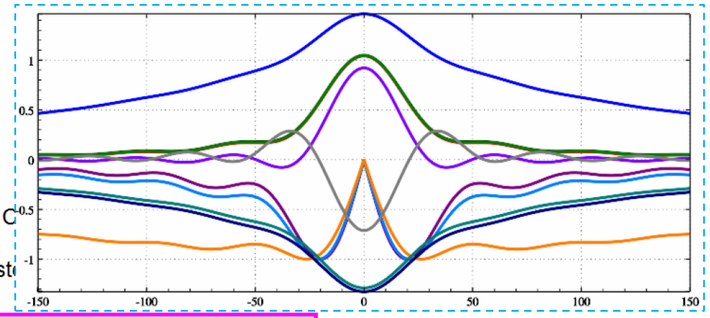
Parameters of cumulative SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	45
maximum degree	1800
burial depth of Bjerhammar sphere	10.0km
action distance of SBRF center	90km
Reuter network level Q	1800

Solution of normal equation: LU triangular decompos | Cumulative SRBF approach times: 1

Save program process as

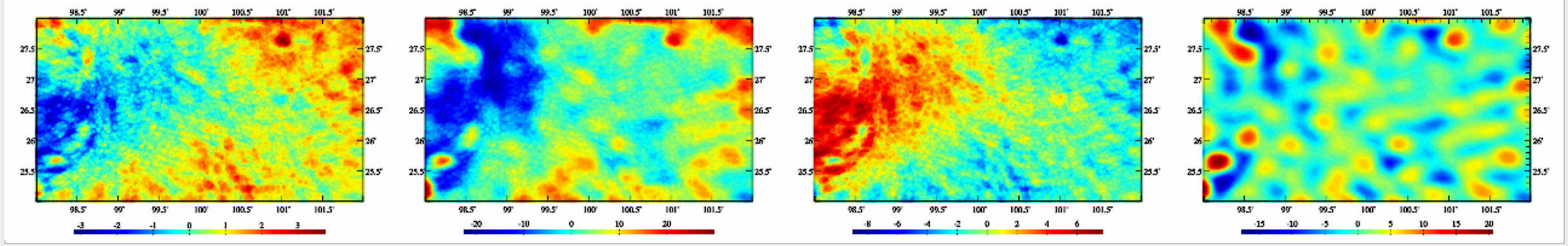
```
  C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/soilewh20180328.dat
  C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/soilewh20180530.dat
  C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/soilewh20180801.dat
  C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/soilewh20181003.dat
  C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/soilewh20181205.dat
>> 6 equivalent water height variation grid time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
 ** The computation process requires time.... During this period, you can open the output file directory C
SRBFrntdfmtmpnt,to look at the computation progress!!
 ** The last attribute in the header of each output file records this epoch time to ensure temporal consist
>> Computation start time：2026-06-24 16:10:10
>> SRBF approximation statistics of 20180131 load EWHs:
   The source EWH observations (cm): Mean  -22.9259  standard deviation  22.8930  minimum  -146.8799  maximum   87.2602.
   The 0th iterated residual EWH (cm): Mean   0.0052  standard deviation   4.4537  minimum   -37.6941  maximum   25.5549.
   The 1th iterated residual EWH (cm): Mean   0.0025  standard deviation   3.5260  minimum   -28.3254  maximum   22.1524.
>> SRBF approximation statistics of 20180328 load EWHs:
   The source EWH observations (cm): Mean  -40.4567  standard deviation  31.3639  minimum  -191.3139  maximum   75.7880.
   The 0th iterated residual EWH (cm): Mean   0.0087  standard deviation   5.5002  minimum   -43.6331  maximum   39.0007.
   The 1th iterated residual EWH (cm): Mean   0.0011  standard deviation   4.5873  minimum   -40.7119  maximum   30.1390.
```



Set the result folder | Import setting parameters | Start Computation

```
98.000  102.000  25.0000  28.000  0.01666667  0.01666667
      1   98.008333   25.008333        0.000     10.6549     -0.4212      4.5657      4.4966     -0.0087      0.0071     -0.0009      0.001
      2   98.025000   25.008333        0.000      9.0048     -0.4191      3.8803      3.8066     -0.0063      0.0079     -0.0005      0.001
      3   98.041667   25.008333        0.000      8.7419     -0.2702      3.7099      3.6809     -0.0046      0.0077     -0.0002      0.001
      4   98.058333   25.008333        0.000     10.2489      0.0459      4.2051      4.2776     -0.0046      0.0086     -0.0005      0.001
      5   98.075000   25.008333        0.000      8.1877      0.0163      3.3624      3.4190     -0.0028      0.0088     -0.0002      0.001
      6   98.091667   25.008333        0.000      6.3786      0.0031      2.6178      2.6642     -0.0008      0.0091      0.0001      0.001
      7   98.108333   25.008333        0.000      6.7264      0.2004      2.6815      2.7888      0.0012      0.0086      0.0004      0.001
      8   98.125000   25.008333        0.000      6.1897      0.2883      2.4235      2.5552      0.0030      0.0078      0.0008      0.001
```

Extract the effects to be plot | Plot↓



geoid / height anomaly (mm) | ground gravity (μGal) | radial displacement (mm) | radial gradient (mE)

The optimization principles for these parameters aim to ensure that the estimated load EWH variations and load effects in space are continuous and differentiable, while minimizing the standard deviation and driving the residual statistical mean toward zero for residual EWH variations.

Regional Approximation of Load Deformation Field Using SRBFs

Approximation of Residual Surface Load and Load Effect Time Series Using SRBFs

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Approximation of Residual Loads and Synthesis of Residual Load Effects Using SRBFs

Approximation of Residual Surface Load and Load Effect Time Series Using SRBFs

Regional Surface Load SRBF Approximation and Load effect SRBF Synthesis

Select the computation point file format

The computation surface grid file

Open computation surface zero value grid file

Open any residual equivalent water height variation grid file

Ordinal number of first wildcard in file name: 8

Number of consecutive wildcards in file name: 8

Parameters of the first SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	15
maximum degree	900
burial depth of Bjerhammar sphere	5.0km
action distance of SBRF center	150km
Reuter network level Q	1800

Parameters of cumulative SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	45
maximum degree	1800
burial depth of Bjerhammar sphere	10.0km
action distance of SBRF center	90km
Reuter network level Q	1800

Solution of normal equation: LU triangular decompo | Cumulative SRBF approach times: 1

Save program process as

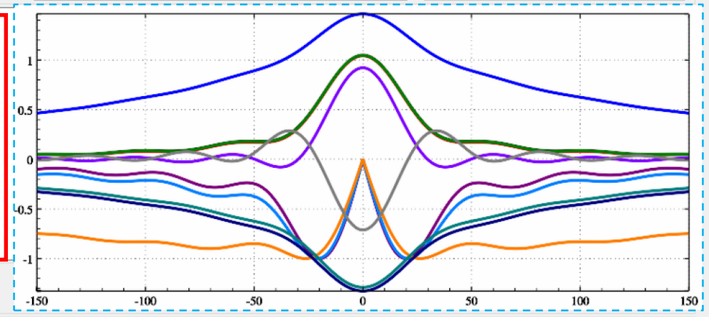
```
  C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/soilewh20181003.dat
  C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/soilewh20181205.dat
>> 6 equivalent water height variation grid time series files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
 ** The computation process requires time.... During this period, you can open the output file directory C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/
SRBFrntdfmtmgrd,to look at the computation progress!!
 ** The last attribute in the header of each output file records this epoch time to ensure temporal consistency.
>> Computation start time：2026-06-24 16:55:23
>> SRBF approximation statistics of 20180131 load EWHs:
   The source EWH observations (cm): Mean  -22.9259  standard deviation  22.8930  minimum  -146.8799  maximum   87.2602.
   The 0th iterated residual EWH (cm): Mean   0.0052  standard deviation   4.4537  minimum   -37.6941  maximum   25.5549.
   The 1th iterated residual EWH (cm): Mean   0.0025  standard deviation   3.5260  minimum   -28.3254  maximum   22.1524.
>> SRBF approximation statistics of 20180328 load EWHs:
   The source EWH observations (cm): Mean  -40.4567  standard deviation  31.3639  minimum  -191.3139  maximum   75.7880.
   The 0th iterated residual EWH (cm): Mean   0.0087  standard deviation   5.5002  minimum   -43.6331  maximum   39.0007.
   The 1th iterated residual EWH (cm): Mean   0.0011  standard deviation   4.5873  minimum   -40.7119  maximum   30.1390.
```

Set the result folder

Import setting parameters

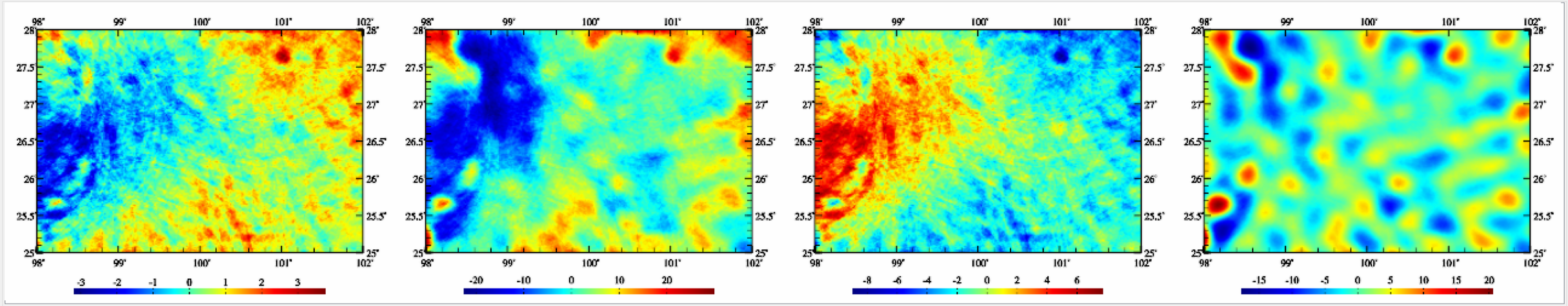
Start Computation

```
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.ewh
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.ksi
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.gra
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.rga
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.dft
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.vdf
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.dph
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.dpr
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.nmh
C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/SRBFrntdfmtmgrd/rntSRBFs20181205.grr
```



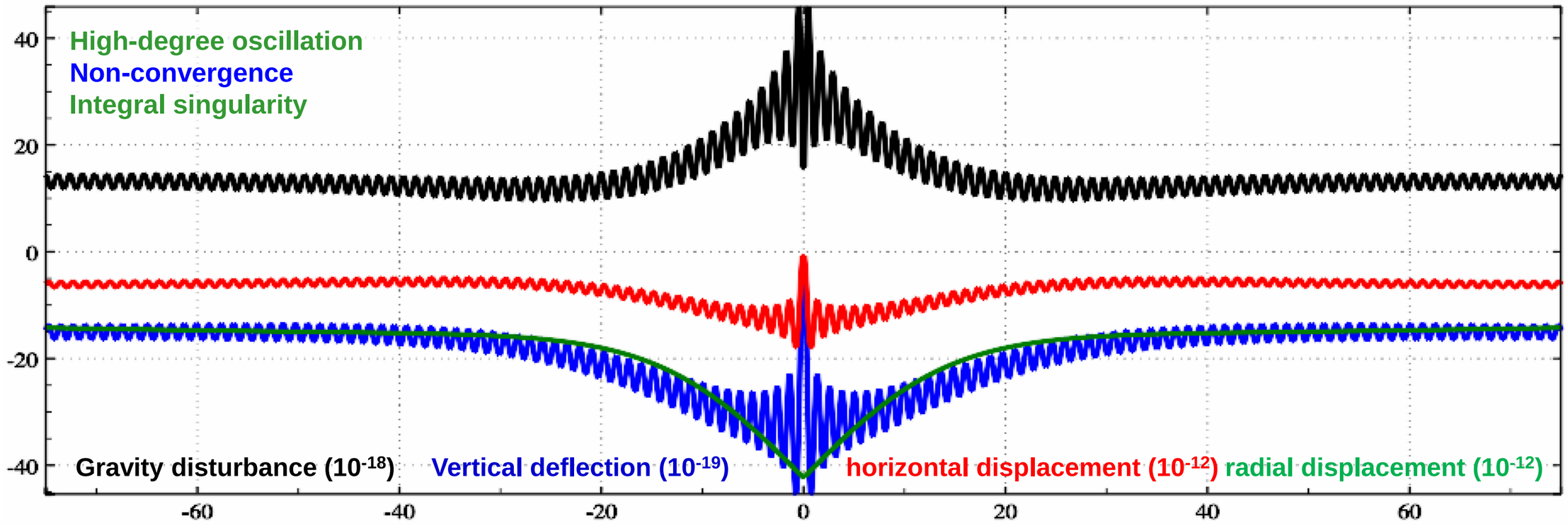
Extract the effects to be plot

Plot↓

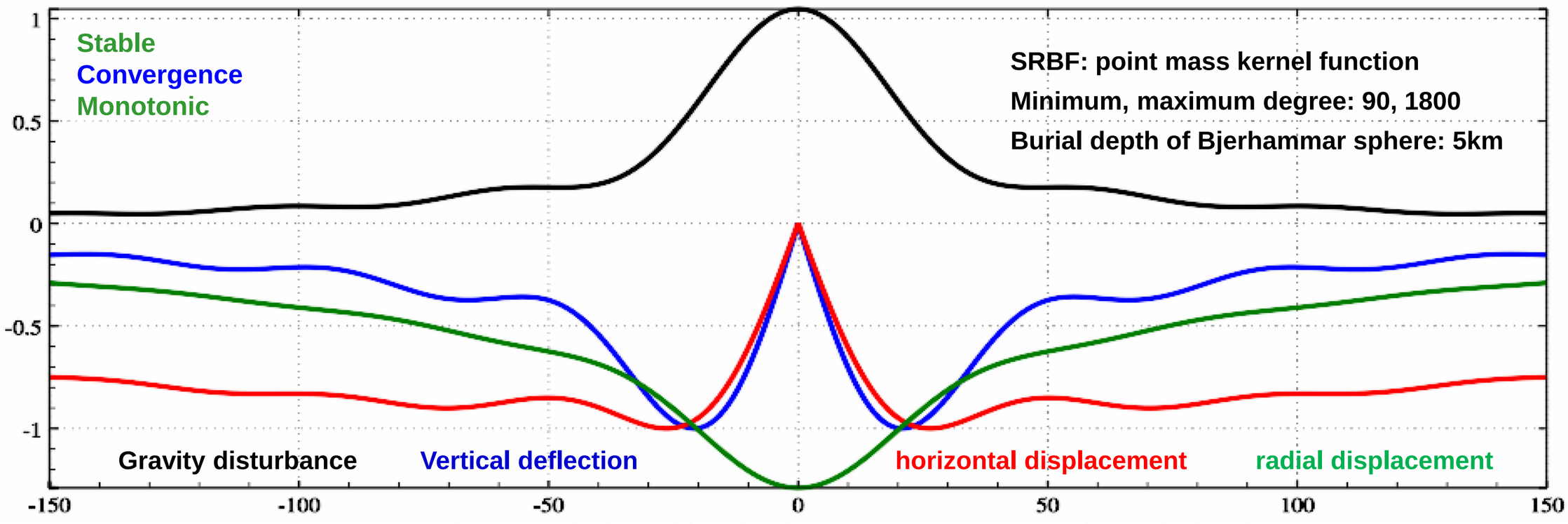


geoid / height anomaly (mm) | ground gravity (μGal) | radial displacement (mm) | radial gradient (mE)

The optimization principles for these parameters aim to ensure that the estimated load EWH variations and load effects in space are continuous and differentiable, while minimizing the standard deviation and driving the residual statistical mean toward zero for residual EWH variations.



The near-zone characteristics of several load Green's functions (Indirect effect)



The near-zone characteristics of load effect SRBFs on several geodetic elements

Load Deformation Field Recovery from Heterogeneous Variations via Green's Integral Constraint

Load Deformation Field Estimation from Heterogeneous Variations via Green's Integral Constraint

Open file | Save as | Import parameters | Start Computation | Save process | Follow example

Open the geodetic variation record time series file

Column ordinal number of the first epoch time in header	2
Column ordinal number of the first variation in record	7
The column ordinal number of the variation type in record	6
The column ordinal number of the weights in record	5
The column ordinal number of the current variations in record	7
Mean distance between geodetic sites	15.0 km

Open the computation surface height grid file

Set algorithm parameters

Load Green's integral radius	150km
Laplace operator weight p	1.0000
Edge effect suppression parameter n	2
Cumulative approach times	3

Select type of the adjustable variations	height anomaly variation (mm)
Contribution rate κ of the adjustable variations	1.00

Load Deformation Field Estimation from Heterogeneous Variations via Green's Integral Constraint

Approximation of EWH variation and Load Effect Grid Time Series via Green's integral constraint

Solution of normal equation: LU triangular decomposition

Save program process as

```
>> [Function] Utilizing ground-based geodetic variations observed by heterogeneous networks (e.g., GNSS leveling height anomaly, gravity disturbance, ground gravity, ellipsoidal height, or normal height) as input constraints, and employing Load Green's Function Integration as a dynamic operator, this function estimates the regional terrestrial water EWH variation and its load effect grids on Height anomaly (geoid, mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, mas), vertical deflection (SW, to the south and to the west, mas), horizontal displacement (mm), ellipsoidal height (mm), normal height (mm), gravity gradient (mE), and horizontal gravity gradient (NW, mE).
>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSadj.txt.
  ** Look at the file information in the window below and set the file parameters of the record time series...
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/dtm3m.dat.
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst.
  ** The program generates the estimated terrestrial EWH variation grid files ewh****.dat, corresponding load effect grid files, and residual analysis files rnt***.txt. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.
  ** All-Element Load Effect Grids:
     Greengeoid***.dat: Height anomaly / Geoid variation (mm)
     Greenterrgrav***.dat: Ground gravity variation (μGal)
     Greengravdist***.dat: Gravity disturbance variation (μGal)
     Greengrndtilt***.dat: Ground tilt variation vector (SW, mas)
```

Set the result folder | Import setting para

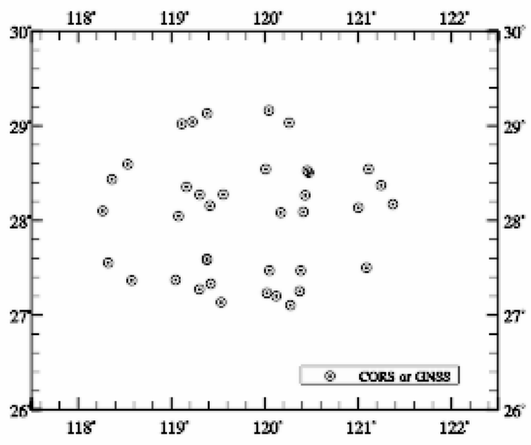
```
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greenhorz
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greenelli
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greennorth
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greengrad
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greenhorz
```

rnt2015011612.txt

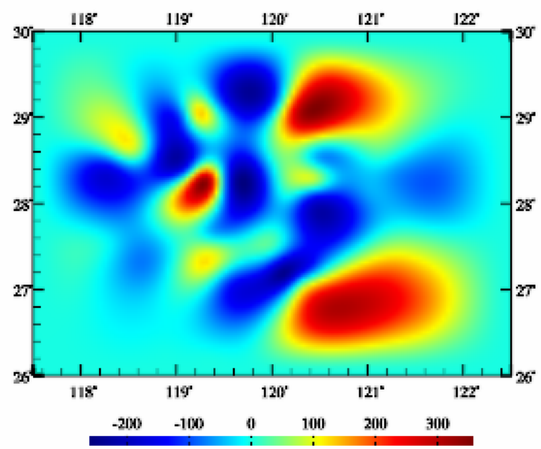
```
Ellipsoidal height:  4
      0    1.7766    3.2313   -8.9800    7.4500
      1    0.0470    1.5335   -4.1846    4.4676
      2   -0.0250    1.2653   -4.1085    4.2485
      3   -0.0276    1.1473   -4.2036    4.1187
      4   -0.0236    1.0787   -4.2537    4.0383
   CORS  121.3725   28.1708    1.00  4     2.3100     0.0611    -0.0322
   CORS  121.2459   28.3706    1.00  4     1.2300     0.1266     0.0791
   CORS  121.1122   28.5421    1.00  4    -1.3400    -0.2021    -0.0768
   CORS  121.0901   27.5005    1.00  4    -4.5000    -0.0760     0.0174
   CORS  121.0032   28.1351    1.00  4     2.0800     0.5581     0.0890
   CORS  120.4708   28.5056    1.00  4     0.6900     0.7964     0.5206
   CORS  120.4557   28.5259    1.00  4    -0.0100     0.4649     0.3275
   CORS  120.4330   28.2659    1.00  4     0.1800    -1.2777    -1.0993
   CORS  120.4128   28.0902    1.00  4     5.0600     1.0729     0.5665
   CORS  120.3856   27.4700    1.00  4     3.5100     0.9558     0.2376
   CORS  120.3739   27.2529    1.00  4     1.6900     1.3661     1.0752
   CORS  120.2754   27.1035    1.00  4    -1.3800    -0.8403    -0.5624
```

The monitoring epoch time 2015011612

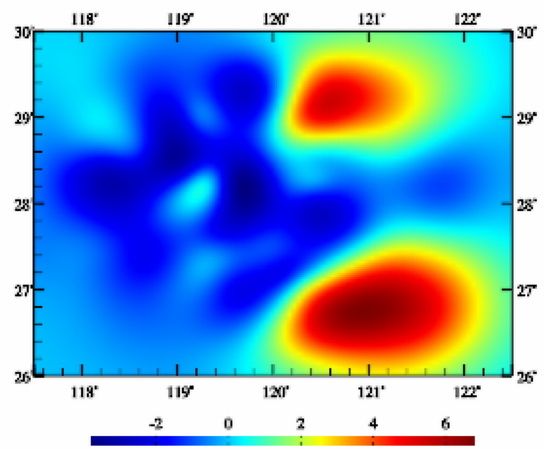
Extract the effects to be plot | Plot↓



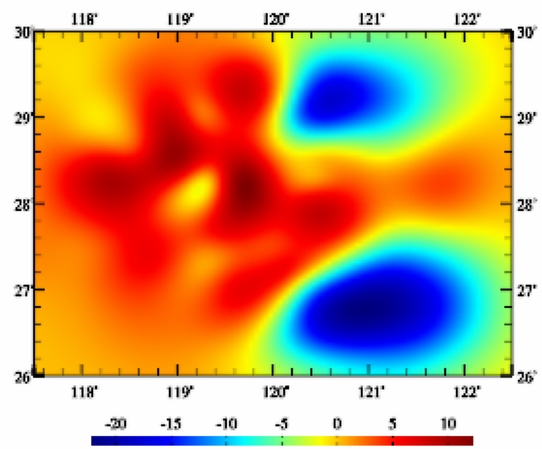
Spatial distribution of geodetic sites



Land water EWH variations (cm)



Ground gravity variations (μGal)



Orthometric height variations (mm)

Acceptable Geodetic Variation Types: (1) Height Anomaly Variation (mm) - Derived from GNSS-leveling networks; (2) Gravity Disturbance Variation (μGal) - Derived from GNSS-gravity networks or CORS-gravity tide stations; (3) Ground Gravity Variation (μGal) - Derived from absolute or relative gravity monitoring networks; (4) Ellipsoidal Height Variation (mm) - Derived from CORS or GNSS monitoring networks; or (5) Normal/Orthometric Height Variation (mm) - Derived from precision leveling networks.

The optimization principles aim to produce spatially continuous and differentiable EWH variation fields while minimizing the standard deviation and driving the statistical mean toward zero for residual observation variations.

Load Deformation Field Recovery from Heterogeneous Variations via Green's Integral Constraint

Load Deformation Field Estimation from Heterogeneous Variations via Green's Integral Constraint

Open file | Save as | Import parameters | Start Computation | Save process | Follow example

Open the geodetic variation record time series file

Column ordinal number of the first epoch time in header	2
Column ordinal number of the first variation in record	7
The column ordinal number of the variation type in record	6
The column ordinal number of the weights in record	5
The column ordinal number of the current variations in record	7
Mean distance between geodetic sites	15.0 km

Open the computation surface height grid file

Set algorithm parameters

Load Green's integral radius	150km
Laplace operator weight p	1.0000
Edge effect suppression parameter n	2
Cumulative approach times	3

Select type of the adjustable variations	height anomaly variation (mm)
Contribution rate κ of the adjustable variations	1.00

Load Deformation Field Estimation from Heterogeneous Variations via Green's Integral Constraint

Approximation of EWH variation and Load Effect Grid Time Series via Green's integral constraint

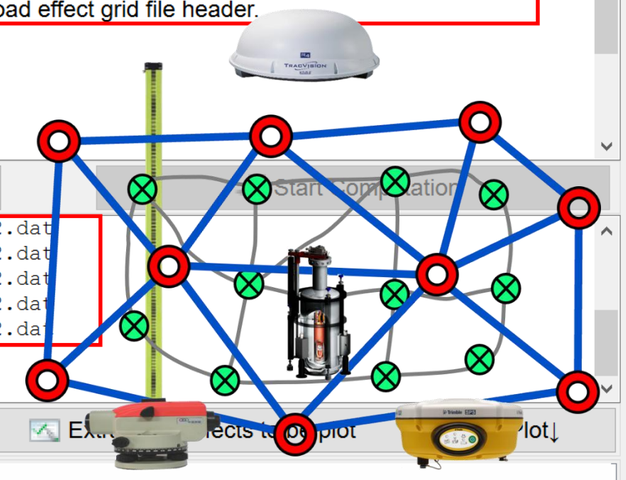
Solution of normal equation: LU triangular decomposition

Save program process as

```
>> [Function] Utilizing ground-based geodetic variations observed by heterogeneous networks (e.g., GNSS leveling height anomaly, gravity disturbance, ground gravity, ellipsoidal height, or normal height) as input constraints, and employing Load Green's Function Integration as a dynamic operator, this function estimates the regional terrestrial water EWH variation and its load effect grids on Height anomaly (geoid, mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, mas), vertical deflection (SW, to the south and to the west, mas), horizontal displacement (mm), ellipsoidal height (mm), normal height (mm), gravity gradient (mE), and horizontal gravity gradient (NW, mE).
>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/heterobstm.txt.
  ** Look at the file information in the window below and set the file parameters of the record time series...
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/dtm3m.dat.
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst.
  ** The program generates the estimated terrestrial EWH variation grid files ewh****.dat, corresponding load effect grid files, and residual analysis files rnt***.txt. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.
  ** All-Element Load Effect Grids:
     Greengeoid***.dat: Height anomaly / Geoid variation (mm)
     Greenterrgrav***.dat: Ground gravity variation (μGal)
     Greengravdist***.dat: Gravity disturbance variation (μGal)
     Greengrndtilt***.dat: Ground tilt variation vector (SW, mas)
```

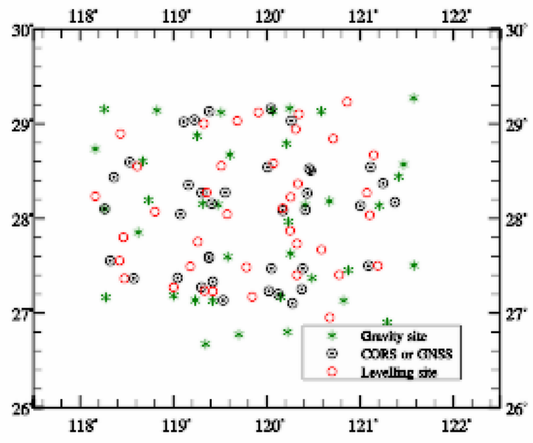
Set the result folder | Import setting parameters | Start Computation

```
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenhorzdisp2015011612.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenelliphgt2015011612.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenorthohgt2015011612.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greengradient2015011612.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenhorzgrad2015011612.dat
```

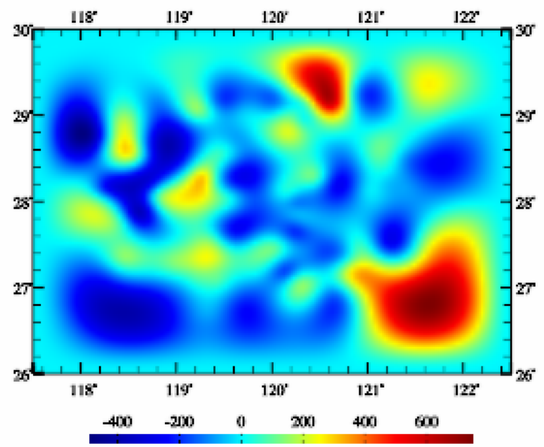


The monitoring epoch time 2015011612

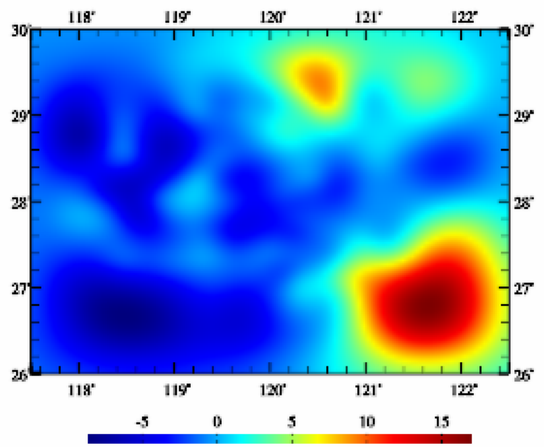
Ex... ...ects to plot | ...lot↓



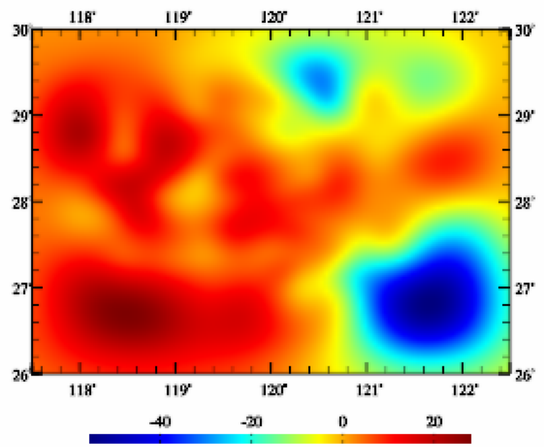
Spatial distribution of geodetic sites



Land water EWH variations (cm)



Ground gravity variations (μGal)



Orthometric height variations (mm)

Acceptable Geodetic Variation Types: (1) Height Anomaly Variation (mm) - Derived from GNSS-leveling networks; (2) Gravity Disturbance Variation (μGal) - Derived from GNSS-gravity networks or CORS-gravity tide stations; (3) Ground Gravity Variation (μGal) - Derived from absolute or relative gravity monitoring networks; (4) Ellipsoidal Height Variation (mm) - Derived from CORS or GNSS monitoring networks; or (5) Normal/Orthometric Height Variation (mm) - Derived from precision leveling networks.

The optimization principles aim to produce spatially continuous and differentiable EWH variation fields while minimizing the standard deviation and driving the statistical mean toward zero for residual observation variations.

Load Deformation Field Recovery from Heterogeneous Variations via Green's Integral Constraint

Approximation of EWH variation and Load Effect Grid Time Series via Green's integral constraint

Open file Save as Import parameters Start Computation Save process Follow example

Open the geodetic variation record time series file

Column ordinal number of the first epoch time in header	2
Column ordinal number of the first variation in record	7
The column ordinal number of the variation type in record	6
The column ordinal number of the weights in record	5
Mean distance between geodetic sites	15.0 km

Open the computation surface height grid file

Set algorithm parameters

Load Green's integral radius	150km
Laplace operator weight p	1.0000
Edge effect suppression parameter n	2
Cumulative approach times	3

Select type of the adjustable variations	height anomaly variation (mm)
Contribution rate κ of the adjustable variations	1.00

Load Deformation Field Estimation from Heterogeneous Variations via Green's Integral Constraint

Approximation of EWH variation and Load Effect Grid Time Series via Green's integral constraint

Solution of normal equation: LU triangular decomposition

Save program process as

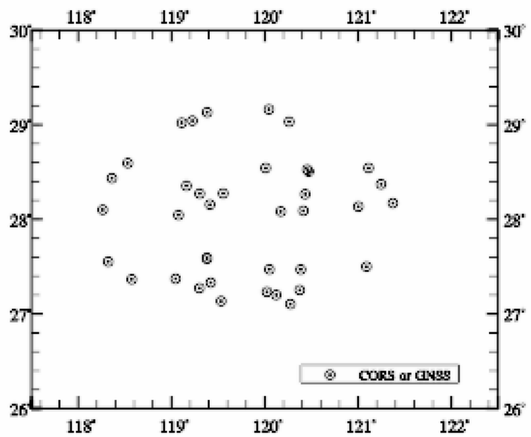
```
>> [Function] Utilizing time-series of heterogeneous geodetic variations as observations and Load Green's Integral as a geodynamic constraint, this module estimates the Terrestrial EWH Variation and All-Element Load Effect Grid Time Series. This is typically used to reconstruct a regional time-varying gravity field.
>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSadj.txt.
  ** Look at the file information in the window below and set the file parameters of the record time series...
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/dtm3m.dat.
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst.
  ** The program generates the estimated terrestrial EWH variation grid files ewh****.dat, corresponding load effect grid files, and residual analysis files rnt***.txt. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.
  ** All-Element Load Effect Grids:
     Greengeoid***.dat: Height anomaly / Geoid variation (mm)
     Greenterrgrav***.dat: Ground gravity variation (μGal)
     Greengravdist***.dat: Gravity disturbance variation (μGal)
     Greengrndtilt***.dat: Ground tilt variation vector (SW, mas)
     Greenvertdefl***.dat: Vertical deflection variation vector (SW, mas)
     Greenhorzdisp***.dat: Horizontal displacement vector (EN, mm)
     Greenelliphgt***.dat: Ellipsoidal height variation (mm)
```

Set the result folder Import setting parameters Start Computation

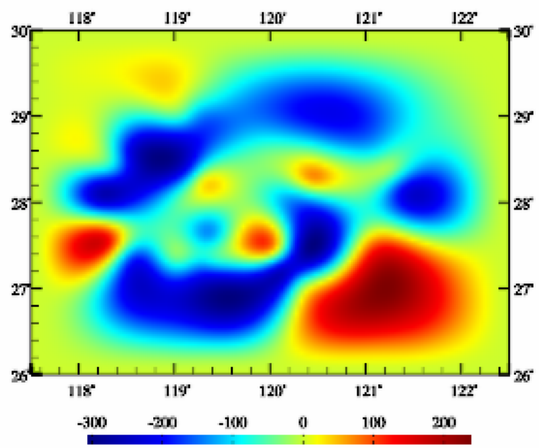
```
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greenhorzdisp2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greenelliphgt2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greenorthohgt2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greengradient2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greenhorzgrad2016021512.dat
```

The monitoring epoch time 2016021512

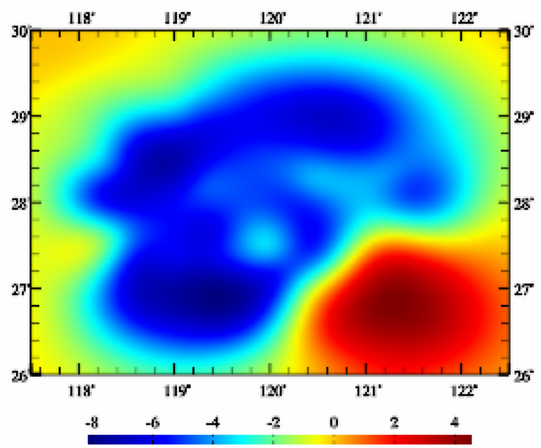
Extract the effects to be plot Plot↓



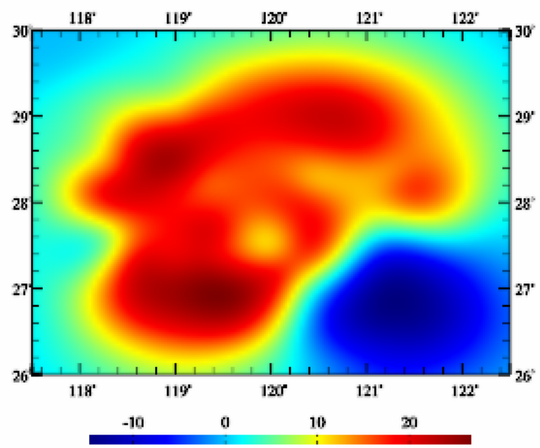
Spatial distribution of geodetic sites



Land water EWH variations (cm)



Ground gravity variations (μGal)



Orthometric height variations (mm)

Acceptable Geodetic Variation Types: (1) Height Anomaly Variation (mm) - Derived from GNSS-leveling networks; (2) Gravity Disturbance Variation (μGal) - Derived from GNSS-gravity networks or CORS-gravity tide stations; (3) Ground Gravity Variation (μGal) - Derived from absolute or relative gravity monitoring networks; (4) Ellipsoidal Height Variation (mm) - Derived from CORS or GNSS monitoring networks; or (5) Normal/Orthometric Height Variation (mm) - Derived from precision leveling networks.

The optimization principles aim to produce spatially continuous and differentiable EWH variation fields while minimizing the standard deviation and driving the statistical mean toward zero for residual observation variations.

Load Deformation Field Recovery from Heterogeneous Variations via Green's Integral Constraint

Approximation of EWH variation and Load Effect Grid Time Series via Green's integral constraint

Open file Save as Import parameters Start Computation Save process Follow example

Open the geodetic variation record time series file

Column ordinal number of the first epoch time in header: 2

Column ordinal number of the first variation in record: 7

The column ordinal number of the variation type in record: 6

The column ordinal number of the weights in record: 5

Mean distance between geodetic sites: 15.0 km

Open the computation surface height grid file

Set algorithm parameters

Load Green's integral radius: 150km

Laplace operator weight p: 1.0000

Edge effect suppression parameter n: 2

Cumulative approach times: 3

Select type of the adjustable variations: height anomaly variation (mm)

Contribution rate κ of the adjustable variations: 1.00

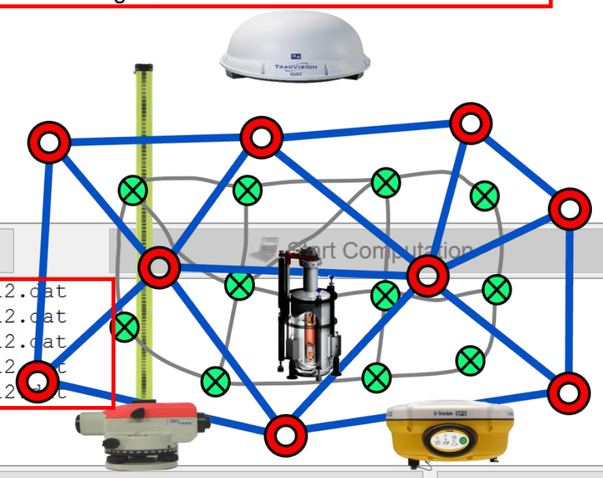
Load Deformation Field Estimation from Heterogeneous Variations via Green's Integral Constraint

Approximation of EWH variation and Load Effect Grid Time Series via Green's integral constraint

Solution of normal equation: LU triangular decomposition

Save program process as

```
>> [Function] Utilizing time-series of heterogeneous geodetic variations as observations and Load Green's Integral as a geodynamic constraint, this module estimates the Terrestrial EWH Variation and All-Element Load Effect Grid Time Series. This is typically used to reconstruct a regional time-varying gravity field.
>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/heterobstm.txt.
  ** Look at the file information in the window below and set the file parameters of the record time series...
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/dtm3m.dat.
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst.
  ** The program generates the estimated terrestrial EWH variation grid files ewh****.dat, corresponding load effect grid files, and residual analysis files rnt***.txt. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.
  ** All-Element Load Effect Grids:
     Greengeoid***.dat: Height anomaly / Geoid variation (mm)
     Greenterrgrav***.dat: Ground gravity variation (μGal)
     Greengravdist***.dat: Gravity disturbance variation (μGal)
     Greengrndtilt***.dat: Ground tilt variation vector (SW, mas)
     Greenvertdefl***.dat: Vertical deflection variation vector (SW, mas)
     Greenhorzdisp***.dat: Horizontal displacement vector (EN, mm)
     Greenelliphgt***.dat: Ellipsoidal height variation (mm)
```

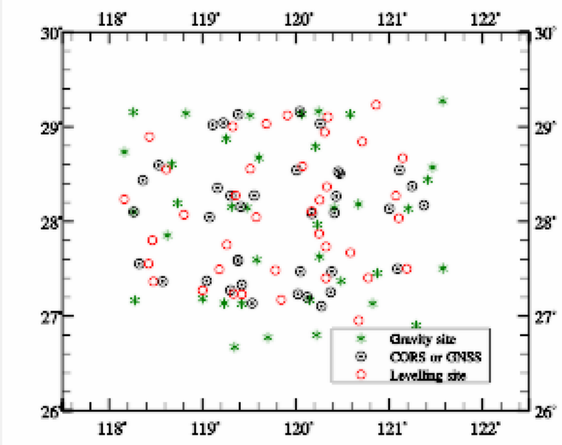


Set the result folder Import setting parameters Start Computation

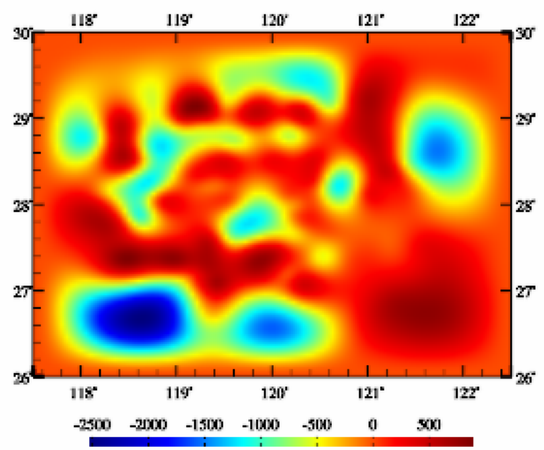
```
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenhorzdisp2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenelliphgt2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenorthohgt2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greengradient2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenhorzgrad2016021512.dat
```

The monitoring epoch time 2016021512

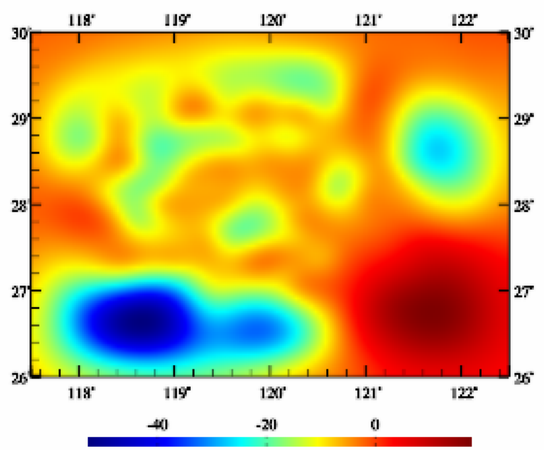
Extract the effects to be plot Plot↓



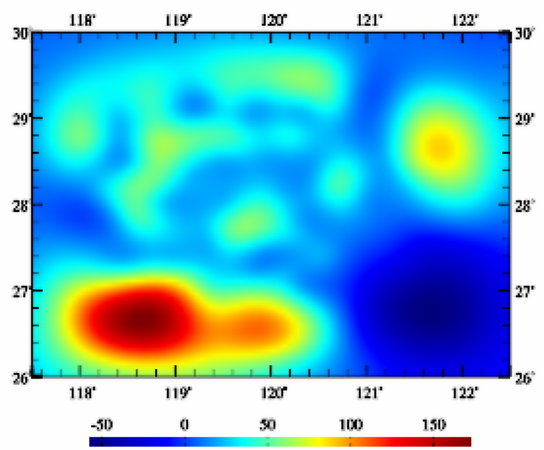
Spatial distribution of geodetic sites



Land water EWH variations (cm)



Ground gravity variations (μGal)



Orthometric height variations (mm)

Acceptable Geodetic Variation Types: (1) Height Anomaly Variation (mm) - Derived from GNSS-leveling networks; (2) Gravity Disturbance Variation (μGal) - Derived from GNSS-gravity networks or CORS-gravity tide stations; (3) Ground Gravity Variation (μGal) - Derived from absolute or relative gravity monitoring networks; (4) Ellipsoidal Height Variation (mm) - Derived from CORS or GNSS monitoring networks; or (5) Normal/Orthometric Height Variation (mm) - Derived from precision leveling networks.

The optimization principles aim to produce spatially continuous and differentiable EWH variation fields while minimizing the standard deviation and driving the statistical mean toward zero for residual observation variations.

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations | SRBF Approximation of EWH Variation and Load Effect Time Series from Heterogeneous Variations | Regional Approximation of Load Deformation Field from heterogeneous variations using SRBFs

Open the geodetic variation record time series file | Open the computation surface height grid file | Set the result folder | Save program process as

Column ordinal number of the first epoch time in header	2
Column ordinal number of the first variation in record	8
The column ordinal number of the observation weights in record	5
The column ordinal number of the variation type in record	6
The column ordinal number of the system weights in record	7
The column ordinal number of the current variations in record	8
Average Station Spacing	5.0 km

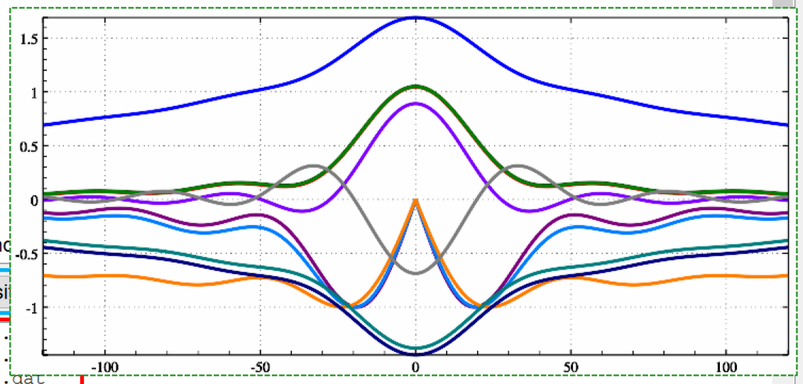
Parameters of the first SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	9
maximum degree	900
burial depth of Bjerhammar sphere	1.00km
SRBF Center Action Distance	120km

Parameters of cumulative SRBF appoach

Select SRBF	Poisson wavelet kernel
order number m	0
minimum degree	720
maximum degree	1800
burial depth of Bjerhammar sphere	5.00km
SRBF Center Action Distance	60km

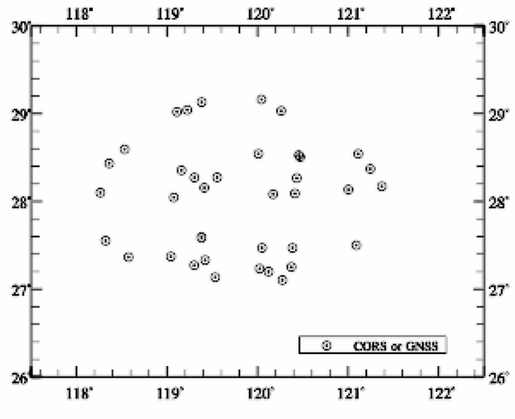
```
>> [Function] Utilizing heterogeneous ground-based observable variations – including GNSS-leveling height anomaly (mm), gravity disturbance (μGal), ground gravity (μGal), ellipsoidal height (mm), normal height (mm), or equivalent water height (cm) – as input constraints, and employing the SRBF approximation algorithm, this function estimates the regional terrestrial Equivalent Water Height (EWH) variation (cm) and associated load effects on the 10 geodetic elements: Height anomaly (geoid, mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, mas), vertical deflection (SW, mas), horizontal displacement (EN, mm), geodetic height (mm), normal height (mm), gravity disturbance gradient (mE), and horizontal gravity gradient (NW, E).
>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSadj.txt。
  ** Look at the file information in the window below and set the file parameters of the record time series...
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/dtm3m.dat.
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst.
  ** The program generates the estimated terrestrial EWH variation grid files ewh****.dat, corresponding load effect grid files, and residual analysis files rnt***.txt. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.
  ** All-Element Load Effect Grids:
     SRBFgeoid***.dat: Height anomaly / Geoid variation (mm)
     SRBFterrgrav***.dat: Ground gravity variation (μGal)
     SRBFgravdist***.dat: Gravity disturbance variation (μGal)
     SRBFgrndtilt***.dat: Ground tilt variation vector (SW, mas)
     SRBFvertdefl***.dat: Vertical deflection variation vector (SW, mas)
     SRBFhorzdisp***.dat: Horizontal displacement vector (EN, mm)
     SRBFelliphgt***.dat: Ellipsoidal height variation (mm)
     SRBForthohgt***.dat: Normal height variation (mm)
     SRBFgradient***.dat: Radial gravity gradient variation (mE)
     SRBFhorzgrad***.dat: Horizontal gravity gradient vector (NW, mE)
  ** The program also outputs the SRBF spatial curve file *spc.rbf and spectral curve files *dgr.rbf and
```



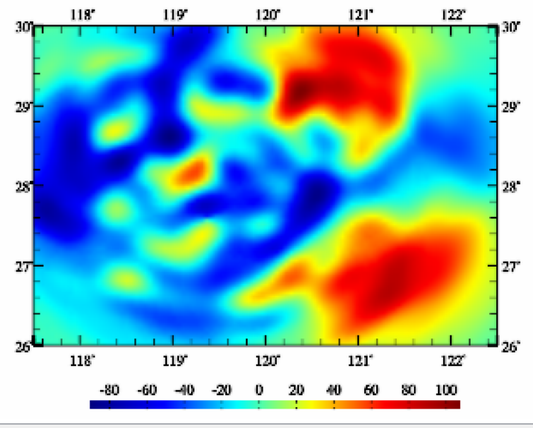
Cumulative SRBF approach times 1 | Solution of normal equation LU triangular decomposi

```
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFhorzdisp2015011612.
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFelliphgt2015011612.
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBForthohgt2015011612.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFgradient2015011612.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFhorzgrad2015011612.dat
```

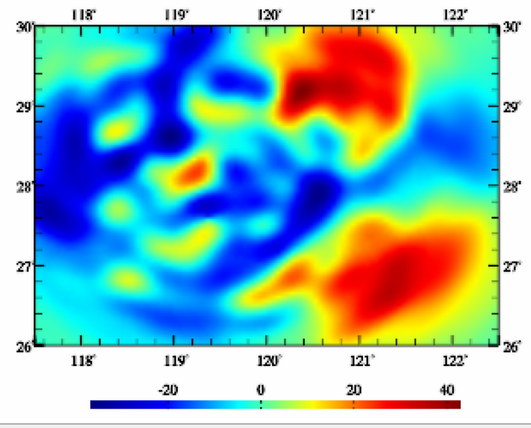
Extract the effects to be plot | Plot↓ | The monitoring epoch time 2015011612



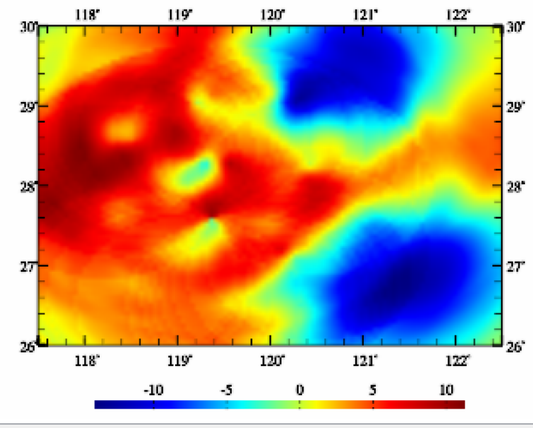
Spatial distribution of geodetic sites



Land water EWH variations (cm)



Ground gravity variations (μGal)



Orthometric height variations (mm)

Acceptable Geodetic Variation Types: (1) Height Anomaly Variation (mm) - Derived from GNSS-leveling networks; (2) Gravity Disturbance Variation (μGal) - Derived from GNSS-gravity networks or CORS-gravity tide stations; (3) Ground Gravity Variation (μGal) - Derived from absolute or relative gravity monitoring networks; (4) Ellipsoidal Height Variation (mm) - Derived from CORS or GNSS monitoring networks; (5) Normal/Orthometric Height Variation (mm) - Derived from precision leveling networks; or (6) Equivalent Water Height (EWH) Variation (cm) - Derived from hydrological monitoring stations.

The optimization principles aim to produce spatially continuous and differentiable EWH variation fields while minimizing the standard deviation and driving the statistical mean toward zero for residual observation variations.

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations | SRBF Approximation of EWH Variation and Load Effect Time Series from Heterogeneous Variations | Regional Approximation of Load Deformation Field from heterogeneous variations using SRBFs

Open the geodetic variation record time series file | Open the computation surface height grid file | Set the result folder | Save program process as

Column ordinal number of the first epoch time in header	2
Column ordinal number of the first variation in record	8
The column ordinal number of the observation weights in record	5
The column ordinal number of the variation type in record	6
The column ordinal number of the system weights in record	7
The column ordinal number of the current variations in record	8
Average Station Spacing	5.0 km

Parameters of the first SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	9
maximum degree	900
burial depth of Bjerhammar sphere	1.00km
SRBF Center Action Distance	120km

Parameters of cumulative SRBF appoach

Select SRBF	Poisson wavelet kernel
order number m	0
minimum degree	720
maximum degree	1800
burial depth of Bjerhammar sphere	5.00km
SRBF Center Action Distance	60km

>> [Function] Utilizing heterogeneous ground-based observable variations – including GNSS-leveling height anomaly (mm), gravity disturbance (μGal), ground gravity (μGal), ellipsoidal height (mm), normal height (mm), or equivalent water height (cm) – as input constraints, and employing the SRBF approximation algorithm, this function estimates the regional terrestrial Equivalent Water Height (EWH) variation (cm) and associated load effects on the 10 geodetic elements: Height anomaly (geoid, mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, mas), vertical deflection (SW, mas), horizontal displacement (EN, mm), geodetic height (mm), normal height (mm), gravity disturbance gradient (mE), and horizontal gravity gradient (NW, E).

>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/heterobstm.txt。

** Look at the file information in the window below and set the file parameters of the record time series...

>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/dtm3m.dat.

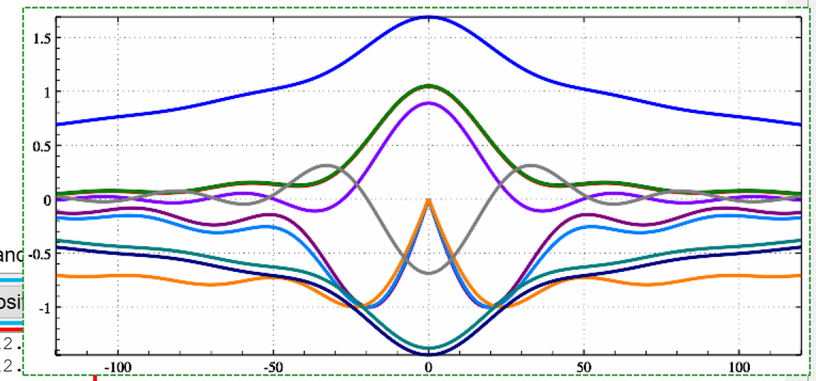
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/htrgrst.

** The program generates the estimated terrestrial EWH variation grid files ewh****.dat, corresponding load effect grid files, and residual analysis files rnt***.txt. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.

** All-Element Load Effect Grids:

SRBFgeoid***.dat: Height anomaly / Geoid variation (mm)
SRBFterrgrav***.dat: Ground gravity variation (μGal)
SRBFgravdist***.dat: Gravity disturbance variation (μGal)
SRBFgrndtilt***.dat: Ground tilt variation vector (SW, mas)
SRBFvertdefl***.dat: Vertical deflection variation vector (SW, mas)
SRBFhorzdisp***.dat: Horizontal displacement vec[illegible]m)
SRBFelliphgt***.dat: Ellipsoidal height variation (r[illegible]
SRBForthohgt***.dat: Normal height var[illegible]tion (mm)
SRBFgradient***.dat: Radial gravity gra[illegible]ent variation (mE)
SRBFhorzgrad***.dat: Horizo[illegible] gravity gradient v[illegible]r (NW, mE)

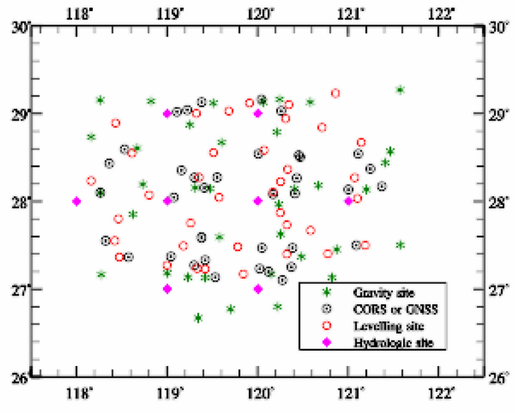
** The program also outputs the S[illegible]F spa[illegible] curve file[illegible]pc.rbf and spectral curve files *dgr.rbf and



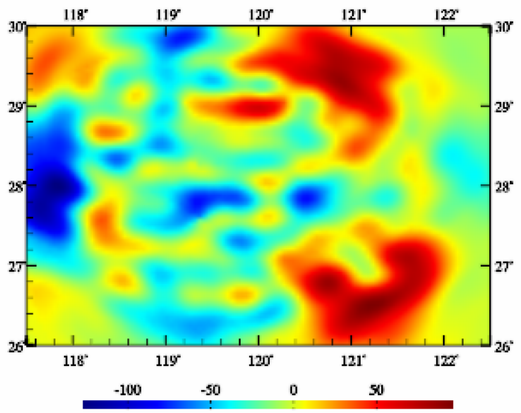
Cumulative SRBF approach times 1 | Solution of normal equation | LC triangular decomposi

C:/ETideLoad4.5_win64en/examples/Loa[illegible]timateSR[illegible]htrgrst\SRBFhorzdisp2015011612.
C:/ETideLoad4.5_win64en/examples/Loa[illegible]timateSR[illegible]htrgrst\SRBFelliphgt2015011612.
C:/ETideLoad4.5_win64en/examples/Loa[illegible]timateSR[illegible]htrgrst\SRBForthohgt2015011612.dat
C:/ETideLoad4.5_win64en/examples/Loa[illegible]timateSR[illegible]htrgrst\SRBFgradient2015011612.dat
C:/ETideLoad4.5_win64en/examples/Loa[illegible]timateSR[illegible]htrgrst\SRBFhorzgrad2015011612.dat

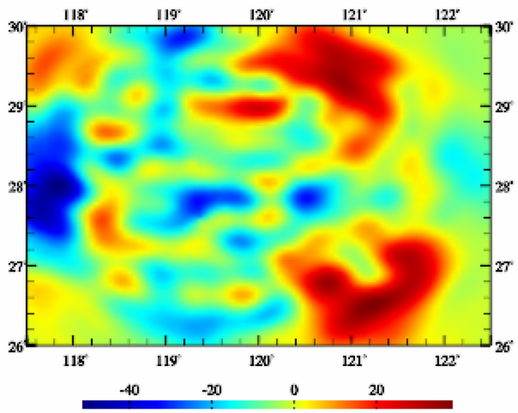
Extract the effects to be plot | [illegible]ot↓ | The monitoring epoch time 2015011612



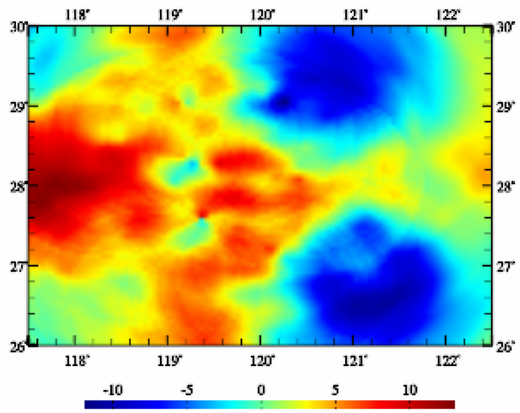
Spatial distribution of geodetic sites



Land water EWH variations (cm)



Ground gravity variations (μGal)



Orthometric height variations (mm)

Acceptable Geodetic Variation Types: (1) Height Anomaly Variation (mm) - Derived from GNSS-leveling networks; (2) Gravity Disturbance Variation (μGal) - Derived from GNSS-gravity networks or CORS-gravity tide stations; (3) Ground Gravity Variation (μGal) - Derived from absolute or relative gravity monitoring networks; (4) Ellipsoidal Height Variation (mm) - Derived from CORS or GNSS monitoring networks; (5) Normal/Orthometric Height Variation (mm) - Derived from precision leveling networks; or (6) Equivalent Water Height (EWH) Variation (cm) - Derived from hydrological monitoring stations.

The optimization principles aim to produce spatially continuous and differentiable EWH variation fields while minimizing the standard deviation and driving the statistical mean toward zero for residual observation variations.

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations

SRBF Approximation of EWH Variation and Load Effect Time Series from Heterogeneous Variations

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations | SRBF Approximation of EWH Variation and Load Effect Time Series from Heterogeneous Variations | Regional Approximation of Load Deformation Field from heterogeneous variations using SRBFs

Open the geodetic variation record time series file | Open the computation surface height grid file | Set the result folder | Save program process as

Column ordinal number of the first epoch time in header	2
Column ordinal number of the first variation in record	8
The column ordinal number of the observation weights in record	5
The column ordinal number of the variation type in record	6
The column ordinal number of the system weights in record	7
Average Station Spacing	5.0 km

Parameters of the first SRBF appoach

Select SRBF	radial multipole kernel
order number m	0
minimum degree	9
maximum degree	900
burial depth of Bjerhammar sphere	1.00km
SRBF Center Action Distance	120km

Parameters of cumulative SRBF appoach

Select SRBF	Poisson wavelet kernel
order number m	0
minimum degree	720
maximum degree	1800
burial depth of Bjerhammar sphere	5.00km
SRBF Center Action Distance	60km

>> [Function] Utilizing time-series of heterogeneous ground-based observable variations, this function computes the time series of grids for terrestrial EWH variation (cm) and associated load effects on the 10 geodetic elements: Height anomaly (geoid, mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, mas), vertical deflection (SW, mas), horizontal displacement (EN, mm), geodetic height (mm), normal height (mm), gravity disturbance gradient (mE), and horizontal gravity gradient (NW, E) using SRBF load deformation field approximation algorithm.

>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSadj.txt。

** Look at the file information in the window below and set the file parameters of the record time series...

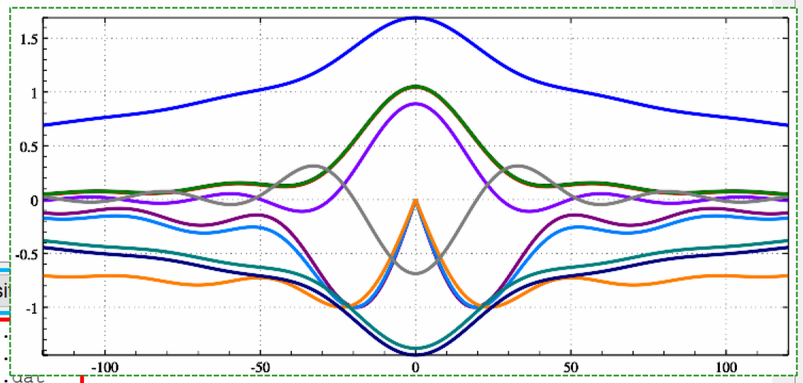
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/dtm3m.dat.

>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst.

** The program generates the estimated terrestrial EWH variation grid files ewh****.dat, corresponding load effect grid files, and residual analysis files rnt***.txt. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.

** All-Element Load Effect Grids:

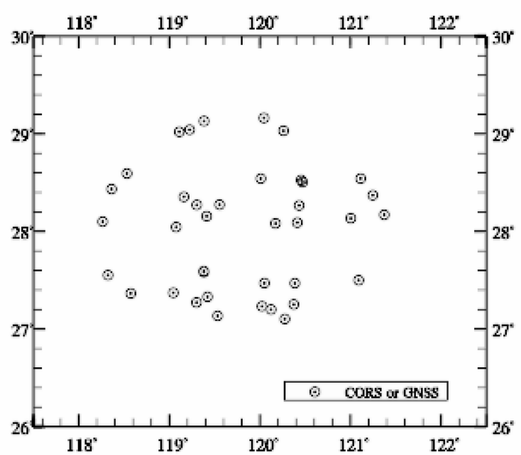
SRBFgeoid***.dat: Height anomaly / Geoid variation (mm)
SRBFterrgrav***.dat: Ground gravity variation (μGal)
SRBFgravdist***.dat: Gravity disturbance variation (μGal)
SRBFgrndtilt***.dat: Ground tilt variation vector (SW, mas)
SRBFvertdefl***.dat: Vertical deflection variation vector (SW, mas)
SRBFhorzdisp***.dat: Horizontal displacement vector (EN, mm)
SRBFelliphgt***.dat: Ellipsoidal height variation (mm)
SRBForthohgt***.dat: Normal height variation (mm)
SRBFgradient***.dat: Radial gravity gradient variation (mE)
SRBFhorzgrad***.dat: Horizontal gravity gradient vector (NW, mE)



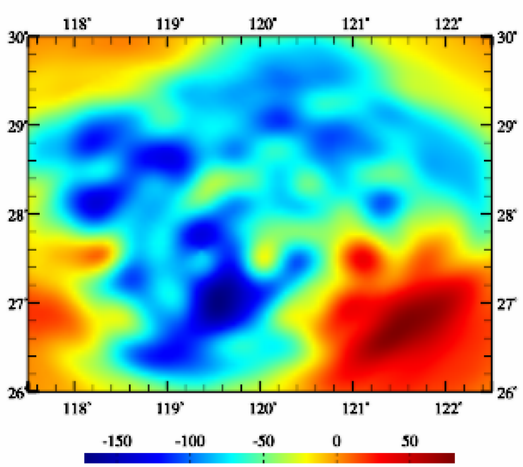
Cumulative SRBF approach times 1 | Solution of normal equation LU triangular decomposi

C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFgravdist2016021512.
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFgrndtilt2016021512.
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFvertdefl2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFhorzdisp2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFelliphgt2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBForthohgt2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFgradient2016021512.dat

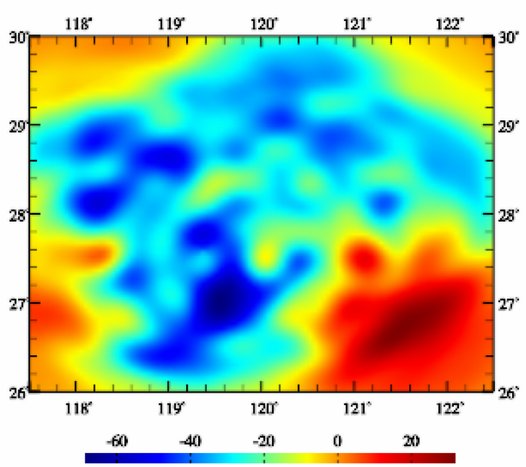
Extract the effects to be plot | Plot↓ | The monitoring epoch time 2016021512



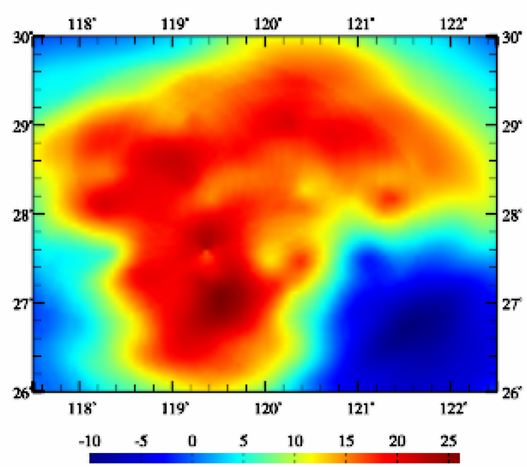
Spatial distribution of geodetic sites



Land water EWH variations (cm)



Ground gravity variations (μGal)



Orthometric height variations (mm)

Acceptable Geodetic Variation Types: (1) Height Anomaly Variation (mm) - Derived from GNSS-leveling networks; (2) Gravity Disturbance Variation (μGal) - Derived from GNSS-gravity networks or CORS-gravity tide stations; (3) Ground Gravity Variation (μGal) - Derived from absolute or relative gravity monitoring networks; (4) Ellipsoidal Height Variation (mm) - Derived from CORS or GNSS monitoring networks; (5) Normal/Orthometric Height Variation (mm) - Derived from precision leveling networks; or (6) Equivalent Water Height (EWH) Variation (cm) - Derived from hydrological monitoring stations.

The optimization principles aim to produce spatially continuous and differentiable EWH variation fields while minimizing the standard deviation and driving the statistical mean toward zero for residual observation variations.

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations

SRBF Approximation of EWH Variation and Load Effect Time Series from Heterogeneous Variations

SRBF Approximation of Land Water Variations and Load Effects from Heterogeneous Variations | SRBF Approximation of EWH Variation and Load Effect Time Series from Heterogeneous Variations | Regional Approximation of Load Deformation Field from heterogeneous variations using SRBFs

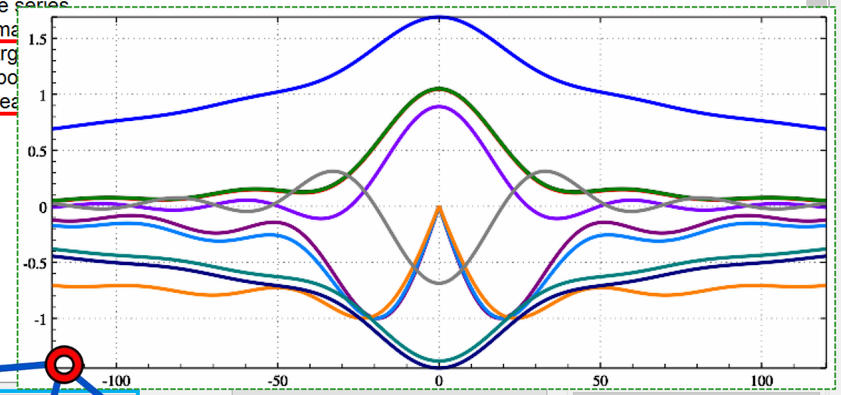
Open the geodetic variation record time series file | Open the computation surface height grid file | Set the result folder | Save program process as

Column ordinal number of the first epoch time in header: 2
Column ordinal number of the first variation in record: 8
The column ordinal number of the observation weights in record: 5
The column ordinal number of the variation type in record: 6
The column ordinal number of the system weights in record: 7
Average Station Spacing: 5.0 km

Parameters of the first SRBF appoach
- Select SRBF: radial multipole kernel
- order number m: 0
- minimum degree: 9
- maximum degree: 900
- burial depth of Bjerhammar sphere: 1.00km
- SRBF Center Action Distance: 120km

Parameters of cumulative SRBF appoach
- Select SRBF: Poisson wavelet kernel
- order number m: 0
- minimum degree: 720
- maximum degree: 1800
- burial depth of Bjerhammar sphere: 5.00km
- SRBF Center Action Distance: 60km

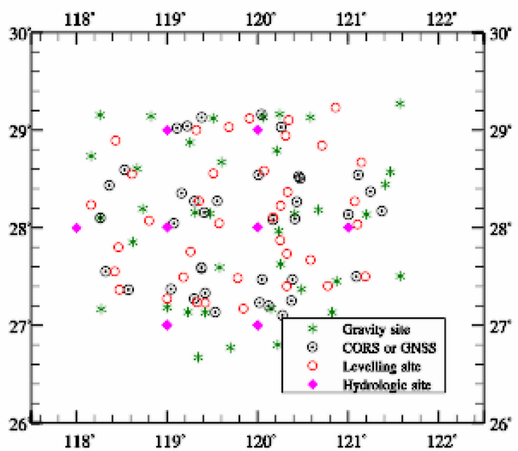
>> [Function] Utilizing time-series of heterogeneous ground-based observable variations, this function computes the time series of grids for terrestrial EWH variation (cm) and associated load effects on the 10 geodetic elements: Height anomaly (geoid, mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, mas), vertical deflection (SW, mas), horizontal displacement (EN, mm), geodetic height (mm), normal height (mm), gravity disturbance gradient (mE), and horizontal gravity gradient (NW, E) using SRBF load deformation field approximation algorithm.
>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/heterobstm.txt。
** Look at the file information in the window below and set the file parameters of the record time series.
>> Open the computation surface height grid file C:/ETideLoad4.5_win64en/examples/Loadestima
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/htrg
** The program generates the estimated terrestrial EWH variation grid files ewh****.dat, correspo
sampling epoch time which is also saved as the last column attribute of the load effect grid file hea
** All-Element Load Effect Grids:
SRBFgeoid***.dat: Height anomaly / Geoid variation (mm)
SRBFterrgrav***.dat: Ground gravity variation (μGal)
SRBFgravdist***.dat: Gravity disturbance variation (μGal)
SRBFgrndtilt***.dat: Ground tilt variation vector (SW, mas)
SRBFvertdefl***.dat: Vertical deflection variation vector (SW, mas)
SRBFhorzdisp***.dat: Horizontal displacement vector (EN, mm)
SRBFelliphgt***.dat: Ellipsoidal height variation (mm)
SRBForthohgt***.dat: Normal height variation (mm)
SRBFgradient***.dat: Radial gravity gradient variation (mE)
SRBFhorzgrad***.dat: Horizontal gravity gradient vector (NW, mE



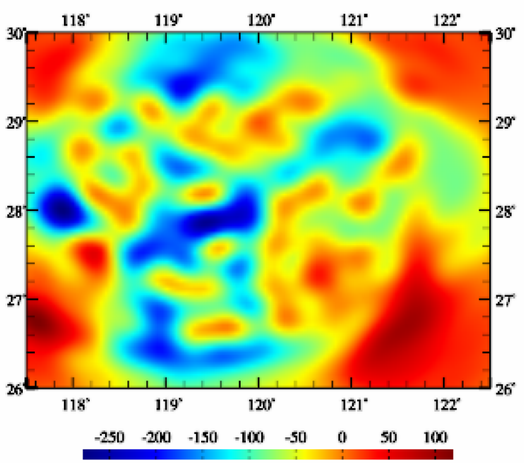
Cumulative SRBF approach times: 1 | Solution of normal equation: LU triangular decomposition | Import setting parameters | Start Computation

C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/htrgrs\SRBFgrndtilt2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/htrgrs\SRBFvertdefl2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/htrgrs\SRBF[illegible]2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/htrgrs\SRBFe[illegible]2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/htrgrs\SRBForthoh[illegible]2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/htrgrs\SRBFradial[illegible]2016021512.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/htrgrs\SRBFhorzgr[illegible]2016021512.dat

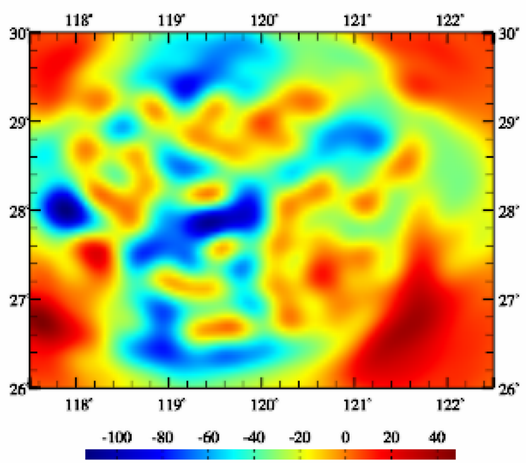
Extract the effects to be plot | Plot↓ | The monitoring epoch time 2016021512



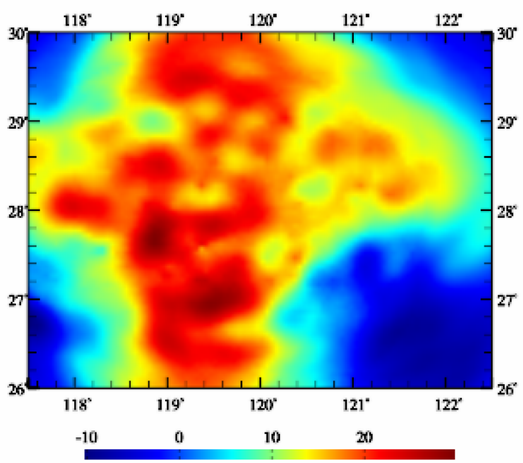
Spatial distribution of geodetic sites



Land water EWH variations (cm)



Ground gravity variations (μGal)



Orthometric height variations (mm)

Acceptable Geodetic Variation Types: (1) Height Anomaly Variation (mm) - Derived from GNSS-leveling networks; (2) Gravity Disturbance Variation (μGal) - Derived from GNSS-gravity networks or CORS-gravity tide stations; (3) Ground Gravity Variation (μGal) - Derived from absolute or relative gravity monitoring networks; (4) Ellipsoidal Height Variation (mm) - Derived from CORS or GNSS monitoring networks; (5) Normal/Orthometric Height Variation (mm) - Derived from precision leveling networks; or (6) Equivalent Water Height (EWH) Variation (cm) - Derived from hydrological monitoring stations.

The optimization principles aim to produce spatially continuous and differentiable EWH variation fields while minimizing the standard deviation and driving the statistical mean toward zero for residual observation variations.

Geodynamic Calculation on Geodetic Field Grid Time Series

Time Difference Operation on Variation (Vector) Grid Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Time Difference Operation on Variation (Vector) Grid Time Series

Horizontal Gradient Calculation on Batch Variation Grids

Inner Product Operation on Two Groups of Vector Grid Time Series

Open any of variation grid time series file

Set the wildcard of the grid file names

Ordinal number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 6

Vector grid time series

Set the differential time scale factor k: 7 per day

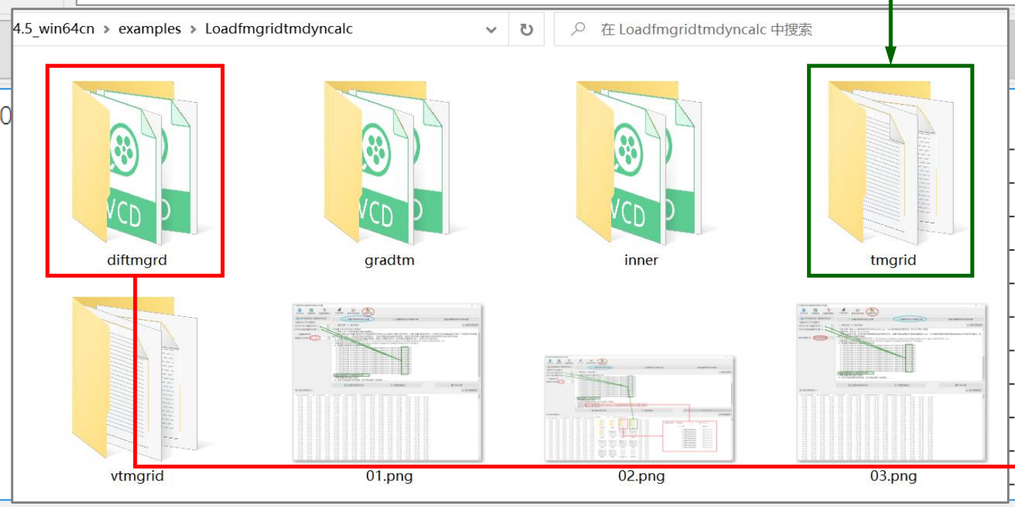
>> Program Process ** Operation Prompts

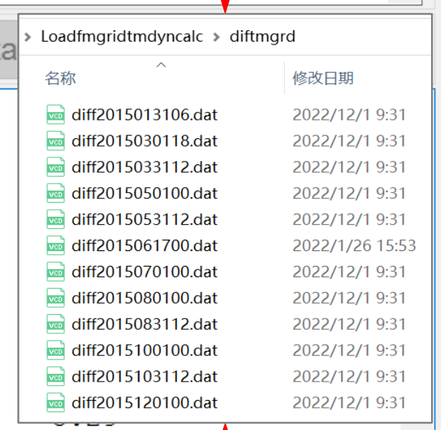
Save program process as

```
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/
diftmgrd.
  ** The vector grid time series files searched by wildcard instantiation:
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201501.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201502.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201503.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201504.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201505.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201506.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201507.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201508.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201509.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201510.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201511.txt
    C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmzl201512.txt
>> There are 12 grid time series files searched by wildcard instantiation.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-26 09:27:03
>> Complete the computation! There are 11 variation rate grid time series files diff***.dat. *** represents the sampling epoch time of the variation rate grid file, and is also 7th atrribute of the file header.
```

Save the result folder

118.50000000	121.50000000	27.00000000	29.0		
-9.27	-9.27	-9.25	-9.24	-9.24	-9.24
-9.12	-9.11	-9.10	-9.10	-9.09	-9.08
-9.02	-9.02	-9.01	-9.00	-9.01	-9.02
-9.08	-9.10	-9.10	-9.11	-9.12	-9.14
-9.21	-9.21	-9.23	-9.21	-9.21	-9.20
-8.99	-8.96	-8.92	-8.90	-8.85	-8.82
-8.26	-8.17	-8.13	-8.06	-7.99	-7.91
-7.14	-7.08	-6.99	-6.89	-6.82	-6.75
-6.00	-5.94	-5.88	-5.82	-5.77	-5.71
-5.24	-5.22	-5.17	-5.15	-5.13	-5.10
-4.92	-4.90	-4.89	-4.89	-4.88	-4.88





Geodynamic Calculation on Geodetic Field Grid Time Series

Horizontal Gradient Calculation on Batch Variation Grids

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Time Difference Operation on Variation (Vector) Grid Time Series

Horizontal Gradient Calculation on Batch Variation Grids

Inner Product Operation on Two Groups of Vector Grid Time Series

Open any of variation grid time series file

Set the wildcard of the grid file names

Ordinal number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 6

The form of horizontal gradient vector: Plane polar coordinates

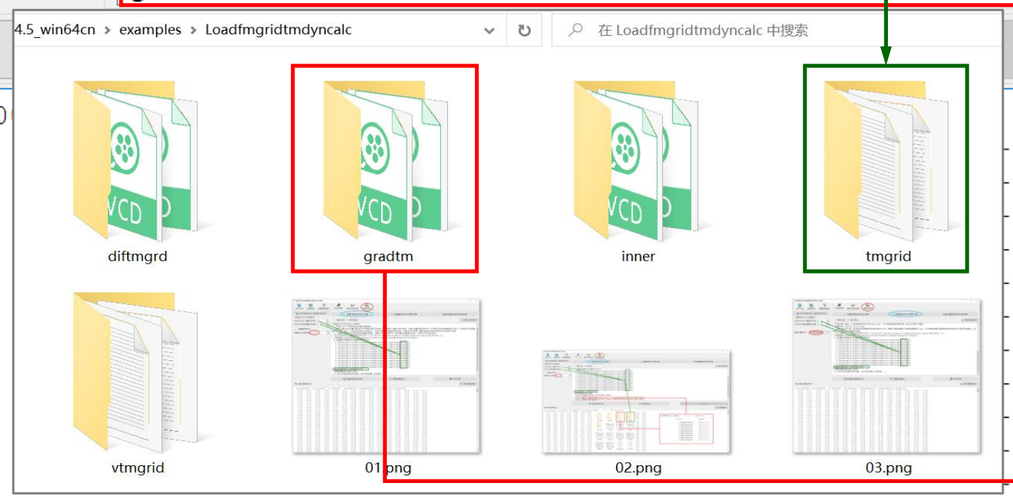
>> Program Process ** Operation Prompts

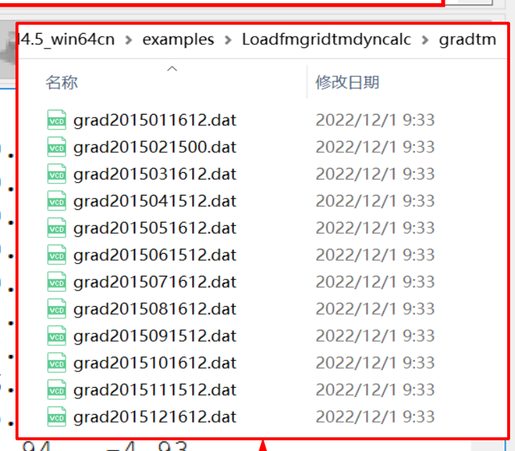
Save program process as

```
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/
gradtm.
 ** The vector grid time series files searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201501.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201502.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201503.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201504.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201505.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201506.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201507.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201508.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201509.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201510.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201511.txt
   C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/tmgrid/dmz201512.txt
>> There are 12 grid time series files searched by wildcard instantiation.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-26 09:30:06
>> Complete the computation! There are 12 variation horizontal gradient vector grid time series
files grad***.dat. *** represents the sampling epoch time of the variation horizontal gradient vector
grid file, is also 7th atrribute of the file header.
```

Save the result folder

```
 118.50000000  121.50000000   27.00000000   29.0
  -9.27   -9.27   -9.25   -9.24   -9.24   -9.24
  -9.12   -9.11   -9.10   -9.10   -9.09   -9.08
  -9.02   -9.02   -9.01   -9.00   -9.01   -9.02
  -9.08   -9.10   -9.10   -9.11   -9.12   -9.14
  -9.21   -9.21   -9.23   -9.21   -9.21   -9.20
  -8.99   -8.96   -8.92   -8.90   -8.85   -8.82
  -8.26   -8.17   -8.13   -8.06   -7.99   -7.91
  -7.14   -7.08   -6.99   -6.89   -6.82   -6.75
  -6.00   -5.94   -5.88   -5.82   -5.77   -5.71
  -5.24   -5.22   -5.17   -5.15   -5.13   -5.10
  -4.92   -4.90   -4.89   -4.89   -4.88   -4.88
```





Geodynamic Calculation on Geodetic Field Grid Time Series

Inner Product Operation on Two Groups of Vector Grid Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Time Difference Operation on Variation (Vector) Grid Time Series

Horizontal Gradient Calculation on Batch Variation Grids

Inner Product Operation on Two Groups of Vector Grid Time Series

Open any of the group 1 of vector grid time series file

Set the wildcard of the grid file names

Ordinal number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 10

The form of horizontal gradient vector: Plane polar coordinates

Open any of the group 2 of vector grid time series file

Set the wildcard of the grid file names

Ordinal number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 10

One stationary vector grid file

>> Program Process ** Operation Prompts

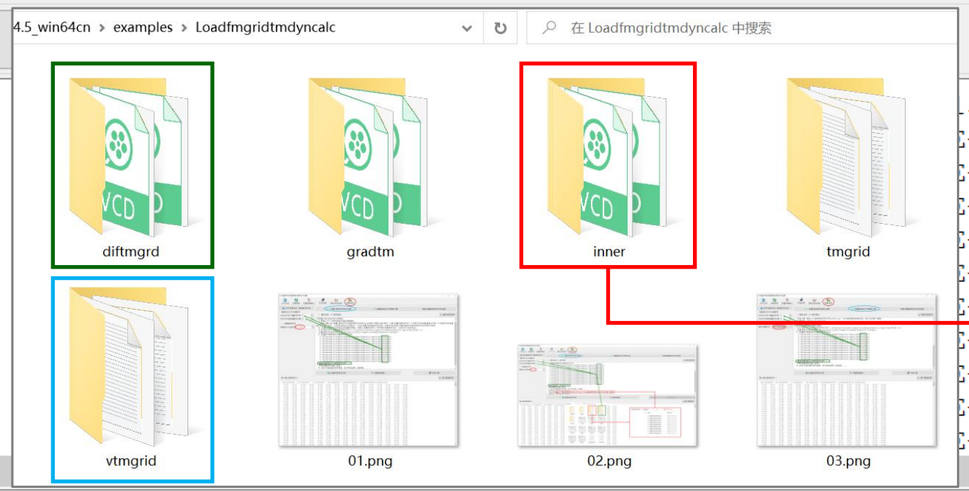
Save program process as

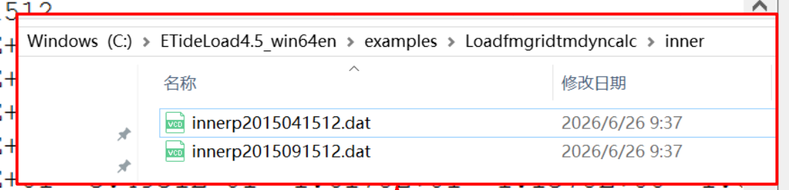
```
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/gradtm/grad2015021500.dat
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/gradtm/grad2015031612.dat
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/gradtm/grad2015041512.dat
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/gradtm/grad2015051612.dat
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/gradtm/grad2015061512.dat
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C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/gradtm/grad2015091512.dat
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/gradtm/grad2015101612.dat
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/gradtm/grad2015111512.dat
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/gradtm/grad2015121612.dat
>> There are 12 grid time series files searched by wildcard instantiation.
 ** The vector grid time series files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/vtmgrid/cxpcbhl2015041512.txt
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/vtmgrid/cxpcbhl2015091512.txt
>> There are 2 vector grid time series files searched by wildcard instantiation.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-26 09:37:49
>> Complete the computation! There are 2 vector inner product grid time series files innerp***.dat.
***  represents the sampling epoch time of the vector inner product grid file, is also 7th atrribute of the file header.
```

Save the result folder

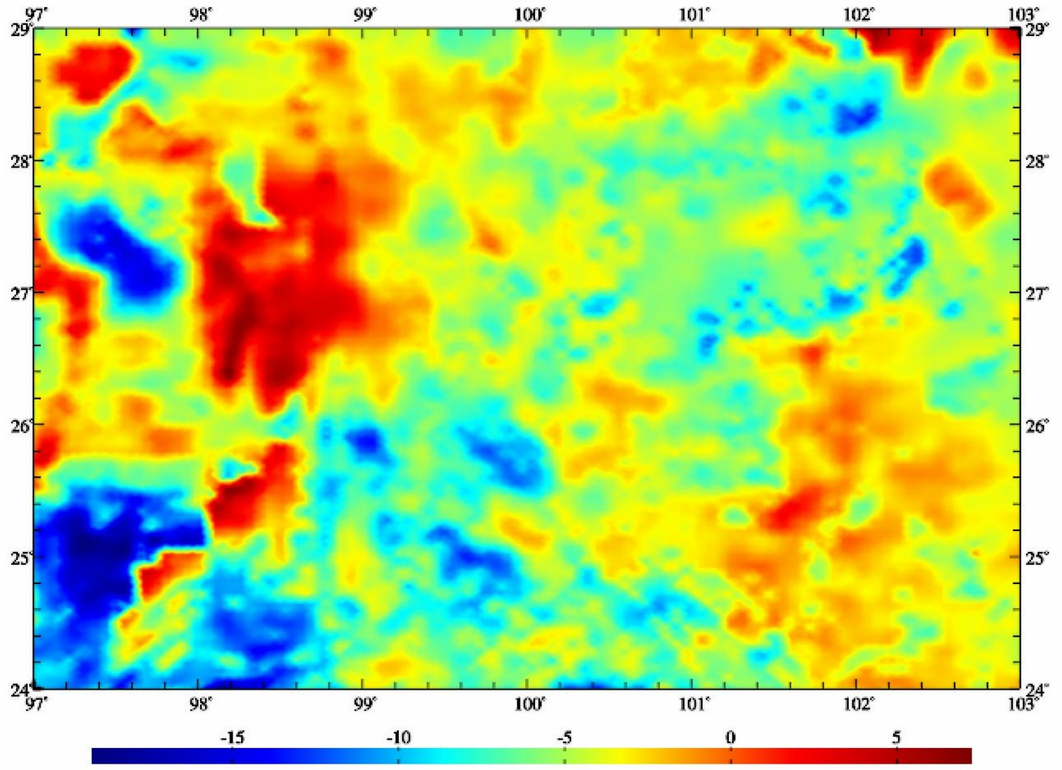
Start computation

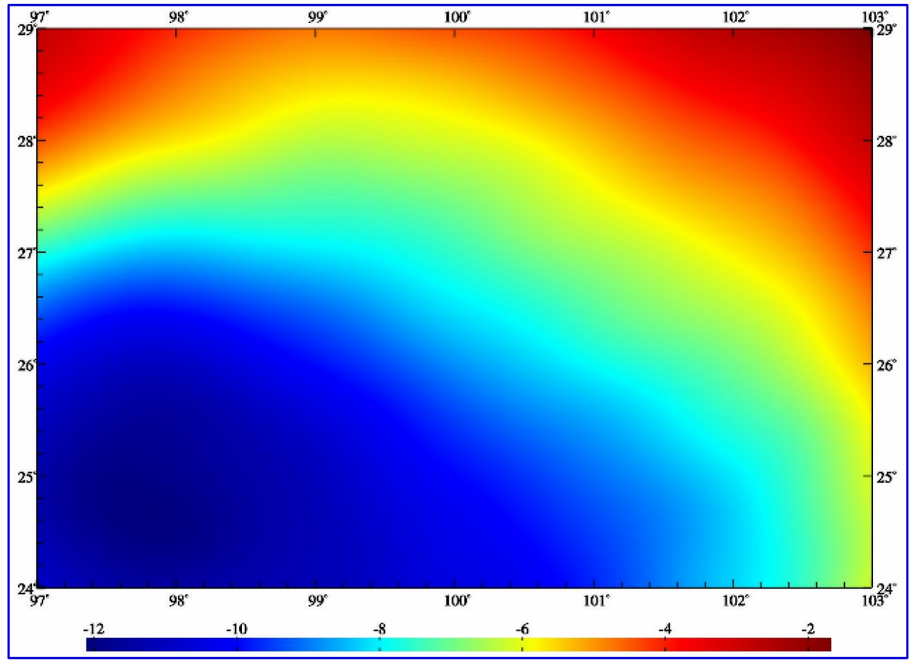
```
 118.500000   121.500000    27.000000
 2.9881E+01   1.5869E+01   2.9432E+01
 1.0200E+01   2.5320E+01   9.2817E+00
 1.9262E+01   2.2855E+00   1.8523E+01
-5.7087E+00   1.0968E+01  -6.8365E+00
 3.2636E+00  -1.3444E+01   2.5051E+00
-1.7935E+01  -3.5131E+00  -1.8074E+01
-7.1160E+00  -2.0679E+01  -7.4254E+00
-2.2336E+01  -1.0459E+01  -2.2765E+01
-1.2615E+01  -2.4651E+01  -1.2905E+01
-2.4452E+01  -1.4911E+01  -2.4382E+01
```



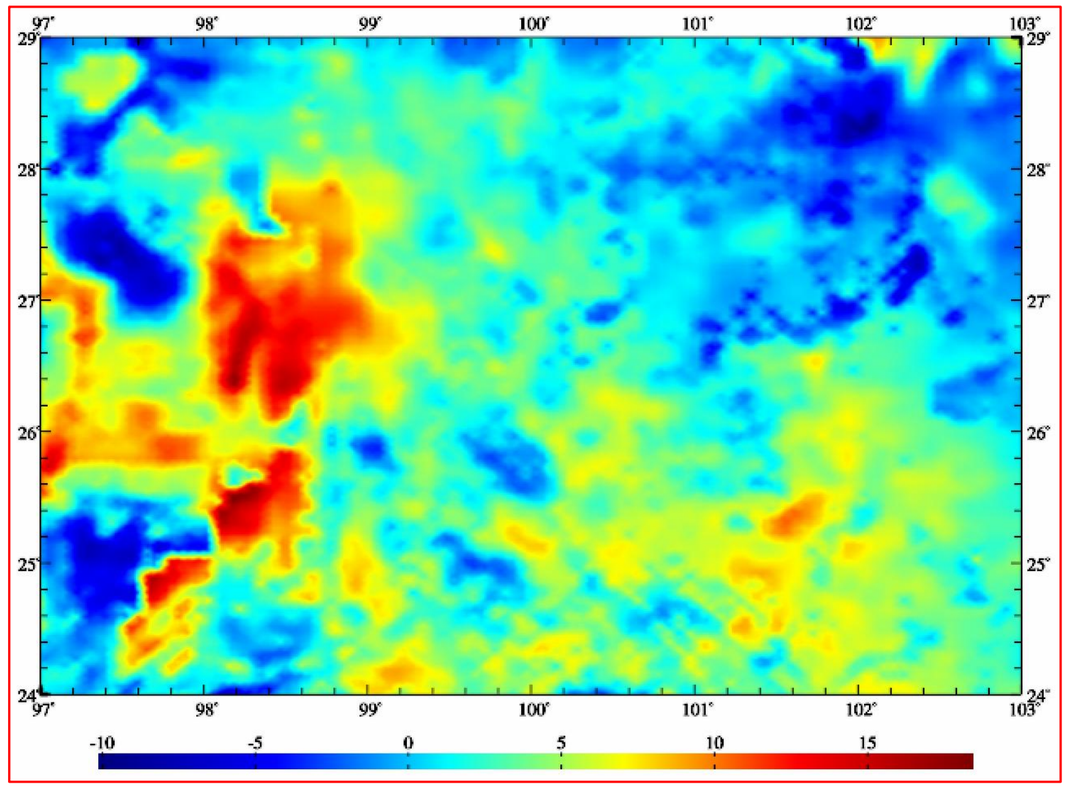


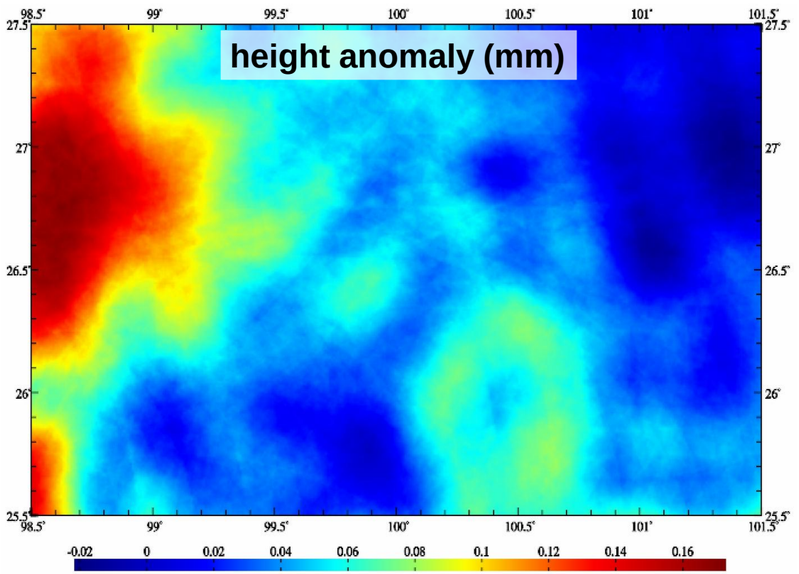

```
+00  -1.9611E+01  -5.7886E+00  -1.9851E+01  -6.0
+01  -8.8226E+00  -2.1657E+01  -9.1320E+00  -2.2
+01  -2.3803E+01  -1.1288E+01  -2.3693E+01  -1.1
+01  -1.4531E+01  -2.4811E+01  -1.4352E+01  -2.4
+01  -2.4592E+01  -1.5290E+01  -2.4192E+01  -1.5
```

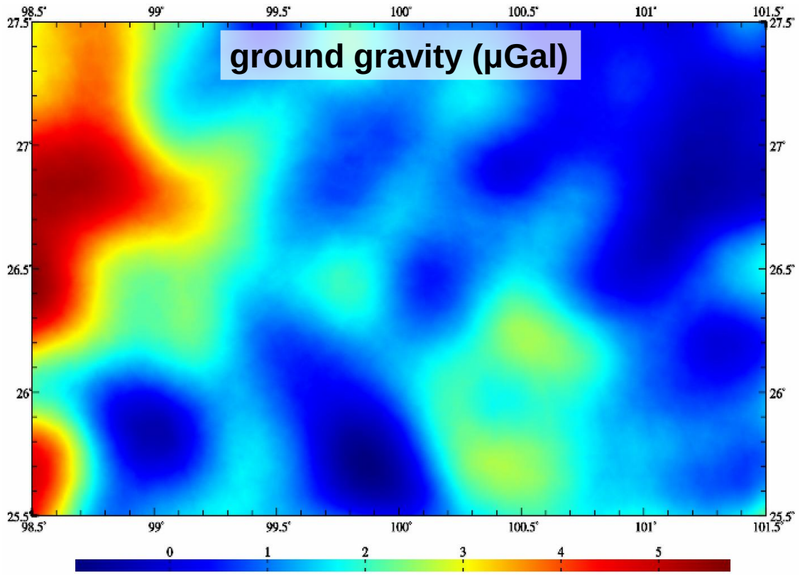


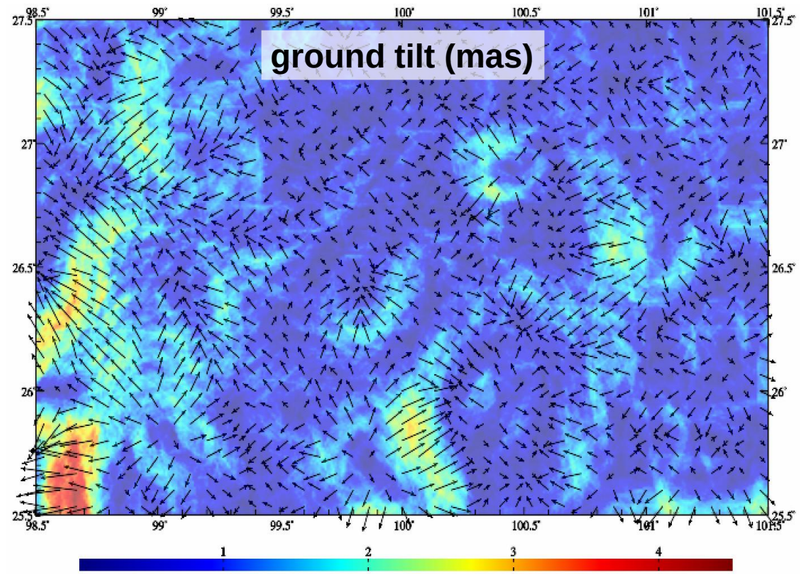


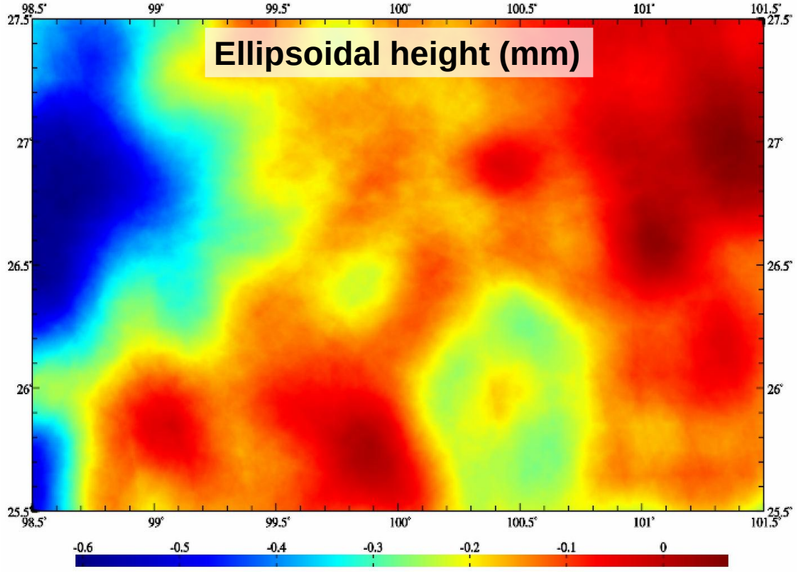
The 1′×1′ land water EWH variation observation, model value and residual grid in the computation area

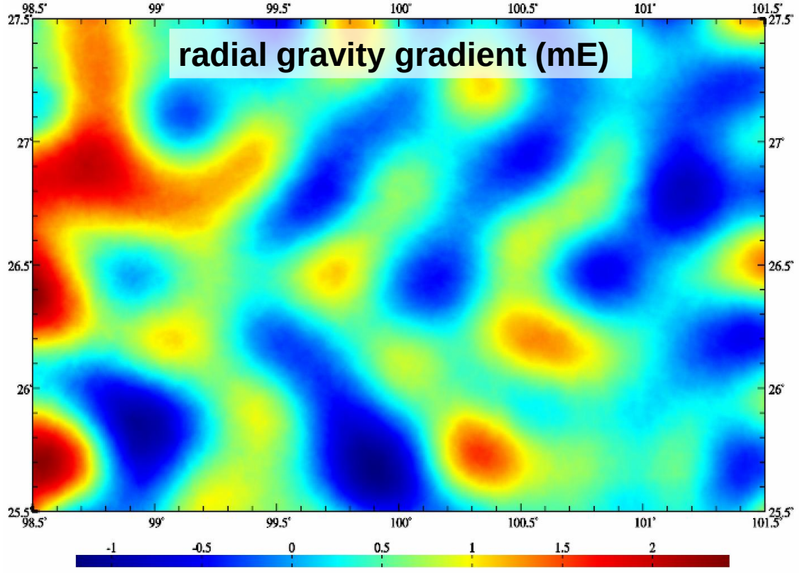


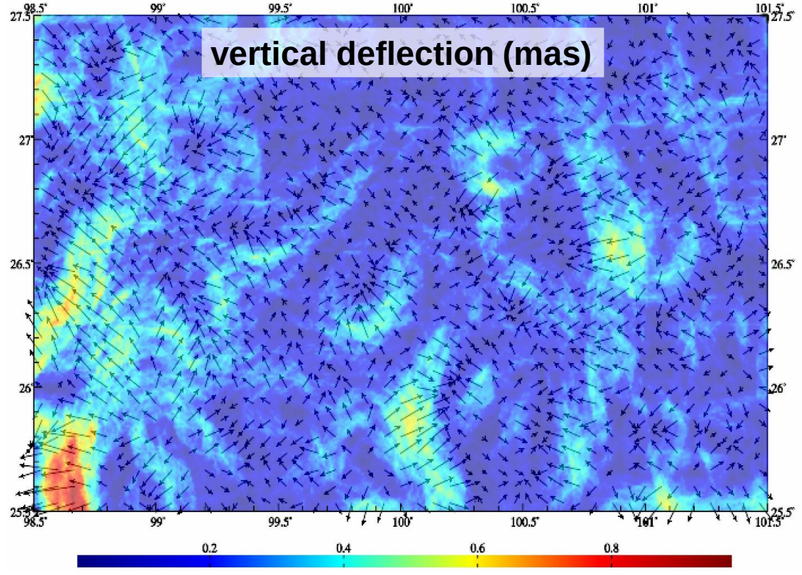




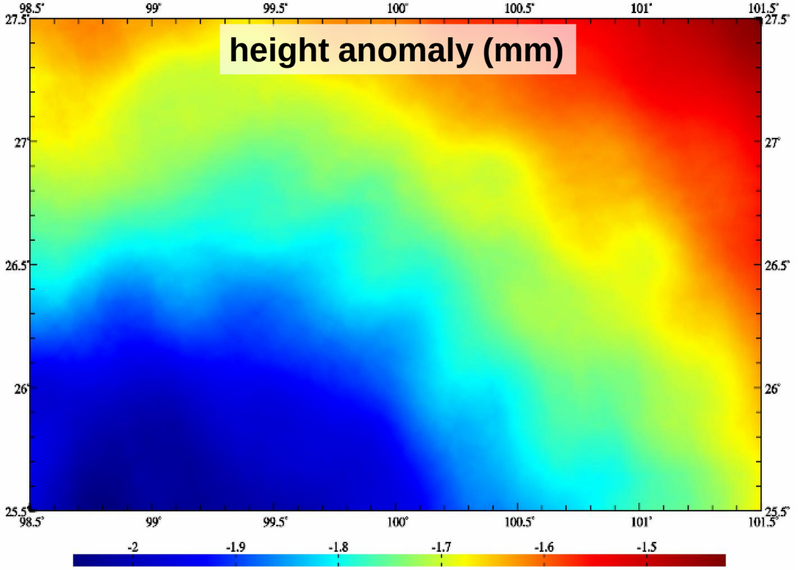


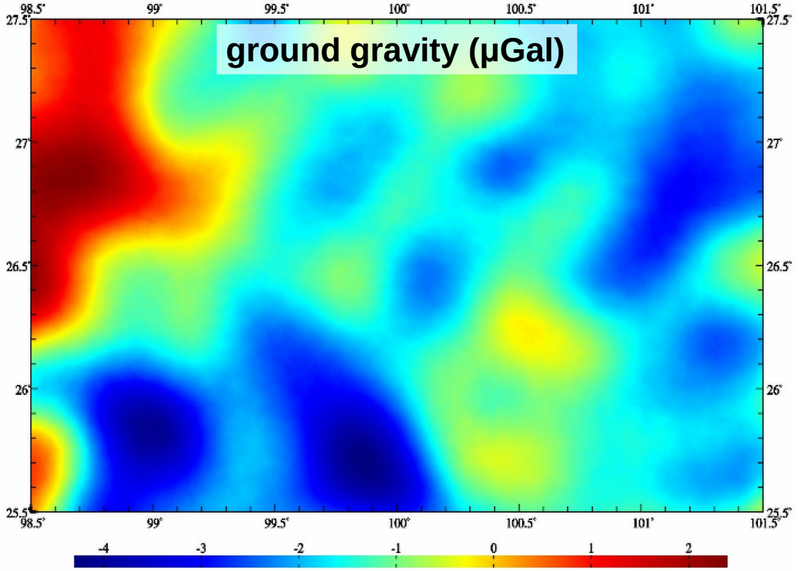


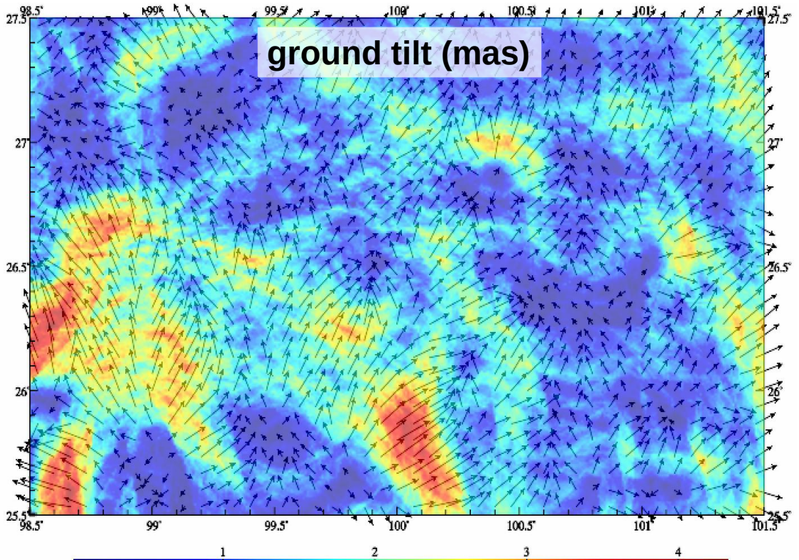


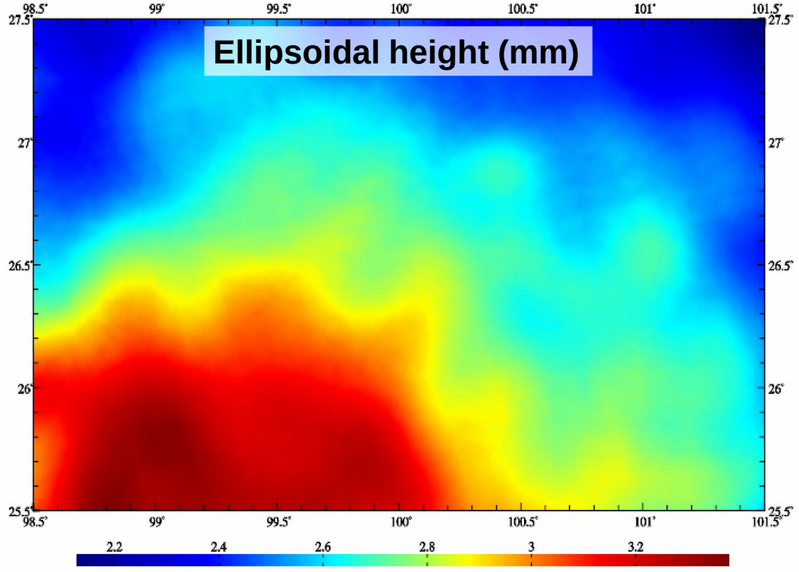


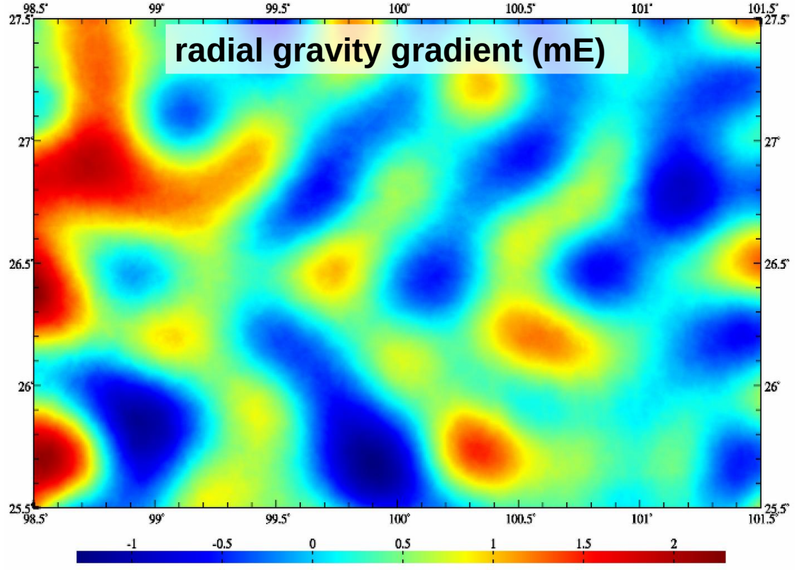
The 1′×1′ land water load deformation field residual value grid using load SRBF approximation

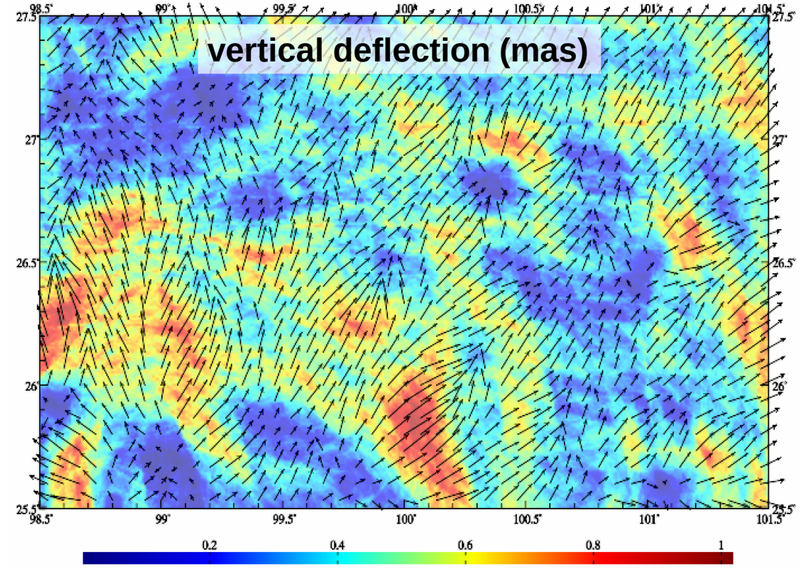




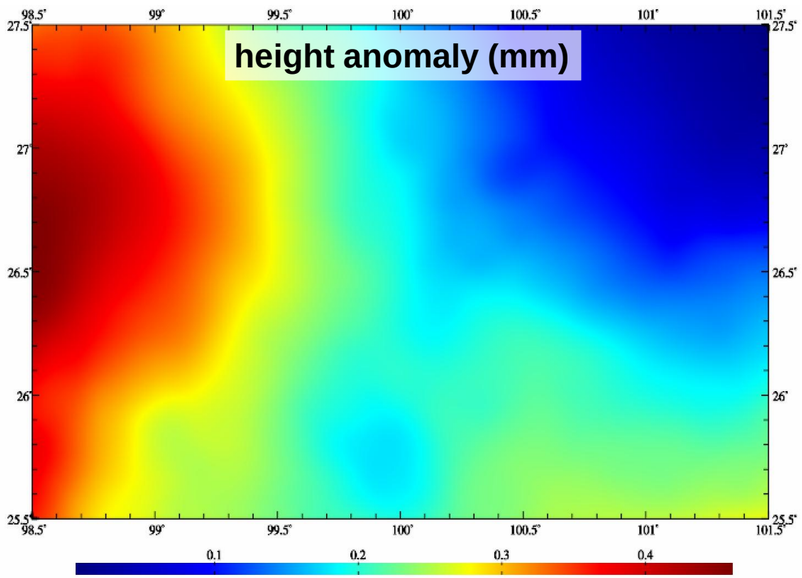


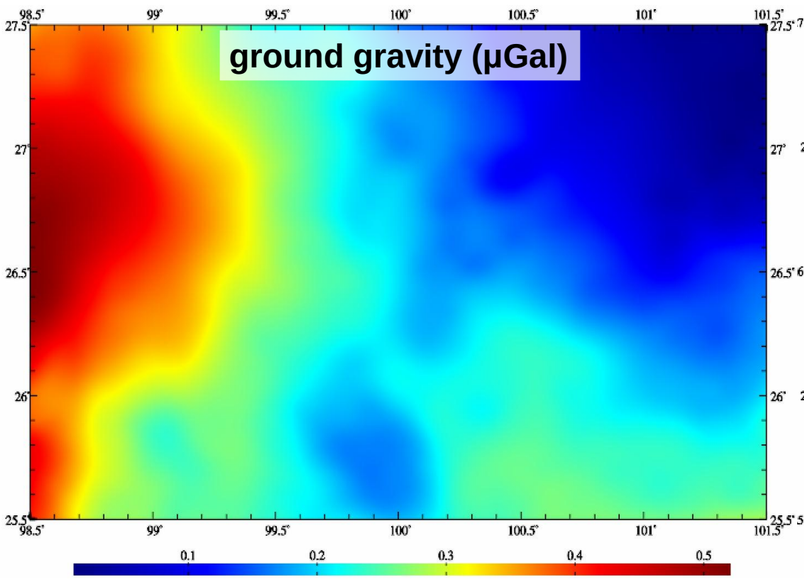


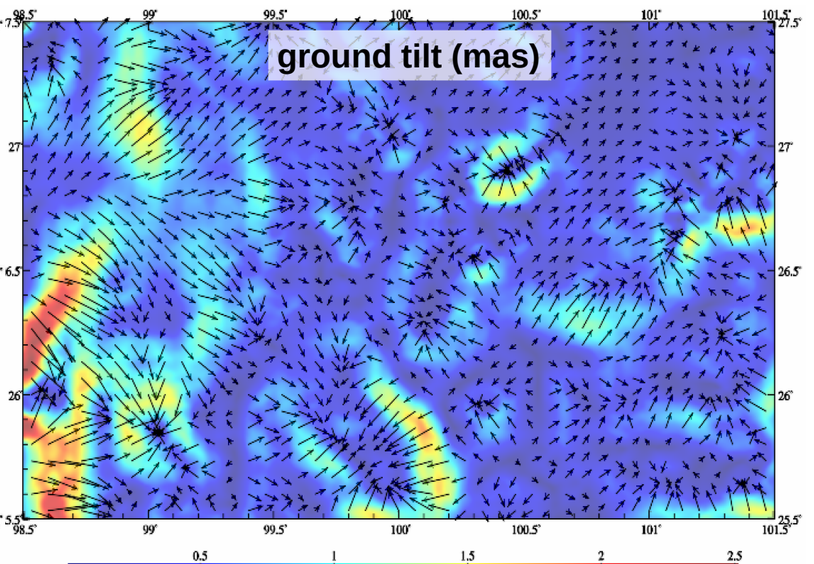


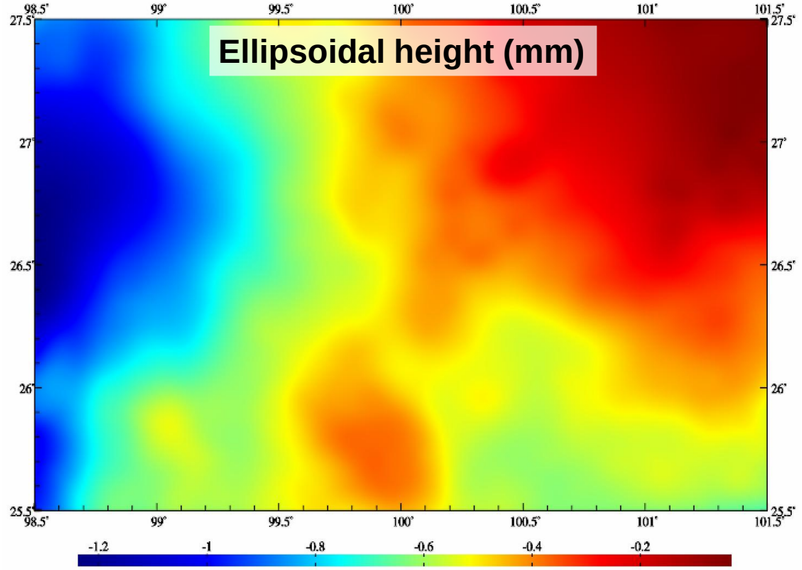


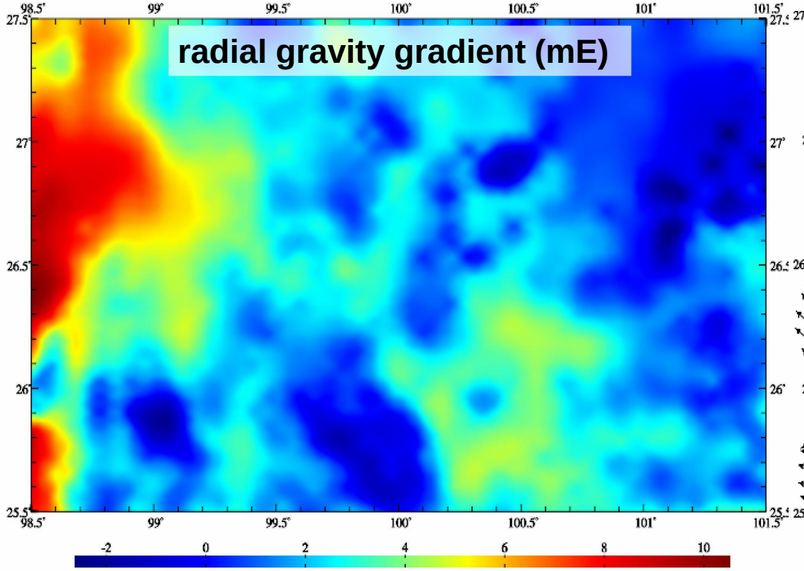
The 1′×1′ land water variation load deformation field grid refined using SRBFs in the result area

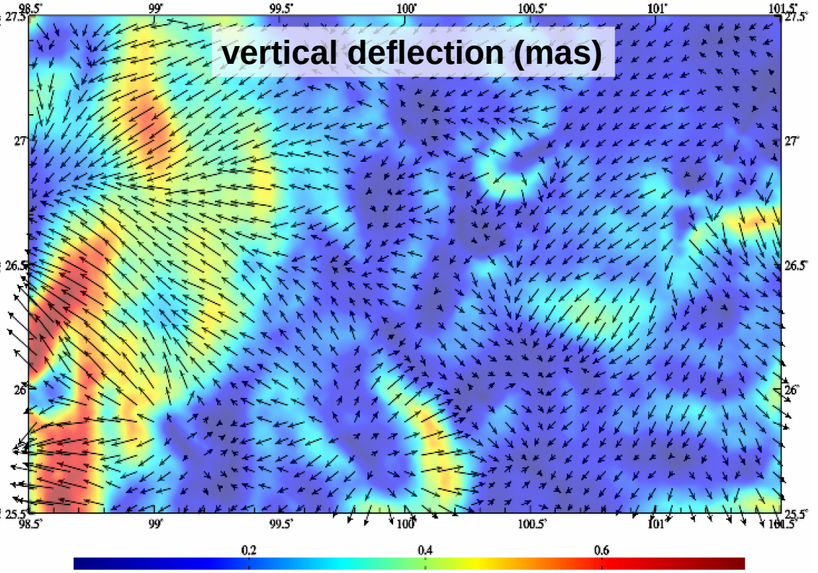






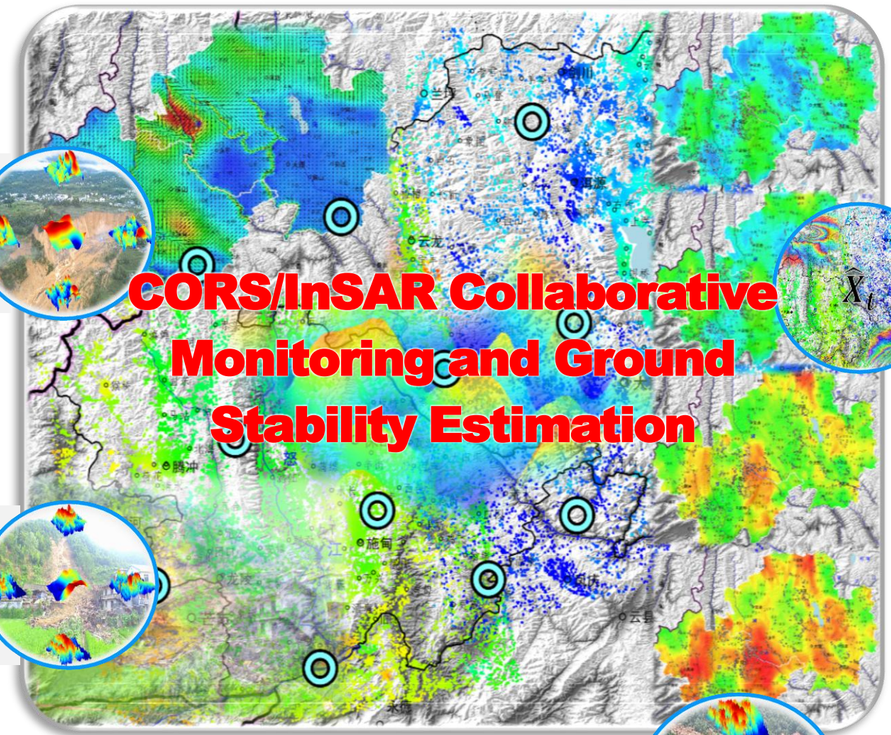




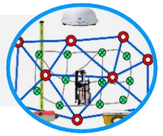


The 1′×1′ land water load deformation field residual value grid using load Green’s integral in the result area

CORS/InSAR Collaborative Monitoring and Ground Stability Estimation



Pseudo-Stable Adjustment of Variation Record Time Series for Geodetic Monitoring Network

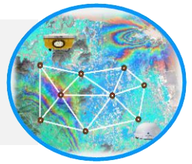


Unification of Reference Epoch for Variation Record Time Series

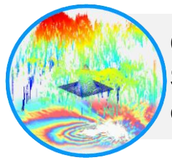
Compatibility Analysis on InSAR Vertical Deformation Using CORS Network

InSAR Variation Time Series Adjustment with Spatio-temporal Frame Constraints

Collaborative Monitoring and Processing of InSAR with CORS Network



Gross Error Detection and Spatial Deformation Analysis on InSAR Variations



Gross Error Detection and Separation on InSAR Variation Record Time Series

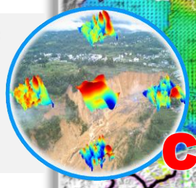
Analysis and Processing of Relative Spatial Deformation on InSAR Variations

Construction of High-Resolution Grid Time Series from Record Time Series

Estimation of Normalized Ground Stability Variation Grid from Vertical Deformation

Estimation of Ground Stability Variation Grid Time Series from Vertical Deformation

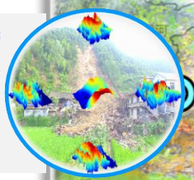
Computation of Ground Stability Variation Based on Vertical Deformation



Estimation of Normalized Ground Stability Variation Grid from Gravity Variations

Estimation of Ground Stability Variation Grid Time Series from Gravity Variations

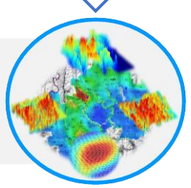
Computation of Ground Stability Variation Based on Gravity Variations



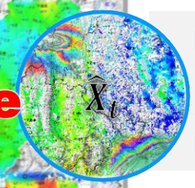
Estimation of Normalized Ground Stability Variation Grid from Variation Vectors

Estimation of Ground Stability Variation Grid Time Series from Variation Vectors

Computation of Ground Stability Variation Based on Variation Vectors



Deep Fusion and Time Series Analysis on Multi-Source InSAR Variations



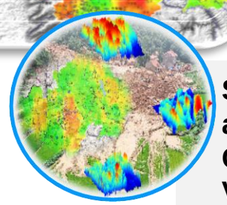
Long-Time Connection for Two Same-Track InSAR Variation Time Series

Seamless Spatial Fusion on Multi-Source InSAR Variations

Analysis and Filtering on Variation Record Time Series

Reconstruction of Time Series with Given Sampling Specifications

Statistical Synthesis and Prediction of Ground Stability Variations



Optimized Synthesis of Two Geodetic Variation Grid Time Series

Optimized Synthesis of Three Stability Variation Grid Time Series

Spatiotemporal Characteristics Synthesis of Ground Stability Variations

Pseudo-Stable Adjustment of Variation Record Time Series for Geodetic Monitoring Network

TsqavrbslnU.txt

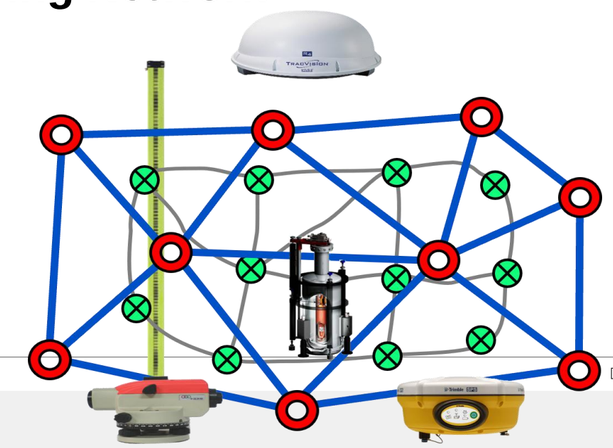
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1	9	0	36						
2	CANN_DONT	120.4247	27.5226	0.00	121.1503	27.8346	0.00	6.4092	3.5311
3	CANN_FDIQ	120.4247	27.5226	0.00	120.2073	27.3353	0.00	7.5566	9999.0000
4	CANN_JHYW	120.4247	27.5226	0.00	120.0784	29.2727	0.00	3.3886	1.7941
5	CANN_JINH	120.4247	27.5226	0.00	119.6426	29.2178	0.00	2.8530	-0.7712
6	CANN_JINX	120.4247	27.5226	0.00	119.3792	29.0709	0.00	4.3333	1.6376
7	CANN_JNJZ	120.4247	27.5226	0.00	119.6375	27.9764	0.00	4.9006	3.1138
8	CANN_JSAN	120.4247	27.5226	0.00	118.6086	28.7279	0.00	2.5860	0.7616
9	CANN_LHAI	120.4247	27.5226	0.00	121.1895	28.9059	0.00	1.0756	-1.6069
10	CANN_LISH	120.4247	27.5226	0.00	119.9295	28.4613	0.00	13.8711	10.5885
11	CANN_LONQ	120.4247	27.5226	0.00	119.1331	28.0807	0.00	7.3816	6.1923
12	CANN_LUOY	120.4247	27.5226	0.00	119.7051	27.5525	0.00	8.8132	9.4984
13	CANN_PANA	120.4247	27.5226	0.00	120.4367	29.0542	0.00	0.2485	-2.0512
14	CANN_PCHQ	120.4247	27.5226	0.00	118.5422	27.9232	0.00	5.5253	5.7473
15	CANN_PCJM	120.4247	27.5226	0.00	118.4454	28.1680	0.00	14.2248	12.7588
16	CANN_QINT	120.4247	27.5226	0.00	120.2900	28.1394	0.00	7.1517	4.5782
17	CANN_QIYU	120.4247	27.5226	0.00	119.0793	27.6213	0.00	7.1481	6.6956
18	CANN_QNYN	120.4247	27.5226	0.00	118.9638	27.6157	0.00	10.9311	7.9043
19	CANN_QUZH	120.4247	27.5226	0.00	118.8908	28.9937	0.00	8.1029	5.9283
20	CANN_QZLY	120.4247	27.5226	0.00	119.1858	29.0336	0.00	7.1312	6.3296
21	CANN_RUIA	120.4247	27.5226	0.00	120.6490	27.7833	0.00	8.9624	7.8483
22	CANN_SHNQ	120.4247	27.5226	0.00	119.5028	27.4576	0.00	4.8563	4.6628
23	CANN_SNYN	120.4247	27.5226	0.00	119.5093	28.4546	0.00	3.3183	3.1267
24	CANN_SUIC	120.4247	27.5226	0.00	119.2693	28.5951	0.00	14.7246	7.6386
25	CANN_TAIZ	120.4247	27.5226	0.00	121.4164	28.6183	0.00	4.0291	3.2741
26	CANN_WENC	120.4247	27.5226	0.00	120.0835	27.7858	0.00	-2.9619	-0.9569
27	CANN_XIAG	120.4247	27.5226	0.00	120.4650	27.1764	0.00	1.1792	0.4462
28	CANN_XNJU	120.4247	27.5226	0.00	120.7658	28.8831	0.00	3.0625	-0.4524
29	CANN_YANT	120.4247	27.5226	0.00	120.7250	28.4496	0.00	2.5296	0.5738
30	CANN_YAYA	120.4247	27.5226	0.00	120.0425	27.3930	0.00	7.9037	5.6073
31	CANN_YONK	120.4247	27.5226	0.00	120.0168	28.9055	0.00	7.4736	5.0929
32	CANN_YUEQ	120.4247	27.5226	0.00	121.0090	28.2307	0.00	3.7159	1.9628
33	CANN_ZJCN	120.4247	27.5226	0.00	120.6275	27.4249	0.00	4.4332	4.1584
34	CANN_ZJWL	120.4247	27.5226	0.00	121.6237	28.2856	0.00	1.6628	-0.6594
35	CANN_ZJXJ	120.4247	27.5226	0.00	120.7856	28.8488	0.00	1.5278	0.7529
36	CANN_ZJYH	120.4247	27.5226	0.00	119.6900	28.2660	0.00	5.6225	4.3857
37	DONT_FDIQ	121.1503	27.8346	0.00	120.2073	27.3353	0.00	-3.7345	9999.0000
38	DONT_JHYW	121.1503	27.8346	0.00	120.0784	29.2727	0.00	-3.1021	-1.8150
39	DONT_JINH	121.1503	27.8346	0.00	119.6426	29.2178	0.00	-4.1842	-1.8144
40	DONT_JINX	121.1503	27.8346	0.00	119.3792	29.0709	0.00	-2.0828	-1.9477
41	DONT_JNJZ	121.1503	27.8346	0.00	119.6375	27.9764	0.00	-1.6654	-0.6237
42	DONT_JSAN	121.1503	27.8346	0.00	118.6086	28.7279	0.00	-3.8995	-2.8540
43	DONT_LHAI	121.1503	27.8346	0.00	121.1895	28.9059	0.00	-5.4796	-5.3385
44	DONT_LISH	121.1503	27.8346	0.00	119.9295	28.4613	0.00	7.5170	6.7829
45	DONT_LONQ	121.1503	27.8346	0.00	119.1331	28.0807	0.00	1.7453	3.4051
46	DONT_LUOY	121.1503	27.8346	0.00	119.7051	27.5525	0.00	2.6363	6.2274
47	DONT_PANA	121.1503	27.8346	0.00	120.4367	29.0542	0.00	-8.1587	-7.4056
48	DONT_PCHQ	121.1503	27.8346	0.00	118.5422	27.9232	0.00	-1.1075	1.9696
49	DONT_PCJM	121.1503	27.8346	0.00	118.4454	28.1680	0.00	7.6772	8.6501
50	DONT_QINT	121.1503	27.8346	0.00	120.2900	28.1394	0.00	0.6890	0.9478
51	DONT_QIYU	121.1503	27.8346	0.00	119.0793	27.6213	0.00	0.6131	2.9869
52	DONT_QNYN	121.1503	27.8346	0.00	118.9638	27.6157	0.00	4.3550	4.1570
53	DONT_QUZH	121.1503	27.8346	0.00	118.8908	28.9937	0.00	1.5898	2.2832
54	DONT_QZLY	121.1503	27.8346	0.00	119.1858	29.0336	0.00	0.7082	2.7859
55	DONT_RUIA	121.1503	27.8346	0.00	120.6490	27.7833	0.00	2.2714	1.3105
56	DONT_SHNQ	121.1503	27.8346	0.00	119.5028	27.4576	0.00	-1.6359	1.0906
57	DONT_SNYN	121.1503	27.8346	0.00	119.5093	28.4546	0.00	-3.2470	-0.5742
58	DONT_SUIC	121.1503	27.8346	0.00	119.2693	28.5951	0.00	7.2791	9.5466
59	DONT_TAIZ	121.1503	27.8346	0.00	121.4164	28.6183	0.00	-2.4877	-0.3965
60	DONT_WENC	121.1503	27.8346	0.00	120.0835	27.7858	0.00	-9.1810	-15.4472

The observed variation record time series of geodetic network

TsqavrbslnU.txt | TsqavrRowU.txt

						2015011612	2015021500	2015031612	2015041600	2015
1	4	0	36							
2	JINH	119.6426	29.2178	1191.60	1.0	1.0000	9.3944	3.7319	0.4720	
3	JINX	119.3792	29.0709	84.79	1.0	-4.3724	1.6001	6.6220	0.8372	
4	JNJZ	119.6375	27.9764	286.78	1.0	-4.1680	3.2284	3.1467	-0.4777	
5	JSAN	118.6086	28.7279	71.54	1.0	4.8394	10.8248	7.4036	2.4828	
6	LISH	119.9295	28.4613	71.54	1.0	4.8394	10.8248	7.4036	2.4828	
7	LONQ	119.1331	28.0807	233.28	1.0	-4.9987	3.4121	3.3682	-2.0458	
8	QIYU	119.0793	27.6213	412.75	1.0	-2.9713	5.7773	7.2012	1.1874	
9	QNYN	118.9638	27.6157	429.39	1.0	0.7446	7.2540	6.9323	0.2500	
10	QUZH	118.8908	28.9937	90.79	1.0	-1.0815	5.9656	5.1221	-1.1572	
11	QZLY	119.1858	29.0336	73.91	1.0	-1.3703	6.4829	8.4987	1.9209	
12	SHNQ	119.5028	27.4576	827.01	1.0	-6.5350	3.4134	3.8402	1.0473	
13	SNYN	119.5093	28.4546	182.77	1.0	-5.6627	5.2965	4.4180	0.4287	
14	YAYA	120.0425	27.3930	555.71	1.0	-2.1462	5.1668	4.1168	0.2007	
15	YONK	120.0168	28.9055	116.22	1.0	-1.6121	4.8168	4.2168	0.2007	
16	ZJYH	119.6900	28.2660	130.05	1.0	-3.2802	4.8168	4.2168	0.2007	
17										

The reference variation record time series of reference sites



Pseudo-Stable Adjustment of Variation Record Time Series for Geodetic Monitoring Network

Open file | Save as | Import parameters | Start adjustment | Save process | Follow example

Open the observed variation record time series file of the geodetic network

Set the file format parameter

Column ordinal number of first epoch time in header: 4

Column ordinal number of starting MJD0 in header: 5

Column ordinal number of the first variation in record: 8

Open the reference variation record time series file of the reference sites

Set the file format parameter

Column ordinal number of first epoch time in header: 4

Column ordinal number of starting MJD0 in header: 5

Column ordinal number of the first variation in record: 6

Column ordinal number of the weight attribute: 5

The constraint mode of the pseudo-stable references: Weighted average with reference values

>> Program Process ** Operation Prompts

Save program process as

>> [Function] Using the variation time series of GNSS baseline components, leveling height differences, or gravity differences as observations, and a specified subset of sites as the pseudo-stable reference datum, this module estimates the adjusted variation time series for CORS site coordinates, leveling network heights, or gravity network values via the indirect least squares adjustment method.
>> This process is essential for constructing an accurate geometric and physical spatiotemporal monitoring frame characterized by regional unification, long-term stability, and high robustness.
** Note: All input variations must be strictly synchronized, sharing identical and unique reference epochs.
>> Open the observed variation record time series file of the geodetic network C:/ETideLoad4.5_win64en/examples/Tmrecordnetwkadjust/TsqavrbslnU.txt.
** Look at the input file information in the text box below, set the format parameters of the observed variation recordstime series file of the geodetic network...
>> Open the variation record time series file of the pseudo-stable reference sites C:/ETideLoad4.5_win64en/examples/Tmrecordnetwkadjust/TsqavrRowU.txt.
** Look at the input file information in the text box below, set the format parameters of the variation record time series file of the reference sites...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Tmrecordnetwkadjust/adjustment.txt.
** Header format: Derived from the reference site file header. Record format: Site name, Lon, Lat, H, Adjusted values (chronological).
>> Setting parameters have been imported into the program!
** Click the control button [Start adjustment], or the tool button [Start adjustment]....
>> Computation start time：2026-06-26 14:39:27
>> Complete the adjustment calculation!
>> The program outputs the reference site adjusted value time series file C:/ETideLoad4.5_win64en/examples/Tmrecordnetwkadjust/adjustment.dmn into the current folder.
** Generated only under 'Weighted Average with Reference Values'. Contains the adjusted values for reference sites and the final row shows the weighted average time series of the source reference values.

Save the results as | Import setting parameters | Start adjustment

TsqavrbslnU.txt | TsqavrRowU.txt | adjustment.dmn

1	4	0	36		2015011612	2015021500	2015031612	2015
2	JINH	119.6426	29.2178	0.0	1.0	-6.3819	0.8464	2.0936
3	JINX	119.3792	29.0709	0.0	1.0	-3.3125	4.1741	6.0701
4	JNJZ	119.6375	27.9764	0.0	1.0	-1.9820	5.8716	5.7523
5	JSAN	118.6086	28.7279	0.0	1.0	-2.7285	5.1591	4.8924
6	LISH	119.9295	28.4613	0.0	1.0	-0.6318	6.9864	5.8433
7	LONQ	119.1331	28.0807	0.0	1.0	-1.6417	6.8370	7.8156
8	QIYU	119.0793	27.6213	0.0	1.0	-1.4896	6.6788	4.9764
9	QNYN	118.9638	27.6157	0.0	1.0	-1.0741	6.6986	6.1344
10	QUZH	118.8908	28.9937	0.0	1.0	-1.7012	6.4466	5.8053
11	QZLY	119.1858	29.0336	0.0	1.0	-1.5597	6.0965	5.6060
12	SHNQ	119.5028	27.4576	0.0	1.0	-2.1911	6.0162	6.1685
13	SNYN	119.5093	28.4546	0.0	1.0	-2.3817	5.6305	5.3006
14	YAYA	120.0425	27.3930	0.0	1.0	-1.6528	6.2326	4.8221
15	YONK	120.0168	28.9055	0.0	1.0	-1.7719	6.1434	5.9597
16	ZJYH	119.6900	28.2660	0.0	1.0	-2.1891	5.9922	5.5566
17						-2.1793	5.7207	5.5198
18								

the reference site adjusted value time series

1	4	0	36		2015011612	2015021500	2015031612	2015041600	2015051612	2015061600
2	CANN	120.4247	27.5226	0.0	-7.8729	1.9248	3.3551	-1.6482	1.1923	2.2703
3	DONT	121.1503	27.8346	0.0	-1.1776	5.7659	4.1846	0.7183	3.6855	1.8917
4	FDIQ	120.2073	27.3353	0.0	-4.4050	9999.0000	-7.4098	-0.0169	0.5123	1.2662
5	JHYW	120.0784	29.2727	0.0	-4.1758	3.9658	3.0622	-2.2638	2.0231	2.5882
6	JINH	119.6426	29.2178	0.0	-6.3819	0.8464	2.0936	-2.1904	-1.4549	-1.6712
7	JINX	119.3792	29.0709	0.0	-3.3125	4.1741	6.0701	1.1211	2.7152	0.7235
8	JNJZ	119.6375	27.9764	0.0	-1.9820	5.8716	5.7523	0.7617	1.1787	-0.2097
9	JSAN	118.6086	28.7279	0.0	-2.7285	5.1591	4.8924	-0.1494	-1.0604	-1.5941
10	LHAI	121.1895	28.9059	0.0	-2.7542	5.0212	5.2462	0.2224	0.5211	-0.5762
11	LISH	119.9295	28.4613	0.0	-0.6318	6.9864	5.8433	1.4288	1.3244	-0.3762
12	LONQ	119.1331	28.0807	0.0	-1.6417	6.8370	7.8156	1.6526	2.0540	1.2098
13	LUOY	119.7051	27.5525	0.0	-1.4472	7.0062	6.7425	1.3174	1.8671	0.7199
14	PANA	120.4367	29.0542	0.0	-2.9586	5.3216	5.0201	0.3398	1.4910	0.8634
15	PCHQ	118.5422	27.9232	0.0	-2.2507	6.0060	5.9032	0.8207	-0.3100	-1.3720

The variation adjusted value record time series of the geodetic network sites

The relationship between baselines (routes) and pseudo-stable reference sites is defined by name composition. A baseline name (e.g., B***A) must be composed of the endpoint site names (A and B). The number of characters in all site names must be equal, and the baseline name length must be at least twice that of a single site name.

Gross Error Detection and Spatial Deformation Analysis on InSAR Variations

Gross Error Detection and Separation on InSAR Variation Record Time Series

Open InSAR file Save as Import parameters Start computation Save process Follow example

Gross Error Detection and Separation on InSAR Variation Record Time Series | Analysis and Processing of Relative Spatial Deformation on InSAR Variations | Construction of High-Resolution Grid Time Series from Record Time Series

Open InSAR variation record time series file

>> Program Process ** Operation Prompts

Save program process as

Set format parameters of the file

Column ordinal number of first epoch time in header: 3

Column ordinal number of the first variation in record: 5

Spatial filtering mode: Moving average filter

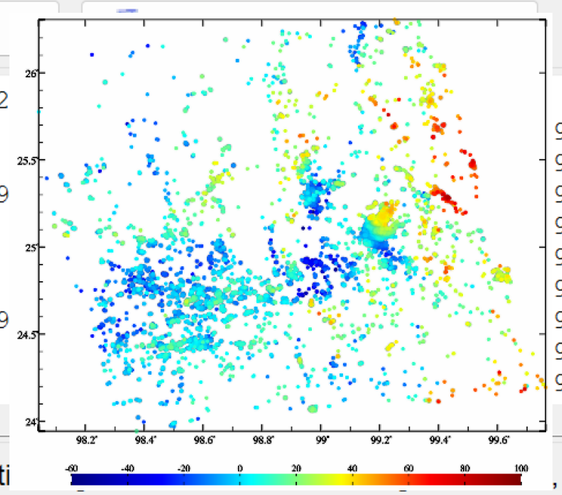
Set low-pass filter parameter n: 5

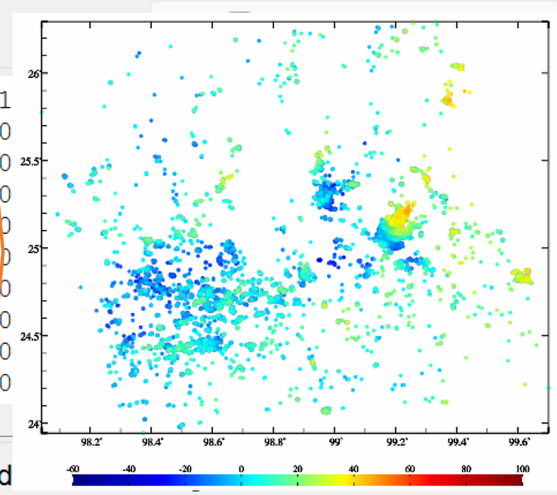
Number of gross error detection iterations: 3

>> [Function] Based on the spatial high-correlation characteristics of ground deformation, a low-pass filter is used to construct a reference surface at each epoch. This identifies and separates outliers, gross errors, and abrupt signals from the input InSAR time series.
** Before and after gross error separation, the format for the InSAR variation record time series, the spatial and temporal distribution of monitoring points, the number of monitoring points, and the InSAR variation values remain unchanged; only the gross error variations in the resulting InSAR variation record time series are replaced with 9999.000.
>> Open InSAR variation record time series file C:/ETideLoad4.5_win64en/examples/DynInSARsptmanalyse/result2018-101-12.txt.
** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
** The window below only shows the InSAR variation records time series with no more than 5000 rows!
>> Save the results as C:/ETideLoad4.5_win64en/examples/DynInSARsptmanalyse/pickerr2018-101-12.txt.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 09:27:07
>> The program automatically outputs the InSAR gross error record time series file in the current directory. Contains the original gross error values. The header includes a column for gross error percentage per epoch. Non-default values indicate identified gross errors.

Save the results as

5	30	20180117	20180129	20180210	20180222	2
3706.787	99.2507841	26.3055050	160.634	999000.0000	999000.0000	
2892.435	99.3321142	26.2945055	354.728	8.7170	17.3080	
3648.860	99.2564506	26.2888390	232.186	999000.0000	999000.0000	999
3647.428	99.2609504	26.2888390	231.518	999000.0000	999000.0000	
3647.428	99.2611170	26.2888390	231.518	999000.0000	999000.0000	
3691.092	99.2579505	26.2881724	202.722	999000.0000	999000.0000	
3693.077	99.2581172	26.2880057	198.786	999000.0000	999000.0000	999
3645.582	99.2572839	26.2878391	217.149	999000.0000	25.3160	
3650.993	99.2574505	26.2878391	209.805	999000.0000	25.7870	





The purpose for gross error detection and separation is to isolate non-geological deformati , and and to eliminate SAR multipath effects and rough surface environment interferences.

The purpose of spatial deformation analysis is to suppress the expansion and contraction effects in surface soil due to temperature changes, rainfall, and other meteorological actions, and to attenuate the short-wave effects of atmospheric delay and surface multipath.

Gross Error Detection and Spatial Deformation Analysis on InSAR Variations

Analysis and Processing of Relative Spatial Deformation on InSAR Variations

Open InSAR file | Save as | Import parameters | Start computation | Save process | Follow example

Gross Error Detection and Separation on InSAR Variation Record Time Series

Analysis and Processing of Relative Spatial Deformation on InSAR Variations

Construction of High-Resolution Grid Time Series from Record Time Series

Open InSAR variation record time series file

>> Program Process ** Operation Prompts

Save program process as

Set format parameters of the file

Column ordinal number of first epoch time in header: 3

Column ordinal number of the first variation in record: 5

Spatial filtering mode: Moving average filter

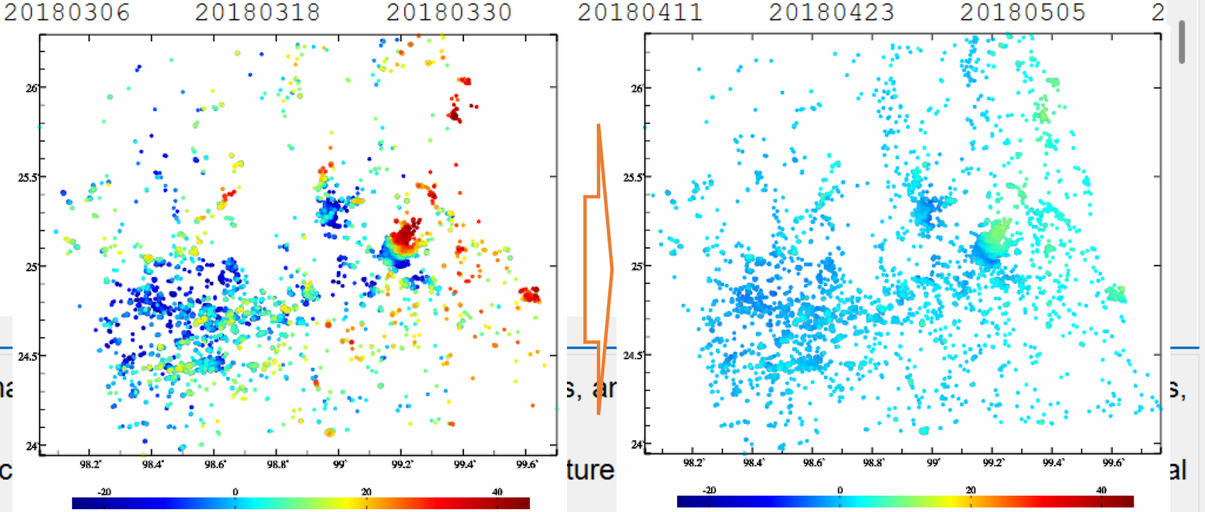
Set low-pass filter parameter n: 8

Use the spatial filtering value to repair the gross error

>> [Function] According to the spatial distribution natures that the ground vertical deformation is inversely proportional to the distance away from the dynamic source, suppress or weaken the local changes due to non-geological dynamics on the shallow surface from the input InSAR variation record time series using the specified spatial filtering algorithm.
** Before and after filtering, the format, spatiotemporal sampling distribution, and quantity for monitoring points in the output InSAR variation record time series file remain identical to those in the input file.
>> Open InSAR variation record time series file C:/ETideLoad4.5_win64en/examples/DynInSARsptmanalyse/pickerr2018-101-12.txt.
** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
** The window below only shows the InSAR variation records time series with no more than 5000 rows!
>> Save the results as C:/ETideLoad4.5_win64en/examples/DynInSARsptmanalyse/guass8flt2018-101-12.txt.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 09:33:25
>> The program automatically outputs the InSAR residual variation record time series file *.rnt in the current directory, where * is the file name for the source input InSAR time series. The file format is identical to the source input InSAR time series file. Residual variation = Input variation – Output variation.
>> Computation end time: 2026-06-27 10:03:40

Save the results as | Import setting parameters | Start computation

5	30	20180117	20180129	20180210	20180222	20180306	20180318	20180330	20180411	20180423	20180505	2
3706.787	99.2507841	26.3055050	160.634	1.5942	6.0892							
2892.435	99.3321142	26.2945055	354.728	1.9607	7.0535							
3648.860	99.2564506	26.2888390	232.186	1.0289	5.1049							
3647.428	99.2609504	26.2888390	231.518	0.6255	4.5162							
3647.428	99.2611170	26.2888390	231.518	0.6186	4.5065							
3691.092	99.2579505	26.2881724	202.722	0.8982	4.9084							
3693.077	99.2581172	26.2880057	198.786	0.8426	4.8262							
3645.582	99.2572839	26.2878391	217.149	0.9168	4.9362							
3650.993	99.2574505	26.2878391	209.805	0.9096	4.9253							



The purpose for gross error detection and separation is to isolate non-geological deforma… s, ar… s, and to eliminate SAR multipath effects and rough surface environment interferences.

The purpose of spatial deformation analysis is to suppress the expansion and contrac… ture …al actions, and to attenuate the short-wave effects of atmospheric delay and surface multipath.

Gross Error Detection and Spatial Deformation Analysis on InSAR Variations

Construction of High-Resolution Grid Time Series from Record Time Series

Open InSAR file Save as Import parameters Start computation Save process Follow example

Gross Error Detection and Separation on InSAR Variation Record Time Series

Analysis and Processing of Relative Spatial Deformation on InSAR Variations

Construction of High-Resolution Grid Time Series from Record Time Series

Open InSAR variation record time series file

>> Program Process ** Operation Prompts

Save program process as

Set format parameters of the file

Column ordinal number of first epoch time in header: 3

Column ordinal number of the first variation in record: 5

Set the grid spatial resolution: 3.0″

```
>> Computation end time: 2026-06-27 10:03:40
>> [Function] Based on a specified minimum number of effective monitoring points within a cell grid, construct the high-resolution variation grid time series using the direct averaging or Gaussian function interpolation method. The number of output grid time series files equals the number of sampling epochs in the variation record time series. Invalid cell grid values are represented by 9999.0.
>> Open InSAR variation record time series file C:/ETideLoad4.5_win64en/examples/DynInSARsptmanalyse/guass8flt2018-101-12.txt.
  ** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
  ** The window below only shows the InSAR variation records time series with no more than 5000 rows!
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/DynInSARsptmanalyse/gridtm.
  ** The results file names are grid***.dat. One file per sampling epoch. Invalid grid values are set to 9999.0. The filename suffix *** represents the sampling epoch in ETideLoad's long integer format.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 10:17:11
>> The program outputs 30 variation grids time series files!
>> Computation end time: 2026-06-27 10:19:38
```

Set the result folder Import setting parameters

5	30	20180117	20180129	20180210	20180222	20180306	20180318	20180330	20180411
3706.787	99.2507841	26.3055050	160.634	1.5942	6.0892	8.9607	8.5397	14.6741	10.2190
2892.435	99.3321142	26.2945055	354.728	1.9607	7.0535	9.1293	9.7770	10.3559	6.4712
3648.860	99.2564506	26.2888390	232.186	1.0289	5.1049	8.7485	8.8066	13.6514	9.8200
3647.428	99.2609504	26.2888390	231.518	0.6255	4.5162	8.6137	8.8836	12.7087	9.2351
3647.428	99.2611170	26.2888390	231.518	0.6186	4.5065	8.6095	8.8834	12.6907	9.2248
3691.092	99.2579505	26.2881724	202.722	0.8982	4.9084	8.6857	8.8221	13.3604	9.6641
3693.077	99.2581172	26.2880057	198.786	0.8426	4.8262	8.6673	8.8337	13.2343	9.5870
3645.582	99.2572839	26.2878391	217.149	0.9168	4.9362	8.6793	8.8091	13.3980	9.6967
3650.993	99.2574505	26.2878391	209.805	0.9096	4.9253	8.6786	8.8121	13.3831	9.6865

examples › DynInSARsptmanalyse › gridtm

名称	修改日期
grid20180117.dat	2022/12/1 12:26
grid20180129.dat	2022/12/1 12:26
grid20180210.dat	2022/12/1 12:26
grid20180222.dat	2022/12/1 12:27
grid20180306.dat	2022/12/1 12:27
grid20180318.dat	2022/12/1 12:27
grid20180330.dat	2022/12/1 12:27
grid20180411.dat	2022/12/1 12:27
grid20180423.dat	2022/12/1 12:27
grid20180505.dat	2022/12/1 12:27
grid20180517.dat	2022/12/1 12:27
grid20180529.dat	2022/12/1 12:27
grid20180610.dat	2022/12/1 12:27
grid20180622.dat	2022/12/1 12:27
grid20180704.dat	2022/12/1 12:27
grid20180716.dat	2022/12/1 12:27
grid20180728.dat	2022/12/1 12:27
grid20180809.dat	2022/12/1 12:27
grid20180821.dat	2022/12/1 12:27
grid20180902.dat	2022/12/1 12:27
grid20180914.dat	2022/12/1 12:28
grid20180926.dat	2022/12/1 12:28
grid20181008.dat	2022/12/1 12:28
grid20181020.dat	2022/12/1 12:28

The purpose for gross error detection and separation is to isolate non-geological deformation signals – such as outliers, gross errors, and sudden and to eliminate SAR multipath effects and rough surface environment interferences.

The purpose of spatial deformation analysis is to suppress the expansion and contraction effects in surface soil due to temperature changes actions, and to attenuate the short-wave effects of atmospheric delay and surface multipath.

Collaborative Monitoring and Processing of InSAR with CORS Network

Unification of Reference Epoch for Variation Record Time Series

Open InSAR file | Save as | Import parameters | Start computation | Save process | Follow example

Unification of Reference Epoch for Variation Record Time Series

Compatibility Analysis on InSAR Vertical Deformation Using CORS Network

InSAR Variation Time Series Adjustment with Spatiotemporal Frame Constraints

Open InSAR variation record time series file

Column ordinal number of first epoch time in header 3

Column ordinal number of the first variation in record 5

Input the reference epoch time 2019051812

Set time interpolation mode Gaussian function

>> Program Process ** Operation Prompts

Save program process as

record time series. Through compatibility analysis on vertical deformation from the CORS network and InSAR, and InSAR variation adjustment constrained by the CORS network, unify the spatiotemporal monitoring frame for the InSAR variation time series to control the accumulation of InSAR monitoring errors over time.
>> Select the computation function from the 3 control buttons on the top of the interface!...
>> [Function] Using cubic spline interpolation, Gaussian function interpolation, or low-pass filtering, estimate the reference value for the variation record time series at the specified reference epoch time, and then remove this reference value from the time series. This process unifies the reference epoch time, setting all variation values to zero at the specified epoch.
** Exception Handling: If the interpolation result at the reference epoch is invalid, the program isolates the affected time series into a separate file (***.rep).
>> Open InSAR variation record time series file C:/ETideLoad4.5_win64en/examples/DynCORScntrtmInSAR/guass6flt2019-101-12.txt.
** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
** The window below only shows the InSAR variation records time series with no more than 5000 rows!
>> Save the results as C:/ETideLoad4.5_win64en/examples/DynCORScntrtmInSAR/guass6flt2019-101-12ep.txt.
** The first atrribute in the result file header is the reference epoch time.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 11:40:48
>> Complete the computation of the unification of reference epoch for the variation record time series!
>> Computation end time: 2026-06-27 11:41:11

Save the results as

Impor

2019051812	5	28	20190124	20190205	20190217	20190301	20190313
3647.981	99.2412845	26.3083382	138.029	3.7651	6.7249	10.3921	1.379
3638.931	99.2412845	26.3081716	138.029	4.3898	6.7233	10.2674	1.674
3688.435	99.2432844	26.3073383	151.494	3.7189	5.5435	10.6172	0.177
3693.478	99.2436177	26.3066716	91.102	7.0913	8.1630	12.8806	2.658
3641.662	99.2437844	26.3061716	122.215	10.2672	7.4166	11.3582	2.938
3638.264	99.2434511	26.3060050	105.500	11.6602	7.4151	11.5549	2.588
3614.724	99.2432844	26.3055050	113.108	12.2276	7.3906	11.2610	3.135
3588.857	99.2429511	26.3053383	102.809	11.6410	7.3555	10.8081	4.389
3747.716	99.2509508	26.3045050	-36.574	18.3631	16.6593	15.5181	14.440
3495.068	99.2447844	26.3025051	38.425	12.8337	7.5575	9.1430	3.830
2147.368	99.1116230	26.2835059	45.125	3.9234	4.5844	3.9990	2.534
3511.911	99.2631170	26.2793394	-178.770	5.4055	3.8922	2.4615	2.572

guass6flt2019-101-12. txt

	5	28	20190124	20190205	20190217	20190301	20190313
2	3647.981	99.2412845	26.3083382	138.029	-14.0100	-11.0502	-7.3830
3	3638.931	99.2412845	26.3081716	138.029	-13.2342	-10.9007	-7.3566
4	3688.435	99.2432844	26.3073383	151.494	-15.5666	-13.7420	-8.6683
5	3693.478	99.2436177	26.3066716	91.102	-14.6992	-13.6275	-8.9099
6	3641.662	99.2437844	26.3061716	122.215	-9.2857	-12.1363	-8.1947
7	3638.264	99.2434511	26.3060050	105.500	-8.5257	-12.7708	-8.6310
8	3614.724	99.2432844	26.3055050	113.108	-7.2319	-12.0689	-8.1985
9	3588.857	99.2429511	26.3053383	102.809	-6.4449	-10.7304	-7.2778
10	3747.716	99.2509508	26.3045050	-36.574	-2.5356	-4.2394	-5.3806
11	3495.068	99.2447844	26.3025051	38.425	-2.2951	-7.5713	-5.9858
12	2147.368	99.1116230	26.2835059	45.125	-4.6100	-3.9490	-4.5344
13	3511.911	99.2631170	26.2793394	-178.770	-1.5400	-3.0533	-4.4840
14	3170.213	99.2541173	26.2783394	43.796	-1.4602	-2.8167	-7.3358
15	2217.898	99.2302849	26.2690065	179.906	-1.5604	-6.4864	-5.3034
16	2738.596	99.2929491	26.2665066	59.076	-2.7593	-6.1245	-6.5034
17	1610.268	99.1304556	26.2476740	110.316	-3.6370	-3.7876	-2.9801
18	1597.445	99.1437884	26.2341745	60.312	-4.0771	-3.5246	-6.3567
19	2622.976	99.1156229	26.2253415	137.279	-2.2598	-2.8764	-3.8379
20	3803.835	99.2016194	26.2058423	-415.811	-2.0618	-2.5617	-3.4914
21	2519.717	99.1602877	26.2040091	-51.331	-1.0519	-2.2246	-3.4704
22	2479.463	99.1599544	26.2035091	-40.762	-1.0461	-2.2208	-3.4678
23	1913.282	99.1427884	26.2033424	20.677	-1.3872	-2.3914	-3.4614
24	3751.985	99.2024527	26.2015092	-470.552	-1.8393	-2.3966	-3.4716
25	2384.009	99.3139483	26.1903429	293.680	-6.8375	-5.5578	-3.9371

The specific objectives are: Error Repair: Repair tidal and non-tidal load effects in InSAR variations and compensate for spatial long-wave tropospheric model errors; Temporal Compensation: Compensate for temporal information in InSAR variations whose spatial wavelengths are larger than the InSAR monitoring region scale, thereby controlling cumulative errors over time; and Scale Calibration: When there are no fewer than 3 CORS stations, precisely repair InSAR differential interferometric scale errors and compensate for other medium-to-long wavelength errors.

Collaborative Monitoring and Processing of InSAR with CORS Network

Compatibility Analysis on InSAR Vertical Deformation Using CORS Network

Open InSAR file | Save as | Import parameters | Start computation | Save process | Follow example

Unification of Reference Epoch for Variation Record Time Series

Compatibility Analysis on InSAR Vertical Deformation Using CORS Network

InSAR Variation Time Series Adjustment with Spatiotemporal Frame Constraints

Open InSAR variation record time series file

Column ordinal number of first epoch time in header 4

Column ordinal number of the first variation in record 5

Open the CORS network ellipsoidal height variation record time series file

Column ordinal number of first epoch time in header 6

Column ordinal number of the first variation in record 5

Set spatial interpolation mode Gaussian function

Minimum number of InSAR points around CORS site 2

Surrounding search radius 500 m

>> Program Process ** Operation Prompts

Save program process as

```
guass6flt2019-101-12ep.txt.
  ** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
  ** The window below only shows the InSAR variation records time series with no more than 5000 rows!
>> Open the CORS network ellipsoidal height variation record time series file C:/ETideLoad4.5_win64en/examples/
DynCORScntrtmInSAR/CORSUadjep2019050812.txt.
  ** Look at the input file information in the text box below, set the format parameters of the CORS site ellipsoidal height variation
record time series file...
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/DynCORScntrtmInSAR/CORSInSARcomp.
  ** (1) Comparison File between the CORS site ellipsoidal height and InSAR variation time series (CORSInSARpntcomp.txt):
Header: Total CORS sites, total InSAR points, and all sampling epochs. Records(3 rows per site): Row 1 : CORS site ellipsoidal
height variation at all InSAR epochs; Row 2: InSAR - averaged height variation at the CORS site, and Row 3 : Number of InSAR
points used in the averaging.
  ** Double Difference Time Series Files (dblediff*.txt),          w
and n is the number of sampling epochs: Header: Number of c
per baseline): Row 1: InSAR variation double - difference time
difference time series.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool butt
>> Computation start time：2026-06-27 11:52:08
>> Complete the computation of the compatibility analys
>> Computation end time: 2026-06-27 11:52:22
```

guass6flt2019-101-12ep.txt

	2019050812	5	28	20190124	20190205	20190217	20190301
2	3647.981	99.2412845	26.3083382	138.029	1.6340	4.5938	8.2610
3	3638.931	99.2412845	26.3081716	138.029	2.1989	4.5324	8.0765
4	3688.435	99.2432844	26.3073383	151.494	1.3589	3.1835	8.2572
5	3693.478	99.2436177	26.3066716	91.102	4.2504	5.3221	10.0397
6	3641.662	99.2437844	26.3061716	122.215	7.4359	4.5853	8.5269
7	3638.264	99.2434511	26.3060050	108.500	8.7021	4.4570	8.5968
8	3614.724	99.2432844	26.3055050	113.108	9.2743	4.4373	8.3077
9	3588.857	99.2429511	26.3053383	102.809	8.7374	4.4519	7.9045
10	3747.716	99.2509508	26.3045050	-36.574	16.2598	14.5560	13.4148
11	3495.068	99.2447844	26.3025051	38.425	10.5116	5.2354	6.8209
12	2147.368	99.1116230	26.2835059	45.125	1.8613	2.5223	1.9369
13	3511.911	99.2631170	26.2793394	-178.770	3.9216	2.4083	0.9776
14	3170.213	99.2541173	26.2783394	43.796	12.2205	10.8640	6.3449

CORSUadjep2019050812.txt

	2019050812	4	4	1	156	2018011012	2018011712	2018012412	2018013112	20
2	BAIS	99.4335		26.1997	2099.7	-25.3269	-23.4638	-19.8262		
3	BCHU	100.5849		25.8397	1408.8	-26.5857	-24.3976	-20.9813		
4	BIAN	100.4397		23.0680	1339.8	9999.0000	9999.0000	9999.0000		
5	CHA3	99.6148		24.8248	1630.6	9999.0000	9999.0000	9999.0000		
6	CHUX	101.5316		25.0301	1898.8	9999.0000	9999.0000	9999.0000		
7	DADO	100.3998		27.1509	1879.2	-23.0100	-21.6797	-19.3412		
8	DLYP	99.5386		25.4661	1674.2	9999.0000	9999.0000	9999.0000		
9	DQKF	100.0720		27.0501	1810.9	9999.0000	9999.0000	9999.0000		
10	EJIA	101.2457		24.4573	1262.5	9999.0000	9999.0000	9999.0000		
11	GASA	101.5788		24.0473	537.1	9999.0000	9999.0000	9999.0000		
12	HPIN	100.2869		26.0874	1421.1	9999.0000	9999.0000	9999.0000		
13	HQIN	100.1664		26.5621	2184.6	9999.0000	9999.0000	9999.0000		
14	HUPI	101.2754		26.6261	1168.3	-18.3785	-16.6083	-14.1445		
15	JCHU	99.9221		26.5019	2159.1	-28.2046	-26.4676	-23.6685		
16	JIGU	100.7302		23.5054	958.3	-20.4976	-18.7917	-15.8715		
17	LJGC	100.2215		26.8909	2394.9	-21.8999	-19.7765	-15.6925		
18	LSHU	100.4663		24.2114	1587.8	-21.7534	-20.2097	-16.9565		
19	MENT	99.6325		24.5268	1048.9	-24.2445	-22.6995	-19.9147		
20	MOUD	101.5454		25.3161	1768.3	-16.0281	-14.0893	-10.6872		
21	MWAN	100.4701		24.5949	928.7	9999.0000	9999.0000	9999.0000		
22	MYON	99.7582		23.9442	1136.6	9999.0000	9999.0000	9999.0000		
23	NIER	101.0471		23.0497	1303.5	9999.0000	9999.0000	9999.0000		
24	NINL	100.8509		27.2775	2233.6	9999.0000	9999.0000	9999.0000		
25	NJIA	100.5535		25.0226	1941.9	9999.0000	9999.0000	9999.0000		
26	PAMP	100.9802		26.9963	2678.6	-23.6466	-21.5482	-17.7050		
27	QINA	100.6244		26.3091	1394.5	-30.8672	-28.7552	-24.7948		
28	SAN1	101.0779		26.0125	2108.4	9999.0000	9999.0000	9999.0000		

Set the result folder | Import se

19	17997	20190124	20190205	20190217	20190301	20190313	20190325	2019040
CHA3	99.6148	24.8248	1630.6	-8.5564	-3.3881	-6.5837	-5.8827	-3.5935
CHA3	99.6148	24.8248	1630.6	4.9102	-9.1881	-15.6973	2.7454	-19.4812
CHA3	99.6148	24.8248	1630.6	53	53	53	53	53
MENT	99.6325	24.5268	1048.9	-10.7378	-4.9710	-7.6137	-7.1970	-5.2320
MENT	99.6325	24.5268	1048.9	30.3372	14.8391	5.3881	19.2131	-2.1984
MENT	99.6325	24.5268	1048.9	5	5	5	5	5
YNSD	99.1902	24.7128	1478.8	-9.6885	-4.1335	-6.6074	-5.8822	-4.6854
YNSD	99.1902	24.7128	1478.8	13.4043	4.3306	-0.9099	4.0043	-6.4658
YNSD	99.1902	24.7128	1478.8	3	3	3	3	3
HOUQ	98.2788	25.3231	1689.8					-6.8194
HOUQ	98.2788	25.3231	1689.8	-0.1625	-1.0678	-1.5805	-0.2575	-1.9246
HOUQ	98.2788	25.3231	1689.8	2	2	2	2	2

The output comparison file CORSInSARpntcomp.txt

The specific objectives are: Error Repair: Repair tidal and non-tidal load effects in InSAR variations and compensate for spatial long-wave tropospheric model errors; Temporal Compensation: Compensate for temporal information in InSAR variations whose spatial wavelengths are larger than the InSAR monitoring region scale, thereby controlling cumulative errors over time; and Scale Calibration: When there are no fewer than 3 CORS stations, precisely repair InSAR differential interferometric scale errors and compensate for other medium-to-long wavelength errors.

Collaborative Monitoring and Processing of InSAR with CORS Network

InSAR Variation Time Series Adjustment with Spatiotemporal Frame Constraints

Open InSAR file Save as Import parameters Start computation Save process Follow example

Unification of Reference Epoch for Variation Record Time Series

Compatibility Analysis on InSAR Vertical Deformation Using CORS Network

InSAR Variation Time Series Adjustment with Spatiotemporal Frame Constraints

Open InSAR variation record time series file

Column ordinal number of first epoch time in header 4

Column ordinal number of the first variation in record 5

Open the CORS network ellipsoidal height variation record time series file

Column ordinal number of first epoch time in header 6

Column ordinal number of the first variation in record 5

Set spatial interpolation mode Gaussian function

Minimum number of InSAR points around CORS site 2

Surrounding search radius 500 m

The linear space scale constraint of height difference variation

>> Program Process ** Operation Prompts

Save program process as

```
difference time series.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 11:52:08
>> Complete the computation of the compatibility analysis of vertical deformation from CORS network and InSAR!
>> Computation end time: 2026-06-27 11:52:22
>> [Function] Based on the comparison file (CORSInSARpntcomp.txt), estimate spatio-temporal datum transformation parameters, construct constraint equations, and adjust the InSAR variation time series. This integrates the InSAR spatiotemporal frame into the CORS network frame.
  ** Constraint Logic: If the scale constraint is not selected, the scale factor defaults to 1.0. A scale factor outside the range (0.5, 2.0) indicates insufficient vertical deformation separation or poor InSAR data quality. The spatial scale constraint is only applied when there are ≥ 3 valid CORS sites within the InSAR monitoring extent.
>> Save the results as C:/ETideLoad4.5_win64en/examples/DynCORScntrtmInSAR/guass6flt2019-101-12adj.txt.
  ** Calibration File (***.scl): Header: Matches the adjusted result file header. Row 2: Time series of scale factors for InSAR spatial differences; and Row 3: Number of CORS baselines used to estimate each scale factor.
>> Setting parameters have been import
  ** Click the control button [Start comput
>> Computation start time：2026-06-27
>> Complete the computation of the InS
>> Computation end time: 2026-06-27 1
```

Save the results as

guass6flt2019-101-12ep.txt

1	2019050812	5	28	20190124	20190205	20190217	20190301
2	3647.981	99.2412845	26.3083382	138.029	1.6340	4.5938	8.2610
3	3638.931	99.2412845	26.3081716	138.029	2.1989	4.5324	8.0765
4	3688.435	99.2432844	26.3073383	151.494	1.3589	3.1835	8.2572
5	3693.478	99.2436177	26.3066716	91.102	4.2504	5.3221	10.0397
6	3641.662	99.2437844	26.3061716	122.215	7.4359	4.5853	8.5269
7	3638.264	99.2434511	26.3060050	105.500	8.7021	4.4570	8.5968
8	3614.724	99.2432844	26.3055050	113.108	9.3614	4.4373	8.3077
9	3588.857	99.2429511	26.3053383	102.809	8.7574	4.4519	7.9045
10	3747.716	99.2509508	26.3045050	-36.574	16.2598	14.5560	13.4148
11	3495.068	99.2447844	26.3025051	38.425	10.5116	5.2354	6.8209
12	2147.368	99.1116230	26.2835059	45.125	1.8613	2.5223	1.9369
13	3511.911	99.2631170	26.2793394	-178.770	3.9216	2.4083	0.9776
14	3170.213	99.2541173	26.2783394	43.796	12.2205	10.8640	6.3449

The input InSAR variation record time series

2019051812	5	28	20190124	20190205	20190217	20190301	20190313
3647.981	99.2412845	26.3083382		138.029	0.9380	24.1216	32.5873
3638.931	99.2412845	26.3081716		138.029	1.5613	24.1189	32.4617
3688.435	99.2432844	26.3073383		151.494	0.8683	22.9292	32.8090
3693.478	99.2436177	26.3066716		91.102	4.2325	25.5437	35.0692
3641.662	99.2437844	26.3061716		122.215	7.4029	24.7937	33.5443
3638.264	99.2434511	26.3060050		105.500	8.7970	24.7919	33.7398
3614.724	99.2432844	26.3055050		113.108	9.3614	24.7645	33.4431
3588.857	99.2429511	26.3053383		102.809	8.7759	24.7291	32.9890
3747.716	99.2509508	26.3045050		-36.574	15.4302	34.0089	37.7017
3495.068	99.2447844	26.3025051		38.425	9.9306	24.9086	31.3106
2147.368	99.1116230	26.2835059		45.125	1.8158	22.0752	25.8978
3511.911	99.2631170	26.2793394		-178.770	2.1593	21.0458	24.5188

The output InSAR variation record time series

CORSInSARpntcomp.txt

1	22	17997	20190124	20190205	20190217	20190301	20190313	20190325	20190406	20190430	20190512	20190524	20190605	20190617
2	CHA3	99.6148	24.8248	1630.6	-22.5446	-17.3763	-20.5719	-19.8709	-17.5817	-18.6100	-18.0395	-15.4956	-14.4397	-15.0017
3	CHA3	99.6148	24.8248	1630.6	4.9582	-9.1400	-15.6493	2.7934	-19.4331	-17.9325	-16.1895	3.0619	-0.0039	0.0617
4	CHA3	99.6148	24.8248	1630.6	53	53	53	53	53	53	53	53	53	53
5	MENT	99.6325	24.5268	1048.9	-9.7833	-4.0165	-6.6592	-6.2425	-4.2775	-3.8415	-2.4255	-0.3496	0.4908	0.0484
6	MENT	99.6325	24.5268	1048.9	27.2030	11.7049	2.2538	16.0789	-5.3327	-4.8088	-4.8920	0.9261	-0.0012	-3.9601
7	MENT	99.6325	24.5268	1048.9	5	5	5	5	5	5	5	5	5	5
8	YNBS	99.2442	25.1935	1690.3	-0.0191	0.0548	0.2277	0.3877	1.0305	-0.0659	-0.1359	2.6257	9999.0000	9999.0000
9	YNBS	99.2442	25.1935	1690.3	6.4342	4.6736	2.2920	3.4252	0.5994	-0.1883	-1.1113	-1.7232	9999.0000	9999.0000
10	YNBS	99.2442	25.1935	1690.3	3	3	3	3	3	3	3	3	0	0
11	YNSD	99.1902	24.7128	1478.8	-8.8451	-3.2901	-5.7640	-5.0388	-3.8420	-4.7583	-3.9262	-1.8875	1.0527	2.0583
12	YNSD	99.1902	24.7128	1478.8	14.6424	5.5687	0.3281	5.2424	-5.2277	-4.6715	-3.3145	-1.0095	0.0013	1.5640
13	YNSD	99.1902	24.7128	1478.8	3	3	3	3	3	3	3	3	3	3
14	HOUQ	98.2788	25.3231	1689.8	-28.6103	-23.1606	-25.6947	-24.3570	-21.7152	-21.9387	-20.5859	-17.2336	-14.6850	-13.1812
15	HOUQ	98.2788	25.3231	1689.8	-0.8479	-1.7531	-2.2658	-0.9428	-2.6099	-2.0422	-1.9614	-0.2526	0.0003	-0.8661
16	HOUQ	98.2788	25.3231	1689.8	2	2	2	2	2	2	2	2	2	2
17	LIAH	98.2893	24.8045	1026.3	-25.1163	-25.1160	-20.3736	-20.3419	-17.4627	-17.6158	-17.0253	-15.0655	-13.3160	-12.9003
18	LIAH	98.2893	24.8045	1026.3	0.1649	-1.2566	7.5803	-0.5794	-4.5814	-4.4439	-5.0151	-0.6682	0.0009	0.1837
19	LIAH	98.2893	24.8045	1026.3	62	62	62	62	62	62	62	62	62	62
20	LIKU	98.8611	25.8165	803.6	9999.0000	9999.0000	-10.6022	-10.7888	-15.6740	-17.4073	-11.9665	0.5716	0.6961	0.3847
21	LIKU	98.8611	25.8165	803.6	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000
22	LIKU	98.8611	25.8165	803.6	0	0	2694	2694	2694	2694	2694	2694	2694	2694
23	MAN1	98.5551	24.3542	1169.0	9999.0000	9999.0000	-2.6203	-2.6203	-0.1494	-0.5939	-0.1165	2.6767	4.1937	4.4021
24	MAN1	98.5551	24.3542	1169.0	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	9999.0000	2.9176	0.0037	1.8654
25	MAN1	98.5551	24.3542	1169.0	25	25	25	25	25	25	25	25	25	25
26	MANK	98.8699	25.4443	791.6	-20.3986	-13.8233	-14.6826	-12.3015	-9.7505	-11.4193	-11.1109	-8.5186	-9.5454	-12.5891
27	MANK	98.8699	25.4443	791.6	-7.8736	-15.2135	-18.9321	-7.6690	-20.0411	-17.0036	-17.0417	-4.0149	0.0051	3.3947
28	MANK	98.8699	25.4443	791.6	12	12	12	12	12	12	12	12	12	12
29	MENN	99.0393	24.3225	750.8	-15.7539	-12.2818	-17.1707	-17.3429	-14.7349	-15.0090	-14.5396	-12.8822	-10.0942	-9.4083
30	MENN	99.0393	24.3225	750.8	12.6285	1.4243	-6.5879	3.9970	-12.3075	-11.5170	-9.5393	-0.8485	0.0011	-1.1268
31	MENN	99.0393	24.3225	750.8	3	3	3	3	3	3	3	3	3	3
32	TENC	98.4970	25.0109	1621.4	-0.0287	5.1191	2.0811	3.1285	6.1346	5.2388	5.5410	8.3464	10.6001	10.8767
33	TENC	98.4970	25.0109	1621.4	-21.0635	-30.2561	-32.5971	-15.3299	-28.2238	-24.6773	-23.3083	-5.1667	0.0066	5.7996
34	TENC	98.4970	25.0109	1621.4	35	35	35	35	35	35	35	35	35	35
35	LUJI	98.8685	24.9688	735.3	-6.3685	-0.3450	-2.1908	-0.8450	1.9115	1.3272	1.1979	9999.0000	9999.0000	2.9640
36	LUJI	98.8685	24.9688	735.3	11.7583	0.2223	-6.7045	6.2037	-9.7850	-8.8872	-10.5207	9999.0000	9999.0000	1.7952
37	LUJI	98.8685	24.9688	735.3	2	2	2	2	2	2	2	0	0	2

The comparison file CORSInSARpntcomp.txt

The specific objectives are: Error Repair: Repair tidal and non-tidal load effects in InSAR variations and
Compensate for temporal information in InSAR variations whose spatial wavelengths are larger than the InS
Calibration: When there are no fewer than 3 CORS stations, precisely repair InSAR differential interferometric

Deep Fusion and Time Series Analysis on Multi-Source InSAR Variations

Long-Time Connection for Two Same-Track InSAR Variation Time Series

Open InSAR file | Save as | Import parameters | Start computation | Save process | Follow example

Long-Time Connection for Two Same -Track InSAR Variation Time Series | Seamless Spatial Fusion on Multi -Source InSAR Variations | Analysis and Filtering on Variation Record Time Series | Reconstruction of Time Series with Given Sampling Specifications

Open the InSAR variation record time series file

Set format parameters of the file

Column ordinal number of first epoch time in header: 4

Column ordinal number of the first variation in record: 5

The spatial resolution for resampling: 300 m

Open the same-track InSAR variation time series file

Column number of first epoch time in header: 4

Column number of the first variation in record: 5

>> Program Process ** Operation Prompts

Save program process as

```
collaborative monitoring.
>> Select the computation function from the 4 control buttons on the top of the interface!...
>> [Function] From two InSAR variation record time series in the same area and with the same reference epoch time, respectively supplement the sampling values of each time series using the Gaussian interpolation method, and then generate a single InSAR variation time series by resampling with the specified spatial resolution.
>> Open the InSAR variation record time series file C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/guass6flt2018-101-12_20190115.txt.
  ** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
  ** The window below only shows the InSAR variation records time series with no more than 5000 rows!
>> Open the same-track InSAR record time series file C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/guass6flt2019-101-12_20190115.txt.
  ** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
  ** The window below only shows the InSAR variation record time series with no more than 2000 rows!
>> Save the results as C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/connectm20182019.txt.
  ** The output file format and reference epoch are identical to those of the input InSAR variation record time series file.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 16:53:07
>> Compete the long-time connection of the same-track InSAR variation time series!
>> Computation end time: 2026-06-27 16
```

Save the results as

50118	58	2018011700	2018012900	2018021000	2018022200	2018030600	2018031800	
1	98.37283	23.94404	3.4066	3.8562	3.3998	3.5846	4.5	
2	98.50218	23.97099	1.9749	1.9254	1.3148	0.5747	0.9	
3	98.49140	23.97369	3.0095	2.1755	1.5621	0.1181	0.7	
4	98.49140	23.97638	2.2013	1.8962	1.4641	0.1275	0.7	
5	98.49140	23.97908	3.9180	3.4735	2.8075	1.4857	2.2	
6	98.49679	23.98716	1.2147	1.1044	-0.4797	-1.9653	-1.6	
7	98.49949	23.98716	-0.5371	-0.5006	-2.0990	-3.7922	-3.5	
8	98.50488	23.99255	-4.3414	-4.6055	-4.0441	-6.3601	-5.9	
9	98.39708	23.99525	4.8639	5.2663	3.5119	3.1328	3.9	
10	98.55608	24.00333	-5.5898	-4.1363	-4.4156	-5.6916	-5.1	
11	98.56147	24.00603	-13.0375	-12.1725	-12.2850	-13.0881	-12.4	
12	98.58303	24.01411	-1.4475	-0.7520	-0.9823	-3.4277	-4.2	
13	98.37822	24.02220	-2.5485	-3.4752	-4.9109	-6.0561	-7.5	
14	98.38091	24.02220	-2.6076	-3.5052	-5.0862	-6.2912	-7.7	

	20190115	5	30	20180117	20180129	20180210	20180222	20180306	20180318
2	3706.787	99.2507841	26.3059050	160.634	-19.0686	-16.9047	-14.5594	-14.6763	-12.8078
3	2892.435	99.3321142	26.2945055	354.728	-4.0088	-1.3401	-1.0050	-1.1013	4.2060
4	3648.860	99.2564506	26.2888390	232.186	-4.3598	-0.3579	-0.8523	0.4722	2.1533
5	3647.428	99.2609504	26.2888390	231.518	-2.5613	0.7342	2.1285	2.7706	1.5398
6	3647.428	99.2611170	26.2888390	231.518	-2.2376	1.1990	2.4180	3.2280	1.4629
7	3691.092	99.2579505	26.2881724	202.722	-2.9801	-0.2490	0.6907	2.1992	3.8167
8	3693.077	99.2581172	26.2880057	198.786	-2.5226	0.1752	1.4215	2.9743	4.2774
9	3649.582	99.2572839	26.2878391	217.149	-3.1796	-0.5442	0.1637	1.6173	3.6489
10	3650.993	99.2574505	26.2878391	209.805	-2.5741	-0.0646	0.4831	1.9556	4.5597
11	3670.276	99.2577838	26.2878391	200.074	-1.8478	0.6010	2.4494	2.4494	5.6416
12	3643.802	99.2574505	26.2876724	216.205	-2.5712	-0.1197	1.6661	1.9397	4.5646
13	3621.288	99.2582838	26.2866724	229.123	-3.6729	-1.2	0.5393	2.5393	2.0667
14	3598.829	99.2631170	26.2865058	208.830	-4.8831	-1.0724	0.5038	-1.7281	0.2333
15	1368.074	99.1412685	26.2848392	234.666	-24.2923	-25.4763	-23.6368	-21.0010	-14.3286
16	1375.606	99.1414552	26.2848392	233.063	-25.1142	-26.1450	-24.5342	-21.9743	-14.8478
17	1531.431	99.1411218	26.2846725	208.623	-24.1970	-25.3218	-23.3027	-20.6683	-14.4797
18	2791.583	99.3054486	26.2820060	266.398	-2.9541	0.5604	2.7927	3.3428	2.7889
19	1621.140	99.1476216	26.2805060	177.024	-35.3601	-35.7532	-32.2572	-29.0349	-27.4726
20	3036.248	99.3357807	26.2756725	191.005	-4.9152	-2.6392	-1.8922	-0.2443	3.4157

The reference epoch time 20190115

	20190115	5	28	20190124	20190205	20190217	20190301	20190313	20190325
2	3647.981	99.2412845	26.3053382	138.029	0.0000	2.9598	6.6270	-2.3861	-0.3717
3	3638.931	99.2412845	26.3081716	138.029	0.0000	2.3335	5.8776	-2.7155	-0.9478
4	3660.435	99.2432844	26.3073383	151.494	0.0000	1.8246	6.8983	-3.5410	-0.6207
5	3693.478	99.2436177	26.3066716	91.102	0.0000	1.0717	5.7893	-4.4327	-1.8786
6	3641.662	99.2437844	26.3061716	122.215	0.0000	-2.8506	1.0910	-7.3285	-5.6713
7	3638.264	99.2434511	26.3060050	105.500	0.0000	-4.2451	-0.1053	-9.0716	-6.9400
8	3614.724	99.2432844	26.3055050	113.108	0.0000	-4.8370	-0.9666	-9.0918	-7.6156
9	3588.857	99.2429511	26.3053383	102.809	0.0000	-4.2855	-0.8329	-7.2517	-7.3151
10	3747.716	99.2509508	26.3045050	-36.574	0.0000	-1.7038	-2.8450	-3.9223	-5.3621
11	3495.068	99.2447844	26.3025051	38.425	0.0000	-5.2762	-3.6907	-9.0036	-8.3055
12	2147.368	99.1116230	26.2835059	45.125	0.0000	0.6610	0.0756	-1.3886	-1.2629
13	3511.911	99.2631170	26.2793394	-178.770	0.0000	-1.5133	-2.9440	-2.8327	-5.3298
14	3170.213	99.2541173	26.2783394	43.796	0.0000	-1.3565	-5.8756	-2.6816	-5.1000
15	2217.898	99.2302849	26.2690065	179.906	0.0000	-4.9260	-3.7430	-6.7734	-6.0877
16	2738.596	99.2929491	26.2665066	59.076	0.0000	-3.3652	-3.7441	-10.0885	-8.7113

Prerequisite: All InSAR time series must have a unified reference epoch prior to fusion.

Deep Fusion and Time Series Analysis on Multi-Source InSAR Variations

Seamless spatial fusion on multi-source InSAR variations

Open InSAR file | Save as | Import parameters | Start computation | Save process | Follow example

Long-Time Connection for Two Same -Track InSAR Variation Time Series | Seamless Spatial Fusion on Multi -Source InSAR Variations | Analysis and Filtering on Variation Record Time Series | Reconstruction of Time Series with Given Sampling Specifications

Open any InSAR variation record time series file

Set the wildcard of the file names

Ordinal number of the first wildcard in file name: 8

Number of consecutive wildcards in file name: 1

Set format parameters of the file

Column ordinal number of first epoch time in header: 3

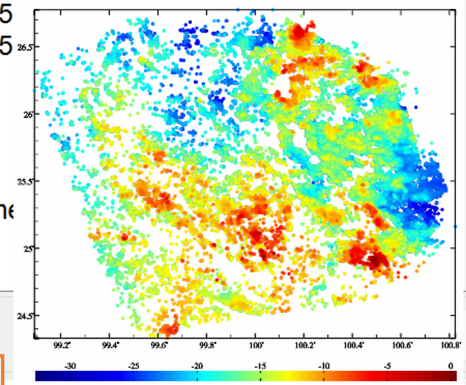
Column ordinal number of the first variation in record: 5

The highest resolution for resampling: 300 m

>> Program Process ** Operation Prompts

Save program process as

```
>> Computation start time：2026-06-27 16:53:07
>> Compete the long-time connection of the same-track InSAR variation time series!
>> Computation end time: 2026-06-27 16:55:40
>> [Function] Resample input multi-source InSAR time series according to a specified spatial resolution to generate a fused time series. Input files are extracted using wildcards and must share the same format.
>> Open any InSAR variation record time series file C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/MultiInSAR/adj6flt1_ep2019050812.txt.
  ** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
  ** The window below only shows the InSAR variation records time series with no more than 5000 rows!
>> Save the results as C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/fusInSARep2019050812.txt.
  ** The output file format and reference epoch are identical to those of the input InSAR variation record time series file.
  ** The InSAR variation record time series files searched by wildcard instantiation:
    C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/MultiInSAR/adj6flt1_ep201905
    C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/MultiInSAR/adj6flt2_ep201905
>> 2 InSAR variation record files are found by wildcard instantiation.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 17:01:16
>> Complete the computation of the seaml
>> Computation end time: 2026-06-27 17:(
```

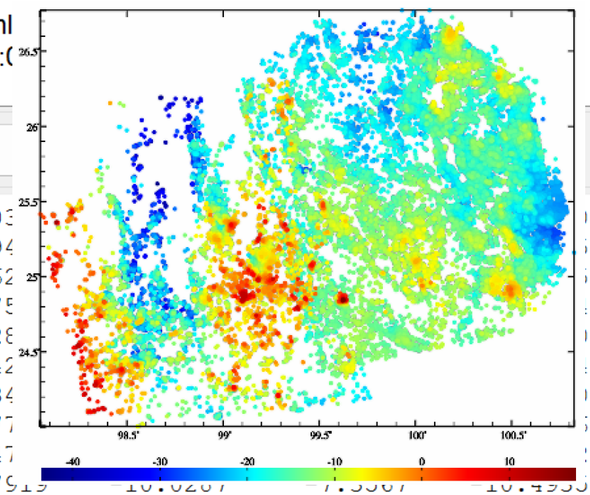


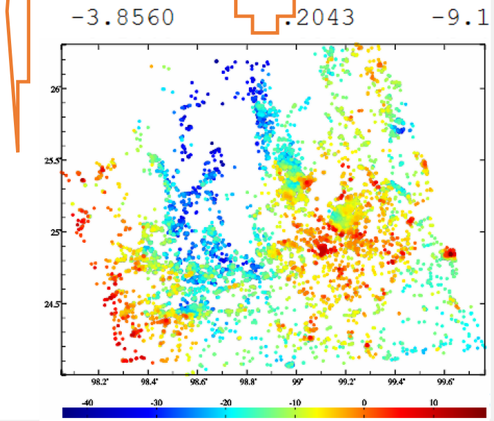
Save the results as

```
2   73  2018011000  2018012000  2018013000  2018020900  2018021900  2018030100  201803
    1    98.55608    24.00404    -7.6454     -6.2773     -8.2698     -7.2605     -3.94
    2    98.56147    24.00674   -12.5772    -10.9210    -13.3331    -12.1169     -8.62
    3    98.58303    24.01482    -7.8541     -6.2181     -8.7632     -7.5465     -4.75
    4    98.58034    24.02291    -8.5455     -6.9257     -9.4113     -8.2090     -5.28
```

adj6flt1_ep2019050812.txt

1	73	40.0	2018011000	2018012000	2018013000	2018020900	2018021900	2018030100
2		10	98.55608	24.00333	16.2650	-7.6454	-6.2773	-8.2698
3		11	98.56147	24.00603	19.3279	-12.5772	-10.9210	-13.3331
4		12	98.58303	24.01411	17.0544	-7.8541	-6.2181	-8.7632
5		15	98.58034	24.02220	17.3339	-8.5455	-6.9257	-9.4113
6		16	98.63424	24.04106	18.6985	-18.8154	-16.9624	-19.8260
7		17	98.96841	24.05993	16.5583	-14.5197	-13.2601	-14.9940
8		18	98.98188	24.05993	18.4648	-18.8134	-17.8357	-18.2933
9		19	98.61807	24.06262	18.7303	-14.9421	-13.1851	-15.8650
10		20	98.96841	24.06262	17.3702	-16.4137	-15.2065	-16.5784
11		21	98.97110	24.06262	19.0135	-20.4673	-19.4410	-20.1126
12		22	98.97380	24.06262	19.4317	-21.7552	-20.8181	-21.0547
13		23	98.97649	24.06262	18.7594	-20.6245	-19.8201	-19.7308
14		24	98.97919	24.06262	20.0331	-21.0509	-19.9227	-20.6072
15		25	98.96571	24.06531	17.3123	-17.3292	-16.2511	-17.0493
16		26	98.97110	24.06531	20.4076	-24.4700	-23.7283	-23.3240





Prerequisite: All InSAR time series must have a unified reference epoch prior to fusion.

Deep Fusion and Time Series Analysis on Multi-Source InSAR Variations

Analysis and Filtering on Variation Record Time Series

Open InSAR file Save as Import parameters Start computation Save process Follow example

Long-Time Connection for Two Same -Track InSAR Variation Time Series | Seamless Spatial Fusion on Multi -Source InSAR Variations | Analysis and Filtering on Variation Record Time Series | Reconstruction of Time Series with Given Sampling Specifications

Open the InSAR variation record time series file

Set format parameters of the file

Column ordinal number of first epoch time in header: 4

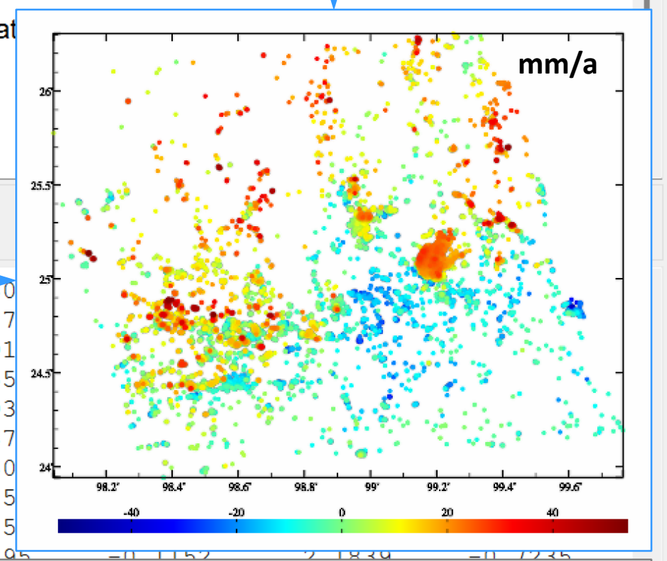
Column ordinal number of the first variation in record: 5

The ratio of the number of sampling epochs to filter parameters: 1.2

>> Program Process ** Operation Prompts

Save program process as

```
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 17:01:16
>> Complete the computation of the seamless spatial fusion with 2 InSAR variation record time series!
>> Computation end time: 2026-06-27 17:02:48
>> [Function] Using a combined Continuous Chebyshev and Triangular Basis Function method, estimate low-pass filtering parameters for each monitoring point. Calculate the filtered values and linear trends (per year, /a).
>> Open the InSAR variation record time series file C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/guass6flt2018-101-12_20190115.txt.
  ** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
  ** The window below only shows the InSAR variation records time series with no more than 5000 rows!
>> Save the results as C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/tmflt2018-101-12.txt.
  ** Format identical to input. The 4th column represents the linear variation (/a).
  ** Outputs also First-Order Time-Derivative File (***.dft): Format identical to the output.The 4th column represents the linear variation(/ a). (Sampling unit : per week, / wk).
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computat
>> Computation start time：2026-06-27 17:08:47
>> Complete the analysis and filtering of variation record time series!
>> Computation end time: 2026-06-27 17:11:22
```



Save the results as | Import setting parameters

20190115	5	30	20180117	20180129	20180210	20180222	20180306	20180318	20180330
3706.787	99.2507841	26.3055050	11.0389	-18.8117	-16.7203	-15.0263	-14.3398	-13.3049	-14.047
2892.435	99.3321142	26.2945055	1.3100	-3.5466	-1.6038	-1.1483	-0.1975	2.7043	1.191
3648.860	99.2564506	26.2888390	8.5051	-3.3247	-1.3958	-0.2976	0.3406	1.4462	-0.555
3647.428	99.2609504	26.2888390	7.7459	-1.8768	0.3328	2.1477	2.3080	1.5464	-0.493
3647.428	99.2611170	26.2888390	7.7966	-1.4969	0.7075	2.5293	2.6164	1.6044	-0.537
3691.092	99.2579505	26.2881724	9.8760	-2.3725	-0.6466	0.8450	2.1960	2.7590	-0.130
3693.077	99.2581172	26.2880057	9.9994	-1.9533	-0.1345	1.5078	2.9262	3.2087	-0.025
3645.582	99.2572839	26.2878391	10.0612	-2.5741	-0.9795	0.3509	1.6985	2.5224	-0.145
3650.993	99.2574505	26.2878391	11.2076	-1.9984	-0.4994	0.6701	2.1672	3.1416	-0.0795
3670.276	99.2577838	26.2878391	12.4958	-1.3121	0.1007	1.1			
3643.802	99.2574505	26.2876724	11.2370	-2.0208	-0.5493	0.6			
3621.288	99.2582838	26.2866724	7.4573	-3.3786	-1.8860	0.5			
3598.829	99.2631170	26.2865058	6.7289	-4.2937	-1.2114	0.1			
1368.074	99.1412885	26.2848392	30.3961	-24.9091	-24.5274	-23.8			

guass6flt2018-101-12_20190115.txt

	20190115	5	30	20180117	20180129	20180210	20180222	20180306
1								
2	3706.787	99.2507841	26.3055050	160.634	-19.0686	-16.9047	-14.5594	-14.6763
3	2892.435	99.3321142	26.2945055	354.728	-4.0088	-1.3401	-1.0050	-1.1013
4	3648.860	99.2564506	26.2888390	232.166	-4.3598	-0.3579	-0.8523	0.4722
5	3647.428	99.2609504	26.2888390	231.518	-2.5613	0.7342	2.1285	2.7706
6	3647.428	99.2611170	26.2888390	231.518	-2.2376	1.1990	2.4180	3.2280
7	3691.092	99.2579505	26.2881724	202.722	-2.9801	-0.2490	0.6907	2.1992
8	3693.077	99.2581172	26.2880057	198.786	-2.5226	0.1752	1.4215	2.9743
9	3645.582	99.2572839	26.2878391	217.149	-3.1796	-0.5442	0.1637	1.6173
10	3650.993	99.2574505	26.2878391	209.805	-2.5741	-0.0646	0.4831	1.9556

Prerequisite: All InSAR time series must have a unified reference epoch prior to fusion.

Deep Fusion and Time Series Analysis on Multi-Source InSAR Variations

Reconstruction of Time Series with Given Sampling Specifications

Open InSAR file Save as Import parameters Start computation Save process Follow example

Long-Time Connection for Two Same -Track InSAR Variation Time Series | Seamless Spatial Fusion on Multi -Source InSAR Variations | Analysis and Filtering on Variation Record Time Series | Reconstruction of Time Series with Given Sampling Specifications

Open the InSAR variation record time series file

Set format parameters of the file

Column ordinal number of first epoch time in header: 4

Column ordinal number of the first variation in record: 5

The ratio of the number of sampling epochs to filter parameters: 1.2

Starting time for the target time series: 20171001

Ending time for the target time series: 20190301

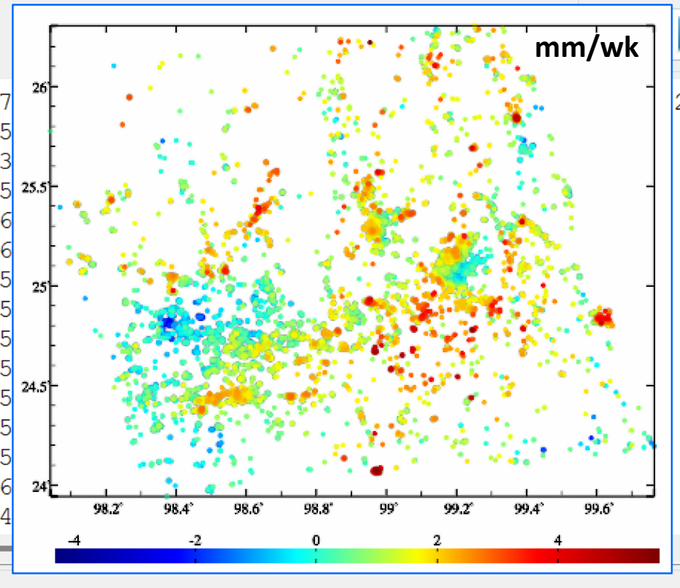
Sampling time internal: 15.000 day

>> Program Process ** Operation Prompts

Save program process as

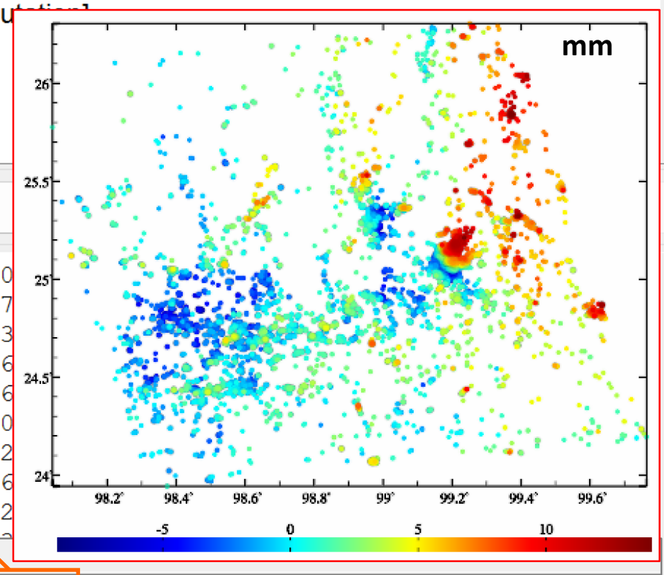
```
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 17:08:47
>> Complete the analysis and filtering of variation record time series!
>> Computation end time: 2026-06-27 17:11:22
>> [Function] Using the continuous Chebyshev and triangular basis function combination method, estimate filtering parameters and reconstruct the time series according to specified sampling specifications. The program supports time-domain interpolation and short-term forecasting.
>> Open the InSAR variation record time series file C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/guass6flt2018-101-12_20190115.txt.
  ** Look at the input file information in the text box below, set the format parameters of InSAR variation record time series file...
  ** The window below only shows the InSAR variation records time series with no more than 5000 rows!
>> Save the results as C:/ETideLoad4.5_win64en/examples/DynInSARfusiontmsqu/construct2018.txt.
  ** Format identical to input. The 4th column represents the linear variation (/a).
  ** Outputs also First-Order Time-Derivative File (***.dft). Format identical to the output.The 4th column represents the linear variation(/ a). (Sampling unit : per week, / wk).
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation].
>> Computation start time：2026-06-27 17:17:22
>> Compete the reconstruction of variation record time series!
>> Computation end time: 2026-06-27 17:22:18
```

Maximum length of valid time for forward and backward forecast is 30.0 days



Save the results as Import setting parameters

35	30.0	2017		2017113000	2017121500	2017123000	2018011400	201801290		
3706.787	99.25			-20.0572	-17.7879	-18.6436	-16.7080	-16.9417		
2892.435	99.33			-0.2531	1.9545	0.4955	2.4973	-1.0053		
3648.860	99.25			-4.4371	-2.5026	-4.0235	-0.9049	-1.6266		
3647.428	99.26			-3.3977	-1.3652	-3.3630	-0.5708	0.8296		
3647.428	99.26			-3.4282	-1.3547	-3.4038	-0.5252	1.1670		
3691.092	99.25			-5.1732	-3.1377	-4.3635	-0.0809	-0.1952		
3693.077	99.25			-5.1680	-3.0821	-4.3269	0.3351	0.5176		
3645.582	99.25			-5.3475	-3.3369	-4.4882	-0.3981	-0.7682		
3650.993	99.25			-6.1079	-4.001					
3670.276	99.25			-6.9547	-4.73					
3643.802	99.25			-6.1273	-4.026					
3621.288	99.25			-3.4704	-1.77					
3598.829	99.26			-2.5259	-0.66					
1368.074	99.14			-19.9980	-18.19					



guass6flt2018-101-12_20190115. txt

	20190115	5	30	20180117	20180129	20180210	20180222	20180306
2	3706.787	99.2507841	26.3055050	160.634	-19.0686	-16.9047	-14.5594	-14.6763
3	2892.435	99.3321142	26.2945055	354.728	-4.0088	-1.3401	-1.0050	-1.1013
4	3648.860	99.2564506	26.2888390	232.186	-4.3598	-0.3579	-0.8523	0.4722
5	3647.428	99.2609504	26.2888390	231.518	-2.5613	0.7342	2.1285	2.7706
6	3647.428	99.2611170	26.2888390	231.518	-2.2376	1.1990	2.4180	3.2280
7	3691.092	99.2579505	26.2881724	202.722	-2.9801	-0.2490	0.6907	2.1992
8	3693.077	99.2581172	26.2880057	198.786	-2.5226	0.1752	1.4215	2.9743
9	3645.582	99.2572839	26.2878391	217.149	-3.1796	-0.5442	0.1637	1.6173
10	3650.993	99.2574505	26.2878391	209.805	-2.5741	-0.0646	0.4831	1.9556

Prerequisite: All InSAR time series must have a unified reference epoch prior to fusion.

Computation of Ground Stability Variation Based on Vertical Deformation

Estimation of Normalized Ground Stability Variation Grid from Vertical Deformation

Open file Save as Import parameters Start computation Save process Follow example

Open the ground vertical deformation rate grid file

Open a ground digital elevation model file with the same grid specifications

Weight of the ground vertical deformation rate	3.00	Exponent	0.5
Weight of horizontal gradient of deformation rate	5.00	Exponent	0.5
Weight of terrain slope	2.00	Exponent	0.5

The weights and exponent parameters are time-invariant and are used to empirically distinguish the response of different variation types to the geological environment. Approximate values are generally sufficient for practical applications.

Estimation of Normalized Ground Stability Variation Grid from Vertical Deformation

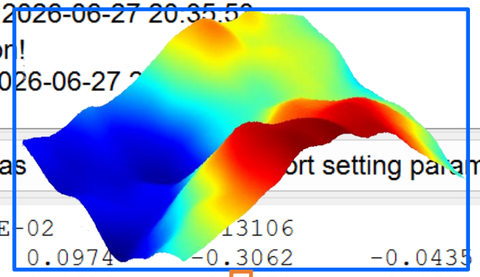
Estimation of Ground Stability Variation Grid Time Series from Vertical Deformation

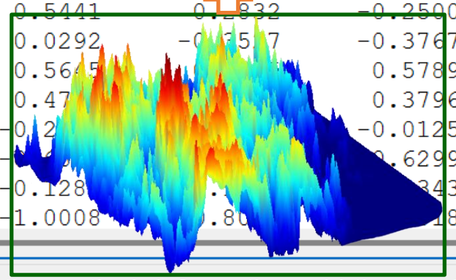
>> Program Process ** Operation Prompts

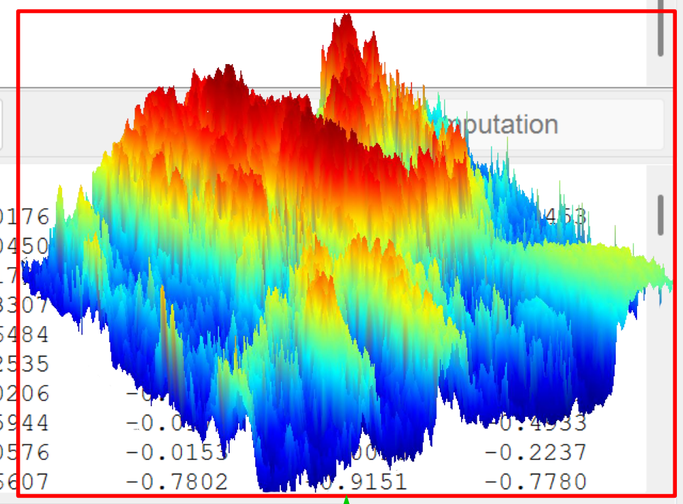
Save program process as

the ground vertical deformation rate and its horizontal gradient grid model. This computation adheres to the quantitative criteria for ground stability weakening as defined by ETideLoad.
** The resulting ground stability variation grid time series quantitatively characterizes the temporal and spatial distribution of stability weakening, including the specific timing, location, and continuous influence periods.
>> Select a computation function from the two control buttons on the upper right of the interface...
>> [Function] Calculates the horizontal gradient vector grid of the ground vertical deformation rate and the terrain slope vector grid from input models. It then estimates the normalized ground stability variation grid using the statistical synthesis algorithm based on the predefined criteria.
>> Open the ground vertical deformation rate grid file C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbhl20150201.dat.
>> Open the ground digital elevation model file with the same grid specifications C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/dtm.dat
>> Save the results as C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/stablrst.dat.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 20:35:5
>> Complete the computation!
>> Computation end time: 2026-06-27 2

Save the results as ort setting parameters mputation







118.500000	121.500000	27.000000	29.000000	1.66666667E-02	1.66666667E-02		13106						
0.7649	0.0870	0.0235	0.0171	-0.2540	0.0249	0.0974	-0.3062	-0.0435	0.0176				458
-0.0943	-0.0695	-0.0805	-0.0034	0.0277	-0.0584	-0.4606	-0 59	-0.4693	0.0450				
0.1922	-0.1074	0.2285	0.6056	0.2524	0.6506	0.5441	0.2832	-0.2500	0.17				
-0.0789	-0.2760	-0.2179	-0.3238	0.0516	0.0248	0.0292	-0 35 7	-0.3767	-0.3307				
0.2663	0.5235	-0.0740	0.4725	0.8661	0.8441	0.564		0.5789	0.6484				
0.4034	0.7395	0.7573	0.4101	0.4818	0.4317	0.47		0.3796	0.2535				
-0.2905	-0.0834	-0.1270	-0.3546	-0.1270	-0.0903	-0.2		-0.0125	0.0206	-0			
-0.3306	-0.3216	-0.5366	-0.6303	-0.8296	-0.6943	-		0.6299	-0.5944	-0.0			-0.4933
-0.1471	0.0026	-0.1765	-0.1347	-0.1054	-0.1410	-0.128		343	-0.0576	-0.0153	00		-0.2237
-0.3575	-0.8016	-0.8758	-0.9009	-0.8440	-0.9440	-1.0008	.80	18	-0.6607	-0.7802	0.9151		-0.7780

The algorithm identifies stability weakening based on the following conditions derived from the vertical deformation grid time series: Significant Vertical Rate: The ground vertical deformation rate exceeds a positive threshold (indicating upward crustal movement); Significant Horizontal Gradient: The modulus of the horizontal gradient vector of the vertical deformation rate is large (indicating localized shear or torsion); or Significant Terrain Slope: The local terrain slope value is relatively steep.

The vertical deformation may represent variations in ellipsoidal height, normal height, or orthometric height. The specific statistical synthesis algorithm is consistent with the module [Statistical Synthesis and Prediction of Ground Stability Variations]

The ground stability variation is a dimensionless continuous real variable. A value greater than zero at a specific grid cell and epoch indicates a current decrease in ground stability; a value less than zero indicates an improvement in stability.

Computation of Ground Stability Variation Based on Vertical Deformation

Estimation of Ground Stability Variation Grid Time Series from Vertical Deformation

Open file Save as Import parameters Start computation Save process Follow example

Open any ground vertical deformation rate grid file

Set the wildcard of the file names

Ordinal number of the first wildcard in file name: 11

Number of consecutive wildcards in file name: 8

Open a ground digital elevation model file with the same grid specifications

Weight of the ground vertical deformation rate	3.00	Exponent	0.5
Weight of horizontal gradient of deformation rate	5.00	Exponent	0.5
Weight of terrain slope	2.00	Exponent	0.5

The weights and exponent parameters are time-invariant and are used to empirically distinguish the response of different variation types to the geological environment. Approximate values are generally sufficient for practical applications.

Estimation of Normalized Ground Stability Variation Grid from Vertical Deformation

Estimation of Ground Stability Variation Grid Time Series from Vertical Deformation

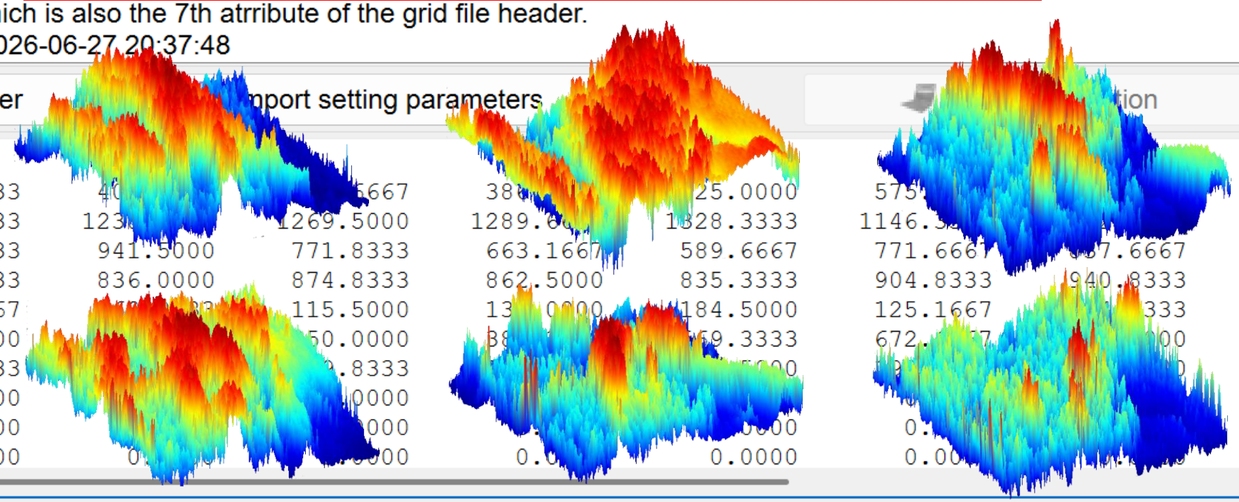
>> Program Process ** Operation Prompts

Save program process as

```
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20170112.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20170201.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20170302.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20170403.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20170504.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20170605.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20170706.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20170807.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20170908.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20171009.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20171110.dat
   C:/ETideLoad4.5_win64en/examples/Dyngrndhgtstablility/vdfmrate/dmzcgYQbh20171211.dat
>> There are 35 ground vertical deformation rate grids files searched by wildcard instantiation.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-27 20:37:46
>> Complete the computation! The program outputs 35 ground stability variation grid time series files stbhgt***.dat. *** represents the sampling epoch time, which is also the 7th atrribute of the grid file header.
>> Computation end time: 2026-06-27 20:37:48
```

Set the result folder Import setting parameters Execution

```
 118.500000  121.500000   27.000000   29.000000  0.01666667  0.01666667
    521.8333    597.0000    751.6667    601.6667    516.3333    525.8333
    682.0000    775.1667    856.5000    896.8333   1101.1667   1256.8333
    884.3333    931.1667    969.1667    994.0000   1123.6667   1169.8333
    923.6667   1019.8333    997.6667   1051.1667   1120.6667    945.8333
    546.3333    454.5000    335.3333    298.1667   1[illegible]  89.6667
     88.6667    116.5000    326.3333    626.166[illegible]  534.5000
    636.3333    646.1667    518.3333    447.83[illegible]  17.3333
    162.5000      0.0000      0.0000      0.000[illegible]   0.0000
      0.0000      0.0000      0.0000      0.0000[illegible]  .0000
      0.0000      0.0000      0.0000      0.0000    0.0000[illegible]
```



The algorithm identifies stability weakening based on the following conditions derived from the vertical deformation grid time series: Significant Vertical Rate: The ground vertical deformation rate exceeds a positive threshold (indicating upward crustal movement); Significant Horizontal Gradient: The modulus of the horizontal gradient vector of the vertical deformation rate is large (indicating localized shear or torsion); or Significant Terrain Slope: The local terrain slope value is relatively steep.

The vertical deformation may represent variations in ellipsoidal height, normal height, or orthometric height. The specific statistical synthesis algorithm is consistent with the module [Statistical Synthesis and Prediction of Ground Stability Variations]

The ground stability variation is a dimensionless continuous real variable. A value greater than zero at a specific grid cell and epoch indicates a current decrease in ground stability; a value less than zero indicates an improvement in stability.

Computation of Ground Stability Variation Based on Gravity Variations

Estimation of Normalized Ground Stability Variation Grid from Gravity Variations

Open file Save as Import parameters Start computation Save process Follow example

Open the ground gravity variation rate grid file

Considering the local terrain effect on gravity

Open the ground digital elevation model file

Weight of ground gravity variation rate	3.00	Exponent	0.5
Weight of horizontal gradient of gravity variation rate	5.00	Exponent	0.5
Weight of local terrain effects	2.00	Exponent	0.5

The weights and exponent parameters are time-invariant and are used to empirically distinguish the response of different variation types to the geological environment. Approximate values are generally sufficient for practical applications.

Estimation of Normalized Ground Stability Variation Grid from Gravity Variations

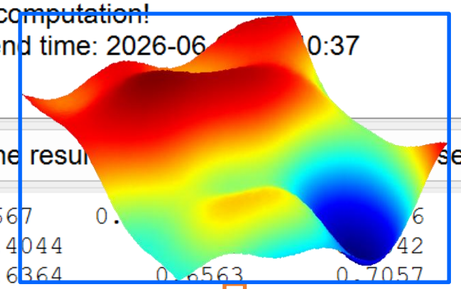
Estimation of Ground Stability Variation Grid Time Series from Gravity Variations

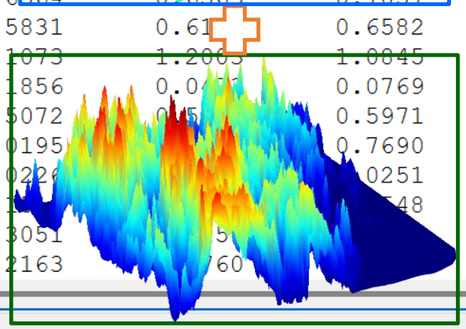
>> Program Process ** Operation Prompts

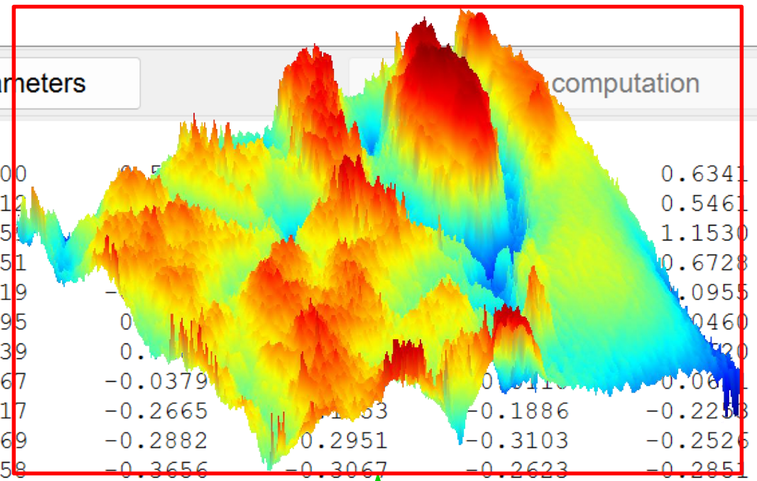
Save program process as

```
>> [Purpose] To quantitatively estimate the ground stability variation grid by applying a normalized statistical synthesis algorithm to the ground gravity (or gravity disturbance) variation rate and its horizontal gradient vector grid model, based on ETideLoad's criteria for stability weakening.
  ** The ground gravity variation may be the ground gravity or gravity disturbance variation.
>> Select a computation function from the two control buttons on the upper right of the interface...
>> [Function] From the ground gravity variation rate grid and ground digital elevation model, calculate the horizontal gradient vector grid for the ground gravity variation rate and the local terrain effect grid on gravity, and then quantitatively estimate the ground stability variation grid by the normalized statistical synthesis algorithm according to the quantitative criteria in ground stability weakening.
>> Open the ground gravity variation rate grid file C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015013106.dat.
>> Open the ground digital elevation model file C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/dtm30s.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/starst.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-28 09:40:12
>> Complete the computation!
>> Computation end time: 2026-06-  0:37
```

Save the resu setting parameters computation







```
 118.50000000  121.50000000   27.00000000   29.00000000    0.01666667    0.                6
      0.8524        0.5934        0.8504        0.3567        0.3348        0.4044                42       0.4800                0.6341
      0.6365        0.5987        0.6464        0.7315        0.7339        0.6364            0.6563       0.7057       .6312    0.5461
      0.4897        0.4605        0.5265        0.6167        0.5763        0.5831            0.61         0.6582       .705     1.1530
      1.1245        0.7552        0.8229        1.0852        0.7726        1.1073            1.2063       1.0845       .7551    0.6728
      0.5414        0.5122        0.5385        0.3513        0.2937        0.1856            0.0          0.0769       .0219    .0955
      0.1748        0.2181        0.2620        0.3313        0.4121        0.5072            0.5          0.5971       .6195    0.0460
      1.2196        1.0652        1.0743        1.1796        1.0169        1.0195            0.9          0.7690       0.8039   0.
      0.1401        0.1350        0.1090        0.0886        0.0645        0.0226            0.0          0.0251       0.0167   -0.0379
     -0.1335       -0.1003       -0.0872       -0.2034       -0.1169       -0.1              0.0          0.0548       -0.2617  -0.2665
     -0.1500       -0.2072       -0.3075       -0.3126       -0.3010       -0.3051           0.5          0.2960       -0.2969  -0.2882
     -0.2318       -0.2613       -0.2264       -0.2795       -0.3434       -0.2163           0.0          0.0760       -0.3058  -0.3656
```

The algorithm identifies stability weakening: Significant Gravity Rate: The ground gravity variation rate is significantly negative (indicating a mass deficit or upward crustal movement); Significant Horizontal Gradient: The modulus of the horizontal gradient vector of the gravity variation rate is large (indicating localized gravitational shear); or Significant Local Terrain Effect: The absolute value of the local terrain effect on gravity is large (the effect is inherently negative).

The ground stability variation is a dimensionless continuous real variable. A value greater than zero at a specific grid cell and epoch indicates a current decrease in ground stability; a value less than zero indicates an improvement in stability.

Computation of Ground Stability Variation Based on Gravity Variations

Estimation of Ground Stability Variation Grid Time Series from Gravity Variations

Open file Save as Import parameters Start computation Save process Follow example

Open any ground gravity variation rate grid file

Set the wildcard of the file names

Ordinal number of the first wildcard in the file name: 5

Number of consecutive wildcards in file name: 10

Considering the local terrain effect on gravity

Open the ground digital elevation model file

Weight of ground gravity variation rate	3.00	Exponent	0.5
Weight of horizontal gradient of gravity variation rate	5.00	Exponent	0.5
Weight of local terrain effects	2.00	Exponent	0.5

The weights and exponent parameters are time-invariant and are used to empirically distinguish the response of different variation types to the geological environment. Approximate values are generally sufficient for practical applications.

Estimation of Normalized Ground Stability Variation Grid from Gravity Variations

Estimation of Ground Stability Variation Grid Time Series from Gravity Variations

>> Program Process ** Operation Prompts

Save program process as

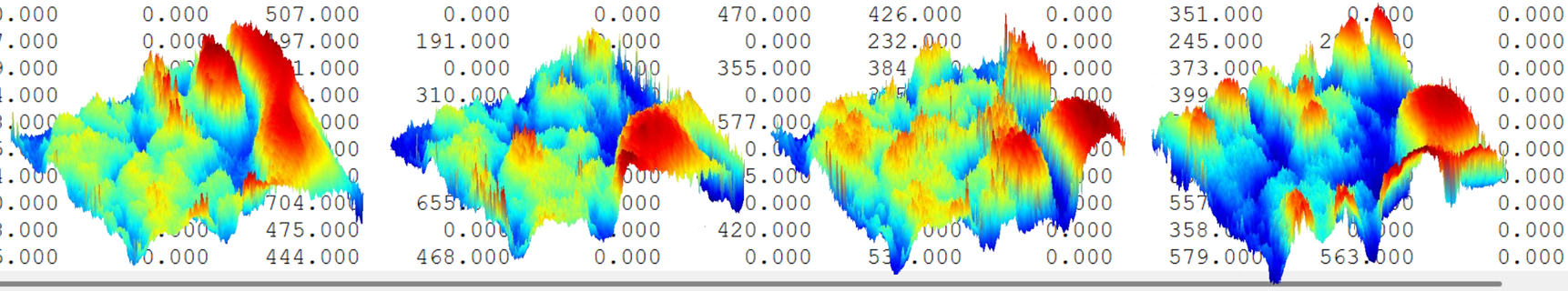
```
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/stability.
  ** The gravity variation rate grid time series files searched by wildcard instantiation:
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015013106.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015030118.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015033112.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015050100.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015053112.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015070100.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015080100.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015083112.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015100100.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015103112.dat
    C:/ETideLoad4.5_win64en/examples/Dyngrngravstablility/gravrate/diff2015120100.dat
>> There are 11 ground gravity variation rate grid files searched by wildcard instantiation.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time:  2026-06-28 09:42:39
>> Complete the computation! The program outputs 11 ground stability variation grid time series files stbgra***.dat. *** represents the sampling epoch time, which is also the 7th atrribute of the grid file header.
>> Computation end time: 2026-06-28 09:43:29
```

Set the result folder Import setting parameters Start computation

```
118.00000000   122.00000000    26.50000000    29.50000000  8.333333333E-03  8.333333333E-03
```

4.0_win64en › examples › Dyngrngravstablility › stability

名称	修改日期
stagra2015013106.dat	2022/2/10 15:00
stagra2015030118.dat	2022/2/10 15:00
stagra2015033112.dat	2022/2/10 15:00
stagra2015050100.dat	2022/2/10 15:00
stagra2015053112.dat	2022/2/10 15:00
stagra2015070100.dat	2022/2/10 15:00
stagra2015080100.dat	2022/2/10 15:00
stagra2015083112.dat	2022/2/10 15:00
stagra2015100100.dat	2022/2/10 15:00
stagra2015103112.dat	2022/2/10 15:00
stagra2015120100.dat	2022/2/10 15:00



The algorithm identifies stability weakening: Significant Gravity Rate: The ground gravity variation rate is significantly negative (indicating a mass deficit or upward crustal movement); Significant Horizontal Gradient: The modulus of the horizontal gradient vector of the gravity variation rate is large (indicating localized gravitational shear); or Significant Local Terrain Effect: The absolute value of the local terrain effect on gravity is large (the effect is inherently negative).

The ground stability variation is a dimensionless continuous real variable. A value greater than zero at a specific grid cell and epoch indicates a current decrease in ground stability; a value less than zero indicates an improvement in stability.

Computation of Ground Stability Variation Based on Variation Vectors

Estimation of Normalized Ground Stability Variation Grid from Variation Vectors

Open file Save as Import parameters Start computation Save process Follow example

Open the variation rate vector grid file

Open a ground digital elevation model file with the same grid specifications

Weight of gradient vector of rate	3.00	Exponent	0.5
Weight of vectors inner product	5.00	Exponent	0.5

The weights and exponent parameters are time-invariant and are used to empirically distinguish the response of different variation types to the geological environment. Approximate values are generally sufficient for practical applications.

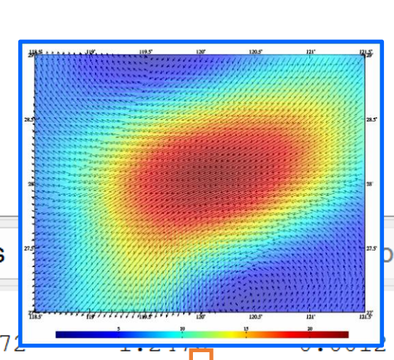
Estimation of Normalized Ground Stability Variation Grid from Variation Vectors

Estimation of Ground Stability Variation Grid Time Series from Variation Vectors

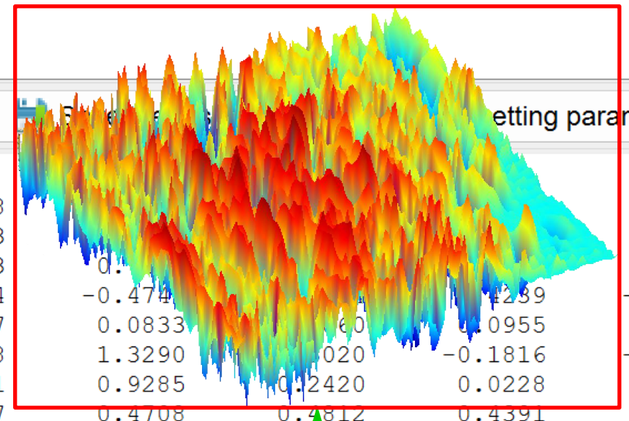
>> Program Process ** Operation Prompts

Save program process as

>> [Purpose] To quantitatively estimate the ground stability variation grid by applying a normalized statistical synthesis algorithm to the ground tilt (vertical deflection or horizontal displacement) variation rate vector grid and the ground digital elevation model (DEM). This computation adheres to the quantitative criteria for ground stability weakening as defined by ETideLoad.
** The input variation vector may represent ground tilt variation, vertical deflection variation, or ground horizontal displacement.
>> Select a computation function from the two control buttons on the upper right of the interface...
>> [Function] Calculates the horizontal gradient vector grids for both the variation rate and the terrain, as well as their inner product grid. It then estimates the normalized ground stability variation grid using the normalized statistical synthesis algorithm based on the predefined criteria.
>> Open the variation rate vector grid file C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate.cxpcbhl20150201.txt.
>> Open the ground digital elevation model file with the same grid specifications C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/dtm.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/starst.dat.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-28 10:27:31
>> Complete the computation!
>> Computation end time: 2026-06-28 10:27:31



Vector type Ground tilt vector



118.500000	121.500000	27.000000	29.000000	1.66666667E-02	1.66666667E-02					
1.1784	1.3003	-0.4974	-0.0941	0.8568	-0.1293	0.2788			672	
1.3303	1.2541	0.9366	1.6049	1.0379	0.2106	0.9273			059	1.03 -0.2171
1.2539	0.4545	0.9804	1.0585	-0.0585	-0.5616	-0.3193	0.		365	0.601 0.2610
0.3726	-0.9776	0.1657	-0.1272	-1.2333	-0.0268	0.6234	-0.474		239	-0.6664 -0.70 0.7081
0.3273	0.9805	0.9826	0.2149	0.9248	1.3723	0.9667	0.0833	60	0955	0.8812 0.3515
1.1489	1.0818	-0.3428	-0.4025	-0.1673	1.3185	1.6198	1.3290	020	-0.1816	-0.0791 1.3718
1.1446	0.9849	1.3006	1.3195	1.1319	1.6247	1.2141	0.9285	0.2420	0.0228	1.405 0435
1.3355	1.3327	0.4323	0.4245	0.4422	0.4461	0.4427	0.4708	0.4812	0.4391	0.425 41
0.4981	0.4708	0.4817	0.5153	0.5077	0.4889	0.4794	0.4513	0.4169	0.4469	0.4689 69
0.4034	0.4344	0.4104	0.3845	0.3936	0.3867	0.3741	0.3967	0.4082	0.3710	0.3336 494

The algorithm identifies stability weakening: Convergence/Divergence: The directions of the ground tilt (vertical deflection or horizontal displacement) variations exhibit convergence or divergence (indicating compressive or tensile stress in the adjacent ground); or Vector Alignment: The inner product of the ground tilt (vertical deflection or horizontal displacement) variation rate vector and the terrain horizontal gradient vector is greater than zero (indicating the ground movement is aligned with the terrain slope direction).

The ground stability variation is a dimensionless continuous real variable. A value greater than zero at a specific grid cell and epoch indicates a current decrease in ground stability; a value less than zero indicates an improvement in stability.

Computation of Ground Stability Variation Based on Variation Vectors

Estimation of Ground Stability Variation Grid Time Series from Variation Vectors

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Open any variation rate vector grid file

Set the wildcard of the file names

Ordinal number of the first wildcard in the file name: 8

Number of consecutive wildcards in file name: 8

Open a ground digital elevation model file with the same grid specifications

Weight of gradient vector of rate: 3.00 Exponent: 0.5

Weight of vectors inner product: 5.00 Exponent: 0.5

The weights and exponent parameters are time-invariant and are used to empirically distinguish the response of different variation types to the geological environment. Approximate values are generally sufficient for practical applications.

Estimation of Normalized Ground Stability Variation Grid from Variation Vectors

Estimation of Ground Stability Variation Grid Time Series from Variation Vectors

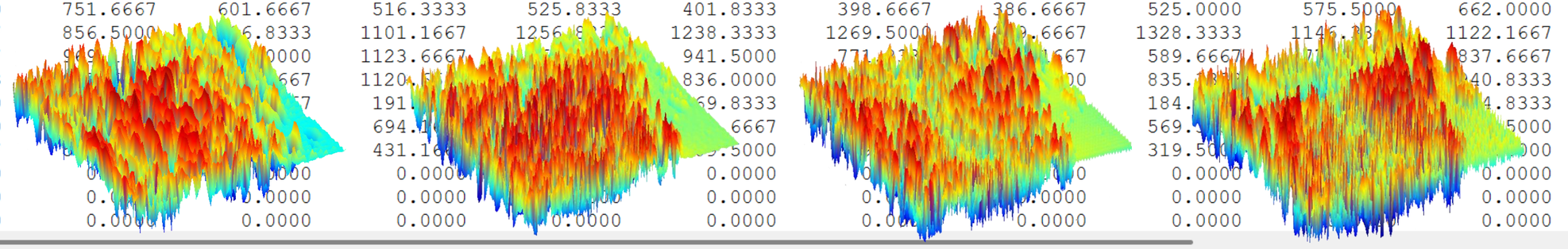
>> Program Process ** Operation Prompts

Save program process as

```
Dyndeflectstablility/dtm.dat.
>> Create or select the result file folder C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/stabiility.
 ** The variation rate vector grid time series files searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20150201.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20150302.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20150403.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20150504.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20150605.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20150706.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20150807.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20150908.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20151009.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20151110.txt
   C:/ETideLoad4.5_win64en/examples/Dyndeflectstablility/vectrate/cxpcbh20151211.txt
>> There are 11 variation rate vector grid files searched by wildcard instantiation.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-28 10:29:02
>> Complete the computation! The program outputs 11 ground stability variation grid time series files stbvdf***.dat. *** represents the sampling epoch time, which is also the 7th atrribute of the grid file header.
>> Computation end time: 2026-06-28 10:29:03
```

Vector type: Ground tilt vector | Set the result folder | Import setting parameters | Start computation

```
 118.500000  121.500000   27.000000   29.000000  0.01666667  0.01666667
    521.8333    597.0000    751.6667    601.6667    516.3333    525.8333    401.8333    398.6667    386.6667    525.0000    575.5000    662.0000
    682.0000    775.1667    856.5000    [illegible]    1101.1667    1256.8[illegible]    1238.3333    1269.5000    [illegible]    1328.3333    1146.[illegible]    1122.1667
    884.3333    931.1667    [illegible]    [illegible]    1123.6667    [illegible]    941.5000    [illegible]    [illegible]    589.6667    [illegible]    837.6667
    923.6667   1019.8333    [illegible]    [illegible]    1120.[illegible]    [illegible]    836.0000    [illegible]    [illegible]    835.[illegible]    [illegible]    840.8333
    546.3333    454.5000    [illegible]    [illegible]    191[illegible]    [illegible]    69.8333    [illegible]    [illegible]    184.[illegible]    [illegible]    4.8333
     88.6667    116.5000    [illegible]    [illegible]    694.1[illegible]    [illegible]    6667    [illegible]    [illegible]    569.[illegible]    [illegible]    5000
    636.3333    646.1667    [illegible]    [illegible]    431.16[illegible]    [illegible]    .5000    [illegible]    [illegible]    319.50[illegible]    [illegible]    000
    162.5000      0.0000    [illegible]    [illegible]    0.0000    [illegible]    0.0000    [illegible]    [illegible]    0.0000    [illegible]    0.0000
      0.0000      0.0000    [illegible]    [illegible]    0.0000    [illegible]    0.0000    [illegible]    [illegible]    0.0000    [illegible]    0.0000
      0.0000      0.0000    [illegible]    [illegible]    0.0000    [illegible]    0.0000    [illegible]    [illegible]    0.0000    [illegible]    0.0000
```



The algorithm identifies stability weakening: Convergence/Divergence: The directions of the ground tilt (vertical deflection or horizontal displacement) variations exhibit convergence or divergence (indicating compressive or tensile stress in the adjacent ground); or Vector Alignment: The inner product of the ground tilt (vertical deflection or horizontal displacement) variation rate vector and the terrain horizontal gradient vector is greater than zero (indicating the ground movement is aligned with the terrain slope direction).

The ground stability variation is a dimensionless continuous real variable. A value greater than zero at a specific grid cell and epoch indicates a current decrease in ground stability; a value less than zero indicates an improvement in stability.

Statistical Synthesis and Prediction of Ground Stability Variations

Optimized Synthesis of Two Geodetic Variation Grid Time Series

Open file Save as Import parameters Start computation Save process Follow example

Optimized Synthesis of Two Geodetic Variation Grid Time Series | Optimized Synthesis of Three Stability Variation Grid Time Series | Spatiotemporal Characteristics Synthesis of Ground Stability Variations

Open any among group 1 of variation grid time series files

Ordinal number of first wildcard in file name: 7

Number of consecutive wildcards: 10

Weight q_a: 3.0 Exponent n_a: 0.5

Open any among group 2 of variation grid time series files

Ordinal number of first wildcard in file name: 7

Number of consecutive wildcards: 10 Single grid

Weight q_b: 5.0 Exponent n_b: 0.5

Set the result folder

Save program process as

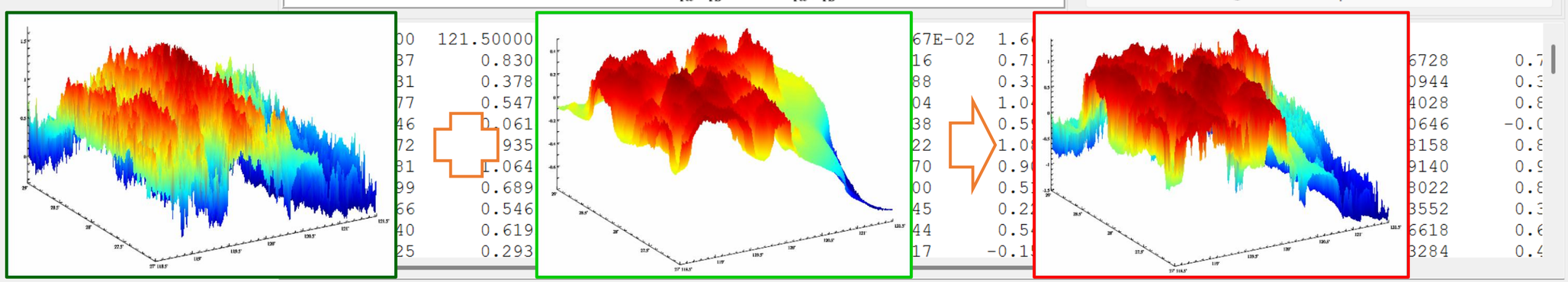
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2016100106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2016103118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2016120106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017010100.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017013106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017030118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017033118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017050106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017053118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017070106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017080100.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017083118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017100106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017103118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017120106.dat
>> There are 35 variation grid files searched by wildcard instantiation.
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-28 11:35:30
>> Complete the computation! The program outputs 3 synthesized variation grid time series files integr***.dat. *** represents the sampling epoch time, which is also the 7th atrribute of the grid file header.
>> Computation end time: 2026-06-28 11:35:31

[Statistical Synthesis Formulation] $x = sgn(A)|A|^{n_a}Q_a + sgn(B)|B|^{n_b}Q_b$

$A = (a - \bar{a})/\sigma_a, B = (b - \bar{b})/\sigma_b, Q_a = \frac{q_a}{q_a+q_b}, Q_b = \frac{q_b}{q_a+q_b}$, sgn(*) is sign function

Import setting parameters

Start computation



By repeatedly calling the function [Optimized Synthesis of Two Geodetic Variation Grid Time Series] n−1 times, the statistical normalization synthesis for n geodetic variation grid time series can be realized. In such cases, n sets of weights and exponents can be designed in advance. During the m-th synthesis (m<n), the accumulated weight is the sum of the previous m−1 weights, and the exponent is set to 1.

The ground stability variations derived from vertical deformation exhibit a large spatial influence range but weak close-range sensitivity. Conversely, those based on gravity variations have strong close-range sensitivity but a limited spatial influence range. Variations based on tilt vectors can describe directional changes in ground stability. The further synthesis of these three indicators effectively improves the overall sensitivity and reliability of the ground stability variation grid time series.

Statistical Synthesis and Prediction of Ground Stability Variations

Optimized Synthesis of Three Stability Variation Grid Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Optimized Synthesis of Two Geodetic Variation Grid Time Series

Optimized Synthesis of Three Stability Variation Grid Time Series

Spatiotemporal Characteristics Synthesis of Ground Stability Variations

Open any among group 1 of variation grid time series files

Ordinal number of first wildcard in file name 7

Number of consecutive wildcards 10

Weight q_a 3.0 Exponent n_a 0.5

Open any among group 2 of variation grid time series files

Ordinal number of first wildcard in file name 7

Number of consecutive wildcards 10 Single grid

Weight q_b 5.0 Exponent n_b 0.5

Open any among group 3 of variation grid time series files

Ordinal number of first wildcard in file name 7

Number of consecutive wildcards 10 Single grid

Weight q_c 5.0 Exponent n_c 0.5

Set the result folder

Save program process as

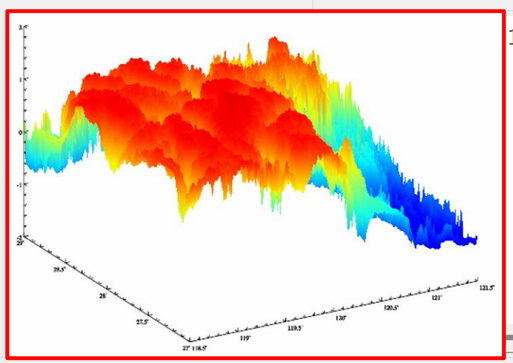
```
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017030118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017033118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017050106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017053118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017070106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017080100.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017083118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017100106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017103118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/vdfstability/stahgt2017120106.dat
>> There are 35 files belonging to group 2 of grid files searched by wildcard instantiation.
 ** The group 3 of grid time series files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/twointegral/statwc2015013106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/twointegral/statwc2015030118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/twointegral/statwc2015080100.dat
>> There are 3 files belonging to group 3 of grid files searched by wildcard instantiation.
>> Setting parameters have been imported into the program!
 ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-28 11:41:15
>> Complete the computation! The program outputs 3 synthesized stability variation grid time series files stathr***.dat. *** represents the sampling epoch time, which is also the 7th atrribute of the grid file header.
>> Computation end time: 2026-06-28 11:41:15
```

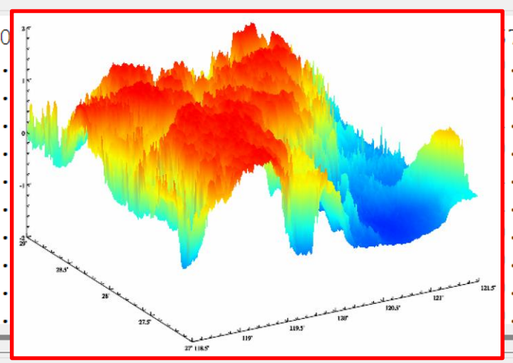
[Statistical Synthesis Formulation] $\boldsymbol{x = sgn(A)|A|^{n_a}Q_a + sgn(B)|B|^{n_b}Q_b}$

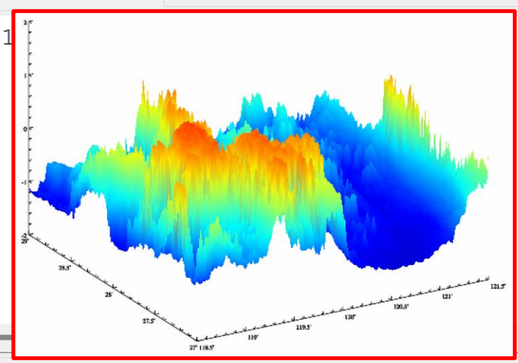
$\boldsymbol{A = (a - \bar{a})/\sigma_a, B = (b - \bar{b})/\sigma_b, Q_a = \frac{q_a}{q_a+q_b}, Q_b = \frac{q_b}{q_a+q_b}}$, sgn(*) is sign function.

Import setting parameters

Start computation







By repeatedly calling the function [Optimized Synthesis of Two Geodetic Variation Grid Time Series] n−1 times, the statistical normalization synthesis for n geodetic variation grid time series can be realized. In such cases, n sets of weights and exponents can be designed in advance. During the m-th synthesis (m<n), the accumulated weight is the sum of the previous m−1 weights, and the exponent is set to 1.

The ground stability variations derived from vertical deformation exhibit a large spatial influence range but weak close-range sensitivity. Conversely, those based on gravity variations have strong close-range sensitivity but a limited spatial influence range. Variations based on tilt vectors can describe directional changes in ground stability. The further synthesis of these three indicators effectively improves the overall sensitivity and reliability of the ground stability variation grid time series.

Statistical Synthesis and Prediction of Ground Stability Variations

Spatiotemporal Characteristics Synthesis of Ground Stability Variations

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Optimized Synthesis of Two Geodetic Variation Grid Time Series

Optimized Synthesis of Three Stability Variation Grid Time Series

Spatiotemporal Characteristics Synthesis of Ground Stability Variations

Open any among groud stability variation grid time series files

Set the result folder

Save program process as

Ordinal number of first wildcard in file name: 7

Number of consecutive wildcards: 10

Weight q_a: 3.0 Exponent n_a: 0.5

Spatial filtering mode: Moving average filter

Spatial domain filter parameter: 2

Time domain filter parameter: 2.0

Start time for the target time series: 20150131

End time for the target time series: 20151201

Sampling internal for target time series: 15.00 day

Weight of horizontal gradient: 5.0 Exponent: 0.5

Weight of time derivative: 5.0 Exponent: 0.5

>> [Function] Calculates the spatial horizontal gradient and time-derivative grid time series from the input stability variation series. Using low-pass filtering and statistical normalization synthesis algorithms, it generates output files (stachr*.dat) that fuse spatiotemporal characteristics according to specified sampling and statistical parameters.

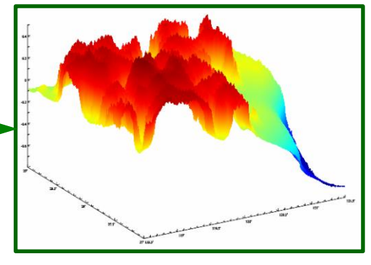
** The program outputs also the filtered ground stability variation grid time series files staflt*.dat, the ground stability variation horizontal gradient (modulus, per km) grid time series files stagrd*.dat, and its time-derivative (per week) grid time series files stadft*.dat into the current directory.

>> Open any of variation grid time series files C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015013106.dat.

>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/natureintegral.

** The group 1 of grid time series files searched by wildcard instantiation:

C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015013106.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015030118.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015033112.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015050100.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015053112.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015070100.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015080100.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015083112.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015100100.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015103112.dat
C:/ETideLoad4.5_win64en/examples/Dynstabgrdintgrestm/grastability/stagra2015120100.dat



>> There are 11 variation grid files searched by wildcard instantiation.

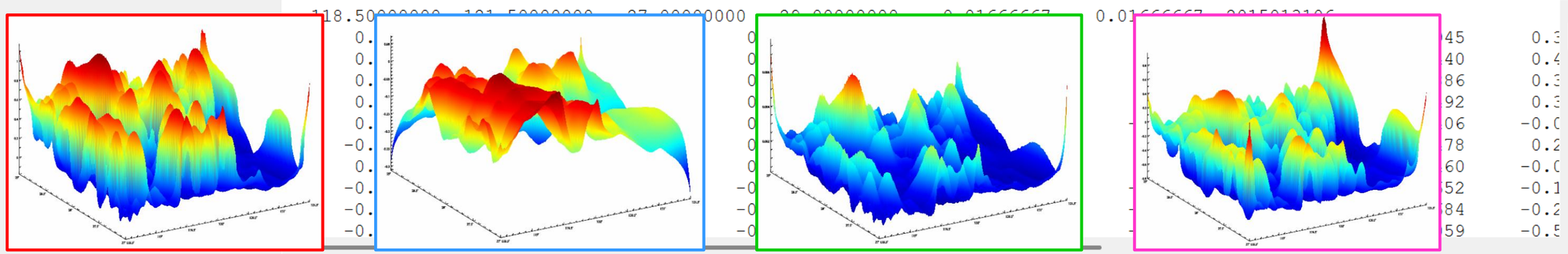
>> Setting parameters have been imported into the program!

[Statistical Synthesis Formulation] $x = sgn(A)|A|^{n_a}Q_a + sgn(B)|B|^{n_b}Q_b$

$A = (a - \overline{a})/\sigma_a, B = (b - \overline{b})/\sigma_b, Q_a = \frac{q_a}{q_a+q_b}, Q_b = \frac{q_b}{q_a+q_b}$, sgn(*) is sign function.

Import setting parameters

Start computation



By repeatedly calling the function [Optimized Synthesis of Two Geodetic Variation Grid Time Series] n−1 times, the statistical normalization synthesis for n geodetic variation grid time series can be realized. In such cases, n sets of weights and exponents can be designed in advance. During the m-th synthesis (m<n), the accumulated weight is the sum of the previous m−1 weights, and the exponent is set to 1.

The ground stability variations derived from vertical deformation exhibit a large spatial influence range but weak close-range sensitivity. Conversely, those based on gravity variations have strong close-range sensitivity but a limited spatial influence range. Variations based on tilt vectors can describe directional changes in ground stability. The further synthesis of these three indicators effectively improves the overall sensitivity and reliability of the ground stability variation grid time series.

Editing, Calculation, and Visualization Tools for Geodetic Data Files

- Data Interpolation, Extraction, and Land/Sea Masking
  - Grid Resolution Modification via Interpolation
  - Spatial Interpolation for Point Attributes from Grid
  - Record Selection Based on Attribute Conditions
  - Separation of (Vector) Grid Data via Masking
- Simple and Direct Calculations on Geodetic Data Files
  - Weighted Operations on Two Attributes in a Record File
  - Weighted Operations on Two Geodetic Grid Files
  - Product Operations on Two Vector Grid Files
  - Weighted Operations on Two Harmonic Coefficient Files
- Simple Gridding and Regional Geodetic Grid Construction
  - Gridding of Discrete Geodetic Data via Simple Interpolation
  - Vector Grid Interpolation from Dual Attribute Records
  - High-Resolution Gridding via Direct Averaging
  - Construction of General Geodetic Grid File
  - Data Extraction by Latitude-Longitude Extent
- Operations on Variation Time Series with Same Specifications
  - Weighted Operations on Two Record Time Series with Same Specifications
  - Construction of Record Time Series from Batch Discrete Point Files
  - Weighted Operations on Two Groups of Grid Time Series
  - Weighted Operations on Two Groups of Vector Grid Time Series
- Construction and Transformation of Vector Grid Files
  - Synthesis of Vector Grid File from Two Scalar Grids
  - Decomposition of Vector Grid File into Scalar Components
  - Vector Grid Representation Transformation
  - Conversion of Vector Grid File to Discrete Point File
- Visualization Plot Tools for Various Geodetic Data Files
  - Visualization for Multi-Attributes in Ground Variation Time Series
  - Visualization for Variation Record Time Series on Geodetic Network
  - Visualization of Specified Attributes in Discrete Point File
  - Visualization of Geodetic Grid or Variation Grid Time Series Files
  - Visualization of Geodetic Vector Grid File
- Conversion of General ASCII Data into ETideLoad Format
- Statistical Analysis of Geodetic Data File
- Visualization for Geodetic Kernel Functions
- Gross Error Detection and Weighted Basis Function Gridding of Geodetic Observations
  - Gross Error Detection Based on a Low-Pass Reference Surface
  - Observation Weight Estimation Using a Specified Reference Attribute
  - Gridding of Heterogeneous Data via Weighted Basis Function Interpolation
  - Batch Gridding via Weighted Basis Function Interpolation
  - Gridding of Record Time Series via Weighted Basis Function Interpolation

Conversion of General ASCII Data into ETideLoad Format

Conversion of General ASCII Data into ETideLoad Format

	62636844.042	62636851.905	62636853.400	-7.8630	-9.3578	-1.4948	
2	102.546777	24.458002	1659.0410	-33.6150	-0.8046	0.94	-0.0014
3	102.632412	24.458211	2120.2558	-33.3212	-0.7142	1.23	0.0890
4	102.725921	24.460578	2111.3872	-33.2058	-0.7612	1.68	0.0420
5	102.420803	24.566357	1990.6386	-33.5334	-0.7157	1.95	0.0875
6	102.528697	24.562786	1936.4260	-33.3720	-0.7491	2.93	0.0541
9	102.832641	24.575505	1977.4949	-33.1581	-0.8223	1.04	-0.0191
10	102.345532	24.668953	1919.7825	-33.7565	-0.7782	3.53	0.0250
11	102.423972	24.652933	1959.3369	-33.4781	-0.7548	2.02	0.0484
12	102.529771	24.667079	2157.7877	-33.2933	-0.7317	1.46	0.0715
13	102.631063	24.657055	1906.3415	-33.3155	-0.8185	3.53	-0.0153
14	102.742718	24.652871	1935.7882	-33.1128	-0.7767	3.39	0.0265
15	102.843573	24.642787	1880.7707	-33.1133	-0.8319	0.81	-0.0287
16	103.137778	24.658224	1838.4387	-32.7463	-0.7730	0.53	0.0302
17	102.426305	24.743284	1929.0475	-33.4575	-0.7771	1.48	0.0261
20	102.729945	24.734909	1856.2213	-33.2087	-0.8356	6.12	-0.0324
21	102.840819	24.752018	2117.8582	-32.8948	-0.7459	1.56	0.0573
22	102.939253	24.728089	2050.9590	-32.8500	-0.7907	0.81	0.0125
23	103.029713	24.748496	2034.1986	-32.8194	-0.8217	0.88	-0.0185
24	103.129600	24.753135	1575.0654	-32.8486	-0.8477	1.41	-0.0445
25	103.227846	24.747081	1668.7801	-32.6509	-0.8116	3.06	-0.0084

Open the source ASCII text file | Number of rows of the file header 1 | Exact and edit data | Organize and display resu

①

Extract and Edit Data from Source Text File

The record atrributes of source file

2
102.546777
24.458002
1659.0410
-33.6150
-0.8046
0.94
-0.0014

Add atrribute | Insert>>> | Delete--- | Clear all

The record atrributes of target file

2
102.546777
24.458002
1659.0410
-33.6150
-0.0014

Set the target file header / Editable

No lon lat hgt ksi residual

Set the target record table header / Editable

Ok | Cancel

②

Conversion of General ASCII Data into ETideLoad Format

Open text file | Save as | Save process | Follow example

No lon lat hgt ksi residual

2	102.546777	24.458002	1659.0410	-33.6150	-0.0014
3	102.632412	24.458211	2120.2558	-33.3212	0.0890
4	102.725921	24.460578	2111.3872	-33.2058	0.0420
5	102.420803	24.566357	1990.6386	-33.5334	0.0875
6	102.528697	24.562786	1936.4260	-33.3720	0.0541
9	102.832641	24.575505	1977.4949	-33.1581	-0.0191
10	102.345532	24.668953	1919.7825	-33.7565	0.0250
11	102.423972	24.652933	1959.3369	-33.4781	0.0484
12	102.529771	24.667079	2157.7877	-33.2933	0.0715
13	102.631063	24.657055	1906.3415	-33.3155	-0.0153
14	102.742718	24.652871	1935.7882	-33.1128	0.0265
15	102.843573	24.642787	1880.7707	-33.1133	-0.0287
16	103.137778	24.658224	1838.4387	-32.7463	0.0302
17	102.426305	24.743284	1929.0475	-33.4575	0.0261
20	102.729945	24.734909	1856.2213	-33.2087	-0.0324
21	102.840819	24.752018	2117.8582	-32.8948	0.0573
22	102.939253	24.728089	2050.9590	-32.8500	0.0125
23	103.029713	24.748496	2034.1986	-32.8194	-0.0185
24	103.129600	24.753135	1575.0654	-32.8486	-0.0445
25	103.227846	24.747081	1668.7801	-32.6509	-0.0084

③

Open the source ASCII text file | Number of rows of the file header 1 | Exact and edit data | Organize and display result file | Save data in the textbox as | Save program process as

Display of the input-output file↓

>> [Function] Converts general ASCII data record files from diverse sources and non-standard formats into discrete geodetic point record files compliant with the ETideLoad format.
** Please click the button [Open the source ASCII text file]...
>> Open the source ASCII text file C:/ETideLoad4.5_win64en/examples/EdPntrecordstandard/rntksich.txt.
** look at the source file information in the text box above，enter the number of rowsof the file header firstly，click the button [Exact and edit data]...
>> Set the format parameters about the target file header, record table headerand record attributes.
** Click the control button [Organize and display result file] to calculate the maximum character width for each column of the target record attributes and display the formatted header and records in an editable textbox. Please wait while the program organizes the target record attributes.
>> Complete the statistics of the maximum number of characters of the target record attributes, and display the target file header, record table header, and all the records in the editable textbox.
** Check the target records file displayed in the editable textbox. Click the control button [Save data in the text box as] to save the contents in the textbox above as the target file...
>> The data in the textbox above have been saved into the geodetic file C:/ETideLoad4.5_win64en/examples/EdPntrecordstandard/result.txt!

Data Interpolation, Extraction, and Land/Sea Masking

Grid Resolution Modification via Interpolation

Open file | Save as | Import parameters | Start computation | Save process

Follow example

Grid Resolution Modification via Interpolation | Spatial Interpolation for Point Attributes from Grid | Record Selection Based on Attribute Conditions | Separation of (Vector) Grid Data via Masking

Open a geodetic grid file

>> Program Process ** Operation Prompts

Save program process as

Process many files in a folder

Grid spatial resolution 5.000′

Interpolation mode

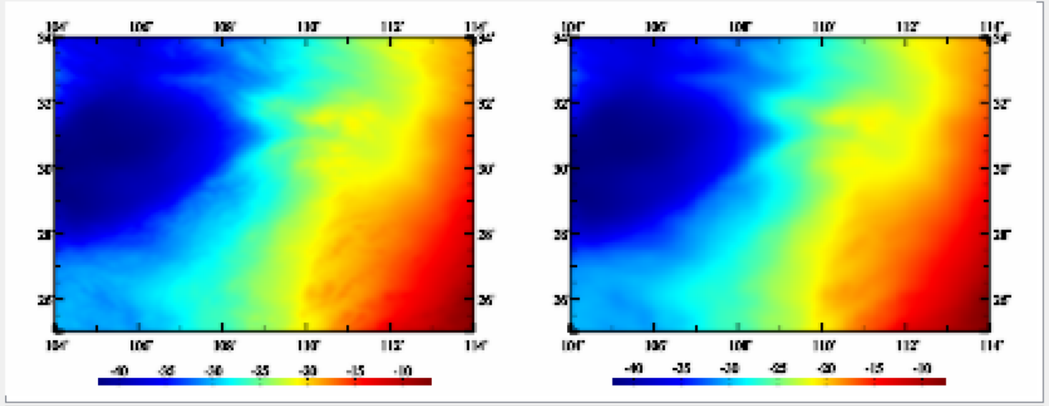
Weighted inverse distance

```
>> Select the function module from the four control buttons at the top of the interface...
>> [Function] Modifies the spatial resolution of a geodetic grid based on a target resolution and a selected interpolation algorithm (Upsampling or Downsampling).
  ** When the target resolution is higher than the source resolution, the program automatically employs the Inverse Distance Weighted (IDW) interpolation method.
>> Open a geodetic grid file C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/dbmGM1800150sksi.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/dbmGM1800300sksi.dat.
>> The parameter settings have been entered into the system!
  ** Click the [Start Computation] control button, or the [Start Computation] tool button...
>> Computation start time：2026-06-29 10:22:36
>> Complete the computation!
>> Computation end time: 2026-06-29 10:22:38
```

Save the results as | Import setting parameters | Start computation

```
  104.000000   114.000000    25.000000    34.0000
   -30.2919     -30.2668     -30.2778     -30.34
   -30.6576     -30.5428     -30.4278     -30.33
   -29.4737     -29.2776     -29.1069     -28.84
   -26.6049     -26.5548     -26.5321     -26.47
   -23.9284     -23.7268     -23.5718     -23.25
   -20.2001     -19.8410     -19.5237     -18.92
   -15.2558     -14.8489     -14.5217     -13.95
   -11.0481     -10.7002     -10.4082      -9.95
   -30.2686     -30.2461     -30.2499     -30.29
   -30.5727     -30.4886     -30.4152     -30.37
   -29.5261     -29.3636     -29.2124     -28.93
   -26.6002     -26.5250     -26.4927     -26.43
   -23.9027     -23.7075     -23.5598     -23.26
   -20.2678     -19.9160     -19.6042     -19.00
```

Extract results | Plot↓



input grid | result grid

Data Interpolation, Extraction, and Land/Sea Masking

Spatial Interpolation for Point Attributes from Grid

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Grid Resolution Modification via Interpolation | Spatial Interpolation for Point Attributes from Grid | Record Selection Based on Attribute Conditions | Separation of (Vector) Grid Data via Masking

Open a discrete point file

Set format parameters of the file

Number of rows of the file header 1

Open the grid file for interpolation

Interpolation mode

Gaussian base function

>> Program Process ** Operation Prompts

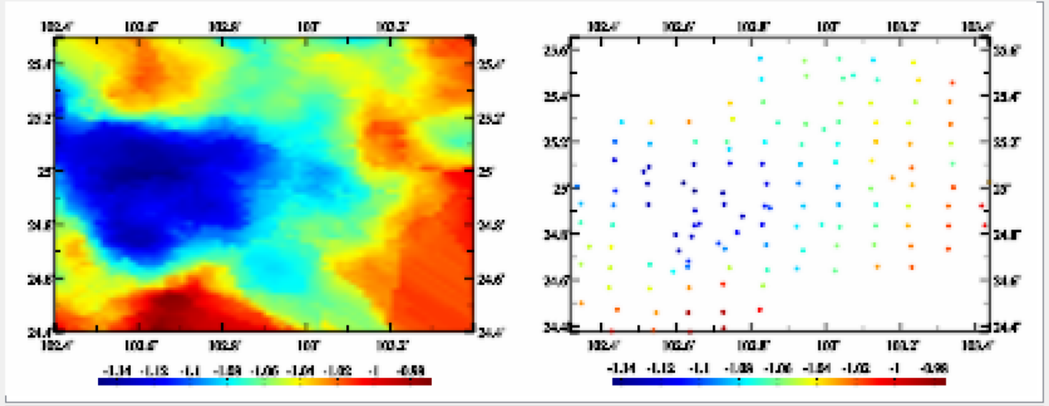
Save program process as

```
>> Open a geodetic grid file C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/dbmGM1800150sksi.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/dbmGM1800300sksi.dat.
>> The parameter settings have been entered into the system!
  ** Click the [Start Computation] control button, or the [Start Computation] tool button...
>> Computation start time：2026-06-29 10:22:36
>> Complete the computation!
>> Computation end time: 2026-06-29 10:22:38
>> [Function] Interpolates attribute values for specific geodetic sites from a numerical grid using a selected spatial interpolation method.
>> Open a discrete point file C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/pntdata.txt.
  ** Look at the input file information in the text box above, set the file format parameters...
>> Open the grid file for interpolationC:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/pntgrid.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/rstpnt.txt.
>> The parameter settings have been entered into the system!
  ** Click the [Start Computation] control button, or the [Start Computation] tool button...
>> Computation start time：2026-06-29 10:24:36
>> Complete the computation!
>> Computation end time: 2026-06-29 10:24:36
```

Save the results as | Import setting parameters | Start computation

```
t ellipHeight(m)  rntKsi(m)  TerEff(mGal)
69   1972.7703   -1.0013      -3.3508      -1.0215
02   1659.0410   -1.0916      -6.6124      -1.0283
11   2120.2558   -0.9639      -5.0422      -0.9844
78   2111.3872   -0.9936      -3.6867      -0.9869
57   1990.6386   -1.0706      -3.1489      -1.0464
36   1936.4260   -1.0402      -2.0473      -1.0453
60   2192.9271   -0.9743      -4.0534      -1.0273
70   2303.7797   -0.9566      -7.1388      -1.0123
05   1977.4949   -1.0619      -5.9858      -1.0524
53   1919.7825   -1.0840      -1.6645      -1.0519
33   1959.3369   -1.0281      -3.0476      -1.0480
79   2157.7877   -1.0165      -4.2396      -1.0696
55   1906.3415   -1.0806      -1.6637      -1.0942
71   1935.7882   -1.0343      -1.7419      -1.0502
```

Extract results | Plot↓



input grid | results interpolated

Data Interpolation, Extraction, and Land/Sea Masking

Record Selection Based on Attribute Conditions

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Grid Resolution Modification via Interpolation | Spatial Interpolation for Point Attributes from Grid | Record Selection Based on Attribute Conditions | Separation of (Vector) Grid Data via Masking

Open a discrete point file

Set format parameters of the file

Number of rows of the file header: 1

Colmun ordinal number of the condition atrribute: 4

Minimum: -28.00

Maximum: 9000.00

>> Program Process ** Operation Prompts

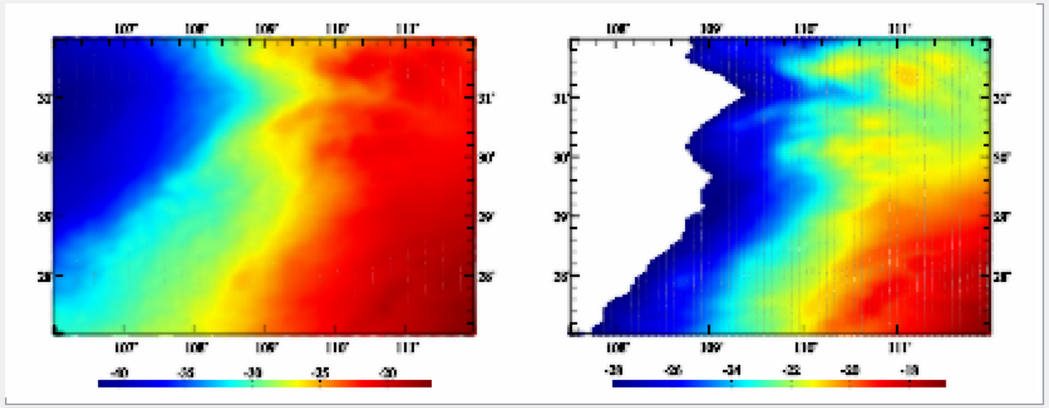
Save program process as

```
>> Open a discrete point file C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/pntdata.txt.
  ** Look at the input file information in the text box above, set the file format parameters...
>> Open the grid file for interpolationC:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/pntgrid.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/rstpnt.txt.
>> The parameter settings have been entered into the system!
  ** Click the [Start Computation] control button, or the [Start Computation] tool button...
>> Computation start time：2026-06-29 10:24:36
>> Complete the computation!
>> Computation end time: 2026-06-29 10:24:36
>> [Function] Filters geodetic records from a file based on a specified minimum and maximum range for a selected attribute.
>> Open a discrete point file C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/chksinterp.txt.
  ** Look at the input file information in the text box above, set the file format parameters...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/chksinterp_.txt.
>> The parameter settings have been entered into the system!
  ** Click the [Start Computation] control button, or the [Start Computation] tool button...
>> Computation start time：2026-06-29 10:25:51
>> Complete the computation!
>> Computation end time: 2026-06-29 10:26:08
```

Save the results as | Import setting parameters | Start computation

lon(degree/decimal)	lat	ellipHeight(m)	rent
11605	107.520833	27.020833	-27.977
11606	107.562500	27.020833	-27.942
11607	107.604167	27.020833	-27.958
11608	107.645833	27.020833	-27.996
11611	107.770833	27.020833	-27.968
11612	107.812500	27.020833	-27.882
11613	107.854167	27.020833	-27.764
11614	107.895833	27.020833	-27.631
11615	107.937500	27.020833	-27.508
11616	107.979167	27.020833	-27.412
11617	108.020833	27.020833	-27.337
11618	108.062500	27.020833	-27.255
11619	108.104167	27.020833	-27.139
11620	108.145833	27.020833	-26.986

Extract results | Plot↓



input points | result points

Data Interpolation, Extraction, and Land/Sea Masking

Separation of (Vector) Grid Data via Masking

Open file | Save as | Import parameters | Start computation | Save process

Follow example

Grid Resolution Modification via Interpolation | Spatial Interpolation for Point Attributes from Grid | Record Selection Based on Attribute Conditions | Separation of (Vector) Grid Data via Masking

Open a geodetic grid file

>> Program Process ** Operation Prompts

Save program process as

Process many files in a folder

Separate vector grid data

Constant cell-grid value 9990.00

Open the reference grid file

Minimum -99000.00

Maximum 0.00

Interpolation mode

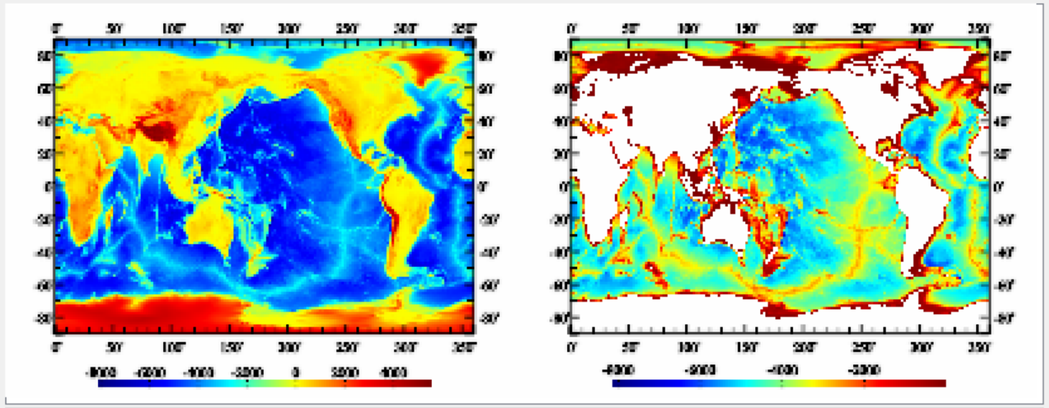
Weighted inverse distance

```
  ** Look at the input file information in the text box above, set the file format parameters...
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/chksinterp_.txt.
>> The parameter settings have been entered into the system!
  ** Click the [Start Computation] control button, or the [Start Computation] tool button...
>> Computation start time：2026-06-29 10:25:51
>> Complete the computation!
>> Computation end time: 2026-06-29 10:26:08
>> [Function] Utilizes a reference grid to delineate distinct regions. It separates the target region (vector) grid data by replacing grid
values that do not meet the reference conditions with constant placeholders (masking).
  ** Requirement: The reference grid must effectively delineate the target area via its cell value range (e.g., land/sea mask).
>> Open a geodetic grid file C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/ETOPO30msph.dat.
>> Open the reference grid file C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/ETOPO30msph.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edatafsimpleprocess/ETOPO30msea.dat.
>> The parameter settings have been entered into the system!
  ** Click the [Start Computation] control button, or the [Start Computation] tool button...
>> Computation start time：2026-06-29 10:28:03
>> Complete the computation!
>> Computation end time: 2026-06-29 10:28:46
```

Save the results as | Import setting parameters | Start computation

```
     0.000000   360.000000   -90.000000    90.000000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
  9990.0000    9990.0000    9990.0000    9990.0000
```

Extract results | Plot↓



input grid | output grid

Simple and Direct Calculations on Geodetic Data Files

Weighted Operations on Two Attributes in a Record File

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Weighted Operations on Two Attributes in a Record File | Weighted Operations on Two Geodetic Grid Files | Product Operations on Two Vector Grid Files | Weighted Operations on Two Harmonic Coefficient Files

Open the discrete point file

The file format parameter

Number of rows of the file header: 0

Column ordinal number of attribute 1: 5

Column ordinal number of attribute 2: 6

Select operation mode

Plus +

The first weight: 1.00

The second weight: 1.00

>> Program Process ** Operation Prompts

Save program process as

```
>> Select the computation function from the 4 control buttons on the top of the interface...
>> [Function] Performs weighted addition, subtraction, or multiplication on two specified attributes within a discrete point file.
>> Open the discrete point file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/pntdata.txt.
  ** Look at the input file information in the text box above, set the file format parameters.....
>> Save the results as C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/pntdataadd.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-29 15:24:43
>> Compete the computation!
>> Computation end time: 2026-06-29 15:24:44
```

Save the results as | Import setting parameters | Start computation

11569	106.020833	27.020833	1217.221	0.9099	0.4819	1.3918
11570	106.062500	27.020833	1201.227	0.2084	0.1406	0.3490
11571	106.104167	27.020833	1185.247	-0.1024	-0.6054	-0.7078
11572	106.145833	27.020833	1210.287	-0.0322	-1.3305	-1.3627
11573	106.187500	27.020833	1228.340	0.2457	-1.5771	-1.3314
11574	106.229167	27.020833	1247.396	0.5067	-1.1008	-0.5941
11575	106.270833	27.020833	1244.440	0.5790	-0.0988	0.4802
11576	106.312500	27.020833	1199.469	0.4192	0.7941	1.2133
11577	106.354167	27.020833	1183.494	0.0998	0.7963	0.8961
11578	106.395833	27.020833	1109.535	-0.2633	-0.3690	-0.6323
11579	106.437500	27.020833	1000.613	-0.6156	-2.1451	-2.7607
11580	106.479167	27.020833	1135.735	-0.9730	-3.2129	-4.1859
11581	106.520833	27.020833	1249.869	-1.4044	-2.8163	-4.2207
11582	106.562500	27.020833	1251.986	-1.8931	-1.3414	-3.2345
11583	106.604167	27.020833	1289.077	-2.2829	0.0504	-2.2325

Simple and Direct Calculations on Geodetic Data Files

Weighted Operations on Two Geodetic Grid Files

Open file Save as Import parameters Start computation Save process

Follow example

Weighted Operations on Two Attributes in a Record File | Weighted Operations on Two Geodetic Grid Files | Product Operations on Two Vector Grid Files | Weighted Operations on Two Harmonic Coefficient Files

Open the first geodetic grid file

Open the second grid file with the same specifications

Select operation mode

Plus +

The first weight 1.00

The second weight 1.00

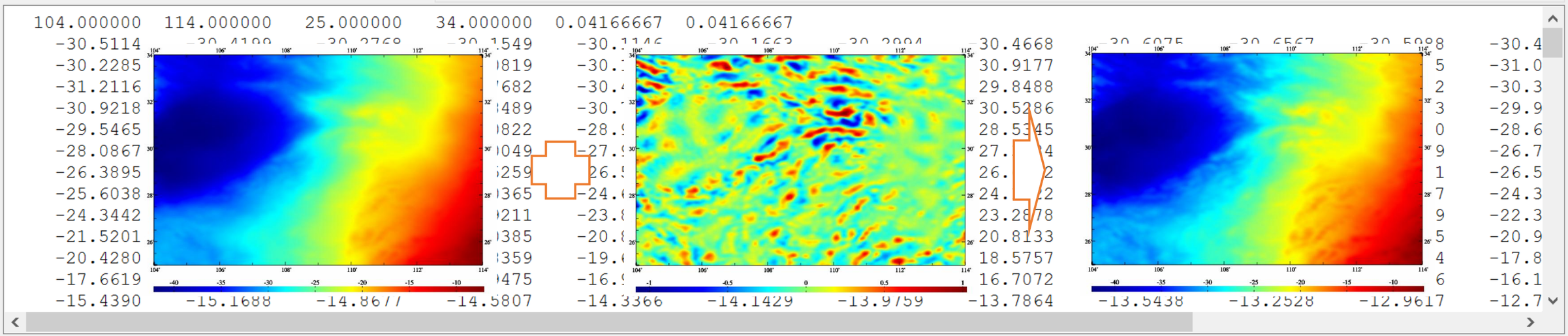
Vector grid operation

>> Program Process ** Operation Prompts

Save program process as

```
>> Open the discrete point file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/pntdata.txt.
  ** Look at the input file information in the text box above, set the file format parameters.....
>> Save the results as C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/pntdataadd.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-29 15:24:43
>> Compete the computation!
>> Computation end time: 2026-06-29 15:24:44
>> [Function] Performs weighted addition, subtraction, or multiplication on corresponding grid cell elements from two (vector) grid files with identical specifications (extent and resolution).
>> Open the first geodetic grid file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/dbmGM1800150sksi.dat.
>> Open the second geodetic grid file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/dbmchksi.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/gridadd.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-29 15:25:54
>> Compete the computation!
>> Computation end time: 2026-06-29 15:25:54
```

Save the results as | Import setting parameters | Start computation



Simple and Direct Calculations on Geodetic Data Files

Product Operations on Two Vector Grid Files

Open file | Save as | Import parameters | Start computation | Save process

Follow example

Weighted Operations on Two Attributes in a Record File

Weighted Operations on Two Geodetic Grid Files

Product Operations on Two Vector Grid Files

Weighted Operations on Two Harmonic Coefficient Files

Open the first vector geodetic grid file

Open the second vector grid file with the same specifications

Select operation mode

Inner product •

The first weight 1.00

The second weight 1.00

The first vector is in SW coordinate system

>> Program Process ** Operation Prompts

Save program process as

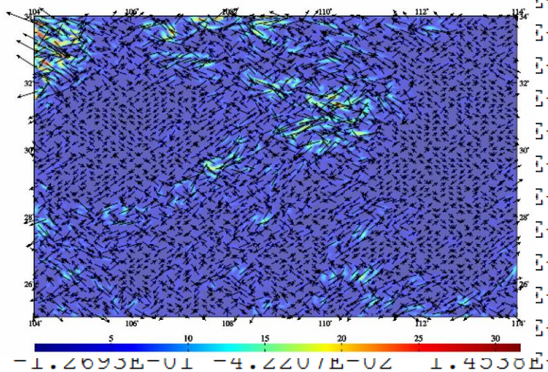
```
>> Open the first geodetic grid file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/dbmGM1800150sksi.dat.
>> Open the second geodetic grid file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/dbmchksi.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/gridadd.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-29 15:25:54
>> Compete the computation!
>> Computation end time: 2026-06-29 15:25:54
>> [Function] Calculates the outer product or inner product of corresponding cell vector elements from two vector grid files with identical specifications.
>> Open the first vector geodetic grid file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/dwmchcpc.dat.
>> Open the second vector grid file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/dtmhgradient.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/vectinproduct.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-29 15:27:32
>> Compete the computation!
>> Computation end time: 2026-06-29 15:27:32
```

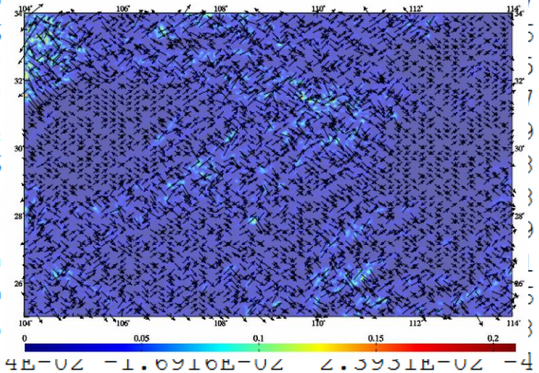
Save the results as

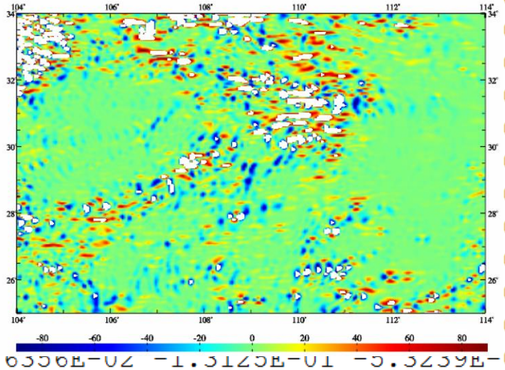
Import setting parameters

Start computation

```
 104.000000  114.000000   25.000000   34.000000  0.04166667  0.04166667
 4.5249E-03 -1.8612E-02 -1.0108E-01 -9.2410E-02 -4.5270E-02 -5.3433E-02 -1.5264E-01 -2.1435E-01 -6.5999E-02  1.7780E-02  3.1589E-02 -1.0507E
 1.4971E-01                                                                                                                  02 -3.4485E
-1.7099E-02                                                                                                                  01 -1.8481E
-8.4274E-02                                                                                                                  02 -4.1800E
 1.5090E-01                                                                                                                  02 -3.4999E
-1.0005E-01                                                                                                                  03 -1.4556E
-2.3723E-02                                                                                                                  03 -1.5087E
 8.6827E-03                                                                                                                  02  1.2054E
-1.4300E-02                                                                                                                  01 -4.9096E
-4.9619E-02                                                                                                                  02 -1.7622E
-6.8843E-04                                                                                                                  01 -1.8813E
-1.6644E-01                                                                                                                  03 -4.4647E
 1.9837E-02 -1.2693E-01 -4.2207E-02  1.4536E-02  2.5484E-02 -1.6916E-02  2.3931E-02 -4.1757E-02 -5.6356E-02 -1.3125E-01 -5.3239E-02 -2.8086E
```







Simple and Direct Calculations on Geodetic Data Files

Weighted Operations on Two Harmonic Coefficient Files

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Weighted Operations on Two Attributes in a Record File | Weighted Operations on Two Geodetic Grid Files | Product Operations on Two Vector Grid Files | Weighted Operations on Two Harmonic Coefficient Files

Open the first spherical harmonic coefficient model file

Open the second spherical harmonic coefficient model file

Select operation mode

Plus +

The first weight 1.00

The second weight 1.00

>> Program Process ** Operation Prompts

Save program process as

```
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-29 15:27:32
>> Compete the computation!
>> Computation end time: 2026-06-29 15:27:32
>> [Function] Performs weighted operations on two normalized spherical harmonic coefficient model files
>> File Header Specification: The file header occupies a single row containing the scale parameters: the geocentric gravitational constant GM (10¹⁴ m³/s²) and the Earth's semi-major axis a (m).
>> Open the first spherical harmonic coefficient model file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/CS50.dat.
>> Open the second spherical harmonic coefficient model file C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/CS60.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/EdFlgeodatacalculate/CSadd60.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-06-29 15:28:39
>> Compete the computation!
>> Computation end time: 2026-06-29 15:28:41
```

Save the results as | Import setting parameters | Start computation

```
 3.986004415d0  6378136.3d0
  2    0 -9.683302875816E-04  0.000000000000E+00  7.4812E-12  0.0000E+00
  2    1 -4.132310181484E-10  2.768827782760E-09  7.0637E-12  7.3484E-12
  2    2  4.878767146566E-06 -2.800547407718E-06  7.2302E-12  7.4258E-12
  3    0  1.914322414187E-06  0.000000000000E+00  5.7314E-12  0.0000E+00
  3    1  4.060924020958E-06  4.964008317138E-07  5.7266E-12  5.9767E-12
  3    2  1.809575789619E-06 -1.238010950355E-06  6.3747E-12  6.4019E-12
  3    3  1.442643514243E-06  2.828698523858E-06  6.0291E-12  6.0284E-12
  4    0  1.079931733278E-06  0.000000000000E+00  4.4312E-12  0.0000E+00
  4    1 -1.072314778778E-06 -9.471346930362E-07  4.5681E-12  4.6840E-12
  4    2  7.010032479252E-07  1.324960052552E-06  5.3078E-12  5.1861E-12
  4    3  1.981713533345E-06 -4.019134471350E-07  5.6320E-12  5.6202E-12
  4    4 -3.770392660460E-07  6.176077642984E-07  5.3729E-12  5.3832E-12
  5    0  1.373405827473E-07  0.000000000000E+00  2.9102E-12  0.0000E+00
```

Operations on Variation Time Series with Same Specifications

Weighted Operations on Two Record Time Series with Same Specifications

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Weighted Operations on Two Record Time Series with Same Specifications | Construction of Record Time Series from Batch Discrete Point Files | Weighted Operations on Two Groups of Grid Time Series | Weighted Operations on Two Groups of Vector Grid Time Series

Open the variation record time series file 1

Column ordinal number of first epoch time in header 3

Column ordinal number of the first variation in record 5

Open the variation record time series file 2 with same specifications

Column ordinal number of first epoch time in header 2

Column ordinal number of the first variation in record 5

Select operation mode

Plus +

The first weight 1.00 The second weight 1.00

>> Program Process ** Operation Prompts

Save program process as

```
variation time series will be neglected.
>> Open the variation record time series file 1 C:/ETideLoad4.5_win64en/examples/
Edtimeseriesfilescalc/tmrecord1.txt.
  ** Look at the input file information in the text box below, set the file format parameters...
  ** The window below only shows the records time series with no more than 2000 rows!
>> Open the variation record time series file 2 with same specifications C:/ETideLoad4.5_win64en/
examples/Edtimeseriesfilescalc/tmrecord2.txt.
  ** Look at the input file information in the text box below, set the file format parameters...
  ** The window below only shows the records time series with no more than 2000 rows!
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmrcrdadd.txt.
  ** The file header is composed of the weighted operation type (0 = addition, 1 = subtraction, 2 =
multiplication), the number n of attribute columns for the variation location information in the record, the
number m of sampling epochs, and the m sampling epochs.
  ** Following the first n column attributes of the first record time series file record, m variations of the
result time series are appended as the output record.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-01 11:55:02
>> Complete the weighted operations of two records time series files! There are 12 pairs of variartions
operated.
>> Computation end time: 2026-07-01 11:55:06
```

Save the results as | Import setting parameters | Start computation

0	4	12	20141103 00	20141127 00	20141221 00	20150114 00	20150502 00	20150526
-9.310	117.3445416	39.0251902	-2.793	-1.6090	-0.2788	-1.2223		
-12.790	117.3457082	39.0251902	-2.304	0.2020	-0.9725	-1.1454		
-7.482	117.3480415	39.0251902	-3.660	-0.8350	9999.0000	-3.5306		
-6.699	117.3487081	39.0251902	-2.582	1.2220	-0.1869	-0.9038		
-7.643	117.3488748	39.0251902	-2.882	1.2550	0.3614	-0.3920		
-9.001	117.3492081	39.0251902	-3.430	-0.8810	-0.1104	-0.9341		
-10.736	117.3495414	39.0251902	-4.123	0.8020	-0.2615	-2.2689		
-10.264	117.3497081	39.0251902	-3.963	0.0700	-0.7230	-2.2171		
-9.893	117.3498747	39.0251902	-3.843	-0.5520	-1.2478	-2.4058		
-14.921	117.3503747	39.0251902	-3.558	-1.5800	-0.8045	-1.4858		
-13.835	117.3507080	39.0251902	-3.246	1.0000	1.4505	0.9364		
-13.217	117.3508747	39.0251902	-3.191	1.1900	1.4479	0.8942		

Operations on Variation Time Series with Same Specifications

Construction of Record Time Series from Batch Discrete Point Files

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Weighted Operations on Two Record Time Series with Same Specifications

Construction of Record Time Series from Batch Discrete Point Files

Weighted Operations on Two Groups of Grid Time Series

Weighted Operations on Two Groups of Vector Grid Time Series

Open any discrete point file with time

Set the wildcard of the file names

Ordinal number of the first wildcard in the file name: 7

Number of consecutive wildcards in the file name: 8

Column ordinal number of sampling epoch in header: 7

Column ordinal number of target variation in record: 6

>> Program Process ** Operation Prompts

Save program process as

```
>> [Function] Extracts specified attribute variations from a series of discrete point files with identical specifications (including the sampling epoch time), composes a time series by sorting chronologically, and generates a record time series file containing several kinds of variations.
  ** The program requires that the file header occupies one row containing a sampling epoch time in ETideLoad format. Additionally, the locations of the variations in all geodetic record files must correspond one-to-one, though the record length may vary.
>> Open any discrete point file with time C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/loadfm20170315.txt.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/pntfltmrecord.txt.
  ** The output file header contains the number of sites, the number (n) of attributes for the site location information in the record, the sampling number (m), and the m sampling time epochs.
  ** The output file record format consists of the first n columns of attributes from the record in the first discrete point file, followed by m sampling variations of the result record time series.
  ** The discrete point files searched by wildcard instantiation:
    C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/loadfm20170315.txt
    C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/loadfm20170415.txt
    C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/loadfm20170515.txt
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time:  2026-07-01 11:56:49
>> Complete the construction of record time series! There are 3 location and time files involved.
```

Save the results as | Import setting parameters | Start computation

```
  14400    4    3  2017031500  2017041500  2017051500
      1  104.041667  25.041667       0.000      2.2258      3.7219      3.3738
      2  104.125000  25.041667       0.000      2.2494      3.7705      3.4286
      3  104.208333  25.041667       0.000      2.2730      3.8219      3.4874
      4  104.291667  25.041667       0.000      2.2966      3.8756      3.5499
      5  104.375000  25.041667       0.000      2.3200      3.9315      3.6158
      6  104.458333  25.041667       0.000      2.3428      3.9892      3.6848
      7  104.541667  25.041667       0.000      2.3650      4.0483      3.7564
      8  104.625000  25.041667       0.000      2.3863      4.1086      3.8303
      9  104.708333  25.041667       0.000      2.4065      4.1695      3.9061
     10  104.791667  25.041667       0.000      2.4254      4.2307      3.9833
     11  104.875000  25.041667       0.000      2.4428      4.2917      4.0614
     12  104.958333  25.041667       0.000      2.4586      4.3521      4.1399
     13  105.041667  25.041667       0.000      2.4726      4.4115      4.2184
```

Operations on Variation Time Series with Same Specifications

Weighted Operations on Two Groups of Grid Time Series

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Weighted Operations on Two Record Time Series with Same Specifications | Construction of Record Time Series from Batch Discrete Point Files | Weighted Operations on Two Groups of Grid Time Series | Weighted Operations on Two Groups of Vector Grid Time Series

Open any grid time series file of the group 1

Set the wildcard of the file names

Ordinal number of the first wildcard in the file name: 7

Number of consecutive wildcards in the file name: 10

Open any grid time series file of the group 2

Set the wildcard of the file names

Ordinal number of the first wildcard in the file name: 11

Number of consecutive wildcards in the file name: 8

Select operation mode

Plus +

The first weight: 1.00 The second weight: 1.00

>> Program Process ** Operation Prompts

Save program process as

```
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid1/stahgt2015050106.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid1/stahgt2015053118.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid1/stahgt2015070106.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid1/stahgt2015080106.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid1/stahgt2015083118.dat
 ** The grid time series files of the group 2 searched by wildcard instantiation:
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid2/dmzcgYQbh20150201.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid2/dmzcgYQbh20150302.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid2/dmzcgYQbh20150403.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid2/dmzcgYQbh20150504.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid2/dmzcgYQbh20150605.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid2/dmzcgYQbh20150706.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid2/dmzcgYQbh20150807.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid2/dmzcgYQbh20150908.dat
   C:/ETideLoad4.5_win64en/examples/Edtimeseriesfilescalc/tmgrid2/dmzcgYQbh20151009.dat
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-01 11:59:11
>> Complete the weighted operations of two groups of grid time series files! There are 6 pairs of grid time series files operated.
>> Computation end time: 2026-07-01 11:59:11
```

Set the result folder | Import setting parameters | Start computation

```
  118.500000  121.500000   27.000000   29.000000  1.66666667E-02  1.66666667E-02
  1.0339E+01  1.0391E+01  1.0422E+01  1.0463E+01  1.0494E+01  1.0546E+01  1.0566E+01
  1.0876E+01  1.0907E+01  1.0938E+01  1.0969E+01  1.0969E+01  1.1000E+01  1.1020E+01
  1.1216E+01  1.1268E+01  1.1320E+01  1.1402E+01  1.1454E+01  1.1516E+01  1.1536E+01
  1.1887E+01  1.1897E+01  1.1918E+01  1.1949E+01  1.1970E+01  1.1990E+01  1.2052E+01
  1.2052E+01  1.1970E+01  1.1949E+01  1.1897E+01  1.1805E+01  1.1743E+01  1.1639E+01
  1.0866E+01  1.0804E+01  1.0711E+01  1.0659E+01  1.0618E+01  1.0577E+01  1.0494E+01
  1.0050E+01  1.0030E+01  9.9884E+00  9.9472E+00  9.9265E+00  9.8853E+00  9.8543E+00
  9.5447E+00  9.5035E+00  9.5138E+00  9.4519E+00  9.4416E+00  9.4312E+00  9.3796E+00
  8.9256E+00  8.8740E+00  8.7812E+00  8.7089E+00  8.6264E+00  8.5748E+00  8.5026E+00
  7.8422E+00  7.8009E+00  7.7699E+00  7.7390E+00  7.7080E+00  7.6874E+00  7.6771E+00
  7.3572E+00  7.3366E+00  7.3056E+00  7.3056E+00  7.2850E+00  7.2850E+00  7.2850E+00
  6.9341E+00  6.8929E+00  6.8516E+00  6.8413E+00  6.8309E+00  6.8000E+00  6.8000E+00
```

Simple Gridding and Regional Geodetic Grid Construction

Gridding of Discrete Geodetic Data via Simple Interpolation

Open file Save as Import parameter Start computation Save process Follow example

Gridding of Discrete Geodetic Data via Simple Interpolation | Vector Grid Interpolation from Dual Attribute Records | High-Resolution Gridding via Direct Averaging | Construction of General Geodetic Grid File | Data Extraction by Latitude-Longitude Extent

Open a discrete point file

☐ Process batch files with same specifications ☐ Output spherical coordinate grid

Save computation process as

Number of rows of the file header: 1

Colnum ordinal number of the target atrribute in the record: 4

Select interpolation mode: weighted inverse distance

Interpolation search radius (multiple number of the cell-grids): 5

```
>> Select the computation function from the 5 control buttons on the top of the interface...
>> [Function] Generates a grid file for a specified attribute from a discrete geodetic point file based on a selected interpolation method and target grid specification. Supports batch processing of multiple input files.
>> Open the discrete point file C:/ETideLoad4.5_win64en/examples/Edareageodeticdata/dbmhgt150s.txt.
  ** Look at the input file information in the text box below, set the file format parameters.....
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edareageodeticdata/dbmhgt150s.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-01 16:53:11
>> Computation end time: 2026-07-01 16:53:21
>> Compete the computation!
```

Maximum latitude: 34.000°

Minimum longitude: 104.000° | Resolution: 2.500′ | Maximum longitude: 114.000°

Minimun latitude: 25.000°

Save the results as

Import setting parameters

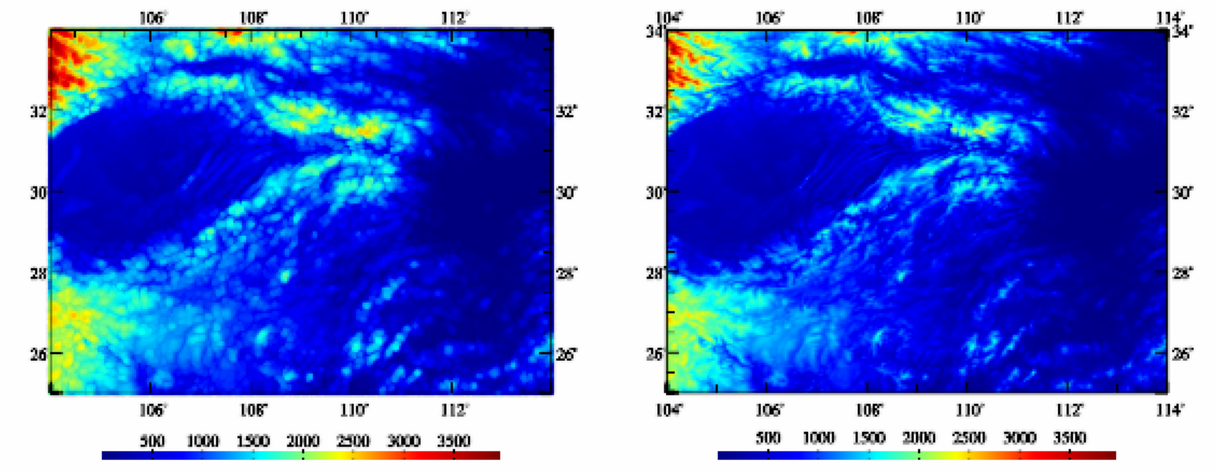
Start computation

```
  104.000000   114.000000    25.000000    34.000000   0.04166667   0.04166667
   1880.6248    1872.6655    1910.7229    1931.7657    1992.7566    1897.7135    1807.62
   1579.5102    1478.5428    1457.5838    1610.5701    1703.5126    1392.4392    1257.31
```

dbmhgt150s.txt

1	1	104.020833	25.020833	1880.623
2	2	104.062500	25.020833	1872.661
3	3	104.104167	25.020833	1910.720
4	4	104.145833	25.020833	1931.765
5	5	104.187500	25.020833	1992.766
6	6	104.229167	25.020833	1897.720
7	7	104.270833	25.020833	1807.631
8	8	104.312500	25.020833	1607.524
9	9	104.354167	25.020833	1451.430
10	10	104.395833	25.020833	1394.383
11	11	104.437500	25.020833	1303.391
12	12	104.479167	25.020833	1337.441
13	13	104.520833	25.020833	1477.493
14	14	104.562500	25.020833	1558.518
15	15	104.604167	25.020833	1555.517
16	16	104.645833	25.020833	1579.516

Extract results | Plot↓



input discrete points | output result grid

Simple Gridding and Regional Geodetic Grid Construction

Construction of General Geodetic Grid File

Open file | Save as | Import parameter | Start computation | Save process | Follow example

Gridding of Discrete Geodetic Data via Simple Interpolation | Vector Grid Interpolation from Dual Attribute Records | High-Resolution Gridding via Direct Averaging | Construction of General Geodetic Grid File | Data Extraction by Latitude-Longitude Extent

Grid construction mode

Guass surface

Set grid value parameter 10.0000

Save computation process as

```
>> [Function] Generates a grid file for a specified attribute from a discrete geodetic point file based on a selected interpolation method and target grid specification. Supports batch processing of multiple input files.
>> Open the discrete point file C:/ETideLoad4.5_win64en/examples/Edareageodeticdata/dbmhgt150s.txt.
  ** Look at the input file information in the text box below, set the file format parameters.....
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edareageodeticdata/dbmhgt150s.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-01 16:49:44
>> Computation end time: 2026-07-01 16:49:54
>> Compete the computation!
>> [Function] Generates synthetic grid files based on user-defined extent and resolution. Supported content types include: Constant Values, Random Numbers (stochastic noise), 2D Array Indices, or Gaussian Surfaces.
>> Save the results as C:/ETideLoad4.5_win64en/examples/Edareageodeticdata/gaussgrd.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-01 16:51:23
>> Computation end time: 2026-07-01 16:51:30
>> Compete the computation!
```

Maximum latitude: 34.000°

Minimum longitude: 104.000° | Resolution: 2.500′ | Maximum longitude: 114.000°

Minimun latitude: 25.000°

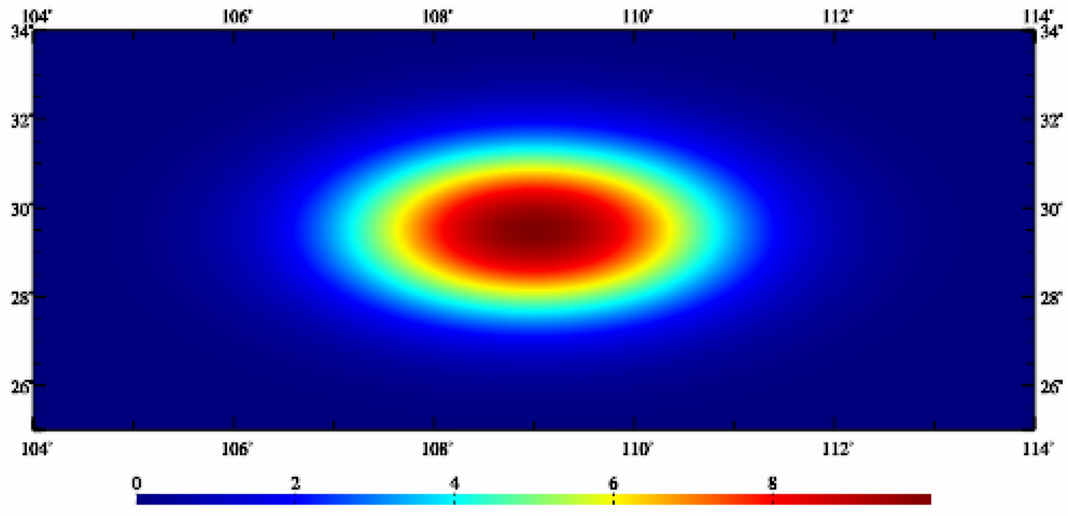
Save the results as

Import setting parameters

Start computation

104.00000000	114.00000000	25.00000000	34.00000000	0.04166667	0.04166667	
0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0(
0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0(
0.0008	0.0009	0.0010	0.0011	0.0011	0.0012	0.0(
0.0027	0.0029	0.0031	0.0033	0.0035	0.0038	0.0(
0.0070	0.0074	0.0079	0.0083	0.0088	0.0092	0.0(
0.0149	0.0155	0.0162	0.0169	0.0175	0.0182	0.0(
0.0254	0.0261	0.0268	0.0275	0.0282	0.0289	0.0(
0.0349	0.0353	0.0358	0.0362	0.0366	0.0369	0.0(
0.0386	0.0385	0.0385	0.0384	0.0382	0.0380	0.0(
0.0344	0.0338	0.0333	0.0327	0.0321	0.0315	0.0(
0.0247	0.0239	0.0232	0.0225	0.0218	0.0210	0.0(
0.0143	0.0136	0.0130	0.0124	0.0119	0.0113	0.0(
0.0066	0.0063	0.0059	0.0055	0.0052	0.0049	0.0(
0.0025	0.0023	0.0021	0.0020	0.0018	0.0017	0.0(
0.0008	0.0007	0.0006	0.0006	0.0005	0.0005	0.0(
0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0(
0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0(
0.0002	0.0002	0.0003	0.0003	0.0003	0.0004	0.0(
0.0009	0.0010	0.0011	0.0012	0.0013	0.0014	0.0(

Extract results | Plot↓



Construction and Transformation of Vector Grid Files

Synthesis of Vector Grid File from Two Scalar Grids

Open file Save as Import parameters Start computation Save process

Follow example

Synthesis of Vector Grid File from Two Scalar Grids | Decomposition of Vector Grid File into Scalar Components | Vector Grid Representation Transformation | Conversion of Vector Grid File to Discrete Point File

Open the grid file 1 with the same specifications

Open the grid file 2 with the same specifications

>> Program Process ** Operation Prompts

Save program process as

```
>> Select the computation function from the 4 control buttons on the top of the interface...
>> [Function] Combines two scalar grid files with identical specifications into a single vector grid file,
treating them as orthogonal components (e.g., U and V).
>> Open the grid file 1 with the same specifications C:/ETideLoad4.5_win64en/examples/
EdVectorgridtransf/dbmchpcs.dat.
>> Open the grid file 2 with the same specifications C:/ETideLoad4.5_win64en/examples/
EdVectorgridtransf/dbmchpcw.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/EdVectorgridtransf/dbmchcxpc.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time:  2026-07-03 07:59:51
>> Complete the computation!
>> Computation end time: 2026-07-03 07:59:51
```

Save the vector grid as

Import setting parameters

Start computation

```
 104.000000  114.000000   25.000000   34.000000  0.04166667  0.04166667
    -0.3925      0.1308      0.6249      0.9540      1.0472      0.9152      0.4482     -0.3451     -1.3375     -2.2115     -2
    -4.1123     -4.4295     -4.7667     -5.1225     -5.3562     -5.3154     -4.3021     -2.3624      0.0198      1.9917      3
     4.7775      6.0556      7.2082      7.8471      7.6580      6.9067      5.7227      4.3219      2.9311      1.6431      0
    -3.4491     -2.6666     -1.1987      0.5665      1.9997      2.7165      2.8804      2           0           0           0
    -3.0411                             -3.1711                             0657        1                       2
     0.7549                              3.4925                             0232       -0                      -0
    -1.3899                             -0.6881                             5168       -4                      -1
     0.0223                             -2.                                 3935        1                       0
    -0.2582                              0.                                 5352       -2                      -3
     0.9317                             -0.6640                             9017       -0                      -2
    -1.8977                             -0.1844                             1100        3                       4
    -2.8537                             -9.5015                             2034       -4                       1
    -0.8920                             -1.7350                             3268        2                       4
```

Construction and Transformation of Vector Grid Files

Decomposition of Vector Grid File into Scalar Components

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Synthesis of Vector Grid File from Two Scalar Grids | Decomposition of Vector Grid File into Scalar Components | Vector Grid Representation Transformation | Conversion of Vector Grid File to Discrete Point File

Open the vector grid file

>> Program Process ** Operation Prompts

Save program process as

```
>> Complete the computation!
>> Computation end time: 2026-07-03 07:59:51
>> [Function] Decomposes a vector grid file into its two constituent scalar grid files.
>> Open the vector grid file C:/ETideLoad4.5_win64en/examples/EdVectorgridtransf/
dbmchcxpc.dat.
>> Save the component 1 grid as C:/ETideLoad4.5_win64en/examples/EdVectorgridtransf/
component1.dat.
>> Save the component 2 grid as C:/ETideLoad4.5_win64en/examples/EdVectorgridtransf/
component2.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-03 08:00:34
>> Complete the computation!
>> Computation end time: 2026-07-03 08:00:34
```

Save the component 1 grid as | Save the component 2 grid as | Import setting parameters | Start computation

```
 104.000000  114.000000   25.000000   34.000000  0.04166667  0.04166667
    -1.4332     -3.6511     -4.2491     -3.0568     -0.8138      1.4282      2.8178      2.8572      1.3077     -1.2866     -3
    -0.8636     -1.8337     -1.6178      0.7910      4.2344      7.0215      7.2157      4.8918      1.8768      0.2369      0
    -1.1199     -2.7074     -4.4938     -6.2618     -7.1936     -6.6895     -4.4944     -1.1828      2.1142      4.3333      5
     3.6134      1.7742     -0.2415     -1.2126     -0.6743      0.3909      0.6795     -0.3748     -1.9201     -2.3764     -1
    -2.3659     -2.0286     -1.5821     -1.9785     -2.7592     -2.4427     -0.3348      2.6427      4.5972      4.0639      1
     1.5151      1.9866      1.7591      1.0222     -0.3285     -2.0617     -3.3488     -3.4277     -2.4846     -1.5008     -1
     1.8340      2.6532      2.6862      2.4825      2.4377      2.5159      2.5286      2.5014      2.5651      2.3487      1
    -0.6055     -0.1037     -2.0308     -4.8279     -5.5277     -3.3950      0.4519      3.7296      4.5873      3.6930      2
    -1.2153     -1.9111     -0.8244      0.6499      0.7233     -0.9452     -3.0408     -3.9305     -3.3174     -2.2773     -1
     0.1091      0.0566     -0.7564     -1.2620     -0.4835      1.6292      4.2897      6.2029      6.1576      4.1138      1
     0.0868     -1.1079     -1.8044     -1.7144     -1.7798     -3.1191     -5.5676     -6.9368     -4.9237     -0.3275      5
    -4.4835     -3.0125     -0.0790      2.3893      3.2160      2.6051      1.6975      1.1395      0.7701      0.2473     -0
    -2.5500     -3.5675     -3.6784     -2.8972     -1.5234     -0.3977     -0.2092     -1.1854     -2.5982     -3.3619     -2
```

Construction and Transformation of Vector Grid Files

Vector Grid Representation Transformation

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Synthesis of Vector Grid File from Two Scalar Grids | Decomposition of Vector Grid File into Scalar Components | Vector Grid Representation Transformation | Conversion of Vector Grid File to Discrete Point File

Open the vector grid file

Transform mode

Plane coordinates (in/out-of-phase amplitude)

Process batch vector grid files

>> Program Process ** Operation Prompts

Save program process as

```
>> Computation start time：2026-07-03 08:00:34
>> Complete the computation!
>> Computation end time: 2026-07-03 08:00:34
>> [Function] Transforms vector grid representations within a vector grid file between: Cartesian Form : In - phase / Quadrature amplitudes(or East - North components); and Polar Form : Amplitude(Magnitude) / Phase(Direction / Azimuth).
>> Open the vector grid file C:/ETideLoad4.5_win64en/examples/EdVectorgridtransf/dbmchcxpc.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/EdVectorgridtransf/vectpolar.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-03 08:01:52
>> Complete the computation!
>> Computation end time: 2026-07-03 08:01:53
```

Save the results as | Import setting parameters | Start computation

```
 104.000000  114.000000   25.000000   34.000000  0.04166667  0.04166667
     1.4860      3.6534      4.2948      3.2022      1.3262      1.6963      2.8532      2.8780      1.8706      2.5585      4
     4.2020      4.7941      5.0338      5.1832      6.8278      8.8065      8.4009      5.4324      1.8769      2.0057      3
     4.9070      6.6333      8.4943     10.0393     10.5068      9.6152      7.2766      4.4808      3.6140      4.6344      5
     4.9953      3.2029      1.2228      1.3384      2.1103      2.7445      2.9595      2.6318      2.8652      2.8174      1
     3.8530      3.7936      3.6261      3.7377      3.8533      2.9313      0.3412      3.1049      5.4503      5.1847      2
     1.6927      3.4129      4.0790      3.6390      2.4838      2.3666      3.3489      3.4997      2.6855      1.8319      1
     2.3012      2.8184      2.7326      2.5761      2.9927      4.1110      5.1764      5.2665      4.6454      3.6513      2
     0.6059      0.7962      2.7649      5.3857      5.8030      3.4269      1.0013      4.0940      4.8549      3.8009      2
     1.2424      1.9496      1.2134      1.1216      0.8003      1.1201      3.4064      4.5035      4.2293      3.7328      3
     0.9381      0.8871      0.7730      1.4260      1.2247      1.9830      4.3834      6.2379      6.1975      4.2847      2
     1.8997      1.5732      1.9197      1.7243      1.8998      3.6576      6.3773      7.8402      6.0836      3.6955      7
     5.3146      6.8932      8.2381      9.7973     10.2188      9.2902      7.4007      4.8346      2.1068      0.2874      1
     2.7015      3.8793      4.1674      3.3770      1.6355      1.0847      2.3362      3.0958      3.9324      4.6886      4
```

Construction and Transformation of Vector Grid Files

Conversion of Vector Grid File to Discrete Point File

Open file Save as Import parameters Start computation Save process

Follow example

Synthesis of Vector Grid File from Two Scalar Grids | Decomposition of Vector Grid File into Scalar Components | Vector Grid Representation Transformation | Conversion of Vector Grid File to Discrete Point File

Convert the grid into discrete points

Open the vector grid file

>> Program Process ** Operation Prompts

Save program process as

```
>> Computation start time：2026-07-03 08:01:52
>> Complete the computation!
>> Computation end time: 2026-07-03 08:01:53
>> [Function] Raster-to-Vector conversion: transforms a (vector) grid file into a discrete point file.
The latitude and longitude of each output point correspond to the centric coordinates of the
respective grid cell.
>> Open the vector grid file C:/ETideLoad4.5_win64en/examples/EdVectorgridtransf/
vectorgrd.dat.
>> Save the results as C:/ETideLoad4.5_win64en/examples/EdVectorgridtransf/vectorpnt.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-03 08:03:04
>> Complete the computation!
>> Computation end time: 2026-07-03 08:03:06
```

Save the results as | Import setting parameters | Start computation

1	104.020833	25.020833	-0.393	-1.433
2	104.062500	25.020833	0.131	-3.651
3	104.104167	25.020833	0.625	-4.249
4	104.145833	25.020833	0.954	-3.057
5	104.187500	25.020833	1.047	-0.814
6	104.229167	25.020833	0.915	1.428
7	104.270833	25.020833	0.448	2.818
8	104.312500	25.020833	-0.345	2.857
9	104.354167	25.020833	-1.337	1.308
10	104.395833	25.020833	-2.212	-1.287
11	104.437500	25.020833	-2.802	-3.650
12	104.479167	25.020833	-3.059	-4.430
13	104.520833	25.020833	-3.188	-3.322
14	104.562500	25.020833	-3.436	-1.513
15	104.604167	25.020833	-3.795	-0.477

vectorgrd. dat

1	104.000000	114.000000	25.000000	34.000000	0.04166667	0.04166667	
2	-0.3925	0.1308	0.6249	0.9540	1.0472	0.9152	0.4482
3	-4.1123	-4.4295	-4.7667	-5.1225	-5.3562	-5.3154	-4.3021
4	4.7775	6.0556	7.2082	7.8471	7.6580	6.9067	5.7227
5	-3.4491	-2.6666	-1.1987	0.5665	1.9997	2.7165	2.8804
6	-3.0411	-3.2056	-3.2628	-3.1711	-2.6898	-1.6204	-0.0657
7	0.7549	2.7751	3.6802	3.4925	2.4620	1.1620	0.0232
8	-1.3899	-0.9508	-0.5012	-0.6881	-1.7360	-3.2512	-4.5168
9	0.0223	-0.7894	-1.8763	-2.3868	-1.7663	-0.4668	0.8935
10	-0.2582	0.3857	0.8903	0.9141	0.3425	-0.6010	-1.5352
11	0.9317	0.8853	0.1592	-0.6640	-1.1252	-1.1305	-0.9017
12	-1.8977	-1.1169	-0.6554	-0.1844	0.6645	1.9103	3.1100
13	-2.8537	-6.2001	-8.2377	-9.5015	-9.6995	-8.9175	-7.2034
14	-0.8920	-1.5237	-1.9587	-1.7350	-0.5952	1.0092	2.3268
15	5.0580	5.3817	6.1200	6.6139	6.3571	5.5005	4.8020
16	-10.1525	-9.9466	-9.9842	-10.5251	-11.2484	-11.3053	-9.1193
17	-3.8921	-1.6265	0.2080	1.1048	1.0989	0.4835	-0.3396
18	-0.3043	-0.3569	-0.5649	-0.7304	-0.7430	-0.6331	-0.4693

Statistical Analysis of Geodetic Data File

Statistical Analysis of Geodetic Data File

Open file Import parameters Start statistic Save statistical information Follow example

Select the file type for statistics

The discrete geodetic point file

Open the discrete geodetic point file

Number of rows of the file header 0

Column ordinal number of the attribute for statistics 5

Import setting parameters

Start statistic

>> Program Process ** Operation Prompts

Save the statistical information as

```
>> Open the discrete geodetic point file C:/ETideLoad4.5_win64en/examples/TIstatisticanalysis/GNSSIksirent.txt.
  ** Look at the input file information in the text box above, set the file format parameters.....
>> Setting parameters have been imported into the program!
  ** Click the control button [Start statistic], or the tool button [Start statistic]....
>> Computation start time：2026-07-03 08:41:49
>> Statistic results:
**Minimum longitude: 102.3455°
  Maximum longitude: 103.4253°
  Minimum laitude: 24.3751°
  Maximum laitude: 25.4877°
**Mean: -0.1007
  Standard deviation: 0.0308
  Minimum: -0.1550
  Maximum: -0.0459
>> Computation end time: 2026-07-03 08:41:49
```

```
   2  102.546777  24.458002  1659.0410  -0.1046
   4  102.725921  24.460578  2111.3872  -0.0612
   6  102.528697  24.562786  1936.4260  -0.0491
   9  102.832641  24.575505  1977.4949  -0.1223
  10  102.345532  24.668953  1919.7825  -0.0782
  11  102.423972  24.652933  1959.3369  -0.0548
  13  102.631063  24.657055  1906.3415  -0.1185
  14  102.742718  24.652871  1935.7882  -0.0767
  15  102.843573  24.642787  1880.7707  -0.1319
  16  103.137778  24.658224  1838.4387  -0.0730
  17  102.426305  24.743284  1929.0475  -0.0771
  20  102.729945  24.734909  1856.2213  -0.1356
  21  102.840819  24.752018  2117.8582  -0.0459
  22  102.939253  24.728089  2050.9590  -0.0907
  23  103.029713  24.748496  2034.1986  -0.1217
  24  103.129600  24.753135  1575.0654  -0.1477
  25  103.227846  24.747081  1668.7801  -0.1116
  26  103.327056  24.734505  1829.6718  -0.0499
  28  102.649137  24.836450  1915.0798  -0.0515
```

Statistical Analysis of Geodetic Data File

Open file Import parameters Start statistic Save statistical information Follow example

Select the file type for statistics

Ground variation time series file

Open ground variation time series file

Column ordinal number of the attribute for statistics 2

Import setting parameters

Start statistic

>> Program Process ** Operation Prompts

Save the statistical information as

```
  Standard deviation: 0.0308
  Minimum: -0.1550
  Maximum: -0.0459
>> Computation end time: 2026-07-03 08:41:49
>> Statistics on the specified attribute time series...
>> Open ground variation time series file C:/ETideLoad4.5_win64en/examples/TIstatisticanalysis/DONT.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start statistic], or the tool button [Start statistic]....
>> Computation start time：2026-07-03 08:43:35
>> Statistic results:
**Mean: 1.6560
  Standard deviation: 11.8303
  Minimum: -38.6090
  Maximum: 35.4710
>> Computation end time: 2026-07-03 08:43:35
```

```
DONT   121.09010    27.50050    85.999      0.6268
2015010112   -32.3690     0.0000    -37.1340     0.0000    -14.7053    -14.7053     0.0000    -15.4277
2015010212   -30.4790     1.0000    -28.0170     1.0000    -14.7998    -14.8015     0.0017    -13.4432
2015010312   -23.8790     2.0000    -22.3910     2.0000    -15.0829    -15.0863     0.0034     -6.5601
2015010412   -20.9390     3.0000    -19.1360     3.0000    -15.5431    -15.5483     0.0051     -3.1599
2015010512   -23.1090     4.0000    -17.4520     4.0000    -16.1620    -16.1689     0.0069     -4.7110
2015010612   -24.4290     5.0000    -16.7770     5.0000    -16.9140    -16.9226     0.0086     -5.2790
2015010712   -16.6890     6.0000    -16.7200     6.0000    -17.7673    -17.7776     0.0103      3.3143
2015010812   -10.1890     7.0000    -17.0190     7.0000    -18.6846    -18.6966     0.0120     10.7316
2015010912   -11.8290     8.0000    -17.5030     8.0000    -19.6239    -19.6377     0.0137     10.0309
2015011012   -10.5790     9.0000    -18.0610     9.0000    -20.5402    -20.5557     0.0154     12.1972
2015011112    -2.8390    10.0000    -18.6260    10.0000    -21.3865    -21.4037     0.0172     20.7835
2015011212   -13.4090    11.0000    -19.1590    11.0000    -22.1156    -22.1344     0.0189     10.9426
2015011312   -23.7590    12.0000    -19.6380    12.0000    -22.6819    -22.7025     0.0206      1.1589
2015011412   -19.7890    13.0000    -20.0510    13.0000    -23.0437    -23.0660     0.0223      5.4907
2015011512   -25.7090    14.0000    -20.3920    14.0000    -23.1647    -23.1888     0.0240     -0.3083
2015011612   -38.6090    15.0000    -20.6590    15.0000    -23.0165    -23.0423     0.0257    -13.3565
2015011712   -34.9890    16.0000    -20.8490    16.0000    -22.5803    -22.6077     0.0275    -10.1727
2015011812   -33.9890    17.0000    -20.9620    17.0000    -21.8485    -21.8777     0.0292     -9.9045
```

Statistical Analysis of Geodetic Data File

Open file Import parameters Start statistic Save statistical information Follow example

Select the file type for statistics

The geodetic grid file

Open the geodetic grid file

Import setting parameters

Start statistic

>> Program Process ** Operation Prompts

Save the statistical information as

```
>> Computation end time: 2026-07-03 08:43:35
>> Statistics on the grid values...
>> Open the geodetic grid file C:/ETideLoad4.5_win64en/examples/TIstatisticanalysis/dwmchrga.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start statistic], or the tool button [Start statistic]....
>> Computation start time：2026-07-03 08:45:19
>> Statistic results:
**Minimum longitude: 104.0000°
  Maximum longitude: 114.0000°
  Minimum laitude: 25.0000°
  Maximum laitude: 34.0000°
**Mean: -0.0578
  Standard deviation: 22.9654
  Minimum: -167.3475
  Maximum: 175.2691
>> Computation end time: 2026-07-03 08:45:19
```

```
104.000000  114.000000   25.000000   34.000000  0.04166667  0.04166667
-25.7608    -13.3875      7.2186     24.7149    31.4088     25.8554    11.1546    -7.3378
  1.2492      8.2511     25.2000     40.5106    41.0960     24.1742     0.2044   -15.8246
-29.8425    -27.6304    -21.0353     -8.0648    11.9223     35.0907    53.6553    60.2656
-28.0596    -34.3250    -31.7398    -22.5722   -14.7619    -14.9851   -22.2831   -28.9478
-20.6078    -11.2485     -7.0605     -4.2518     3.7133     16.9466    26.6261    22.7704
 -3.7192     -7.1358    -10.4737    -14.0606   -16.8846    -15.9327    -9.6025    -0.7566
 23.5480     14.7230      6.4201      0.9377    -2.7797     -6.1543    -9.0524   -11.1821
  0.9535     -7.9694    -13.4650     -5.3219    14.5052     32.3989    35.0476    21.3620
-27.3478    -15.9170     -7.6469     -8.9631   -16.5572    -21.0556   -16.2946    -4.7053
 15.2363     11.7503     12.4323     19.1381    28.3574     33.1812    28.0544    12.9128
-17.6659    -15.7030    -10.1794     -6.3843     -7.6680     -9.8771    -3.6331    16.1123
-17.7655      1.2673      5.9326     -3.5091   -17.4385    -26.5756   -28.4004   -26.0687
-13.0422     -6.7514      1.6317      7.7796     7.9082      1.4472    -8.1695   -14.9762
-16.6912    -31.8561    -41.6307    -46.2785   -44.9045    -36.2659   -22.6265   -11.4554
 -5.8045    -11.3379     -8.5159      8.4189    30.5415     41.5710    33.0601    12.7848
-28.0545    -27.7900    -19.5914    -11.1066    -6.6577     -6.0715    -7.2473    -8.6021
-25.3946    -11.9016      9.0319     26.3244    32.9950     27.5417    12.0408    -8.9510
```

Statistical Analysis of Geodetic Data File

Open file Import parameters Start statistic Save statistical information Follow example

Select the file type for statistics

The vector grid file

Open the vector grid file

Import setting parameters

Start statistic

>> Program Process ** Operation Prompts

Save the statistical information as

```
>> Computation end time: 2026-07-03 08:45:19
>> Statistics on the vector grid values...
>> Open the vector grid file C:/ETideLoad4.5_win64en/examples/TIstatisticanalysis/vectorgrd.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start statistic], or the tool button [Start statistic]....
>> Computation start time：2026-07-03 08:46:18
>> Statistic results:
**Minimum longitude: 104.0000°
  Maximum longitude: 114.0000°
  Minimum laitude: 25.0000°
  Maximum laitude: 34.0000°
**Mean: -0.0043
  Standard deviation: 2.8762
  Minimum: -16.5760
  Maximum: 19.3528
>> Computation end time: 2026-07-03 08:46:18
```

```
104.000000  114.000000   25.000000   34.000000  0.04166667  0.04166667
-0.3925      0.1308      0.6249      0.9540     1.0472      0.9152    0.4482    -0.3451    -1.3375    -2
-4.1123     -4.4295     -4.7667     -5.1225    -5.3562     -5.3154   -4.3021    -2.3624     0.0198     1
 4.7775      6.0556      7.2082      7.8471     7.6580      6.9067    5.7227     4.3219     2.9311     1
-3.4491     -2.6666     -1.1987      0.5665     1.9997      2.7165    2.8804     2.6050     2.1267     1
-3.0411     -3.2056     -3.2628     -3.1711    -2.6898     -1.6204   -0.0657     1.6299     2.9278     3
 0.7549      2.7751      3.6802      3.4925     2.4620      1.1620    0.0232    -0.7063    -1.0192    -1
-1.3899     -0.9508     -0.5012     -0.6881    -1.7360     -3.2512   -4.5168    -4.6346    -3.8730    -2
 0.0223     -0.7894     -1.8763     -2.3868    -1.7663     -0.4668    0.8935     1.6885     1.5897     0
-0.2582      0.3857      0.8903      0.9141     0.3425     -0.6010   -1.5352    -2.1983    -2.6233    -2
 0.9317      0.8853      0.1592     -0.6640    -1.1252     -1.1305   -0.9017    -0.6602    -0.7023    -1
-1.8977     -1.1169     -0.6554     -0.1844     0.6645      1.9103    3.1100     3.6536     3.5731     3
-2.8537     -6.2001     -8.2377     -9.5015    -9.6995     -8.9175   -7.2034    -4.6984    -1.9610     0
-0.8920     -1.5237     -1.9587     -1.7350    -0.5952      1.0092    2.3268     2.8599     2.9518     3
 5.0580      5.3817      6.1200      6.6139     6.3571      5.5005    4.8020     4.7544     5.1287     5
-10.1525    -9.9466     -9.9842    -10.5251   -11.2484    -11.3053   -9.1193    -5.5314    -1.8331     0
-3.8921     -1.6265      0.2080      1.1048     1.0989      0.4835   -0.3396    -1.0180    -1.2785    -1
-0.3043     -0.3569     -0.5649     -0.7304    -0.7430     -0.6331   -0.4693    -0.4102    -0.3963    -0
```

Gross Error Detection and Weighted Basis Function Gridding

Gross Error Detection Based on a Low-Pass Reference Surface

Open file | Save as | Import parameters | Start computation | Save process | Follow example

Gross Error Detection Based on a Low-Pass Reference Surface | Observation Weight Estimation Using a Specified Reference Attribute | Gridding of Heterogeneous Data via Weighted Basis Function Interpolation | Batch Gridding via Weighted Basis Function Interpolation | Gridding of Record Time Series via Weighted Basis Function Interpolation

Open the discrete point file

Number of rows of the file header: 1

Column ordinal number of the attribute to be detected in the record: 5

Beyond multiples number of the standard deviation: 3.0

Open the reference surface grid file

>> Program Process ** Operation Prompts

Save program process as

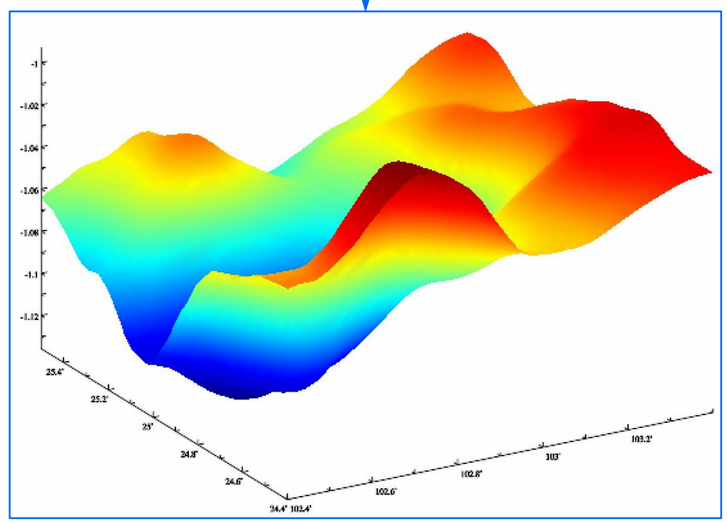
```
>> Select the computation function from the 5 control buttons on the top of the interface...
>> [Function] This module utilizes a low-pass filtered grid as a reference surface to interpolate reference values for a specified attribute at discrete observation points. Subsequently, it detects and isolates records containing gross errors by analyzing the statistical properties of the residuals (the differences between observed and reference values).
>> Open the discrete point file C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/pntdata.txt.
  ** Look at the input file information in the text box below, set the file format parameters.....
>> Open the reference surface grid file C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/lowpass.dat.
>> Save no error results as C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/pntdatanoerr.txt.
>> Save the gross error results as C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/pntdataerror.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-03 11:30:26
>> Complete the computation!
>> Computation end time: 2026-07-03 11:30:26
```

Save no error results as | Save the gross error results as | Import the parameters | Start computation

```
     0.0016      0.0317     -0.0865      0.0795
    38  102.650330  24.901415  1906.8332   1.3251     -2.4011
    39  102.728540  24.928290  1854.5060  -1.2841     -0.5680
    51  102.725170  24.977718  1855.6502  -1.2383     -0.6228
    70  102.837115  25.198024  1936.8741  -1.4671
    92  102.943103  25.551328  2765.1663  -0.9426
   100  103.047075  25.617384  2895.2142  -1.0473
   101  103.122968  25.654139  2271.4942  -1.1347
   106  102.332951  25.189684  2155.2115  -1.1590
   112  103.229955  24.655854  1609.7162  -1.3869
   120  102.328407  24.571182  2009.5019  -1.0530
   124  102.316904  25.093934  1819.0631  -1.1615
  2001  102.648977  24.986605  1856.7693  -1.2340
```

pntdata.txt

	number	long(deg/decimal)	lat	ellipHeight(m)	rentKsi(m)	TerEffect(mGal)
2	1	102.442457	24.471769	1972.7703	-1.0013	-3.3508
3	2	102.546777	24.458002	1659.0410	-1.0916	-6.6124
4	3	102.632412	24.458211	2120.2558	-0.9639	-5.0422
5	4	102.725921	24.460578	2111.3872	-0.9936	-3.6867
6	5	102.420803	24.566357	1990.6386	-1.0706	-3.1489
7	6	102.528697	24.562786	1936.4260	-1.0402	-2.0473
8	7	102.634437	24.565660	2192.9271	-0.9743	-4.0534
9	8	102.725888	24.581970	2303.7797	-0.9566	-7.1388
10	9	102.832641	24.575505	1977.4949	-1.0619	-5.9858
11	10	102.345532	24.668953	1919.7825	-1.0840	-1.6645
12	11	102.423972	24.652933	1959.3369	-1.0281	-3.0476
13	12	102.529771	24.667079	2157.7877	-1.0165	-4.2396
14	13	102.631063	24.657055	1906.3415	-1.0806	-1.6637
15	14	102.742718	24.652871	1935.7882	-1.0343	-1.7419
16	15	102.843573	24.642787	1880.7707	-1.0819	-7.7294
17	16	103.137778	24.658224	1838.4387	-0.9843	-11.7862
18	17	102.426305	24.743284	1929.0475	-1.0229	-4.1779
19	20	102.729945	24.734909	1856.2213	-1.0884	-0.8096
20	21	102.840819	24.752018	2117.8582	-1.0735	-3.9704
21	22	102.939253	24.728089	2050.9590	-1.0675	-7.6863
22	23	103.029713	24.748496	2034.1986	-1.0563	-7.0713
23	24	103.129600	24.753135	1575.0654	-1.0679	-4.3988
24	25	103.227846	24.747081	1668.7801	-1.0284	-1.9514



Gross Error Detection and Weighted Basis Function Gridding

Observation Weight Estimation Using a Specified Reference Attribute

Open file Save as Import parameters Start computation Save process Follow example

Gross Error Detection Based on a Low-Pass Reference Surface | Observation Weight Estimation Using a Specified Reference Attribute | Gridding of Heterogeneous Data via Weighted Basis Function Interpolation | Batch Gridding via Weighted Basis Function Interpolation | Gridding of Record Time Series via Weighted Basis Function Interpolation

Open the discrete point file

Number of rows of the file header: 1

Column ordinal number of reference attribute: 6

Smoothing factor of the weigh function (a): 2.0

>> Program Process ** Operation Prompts

Save program process as

```
>> Save no error results as C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/pntdatanoerr.txt.
>> Save the gross error results as C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/pntdataerror.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-03 11:30:26
>> Complete the computation!
>> Computation end time: 2026-07-03 11:30:26
>> [Function] Estimates observation weights based on the statistical properties of a specified reference attribute within the input geodetic record file, utilizing the proprietary weight function defined by ETideLoad4.5.
>> Open the discrete point file C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/pntdatanoerr.txt.
  ** Look at the input file information in the text box below, set the file format parameters.....
>> Save the estimated weights as C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/pntwghrst.txt.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-03 11:31:31
>> Complete the computation!
>> Computation end time: 2026-07-03 11:31:31
```

Save the estimated weights as

Import the parameters

Start computation

number	long(deg/decimal)	lat	ellipHeight(m)	rentKsi(m)	TerEffect(mGal)
1	102.442457	24.471769	1972.7703	-1.0013	-3.3508	4.43
2	102.546777	24.458002	1659.0410	-1.0916	-6.6124	2.43
3	102.632412	24.458211	2120.2558	-0.9639	-5.0422	3.12
4	102.725921	24.460578	2111.3872	-0.9936	-3.6867	4.09
5	102.420803	24.566357	1990.6386	-1.0706	-3.1489	4.65
6	102.528697	24.562786	1936.4260	-1.0402	-2.0473	6.28
7	102.634437	24.565660	2192.9271	-0.9743	-4.0534	3.78
8	102.725888	24.581970	2303.7797	-0.9566	-7.1388	2.26
9	102.832641	24.575505	1977.4949	-1.0619	-5.9858	2.66
10	102.345532	24.668953	1919.7825	-1.0840	-1.6645	7.05
11	102.423972	24.652933	1959.3369	-1.0281	-3.0476	4.77
12	102.529771	24.667079	2157.7877	-1.0165	-4.2396	3.63
13	102.631063	24.657055	1906.3415	-1.0806	-1.6637	7.05
14	102.742718	24.652871	1935.7882	-1.0343	-1.7419	6.89
15	102.843573	24.642787	1880.7707	-1.0819	-7.7294	2.09
16	103.137778	24.658224	1838.4387	-0.9843	-11.7862	1.39
17	102.426305	24.743284	1929.0475	-1.0229	-4.1779	3.68
20	102.729945	24.734909	1856.2213	-1.0884	-0.8096	8.98
21	102.840819	24.752018	2117.8582	-1.0735	-3.9704	3.85
22	102.939253	24.728089	2050.9590	-1.0675	-7.6863	2.10
23	103.029713	24.748496	2034.1986	-1.0563	-7.0713	2.28
24	103.129600	24.753135	1575.0654	-1.0679	-4.3988	3.52

Gross Error Detection and Weighted Basis Function Gridding

Gridding of Heterogeneous Data via Weighted Basis Function Interpolation

Open file Save as Import parameters Start computation Save process Follow example

Gross Error Detection Based on a Low-Pass Reference Surface | Observation Weight Estimation Using a Specified Reference Attribute | Gridding of Heterogeneous Data via Weighted Basis Function Interpolation | Batch Gridding via Weighted Basis Function Interpolation | Gridding of Record Time Series via Weighted Basis Function Interpolation

Open the discrete point file

Number of rows of the file header: 1

Column ordinal number of the attribute to be grided in the record: 5

Select the base function: Guassian function

Equal weights of observations

>> Program Process ** Operation Prompts

Save program process as

```
>> Computation start time：2026-07-03 11:53:05
>> Complete the computation!
>> Computation end time: 2026-07-03 11:53:05
>> [Function] Generates a regular grid for a specified attribute from an input discrete geodetic point file using the Weighted Basis Function
Interpolation, subject to user-defined grid specifications (extent and spatial resolution) and a selected basis function.
>> Open the discrete point file C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/pntwghrst.txt.
  ** Look at the input file information in the text box below, set the file format parameters.....
>> Save the griding results as C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/pntgrid.dat.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-03 11:54:28
>> Complete the computation!
>> Computation end time: 2026-07-03 11:54:28
```

Parameters of base function

Column ordinal number of weight: 7

Number of the neighboring points for interpolation: 25

The kurtosis of base function: 3

Maximum latitude: 25.500°

Minimum longitude: 102.400° | Resolution: 1.000′ | Maximum longitude: 103.400°

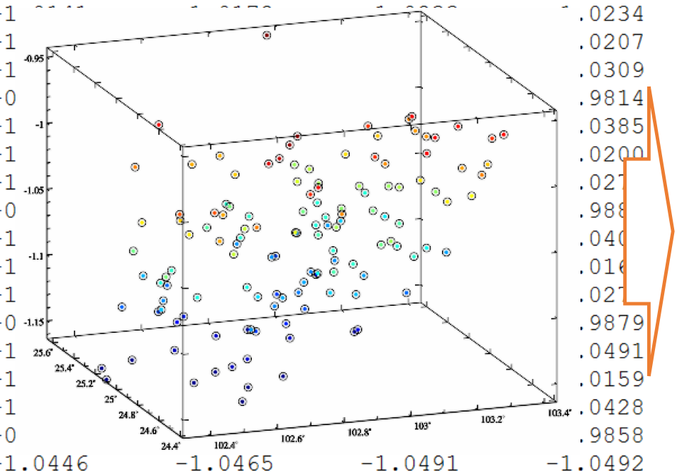
Minimun latitude: 24.400°

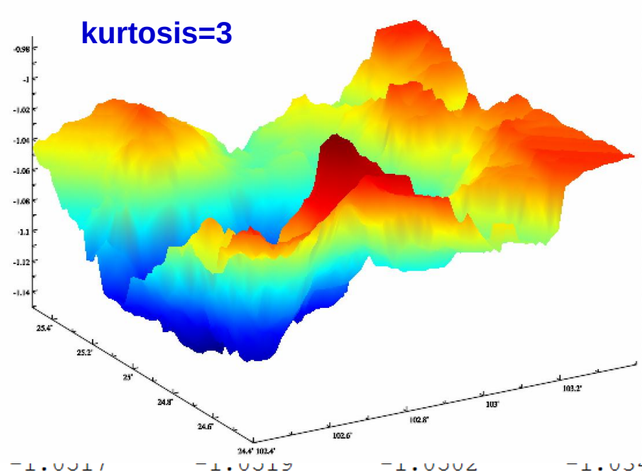
Save the griding results as

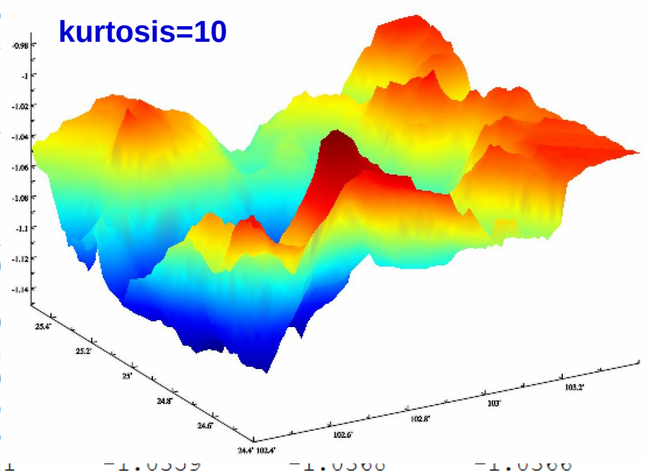
Import the parameters

Start computation

```
102.400000  103.400000   24.400000   25.500000  0.01666667  0.01666667
    -1.0081     -1.0094     -1.0157     -1.0159     -1.0185     -1.0356     -1.0357     -1.0357     -1.0182     -1.0118     -1.0105     -0.9821     -0.97
    -0.9658     -0.9663     -0.9747     -0.9780     -0.9788     -0.9915     -0.9940     -0.9947     -0.9957     -0.9970     -0.9972     -1.0005     -0.99
    -1.0097     -1                      .0234                                                                                                   -1.03
    -1.0365     -1                      .0207                                                                                                   -1.00
    -1.0075     -1                      .0309                                                                                                   -0.99
    -0.9692     -0                      .9814                                                                                                   -1.00
    -1.0142     -1                      .0385                                                                                                   -1.03
    -1.0344     -1                      .0200                                                                                                   -1.00
    -1.0087     -1                      .027                                                                                                    -0.99
    -0.9708     -0                      .988                                                                                                    -1.00
    -1.0174     -1                      .040                                                                                                    -1.03
    -1.0357     -1                      .016                                                                                                    -1.00
    -1.0102     -1                      .027                                                                                                    -0.99
    -0.9724     -0                      .9879                                                                                                   -1.01
    -1.0203     -1                      .0491                                                                                                   -1.03
    -1.0322     -1                      .0159                                                                                                   -1.00
    -1.0176     -1                      .0428                                                                                                   -0.99
    -0.9828     -0                      .9858                                                                                                   -1.01
    -1.0381     -1.0446     -1.0465     -1.0491     -1.0492                                                                                     -1.03
    -1.0300     -1.0275     -1.0209     -1.0159     -1.0144     -1.0126     -1.0111     -1.0097     -1.0072     -1.0052     -1.0052     -1.0045     -1.00
    -1.0205     -1.0185     -1.0339     -1.0402     -1.0435     -1.0481     -1.0523     -1.0347     -1.0331     -1.0250     -1.0232     -1.0142     -1.00
```







Gross Error Detection and Weighted Basis Function Gridding

Batch Gridding via Weighted Basis Function Interpolation

Open file Save as Import parameters Start computation Save process Follow example

Gross Error Detection Based on a Low-Pass Reference Surface | Observation Weight Estimation Using a Specified Reference Attribute | Gridding of Heterogeneous Data via Weighted Basis Function Interpolation | Batch Gridding via Weighted Basis Function Interpolation | Gridding of Record Time Series via Weighted Basis Function Interpolation

Open any discrete point file

Number of rows of the file header: 1

Column ordinal number of the attribute to be grided in the record: 6

Set the wildcard of the file names

Ordinal number of the first wildcard in file name: 3

Number of consecutive wildcards in file name: 10

Select the base function

Guassian function ☑ Equal weights of observations

>> Program Process ** Operation Prompts

Save program process as

```
>> [Function] Applies Weighted Basis Function Interpolation to batch-process discrete point files stored in a directory. According
to the given grid specifications, basis function, and other parameters, the program grids the specified attribute in each input file.
  ** Batch discrete geodetic point files sharing the same format.
>> Open any discrete point file C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/FH2018010312.txt.
  ** Look at the input file information in the text box below, set the file format parameters.....
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate.
  ** The discrete point files searched by wildcard instantiation:
    C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/FH2018010312.txt
    C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/FH2018011012.txt
    C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/FH2018011712.txt
    C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/FH2018012412.txt
    C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/FH2018013112.txt
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
```

Parameters of base function

Number of the neighboring points for interpolation: 25

The kurtosis of base function: 3

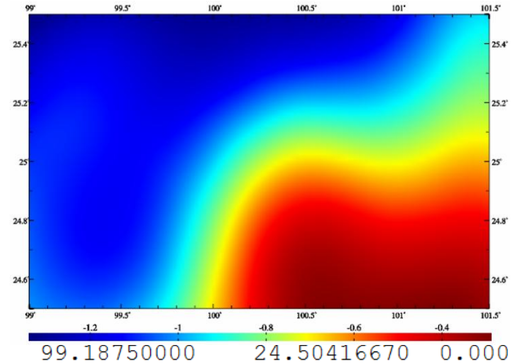
Maximum latitude: 25.500°

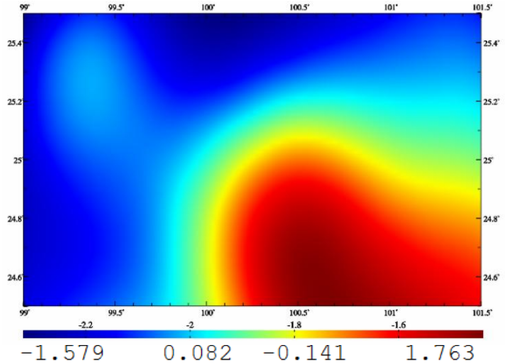
Minimum longitude: 99.000° | Resolution: 1.000′ | Maximum longitude: 101.000°

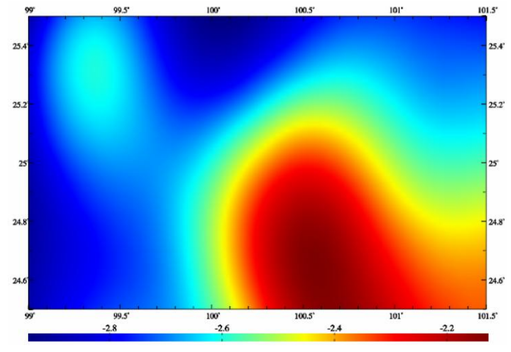
Minimun latitude: 24.500°

Set the result folder | Import the parameters | Start computation

57781	99.00416670	24.50416670	0.000	-1.581	-1.005	0.230	0.336	-1.553	0.064	-0.154	1.775	3.356
57782	99.01250000	24.50416670	0.000	-1.580	-1.007	0.195	0.355	-1.555	0.064	-0.153	1.774	3.354
57783	99.02083330	24.50416670	0.000	-1.580	-1.009	0.158	0.368	-1.556	0.064	-0.152	1.773	3.353
57784	99.02916670	24.50416670	0.000	-1.578	-1.011	0.120	0.388	-1.558	0.064	-0.151	1.773	3.351
57785	99.03750000	24.50416670	0.000	-1.577	-1.012	0.077	0.406	-1.559	0.065	-0.150	1.773	3.350
57786	99.04583330	24.50416670	0.000	-1.577	-1.013	0.030	0.409	-1.560	0.065	-0.149	1.771	3.348
57787	99.05416670	24.50416670	0.000	-1.576	-1.015	-0.019	0.409	-1.562	0.065	-0.148	1.771	3.347
57788	99.06250000	24.50416670	0.000	-1.575	-1.017	-0.071	0.407	-1.563	0.065	-0.147	1.770	3.345
57789	99.07083330	24.50416670	0.000	-1.574	-1.018	-0.124	0.405	-1.564	0.066	-0.146	1.769	3.344
57790	99.07916670	24.50416670	0.000	-1.573	-1.020	-0.176	0.392	-1.565	0.066	-0.145	1.769	3.342
57791				-1.572	-1.021	-0.225	0.373					3.340
57792				-1.572	-1.022	-0.266	0.330					3.338
57793				-1.570	-1.023	-0.298	0.268					3.336
57794				-1.569	-1.025	-0.326	0.197					3.335
57795				-1.569	-1.026	-0.346	0.105					3.334
57796				-1.569	-1.028	-0.359	0.006					3.333
57797				-1.568	-1.029	-0.361	-0.094					3.332
57798				-1.567	-1.030	-0.351	-0.180					3.331
57799				-1.567	-1.030	-0.335	-0.264					3.331
57800				-1.566	-1.032	-0.303	-0.346					3.330
57801				-1.566	-1.033	-0.255	-0.413					3.329
57802				-1.565	-1.034	-0.202	-0.479					3.329
57803	99.18750000	24.50416670	0.000	-1.565	-1.035	-0.145	-0.546	-1.579	0.082	-0.141	1.763	3.328







Gross Error Detection and Weighted Basis Function Gridding

Gridding of Record Time Series via Weighted Basis Function Interpolation

Open file Save as Import parameters Start computation Save process Follow example

Gross Error Detection Based on a Low-Pass Reference Surface | Observation Weight Estimation Using a Specified Reference Attribute | Gridding of Heterogeneous Data via Weighted Basis Function Interpolation | Batch Gridding via Weighted Basis Function Interpolation | Gridding of Record Time Series via Weighted Basis Function Interpolation

Open the variation record time series file

Column ordinal number of first epoch time in header: 4

Column ordinal number of the first variation in record: 5

Select the base function: Guassian function

>> Program Process ** Operation Prompts

Save program process as

```
>> Computation start time：2026-07-03 11:56:16
>> Complete the gridding of 5 discrete point files by basis function weighted interpolation!
>> Computation end time: 2026-07-03 11:56:40
>> [Function] Processes an input record time series file to generate variation grid time series files. According to the given grid specifications,
weight function, and other parameters, the program grids the variations at each sampling epoch time via Weighted Basis Function Interpolation.
>> Open the variation record time series file C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/guass6flt2018-101-12.txt.
  ** Look at the input file information in the text box below, set the file format parameters.....
>> Create or select the result folder C:/ETideLoad4.5_win64en/examples/AppGerrweighgridate/gridtm.
>> Setting parameters have been imported into the program!
  ** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time：2026-07-03 11:58:00
>> Complete the computation! Output 30 grid time series files!
>> Computation end time: 2026-07-03 12:05:26
```

Parameters of base function

Number of the neighboring points for interpolation: 80

The kurtosis of base function: 2

Maximum latitude: 25.500°

Minimum longitude: 98.500° | Resolution: 1.000′ | Maximum longitude: 99.500°

Minimun latitude: 24.500°

Set the result folder | Import the parameters | Start computation

20190115	5	30	20180117	20180129	20180210	20180222	20180306	20180318	20180330	20180411	20180423	20180505	20180517
3706.787	99.2507841	26.3055050	160.634	-19.0686	-16.9047	-14.5594	-14.6763	-12.8078	-14.3124	-13.7744	-10.7207	-14.6294	-17.436
2892.435	99.3321142	26.2945055	354.728	-4.0088	-1.3401	-1.0050	-1.1013	4.2060	0.3074	1.3835	3.0396	-1.1031	-1.792
3648.860	99.2564506	26.2888390	232.186	-4.3598	-0.3579	-0.8523	0.4722	2.1533	-1.2641	-0.3149	2.8308	-0.9414	-3.723
3647.428	99.2609504	26.2888390	231.518	-2.5613	0.7342	2.1285	2.7706	1.5398	-0.8897	0.4223	3.4801	-0.2824	-2.983
3647.428	99.2611170	26.2888390	231.518	-2.2376	1.1990	2.4180	3.2280	1.4629	-0.8851	0.4335	3.4901	-0.2722	-2.972
3691.092	99.2579505	26.2881724	202.722	-2.9801	-0.2490	0.6907	2.1992	3.8167	-1.1600	-0.1150	3.0100	-0.7566	-3.521
3693.077				-2.5226				4.2774	-1.109				-3.423
3645.582				-3.1796				3.6489	-1.188				-3.567
3650.993				-2.5741				4.5597	-1.180				-3.553
3670.276				-1.8478				5.6416	-1.168				-3.532
3643.802				-2.5712				4.5646	-1.180				-3.552
3621.288				-3.6729				2.0667	-1.114				-3.398
3598.829				-4.8831				0.2333	-0.816				-2.676
1368.074				-24.2923				4.3286	-12.246				-7.070
1375.606				-25.1142				4.8478	-12.628				-7.810
1531.431				-24.1970				4.4797	-12.541				-7.088
2791.583				-2.9541				2.7889	1.975				-0.311
1621.140				-35.3601				7.4726	-25.634				-16.170
3036.248	99.3357807	26.2756729	191.005	-4.9152	-2.6392	-1.8922	-0.2443	3.4157	-1.0698	0.2709	2.1522	-1.9640	-2.535
1690.304	99.1432884	26.2715064	226.553	-35.1037	-35.6622	-32.8197	-30.9184	-26.1334	-25.1155	-18.9363	-12.0436	-14.6459	-13.506
1913.816	99.1499548	26.2711731	234.157	-26.1971	-26.8630	-21.3457	-19.7327	-15.6241	-14.4863	-9.3144	-5.8718	-9.6100	-10.118

Visualization for Multi-Attributes in Ground Variation Time Series

Visualization for Multi-Attributes in Ground Variation Time Series

Open file | Import parameters | Chart plot | Plot save | Follow example

Open the ground variation time series file

Select the sampling epoch time format: ETideLoad long interger

Column ordinal number of the sampling epoch in header: 1

Location parameter of the group 1 time series to be plot: 201

Location parameter of the group 2 time series to be plot: 402

Location parameter of the group 2 time series to be plot: 702

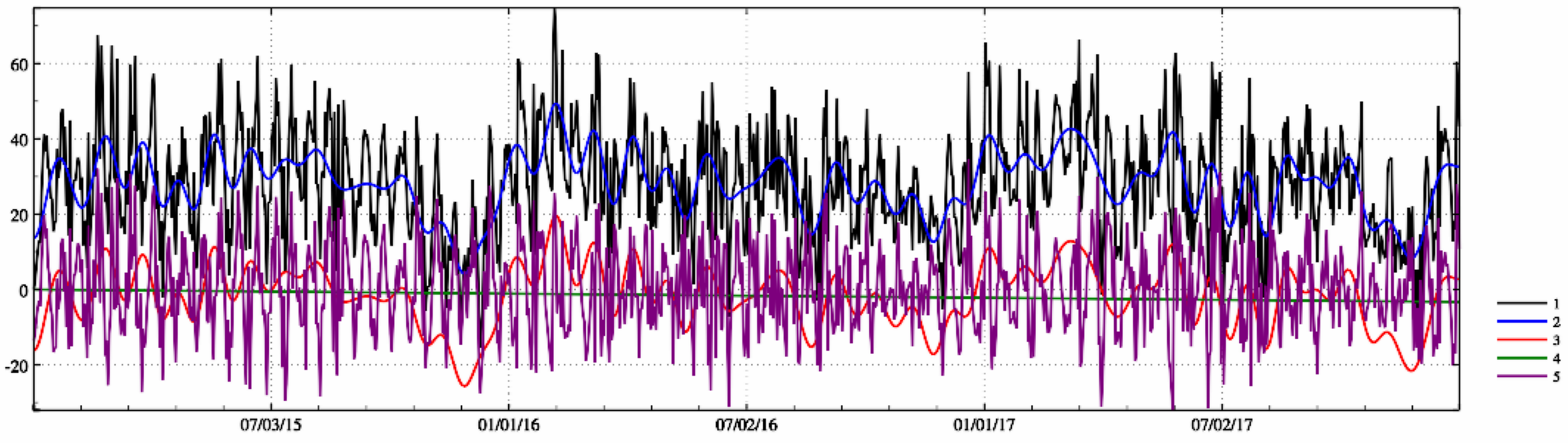
Min-maximum variations: -9990.0 | 9990.0

Row ordinal number of the starting-ending sampling epochs in record: 1 | 99990

Maximum capacity: 15 curves per operation.

JHYW U	120.0442179	29.16216832	109.8773	57023.500	29.8295	-1.0976	
2015010112	0.03	0.0	13.6641	-16.1654	-16.1654	0.0000	-13.6341
2015010212	2.2	1.0	13.8010	-16.0285	-16.0255	-0.0030	-11.6010
2015010312	6.51	2.0	14.2137	-15.6159	-15.6098	-0.0060	-7.7037
2015010412	9.96	3.0	14.8905	-14.9391	-14.9300	-0.0090	-4.9305
2015010512	12.85	4.0	15.8123	-14.0172	-14.0052	-0.0120	-2.9623
2015010612	12.55	5.0	16.9534	-12.8761	-12.8611	-0.0150	-4.4034
2015010712	25.9	6.0	18.2822	-11.5474	-11.5293	-0.0180	7.6178
2015010812	34.52	7.0	19.7620	-10.0675	-10.0465	-0.0210	14.7580
2015010912	41.16	8.0	21.3528	-8.4767	-8.4527	-0.0240	19.8072
2015011012	36.64	9.0	23.0120	-6.8175	-6.7905	-0.0270	13.6280
2015011112	40.85	10.0	24.6960	-5.1336	-5.1035	-0.0301	16.1540
2015011212	32.32	11.0	26.3613	-3.4683	-3.4352	-0.0331	5.9587
2015011312	31.81	12.0	27.9659	-1.8636	-1.8276	-0.0361	3.8441
2015011412	24.43	13.0	29.4706	-0.3590	-0.3199	-0.0391	-5.0406
2015011512	24.08	14.0	30.8395	1.0100	1.0521	-0.0421	-6.7595
2015011612	15.37	15.0	32.0417	2.2122	2.2573	-0.0451	-16.6717
2015011712	17.61	16.0	33.0513	3.2218	3.2698	-0.0481	-15.4413
2015011812	18.29	17.0	33.8481	4.0186	4.0697	-0.0511	-15.5581
2015011912	37.3	18.0	34.4184	4.5888	4.6429	-0.0541	2.8816
2015012012	29.64	19.0	34.7543	4.9248	4.9819	-0.0571	-5.1143
2015012112	32.68	20.0	34.8548	5.0253	5.0854	-0.0601	-2.1748

Label font size: 7 | Line thickness: 2 | Import set parameters | Chart plot↓ | Save current plot as



Rotate: Hold and drag the Left Mouse Button; Zoom: Hold and drag the Right Mouse Button, or scroll the Middle Mouse Wheel; and Pan: Hold and drag the Middle Mouse Button.

Visualization for Variation Record Time Series on Geodetic Network

Visualization for variation record time series on geodetic network

Open file Import parameters Chart plot Plot save Follow example

Open the variation record time series file

Format parameters for the record time series file

Ordinal number of the first sampling epoch in header: 4

Ordinal number of the first sampling variation in record: 5

Set parameters of record time series to be plot

Location parameters of the group 1 variations: 103

Location parameters of the group 2 variations: 501

Location parameters of the group 3 variations: 1402

Location parameters of the group 4 variations: 200

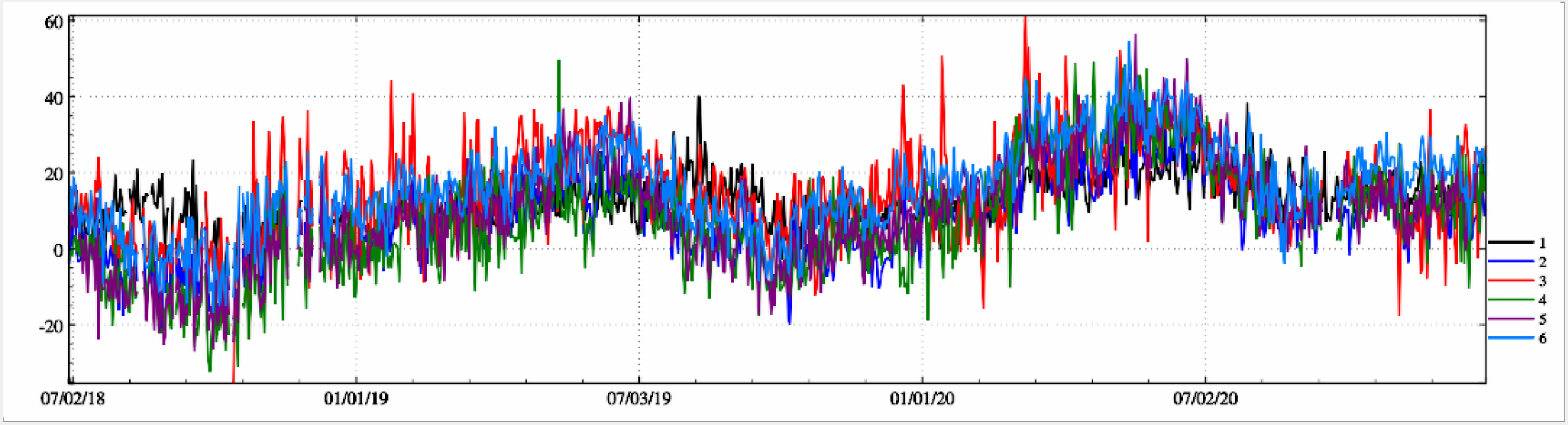
Location parameters of the group 5 variations: 100

Ordinal number of starting-ending sampling epoch: 1 — 2000

Min-maximum variations: -9900.0 — 9900.0

4	3	1095	2018063000	2018070100	2018070200	2018070300	2018070400	2018070500	20
DAEJ	127.3745	36.3994	116.84	6.0600	2.4000	4.8200	8.7400	9.4300	
SCPZ	101.7439	26.5032	1167.55	-3.9700	5.4100	0.8300	8.6800	8.3400	
XIAG	100.2546	25.6081	1974.27	13.0800	15.7000	12.0300	14.0300	16.9400	
YNGM	99.3924	23.5460	1104.80	14.1900	21.5100	16.2800	23.9900	35.6000	
YNJD	100.8808	24.4371	1244.60	-2.9200	-0.7600	-1.7800	1.8400	3.4500	
YNLC	100.0755	23.8678	1559.44	7.5100	12.3500	9.2600	14.9100	16.3300	
YNLJ	100.0293	26.6956	3195.75	7.3700	4.9300	-0.0900	3.8000	9.3600	
YNMJ	101.6748	23.4160	1281.64	8.8200	12.8200	10.7700	20.7500	14.8500	
YNRL	97.8453	24.0005	723.34	-0.6900	0.7700	-0.2200	6.8100	14.7000	
YNSD	99.1902	24.7128	1478.79	2.2800	4.0700	-6.8200	6.0300	6.6100	
YNTC	98.4384	24.9546	1470.12	1.6100	1.0900	0.2300	5.8800	6.8300	
YNXP	101.9061	24.1024	1977.98	13.1800	17.4200	17.8300	21.1300	21.4600	
YNYA	101.3274	25.7235	1846.15	6.3000	10.1300	1.7900	10.2700	8.3200	
YNYL	99.3716	25.8847	1696.26	1.1800	12.0300	7.6200	5.6400	10.3000	
YNYM	101.8609	25.6894	1077.79	8.8500	16.5900	9.8100	18.6700	16.4100	
YNYS	100.7539	26.6831	2143.89	-0.4300	4.5300	-0.6300	4.9000	8.8900	
YSSK	142.7167	47.0297	91.29	7.1900	8.3400	7.8200	5.3900	1.8200	

Label font size: 8 Line thickness: 2 Import set parameters Chart plot↓ Save current plot as



Rotate: Hold and drag the Left Mouse Button; Zoom: Hold and drag the Right Mouse Button, or scroll the Middle Mouse Wheel; and Pan: Hold and drag the Middle Mouse Button.

The program can plot less than 15 rows of record time series curves once.

Visualization of Specified Attributes in Discrete Point File

Visualization of Specified Attributes in Discrete Point File

Open file | Import parameters | Scatter plot | Plot save | Follow example

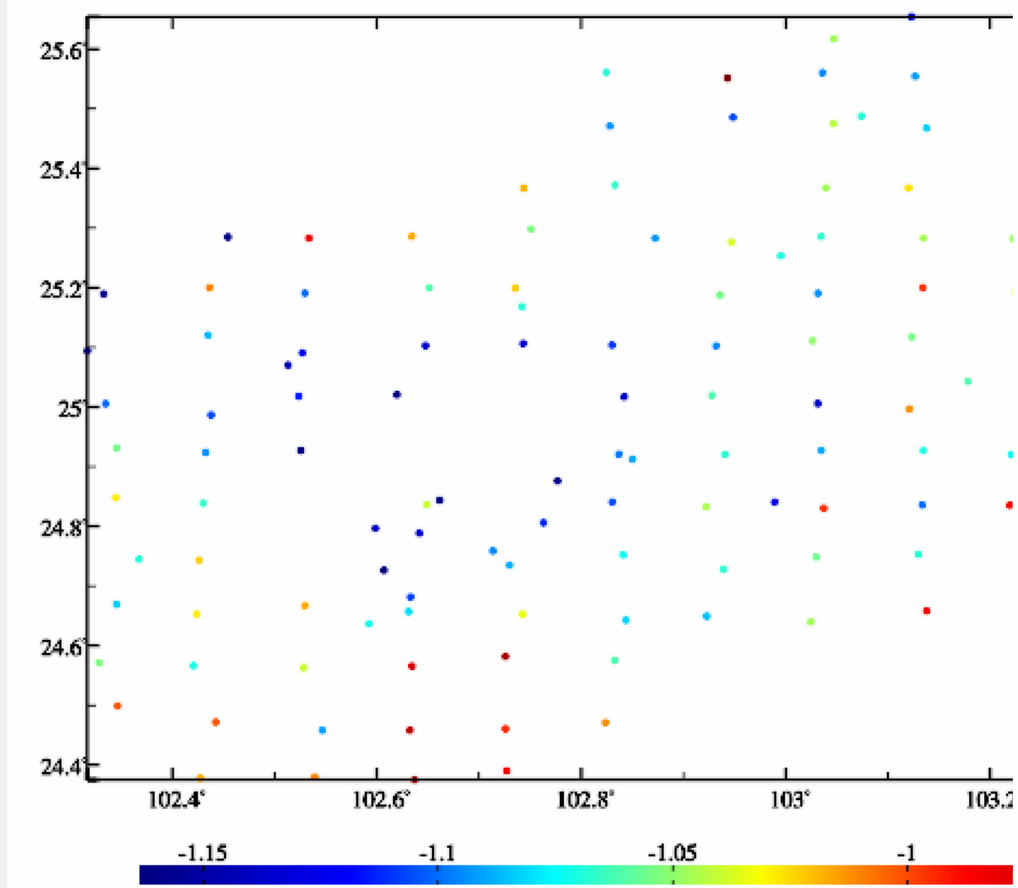
Open the discrete geodetic point file

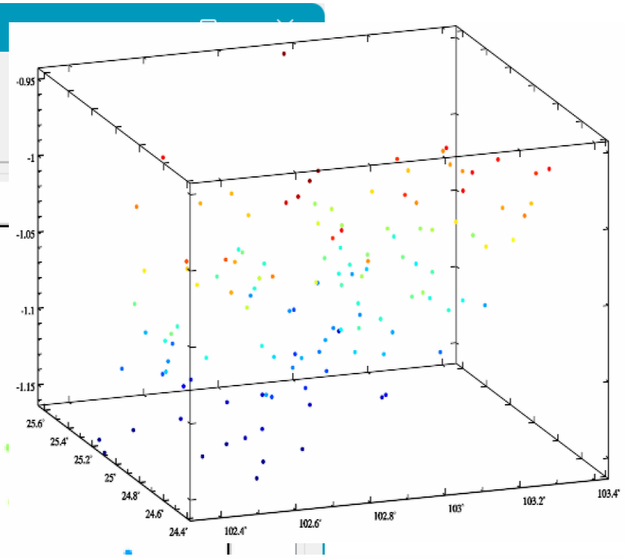
Number of rows of file header: 1
Column ordinal number of x: 2
Column ordinal number of y: 3
Column ordinal number of z: 5
minimum of z: -9990.0
maximum of z: 9990.0
Display style: Plane color scatter plot
Label font size: 6
Custom scale range (can be used for batch plots)

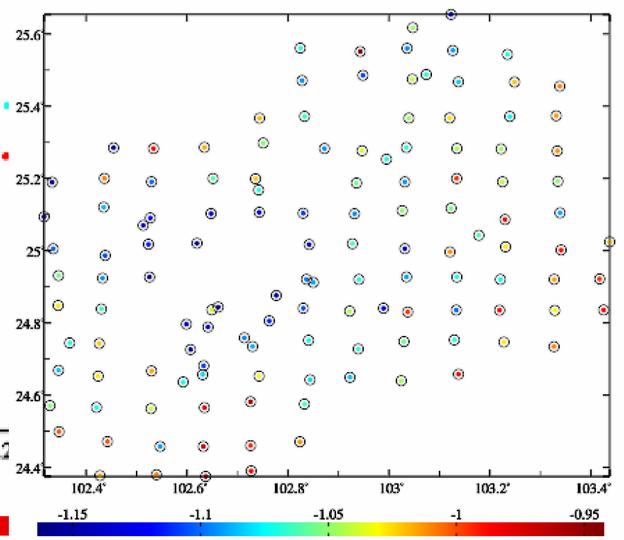
Import parameters | Scatter plot →

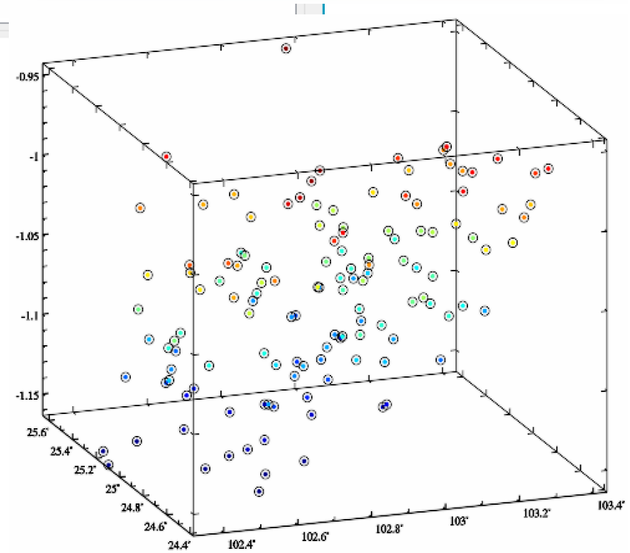
Save the current plot as

- Rotate: Hold and drag the Left Mouse Button.
- Zoom: Hold and drag the Right Mouse Button, or scroll the Middle Mouse Wheel.
- Pan: Hold and drag the Middle Mouse Button.









number	long(deg/decimal)	lat	ellipHeight(m)	rentKsi(m)	TerEffect(mGal)
1	102.442457	24.471769	1972.7703	-1.0013	-3.3508
2	102.546777	24.458002	1659.0410	-1.0916	-6.6124
3	102.632412	24.458211	2120.2558	-0.9639	-5.0422
4	102.725921	24.460578	2111.3872	-0.9936	-3.6867
5	102.420803	24.566357	1990.6386	-1.0706	-3.1489
6	102.528697	24.562786	1936.4260	-1.0402	-2.0473
7	102.634437	24.565660	2192.9271	-0.9743	-4.0534
8	102.725888	24.581970	2303.7797	-0.9566	-7.1388
9	102.832641	24.575505	1977.4949	-1.0619	-5.9858
10	102.345532	24.668953	1919.7825	-1.0840	-1.6645
11	102.423972	24.652933	1959.3369	-1.0281	-3.0476
12	102.529771	24.667079	2157.7877	-1.0165	-4.2396
13	102.631063	24.657055	1906.3415	-1.0806	-1.6637
14	102.742718	24.652871	1935.7882	-1.0343	-1.7419
15	102.843573	24.642787	1880.7707	-1.0819	-7.7294
16	103.137778	24.658224	1838.4387	-0.9843	-11.7862
17	102.426305	24.743284	1929.0475	-1.0229	-4.1779

Visualization of Geodetic Grid or Variation Grid Time Series Files

Visualization of Geodetic Grid or Variation Grid Time Series Files

Open file | Import parameters | Draw plot | Plot save | Follow example

Open the geodetic numerical grid file

Minimum -9000.0 Maximum 9000.0

Plot parameters

Label font size 6

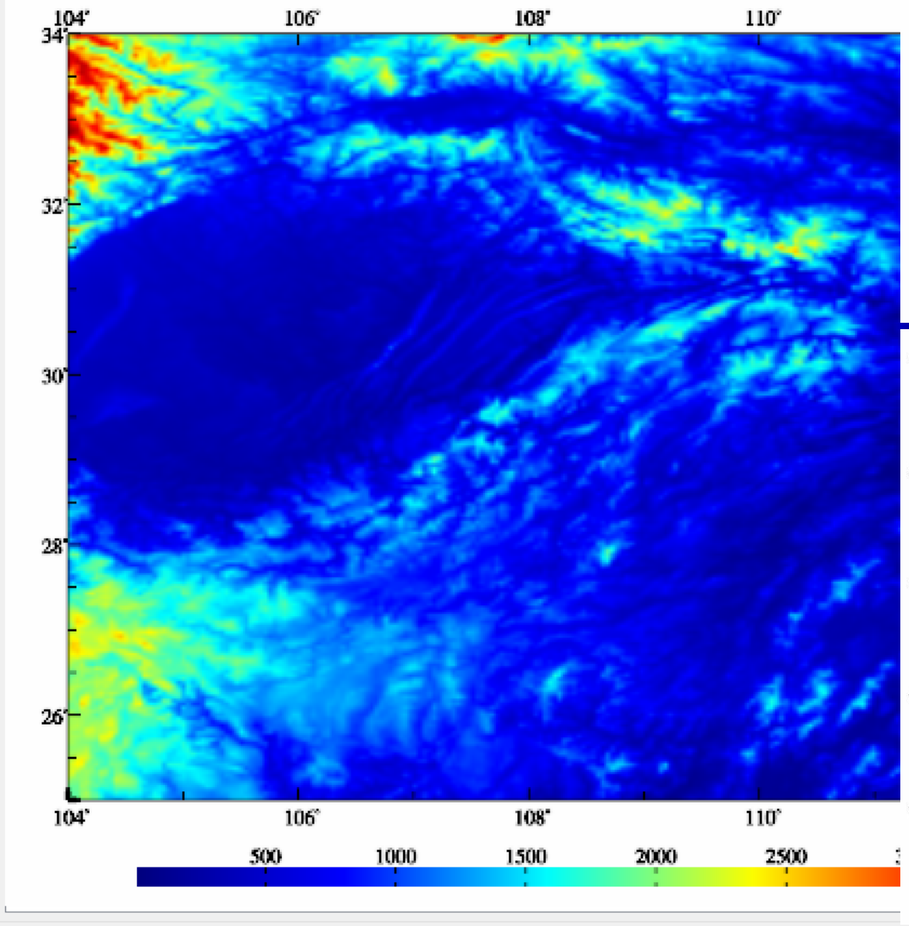
Display style 2D color map

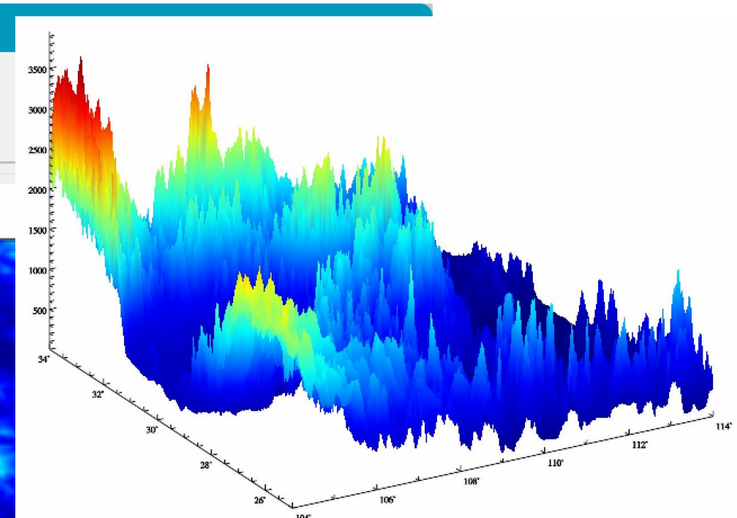
Custom scale range (employed for grid time series plots)

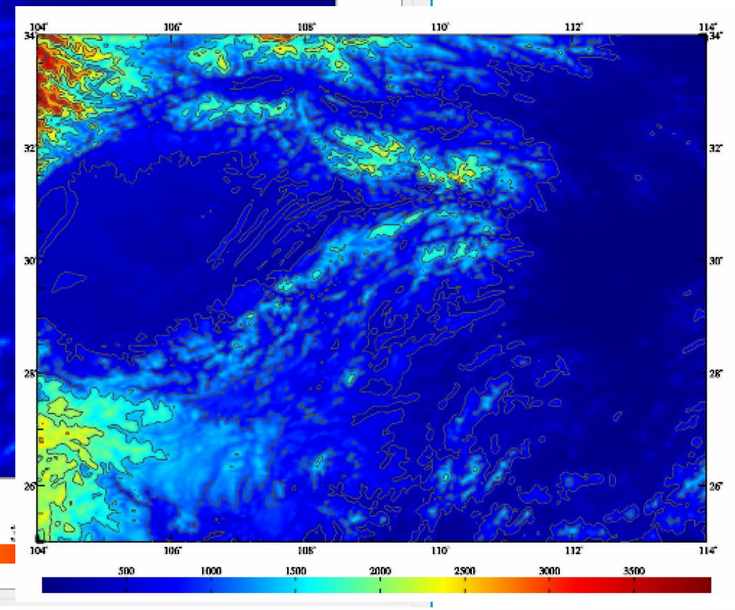
Import parameters | Draw plot →

Save the current plot as

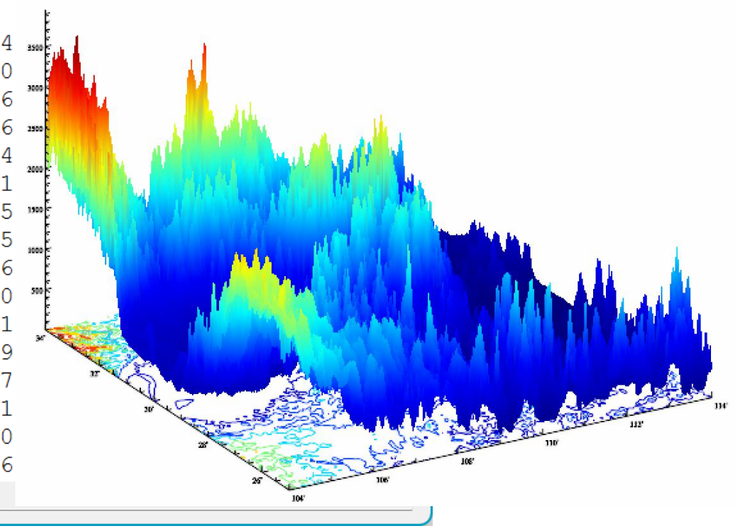
- Rotate: Hold and drag the Left Mouse Button.
- Zoom: Hold and drag the Right Mouse Button, or scroll the Middle Mouse Wheel.
- Pan: Hold and drag the Middle Mouse Button.







104.000000	114.000000	25.000000	34.000000	0.04166667	0.04166667				
1880.6229	1872.6631	1910.7226	1931.7678	1992.7628	1897.7201	1807.6282	1607.5273	1451.4399	1394
1579.5092	1478.5386	1457.5814	1610.5779	1703.5245	1392.4420	1257.3073	1156.1960	1088.1513	1250
1127.0908	1141.1294	1156.2046	1181.3156	1335.4458	1400.5863	1424.7030	1433.7637	1352.7645	1266
530.3341	562.3269	484.3763	478.4654	553.5572	717.6303	623.7012	541.7780	488.8902	636
642.5738	575.7033	629.8140	654.9278	694.0588	807.1893	877.3003	868.3630	752.3735	584
726.9660	439.0429	598.0917	604.1553	596.2404	510.3625	572.5056	692.6572	840.7887	791
820.3976	667.4142	588.4198	585.4228	661.4284	557.4446	337.4741	378.4927	359.5243	305
494.4589	433.5887	353.7412	430.9411	723.1664	821.3833	718.5536	599.6331	615.6516	595
128.9313	219.0568	175.1873	152.2870	137.3672	113.4730	108.6262	179.8153	317.0100	466
456.2484	331.3966	360.5464	451.7045	575.8571	698.9677	492.0606	313.0891	189.0889	170
151.7808	150.9295	208.1037	343.2835	296.4796	343.6928	326.9646	534.2658	1004.5335	951
220.4672	560.7057	752.8913	548.0598	375.1793	295.2814	273.3952	273.5185	318.6440	319
267.7158	300.9213	596.1217	576.3492	569.5540	559.7308	469.9046	541.0749	593.2796	657
466.1732	254.1907	224.2331	236.3034	250.4140	331.5690	326.7496	452.8991	547.0093	341
509.0990	504.2612	607.4467	873.6645	972.9187	777.1467	812.2700	762.3513	763.4239	620
129.8285	112.8844	145.9994	223.1332	239.2705	219.3964	222.5152	128.6432	125.7744	126



Visualization of Geodetic Grid or Variation Grid Time Series Files

Visualization of Geodetic Vector Grid File

Open file | Import parameters | Draw plot | Plot save | Follow example

Open the geodetic vector grid file

Label font size 5

Vector line parameters

x direction arrow number 60

Vector arrow size 18

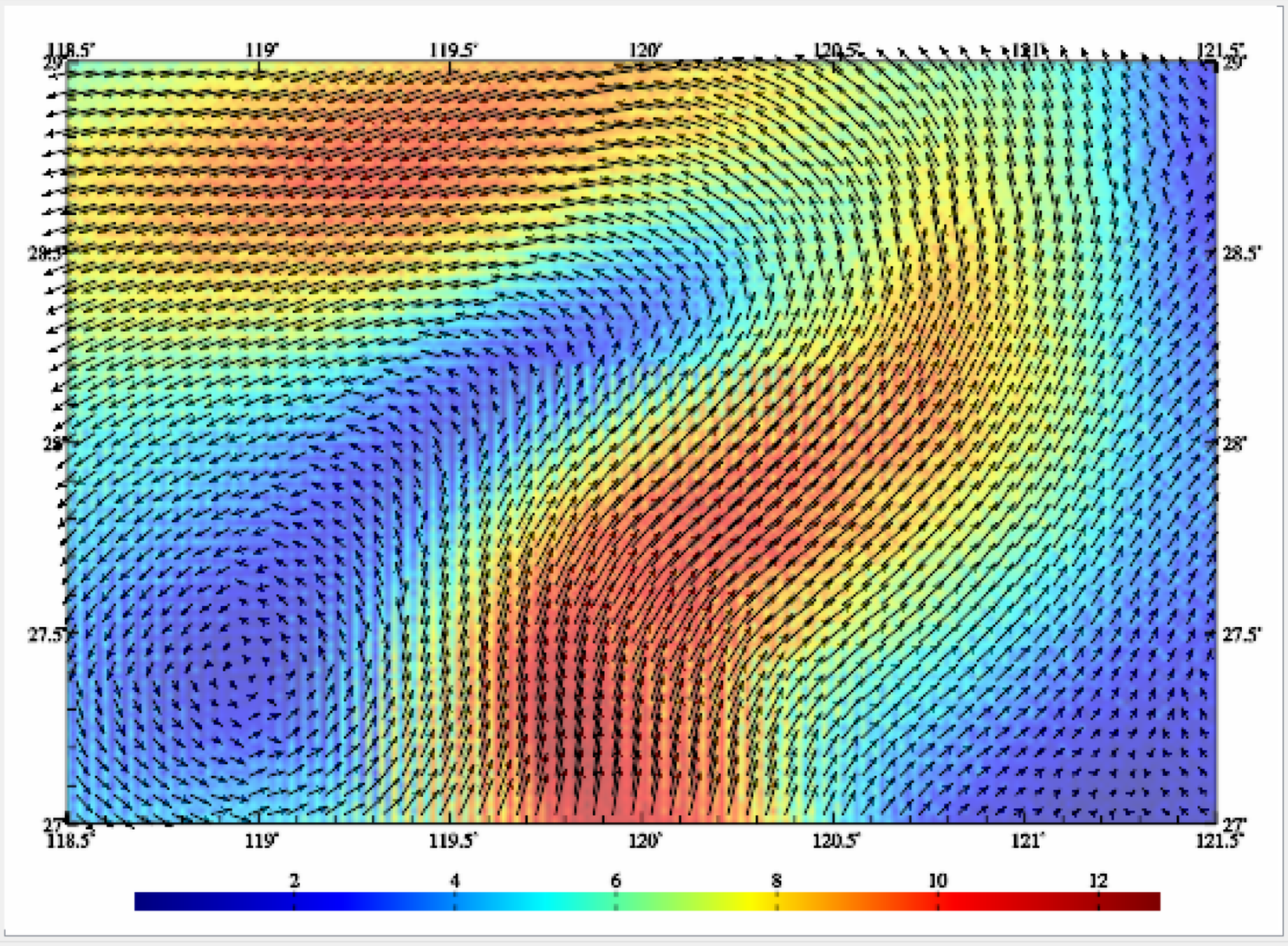
Line length of modulus of vector 18

Vector form South-West (SW)

Import parameters | Draw plot →

Save the current plot as

- Rotate: Hold and drag the Left Mouse Button.
- Zoom: Hold and drag the Right Mouse Button, or scroll the Middle Mouse Wheel.
- Pan: Hold and drag the Middle Mouse Button.

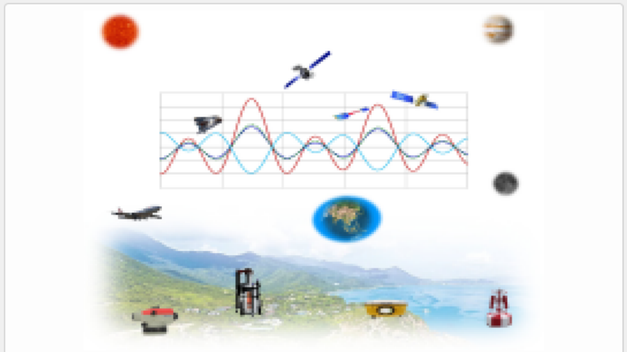



```
 118.500000  121.500000   27.000000   29.000000  1.66666667E-02  1.66666667E-02       2015070106
 4.2017E+00  1.8364E+00  3.5829E+00  1.1078E+00  3.3135E+00  1.0280E+00  3.7127E+00  6.4872E-01  2.8045E+00  6.1878E-01  3.4332
-1.6967E-01  2.8743E+00 -6.7866E-01  2.2256E+00 -1.2675E+00  2.1258E+00 -6.9862E-01  1.8563E+00 -1.9861E+00  1.9162E+00 -1.4072
 1.4771E+00 -2.1258E+00  9.9803E-01 -3.0041E+00  5.5890E-01 -3.0340E+00  1.0879E+00 -3.4732E+00  9.9803E-03 -3.5630E+00  5.4892
-4.7606E+00 -5.7886E-01 -5.4493E+00 -1.5669E+00 -6.2776E+00 -1.9761E+00 -6.0181E+00 -2.7646E+00 -7.5351E+00 -3.2037E+00 -7.2457
-5.2097E+00 -8.4234E+00 -5.8485E+00 -9.0821E+00 -6.5770E+00 -9.2518E+00 -6.2676E+00 -9.9404E+00 -7.7447E+00 -9.8606E+00 -7.3755
-1.0978E+01 -9.4813E+00 -1.1208E+01 -1.0489E+01 -1.1907E+01 -1.0879E+01 -1.0928E+01 -1.1427E+01 -1.2006E+01 -1.1368E+01 -1.0589
-1.1068E+01 -9.9304E+00 -1.1108E+01 -1.0090E+01 -1.1577E+01 -9.7009E+00 -1.0260E+01 -9.8007E+00 -1.1138E+01 -9.0122E+00 -1.0040
```

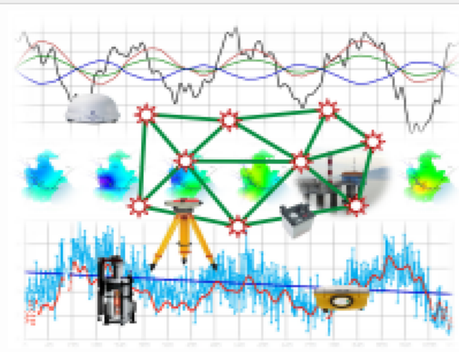
Earth Tide, Load Effects and Deformation Monitoring Computation 4.5



Summary, Parameter Settings and Visualization for ETideLoad4.5



Computation of Various Tidal and Polar Shift Effects on All Geodetic Elements



Processing and Analysis of Non-Tidal Geodetic Variation Time Series

- Analytically geodetic and geodynamic algorithms with unified standards and coordinated geophysical models
- IERS conventions (2010) compliant and improved, with clarified concepts and fully derived and verified algorithms
- Uniform computation of tidal, polar shift, and COM variation effects on full-space various geodetic elements
- Analytical computation of surface load effects and collaborative monitoring of temporal local gravity field
- Geodetic estimation of terrestrial water EWH and computation of spatiotemporal ground stability variations

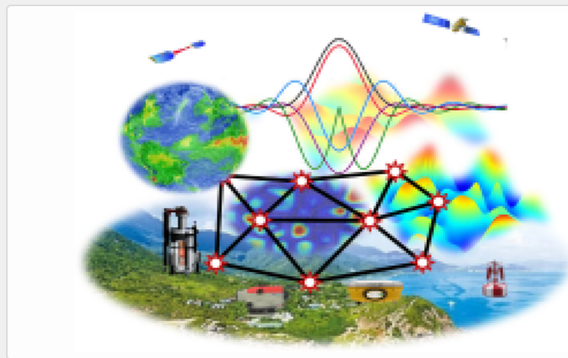
ETideLoad4.5 Organization Structure

www.zcyphygeodesy.com/en/

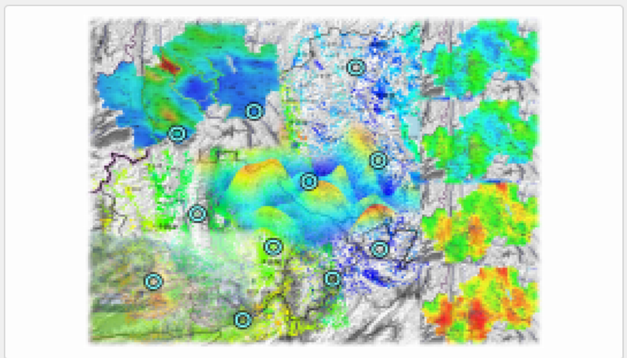


To facilitate both classroom instruction and independent learning, comprehensive example files are provided in the folder: C:\ETideLoad4.5_win64en\examples.
Each example set includes: An operation process description file (process.txt); Relevant input and output data files; and Result screenshots for validation.
Recommended Procedure: Users are strongly advised to execute the program examples using the provided data. Results should be compared against the supplied screenshots according to the instructions in process.txt.
Estimated Time Commitment: Completing all example exercises typically requires approximately 7 working days.
Outcome: Upon completion, users will be proficient in independently operating ETideLoad4.5.

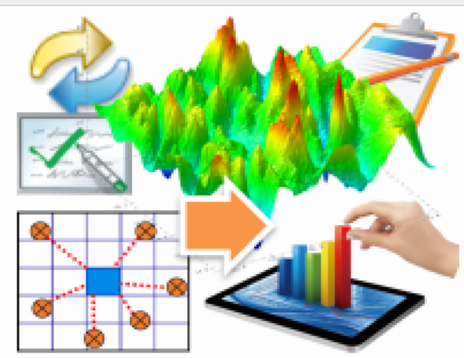
Geophysical Models and Numerical Standards



Load Deformation Field Approximation and Monitoring from Heterogeneous Variations



CORS/InSAR Collaborative Monitoring and Ground Stability Estimation



Editing and Calculation Tools for Geodetic Data Files

Classroom Instruction, Self-study Exercises, Scientific Research, and Engineering Computations

ZHANG Chuanyin, Beijing, China June 2026 www.zcyphygeodesy.com