www.zcyphygeodesy.com

Load deformation field approach and monitoring from heterogeneous variations

- Analytically compatible geodetic and geodynamic algorithm package using the numerical standards unified and geophysical models coordinated
- Compute and approach the global and regional non-tidal surface load effects on all-element geodetic variations
- Constrain and assimilate the deep fusion of multi-source heterogeneous geodetic data according to the principles of geodesy and geodynamics
- Realize the collaborative monitoring of the land water variations and time-varying gravity field from heterogeneous geodetic techniques

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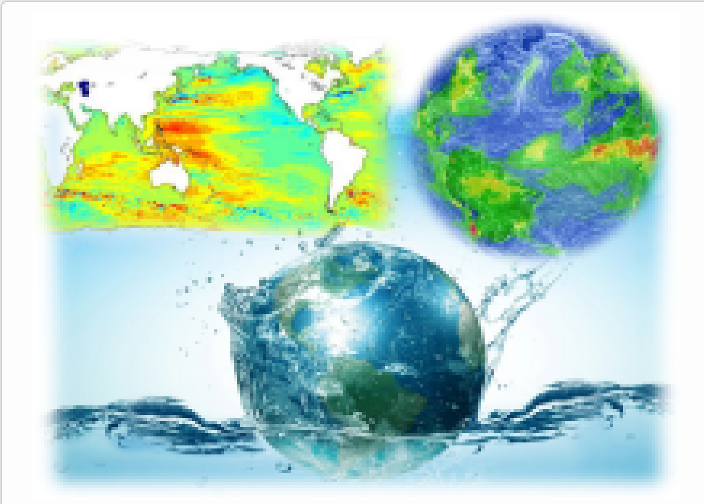
Load deformation field approach and monitoring from heterogeneous variations

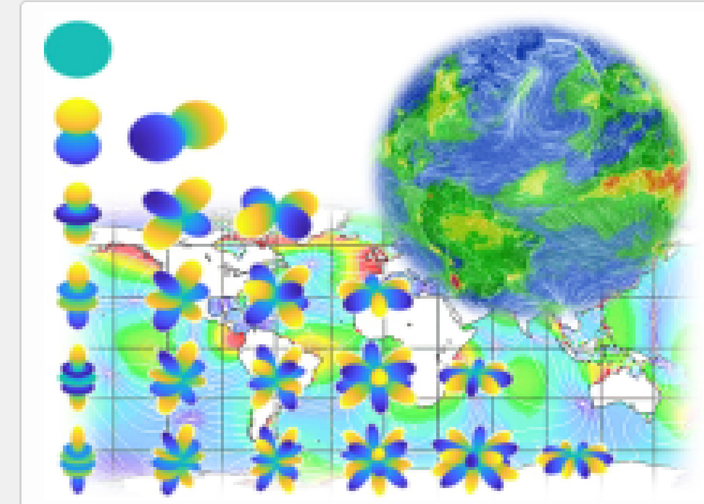


Spherical harmonic analysis on global surface load time series

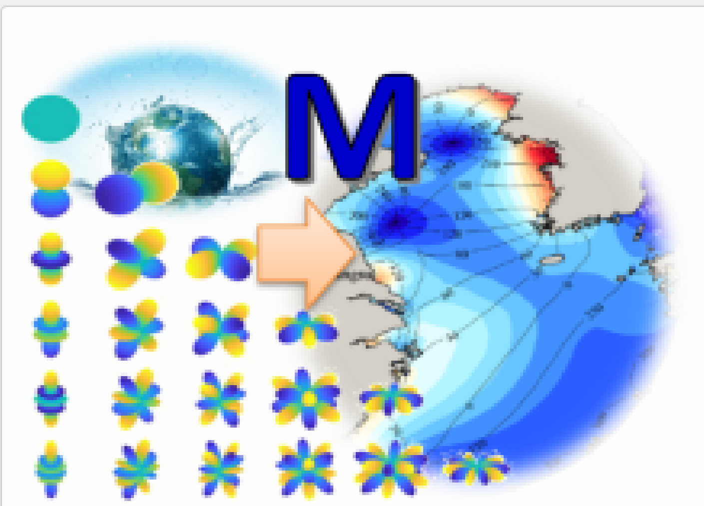
Load deformation field approach and monitoring from heterogeneous variations

The non-tidal load variations of atmosphere, sea level, soil water, groundwater, lakes and glaciers in the Earth's surface layer lead to geopotential variation, while can excite solid Earth deformation and then cause all-element geodetic variations with time, while these variations can also be captured by various geodetic technologies.

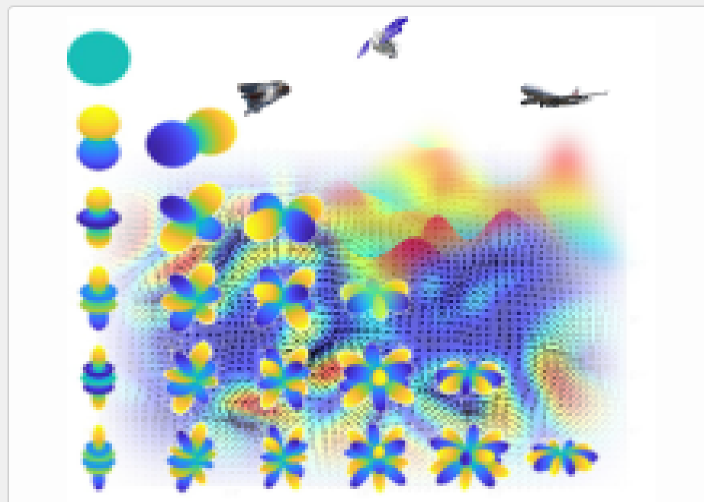
Functional architecture of the subsystem



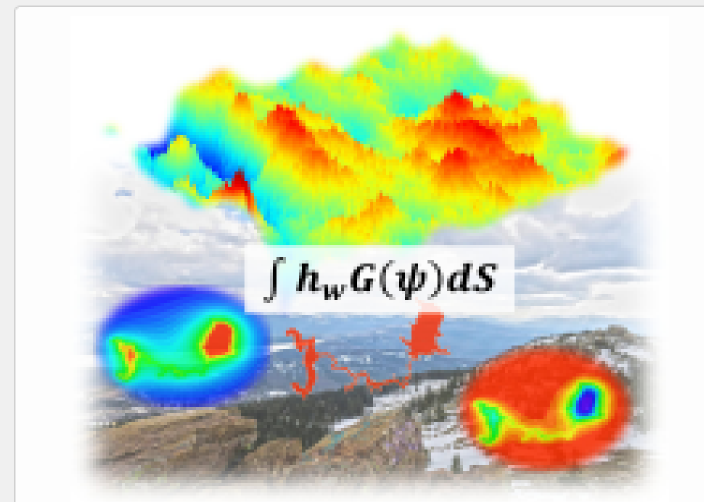
Spherical analysis on tide constants and construction of tidal load model



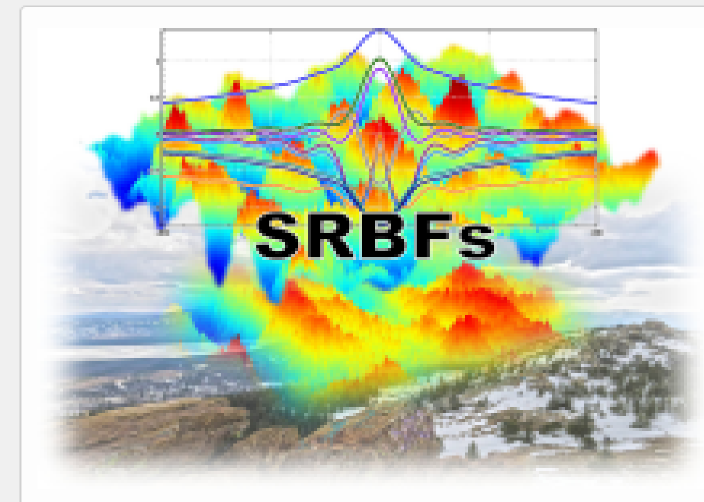
Computation of the load model value by spherical harmonic synthesis



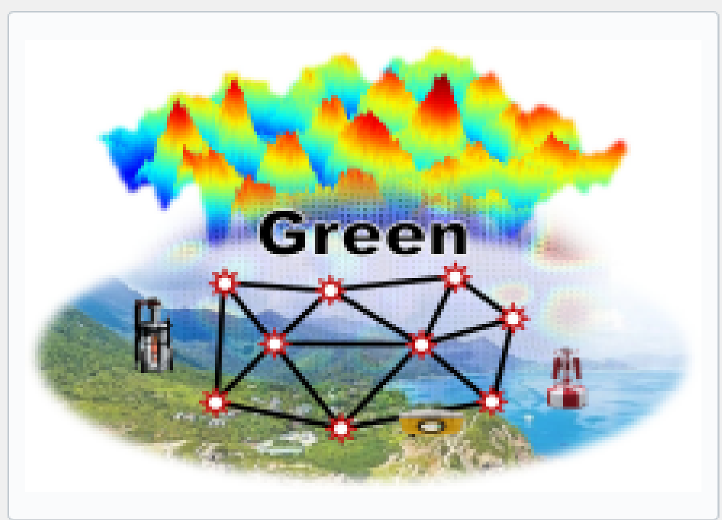
Computation of load deformation field by spherical harmonic synthesis



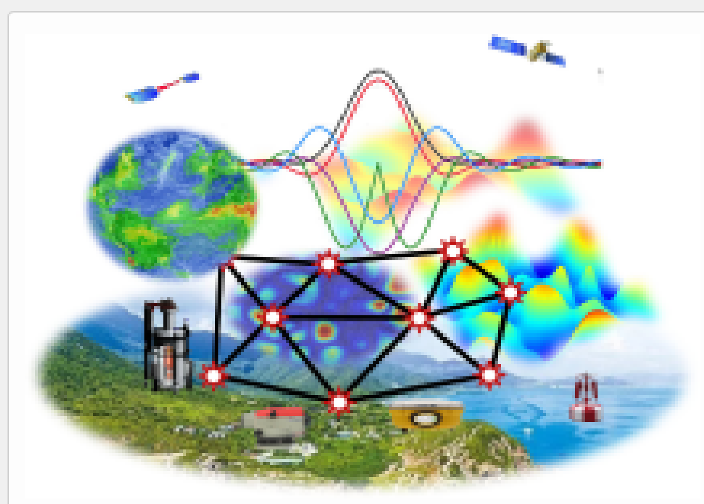
Regional refinement of load deformation field by Green's Integral



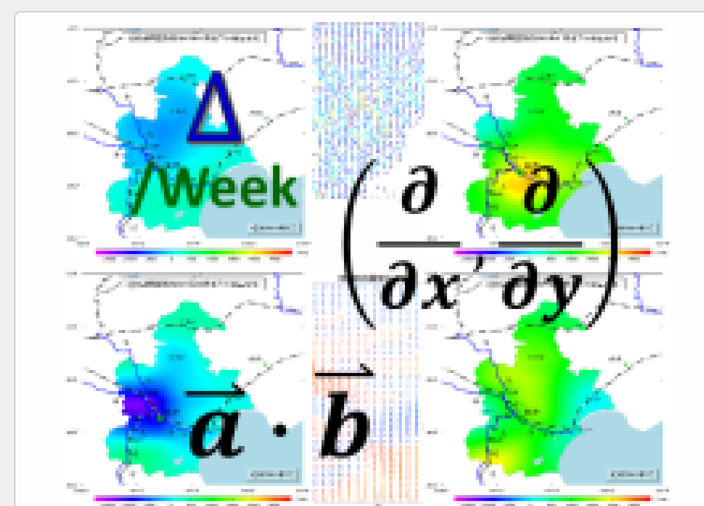
Regional approach of load deformation field using SRBFs



Load deformation field monitoring from heterogeneous variations with Green's integral constraints



Load deformation field monitoring from heterogeneous variations using spherical radial basis functions

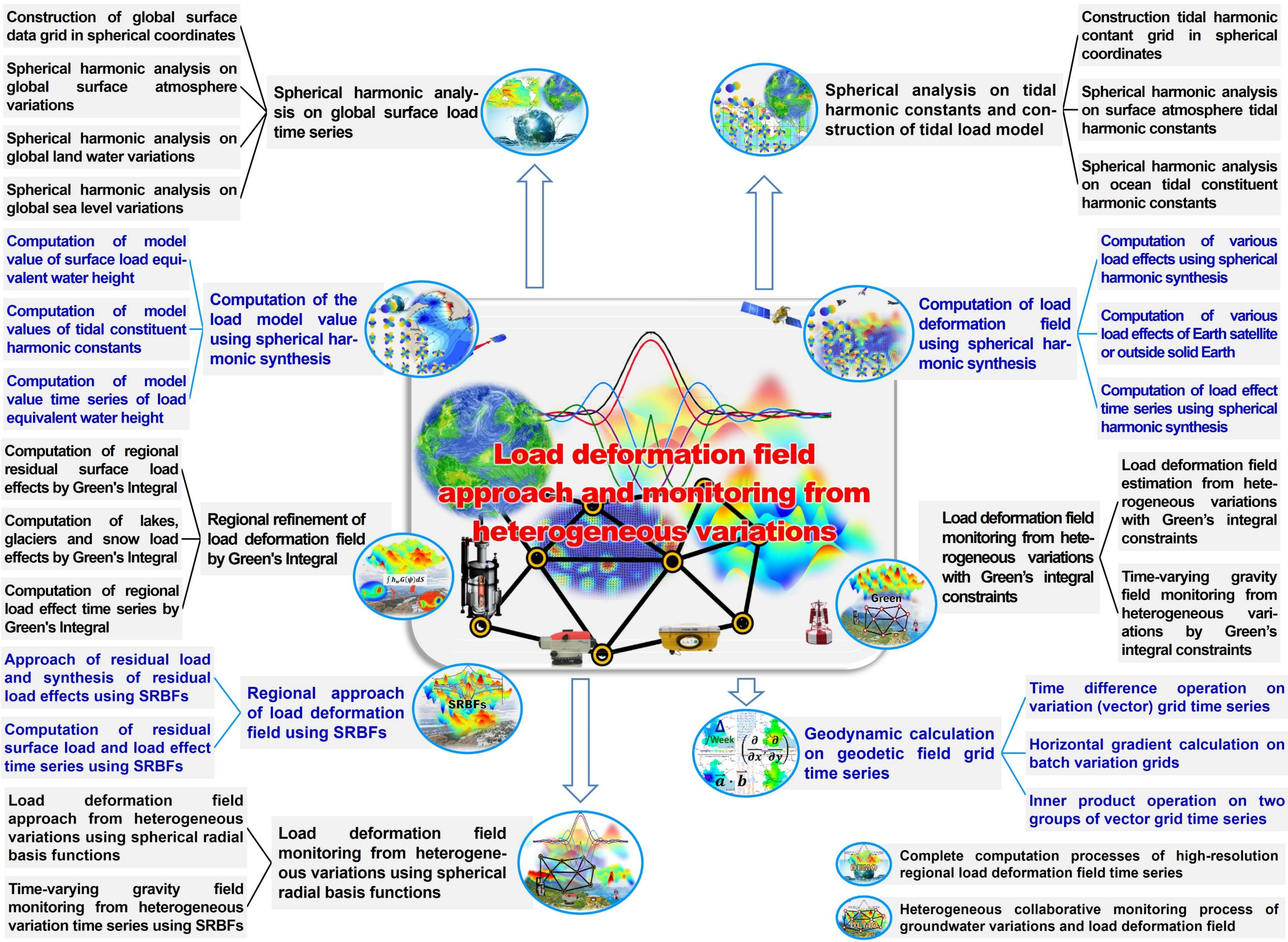


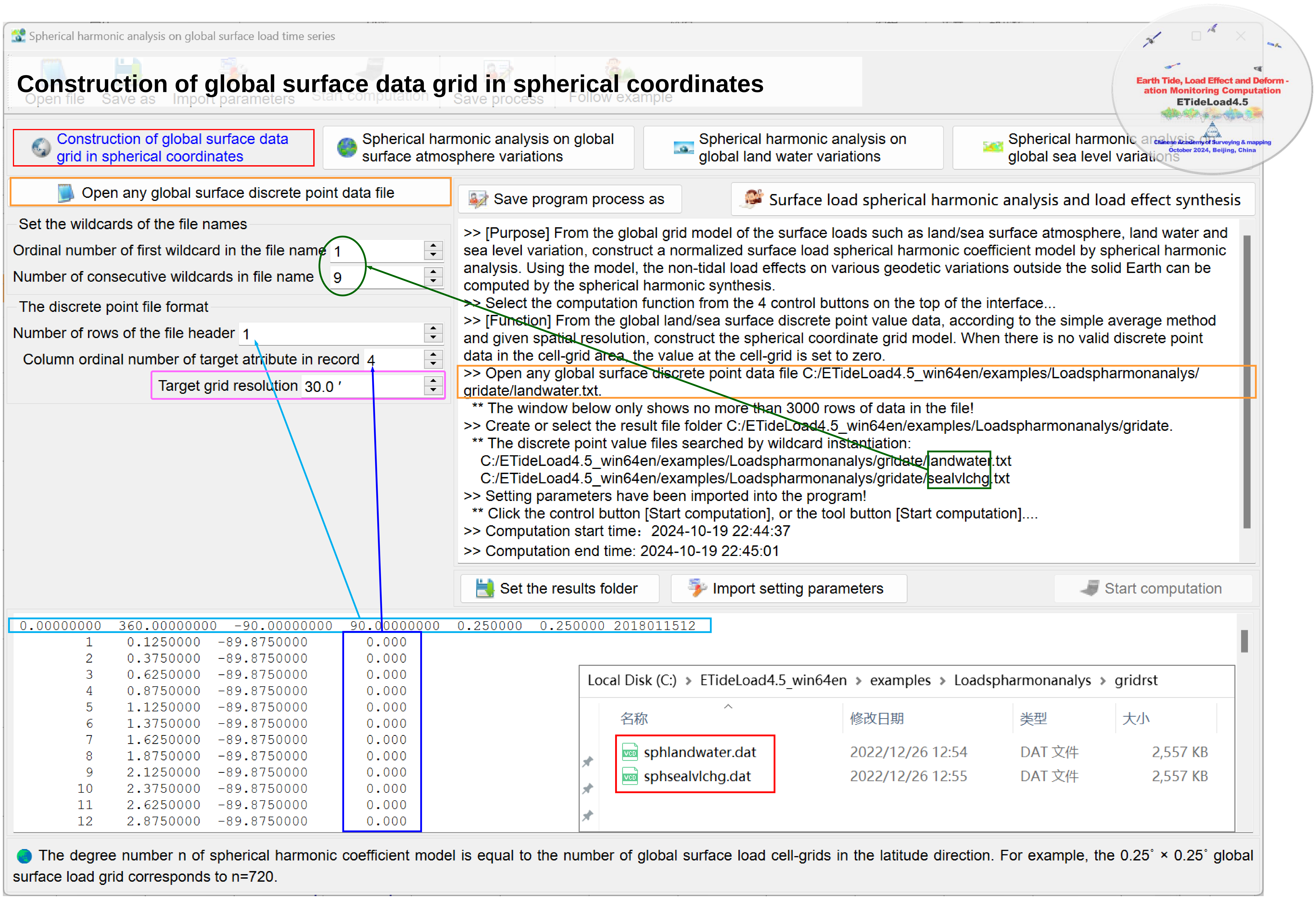
Geodynamic calculation on geodetic field grid time series

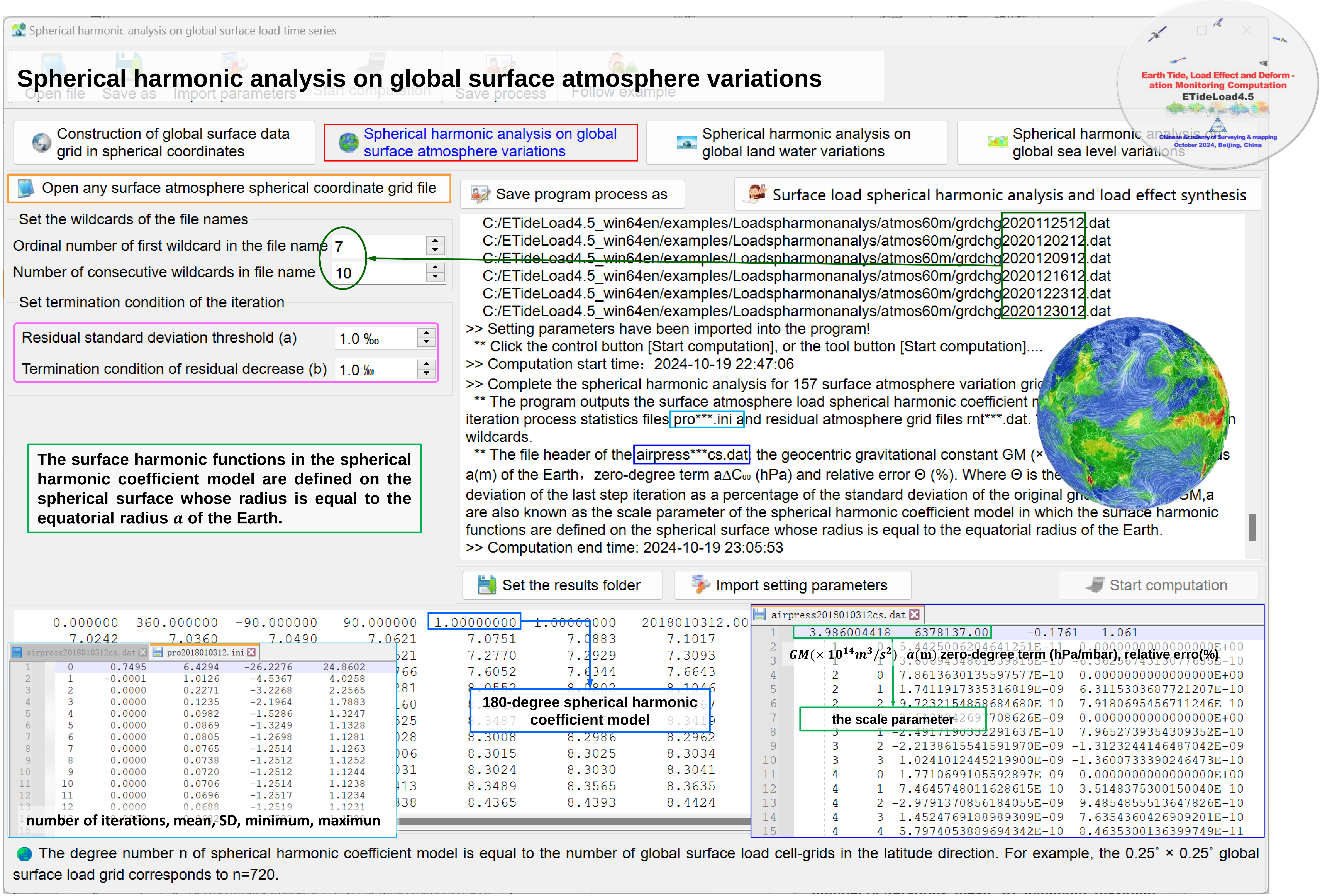
Complete computation processes of high-resolution regional load deformation field time series

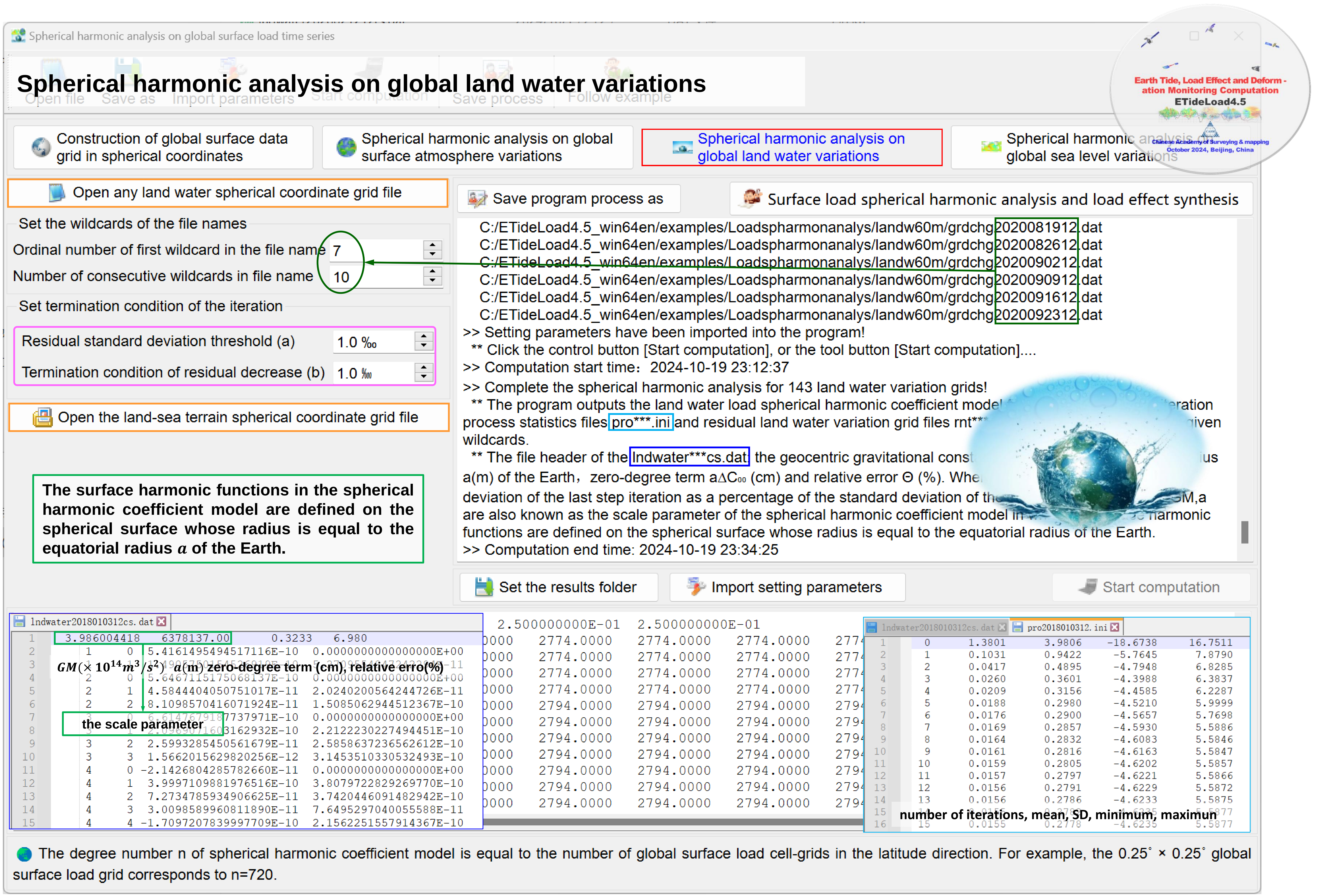
Collaborative monitoring process of groundwater variations and load deformation field

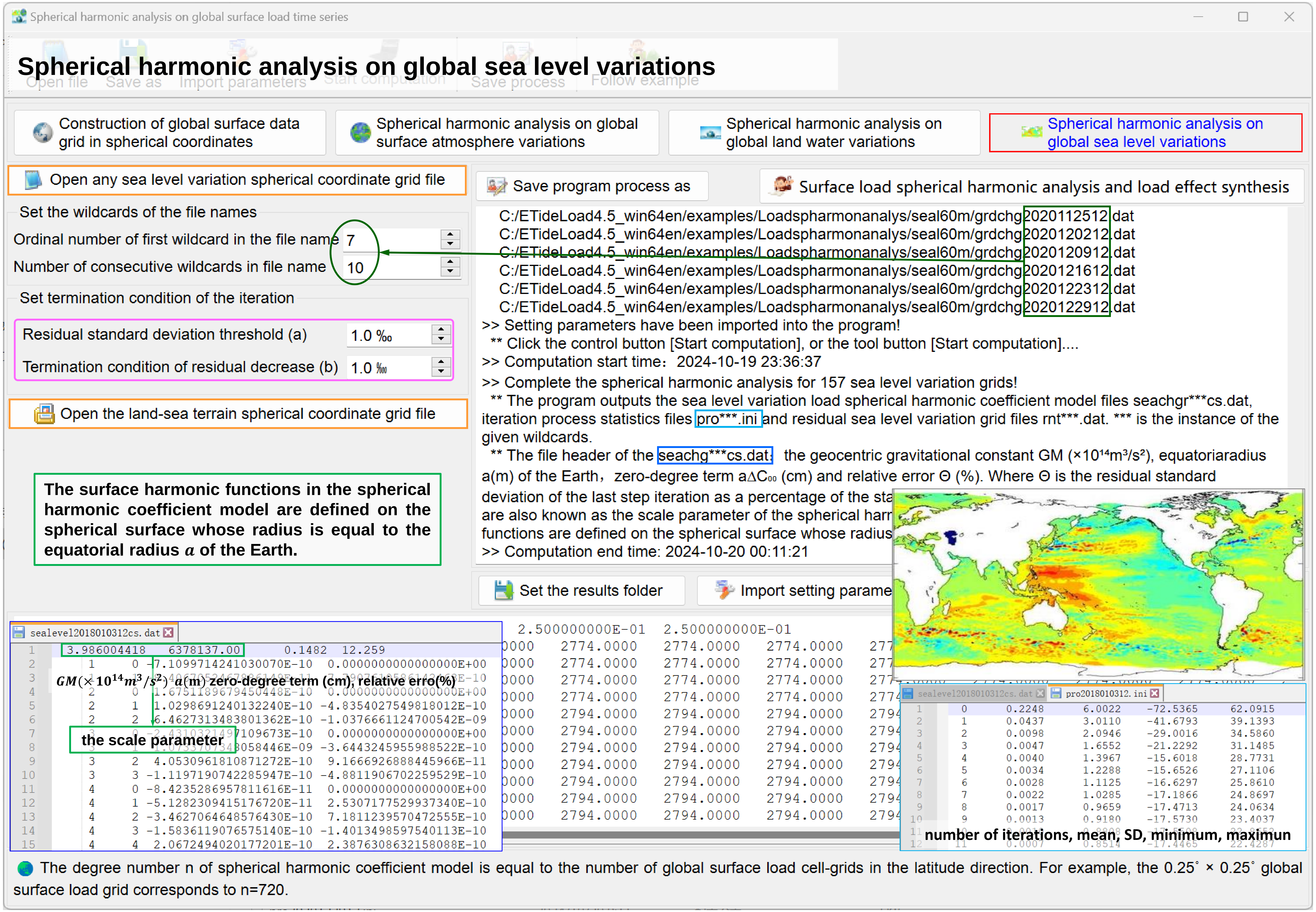
Surface load and load deformation field monitoring computation processes

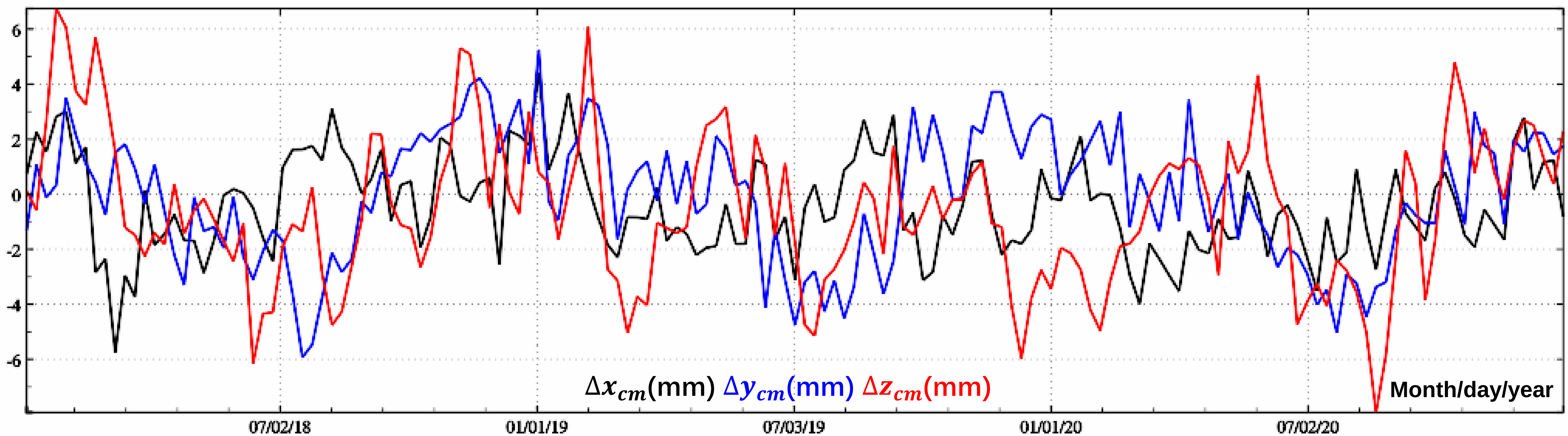

Construction of global surface data grid in spherical coordinates
Spherical harmonic analysis on global surface atmosphere variations
Spherical harmonic analysis on global land water variations
Spherical harmonic analysis on global sea level variations
Spherical harmonic analysis on global surface load time series
Spherical analysis on tidal harmonic constants and construction of tidal load model
Construction tidal harmonic contant grid in spherical coordinates
Spherical harmonic analysis on surface atmosphere tidal harmonic constants
Spherical harmonic analysis on ocean tidal constituent harmonic constants
Computation of model value of surface load equivalent water height
Computation of model values of tidal constituent harmonic constants
Computation of model value time series of load equivalent water height
Computation of the load model value using spherical harmonic synthesis
Computation of load deformation field using spherical harmonic synthesis
Computation of various load effects using spherical harmonic synthesis
Computation of various load effects of Earth satellite or outside solid Earth
Computation of load effect time series using spherical harmonic synthesis
Load deformation field approach and monitoring from heterogeneous variations
Computation of regional residual surface load effects by Green's Integral
Computation of lakes, glaciers and snow load effects by Green's Integral
Computation of regional load effect time series by Green's Integral
Regional refinement of load deformation field by Green's Integral
Load deformation field monitoring from heterogeneous variations with Green's integral constraints
Load deformation field estimation from heterogeneous variations with Green's integral constraints
Time-varying gravity field monitoring from heterogeneous variations by Green's integral constraints
Green
Approach of residual load and synthesis of residual load effects using SRBFs
Computation of residual surface load and load effect time series using SRBFs
Regional approach of load deformation field using SRBFs
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
Load deformation field approach from heterogeneous variations using spherical radial basis functions
Time-varying gravity field monitoring from heterogeneous variation time series using SRBFs
Load deformation field monitoring from heterogeneous variations using spherical radial basis functions
Complete computation processes of high-resolution regional load deformation field time series
Heterogeneous collaborative monitoring process of groundwater variations and load deformation field


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
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Construction of global surface data grid in spherical coordinates
Spherical harmonic analysis on global surface atmosphere variations
Spherical harmonic analysis on global land water variations
Spherical harmonic analysis on global sea level variations
Open any global surface discrete point data file
Save program process as
Surface load spherical harmonic analysis and load effect synthesis
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] From the global grid model of the surface loads such as land/sea surface atmosphere, land water and sea level variation, construct a normalized surface load spherical harmonic coefficient model by spherical harmonic analysis. Using the model, the non-tidal load effects on various geodetic variations outside the solid Earth can be computed by the spherical harmonic synthesis.
>> Select the computation function from the 4 control buttons on the top of the interface...
>> [Function] From the global land/sea surface discrete point value data, according to the simple average method and given spatial resolution, construct the spherical coordinate grid model. When there is no valid discrete point data in the cell-grid area, the value at the cell-grid 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 value 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：2024-10-19 22:44:37
>> Computation end time: 2024-10-19 22:45:01
Set the results 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
12 2.8750000 -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 degree number n of spherical harmonic coefficient model is equal to the number of global surface load cell-grids in the latitude direction. For example, the 0.25˚ × 0.25˚ global surface load grid corresponds to n=720.


Spherical harmonic analysis on global surface load time series
Spherical harmonic analysis on global surface atmosphere variations
Open file
Save as
Import parameters
Start computation
Save process
Follow example
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Construction of global surface data grid in spherical coordinates
Spherical harmonic analysis on global surface atmosphere variations
Spherical harmonic analysis on global land water variations
Spherical harmonic analysis on global sea level variations
Open any surface atmosphere spherical coordinate grid file
Save program process as
Surface load spherical harmonic analysis and load effect synthesis
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/grdchg2020112512.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020120212.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020120912.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020121612.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020122312.dat
C:/ETideLoad4.5_win64en/examples/Loadspharmonanalys/atmos60m/grdchg2020123012.dat
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time: 2024-10-19 22:47:06
>> Complete the spherical harmonic analysis for 157 surface atmosphere variation gri
** The program outputs the surface atmosphere load spherical harmonic coefficient m
iteration process statistics files pro***.ini and residual atmosphere grid files rnt***.dat.
wildcards.
** The file header of the airpress***cs.dat the geocentric gravitational constant GM (×
a(m) of the Earth, zero-degree term aΔC₀₀ (hPa) and relative error Θ (%). Where Θ is the
deviation of the last step iteration as a percentage of the standard deviation of the original gr
are also known as the scale parameter of the spherical harmonic coefficient model in which the surface harmonic functions are defined on the spherical surface whose radius is equal to the equatorial radius of the Earth.
>> Computation end time: 2024-10-19 23:05:53
Set the results folder
Import setting parameters
Start computation
0.000000 360.000000 -90.000000 90.000000 1.00000000 1.00000000 2018010312.00
airpress2018010312cs.dat
pro2018010312.ini
number of iterations, mean, SD, minimum, maximun
180-degree spherical harmonic coefficient model
airpress2018010312cs.dat
3.986004418 6378137.00 -0.1761 1.061
GM(× 10¹⁴m³/s²) a(m) zero-degree term (hPa/mbar), relative erro(%)
the scale parameter
The degree number n of spherical harmonic coefficient model is equal to the number of global surface load cell-grids in the latitude direction. For example, the 0.25˚ × 0.25˚ global surface load grid corresponds to n=720.

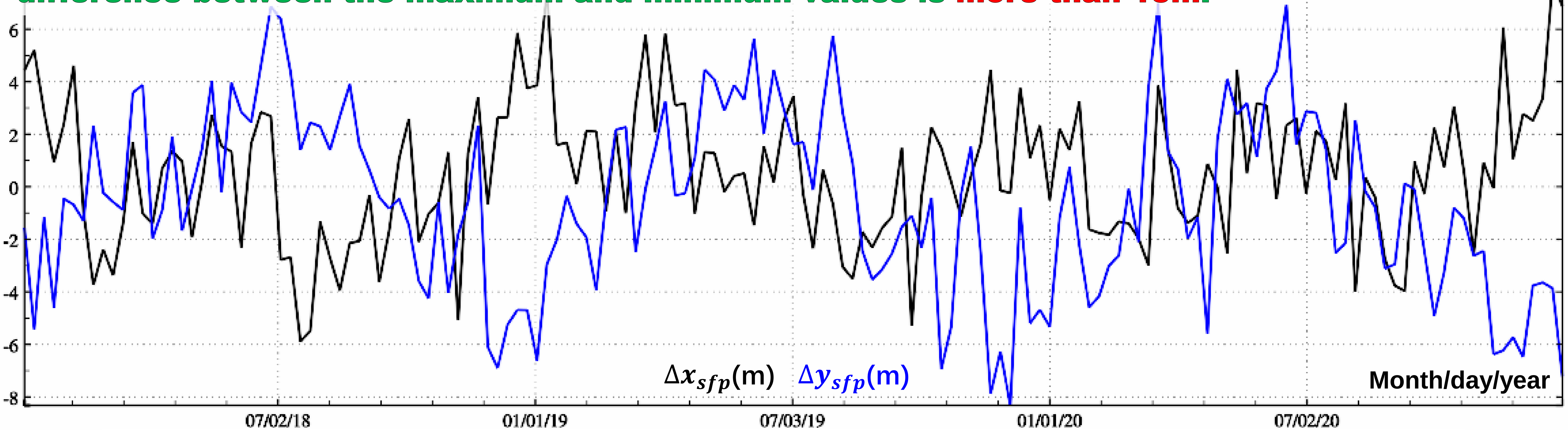

Spherical harmonic analysis on global surface load time series
Spherical harmonic analysis on global land water variations
Open file
Save as
Import parameters
Start computation
Save process
Follow example
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Construction of global surface data grid in spherical coordinates
Spherical harmonic analysis on global surface atmosphere variations
Spherical harmonic analysis on global land water variations
Spherical harmonic analysis on global sea level variations
Open any land water spherical coordinate grid file
Save program process as
Surface load spherical harmonic analysis and load effect synthesis
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.
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: 2024-10-19 23:12:37
>> Complete the spherical harmonic analysis for 143 land water variation grids!
** The program outputs the land water load spherical harmonic coefficient model ... iteration process statistics files pro***.ini and residual land water variation grid files rnt*** ... given wildcards.
** The file header of the lndwater***cs.dat: the geocentric gravitational const... radius a(m) of the Earth, zero-degree term aΔC₀₀ (cm) and relative error Θ (%). Whe... deviation of the last step iteration as a percentage of the standard deviation of th... GM,a are also known as the scale parameter of the spherical harmonic coefficient model in ... harmonic functions are defined on the spherical surface whose radius is equal to the equatorial radius of the Earth.
>> Computation end time: 2024-10-19 23:34:25
Set the results folder
Import setting parameters
Start computation
lndwater2018010312cs.dat
3.986004418 6378137.00 0.3233 6.980
GM(×10^14 m^3/s^2) a(m) zero-degree term (cm), relative erro(%)
the scale parameter
1 0 5.4161495494517116E-10 0.0000000000000000E+00
2 0 5.6467115175068137E-10 0.0000000000000000E+00
2 1 4.5844404050751017E-11 2.0240200564244726E-11
2 2 8.1098570416071924E-11 1.5085062944512367E-10
3 2 2.5993285450561679E-11 2.5858637236562612E-10
3 3 1.5662015629820256E-12 3.1453510330532493E-10
4 0 -2.1426804285782660E-11 0.0000000000000000E+00
4 1 3.9997109881976516E-10 3.8079722829269770E-10
4 2 7.2734785934906625E-11 3.7420446091482942E-10
4 3 3.0098589960811890E-11 7.6495297040055588E-11
4 4 -1.7097207839997709E-10 2.1562251557914367E-10
2.500000000E-01 2.500000000E-01
pro2018010312.ini
number of iterations, mean, SD, minimum, maximum
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
15 0.0155 0.2778 -4.6235 5.5877
The degree number n of spherical harmonic coefficient model is equal to the number of global surface load cell-grids in the latitude direction. For example, the 0.25° × 0.25° global surface load grid 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 land water variations
Spherical harmonic analysis on global sea level variations
Open any sea level variation spherical coordinate grid file
Save program process as
Surface load spherical harmonic analysis and load effect synthesis
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
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: 2024-10-19 23:36:37
>> Complete the spherical harmonic analysis for 157 sea level variation grids!
** The program outputs the sea level variation load spherical harmonic coefficient model files seachgr***cs.dat, iteration process statistics files pro***.ini and residual sea level variation grid files rnt***.dat. *** is the instance of the given wildcards.
** The file header of the seachg***cs.dat: the geocentric gravitational constant GM (×10¹⁴m³/s²), equatoriaradius a(m) of the Earth, zero-degree term aΔC₀₀ (cm) and relative error Θ (%). Where Θ is the residual standard deviation of the last step iteration as a percentage of the sta
are also known as the scale parameter of the spherical harr
functions are defined on the spherical surface whose radius
>> Computation end time: 2024-10-20 00:11:21
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 results folder
Import setting parame
sealevel2018010312cs.dat
3.986004418 6378137.00 0.1482 12.259
GM(×10¹⁴m³/s²) a(m) zero-degree term (cm), relative erro(%)
the scale parameter
sealevel2018010312cs.dat
pro2018010312.ini
number of iterations, mean, SD, minimum, maximun
The degree number n of spherical harmonic coefficient model is equal to the number of global surface load cell-grids in the latitude direction. For example, the 0.25˚ × 0.25˚ global surface load grid corresponds to n=720.

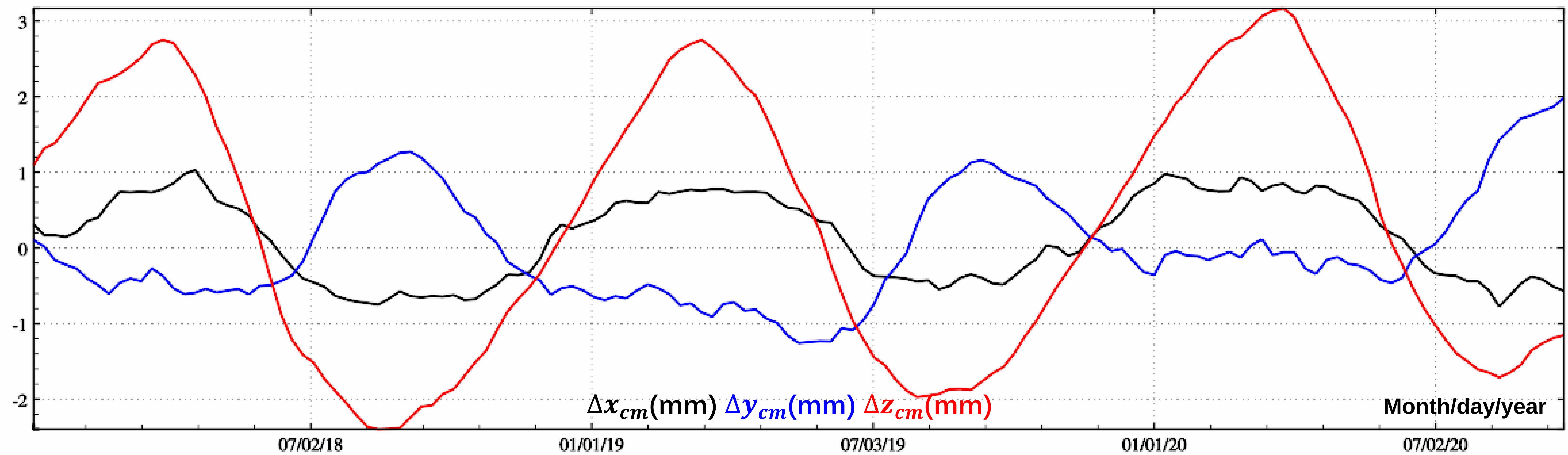


The surface atmosphere load effect time series (mm) on Earth's mass centric variations

The atmospheric load effect on the figure polar shift is the largest, and the difference between the maximum and minimum values is more than 15m.

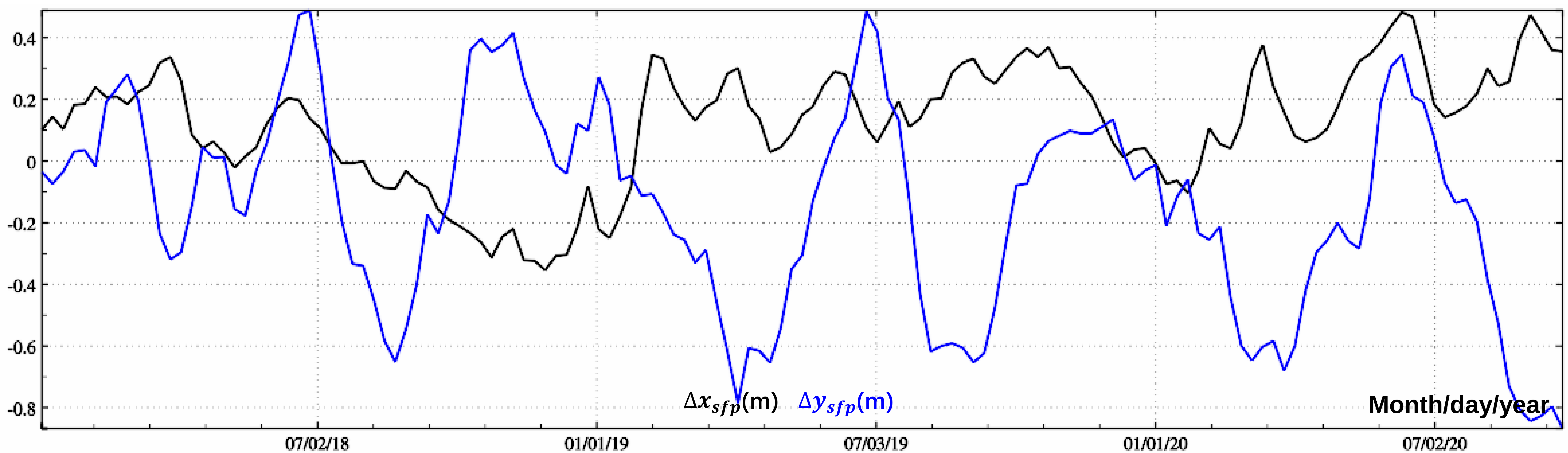


The surface atmosphere variation load effect time series (m) on Earth's figure polar shift in ITRS

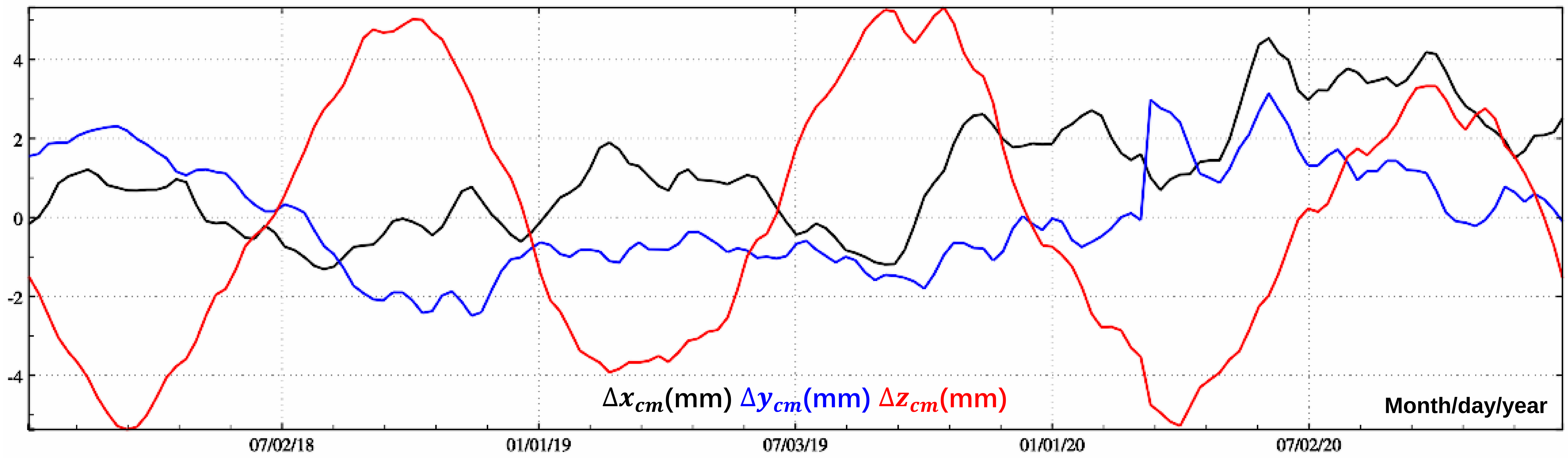


The global land water variation load effect time series (mm) on Earth's mass centric variations

The land water load effect on the figure polar shift can reach 1.2m.

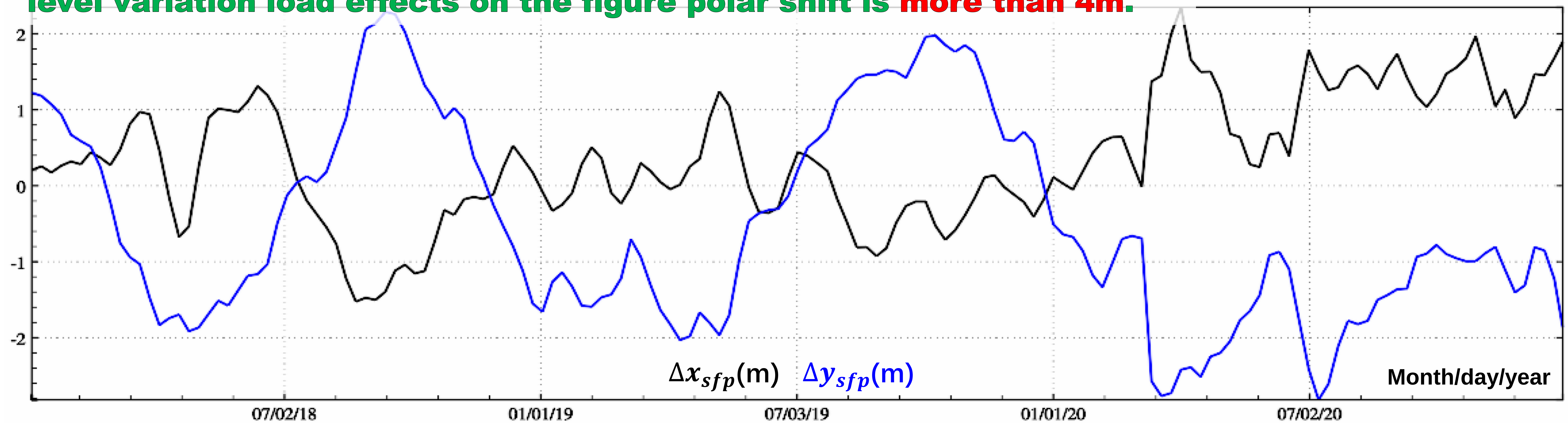


The global land water variation load effect time series (m) on Earth's figure polar shift in ITRS

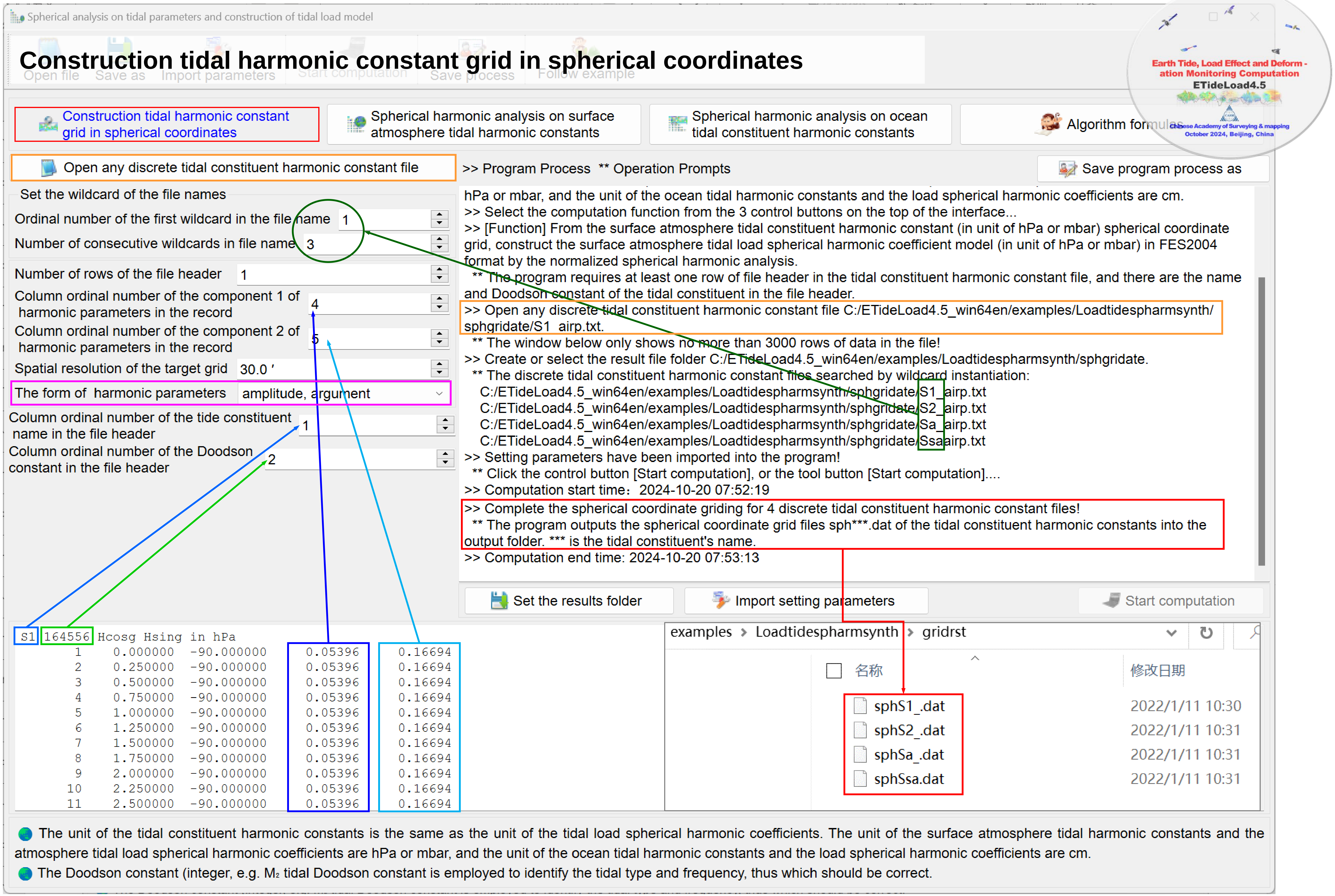


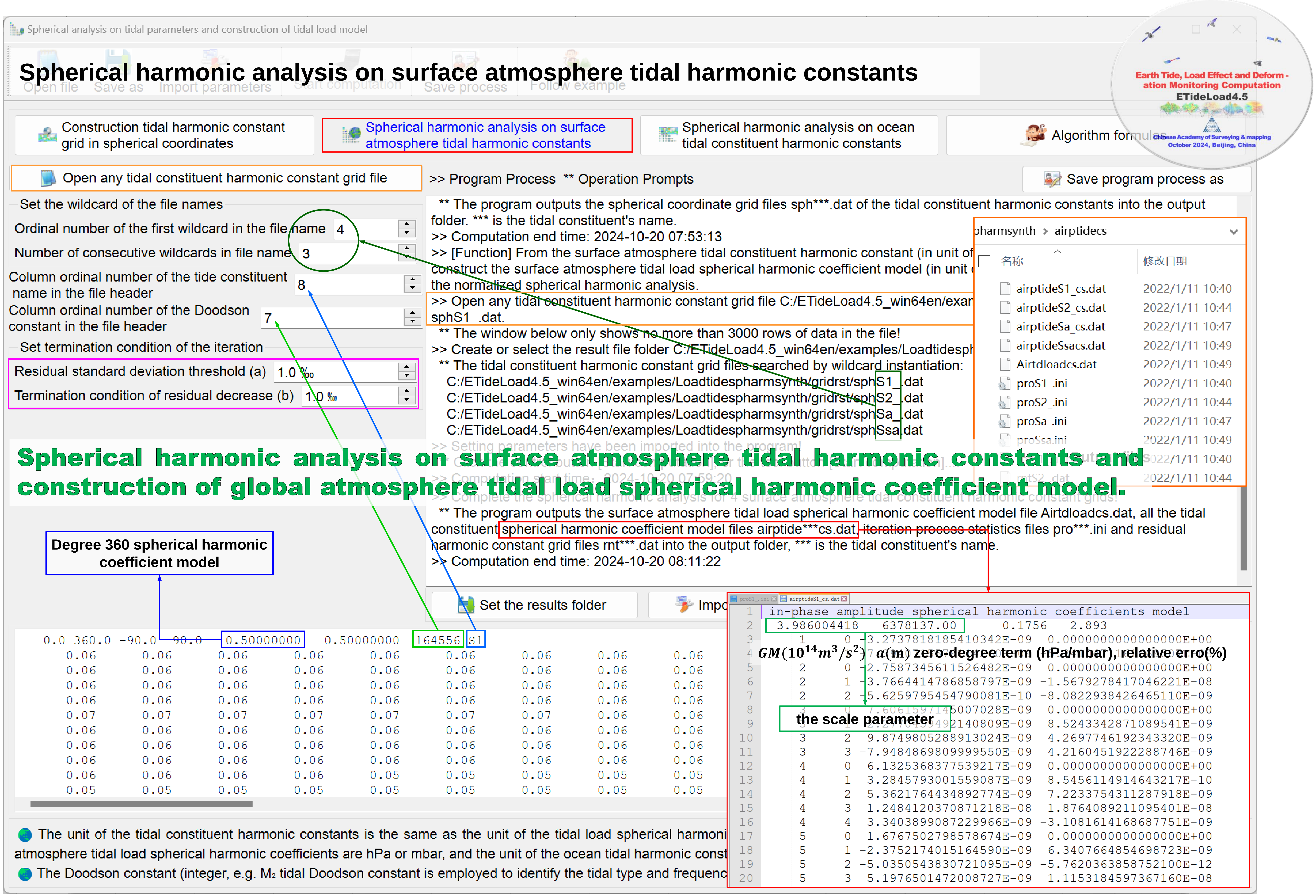
The global sea level variation load effect time series (mm) on Earth's mass centric variations

The difference between the maximum and minimum values of the sea level variation load effects on the figure polar shift is more than 4m.



The global sea level variation load effect time series (m) on Earth’s figure polar shift in ITRS


Spherical analysis on tidal parameters and construction of tidal load model
Construction tidal harmonic constant grid in spherical coordinates
Open file
Save as
Import parameters
Start computation
Save process
Follow example
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Construction 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
>> Program Process ** Operation Prompts
Save program process as
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
hPa or mbar, and the unit of the ocean tidal harmonic constants and the load spherical harmonic coefficients are cm.
>> Select the computation function from the 3 control buttons on the top of the interface...
>> [Function] From the surface atmosphere tidal constituent harmonic constant (in unit of hPa or mbar) spherical coordinate grid, construct the surface atmosphere tidal load spherical harmonic coefficient model (in unit of hPa or mbar) in FES2004 format by the normalized spherical harmonic analysis.
** The program requires at least one row of file header in the tidal constituent harmonic constant file, and there are the name and Doodson constant of the tidal constituent in the file header.
>> 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/Ssaairp.txt
>> Setting parameters have been imported into the program!
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time: 2024-10-20 07:52:19
>> 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: 2024-10-20 07:53:13
Set the results 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 unit of the tidal constituent harmonic constants is the same as the unit of the tidal load spherical harmonic coefficients. The unit of the surface atmosphere tidal harmonic constants and the atmosphere tidal load spherical harmonic coefficients are hPa or mbar, and the unit of the ocean tidal harmonic constants and the load spherical harmonic coefficients are cm.
The Doodson constant (integer, e.g. M₂ tidal Doodson constant is employed to identify the tidal type and frequency, thus which should be correct.



Spherical analysis on tidal parameters 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
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Construction 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
>> Program Process ** Operation Prompts
Save program process as
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 ‰
** 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: 2024-10-20 07:53:13
>> [Function] From the surface atmosphere tidal constituent harmonic constant (in unit of
construct the surface atmosphere tidal load spherical harmonic coefficient model (in unit
the normalized spherical harmonic analysis.
>> Open any tidal constituent harmonic constant grid file C:/ETideLoad4.5_win64en/exan
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/Loadtidesph
** The tidal constituent harmonic constant grid files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/gridrst/sphS1_.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/gridrst/sphS2_.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/gridrst/sphSa_.dat
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/gridrst/sphSsa.dat
>> Setting parameters have been imported into the program!
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
2022/1/11 10:40
rntS2_.dat 2022/1/11 10:44
Spherical harmonic analysis on surface atmosphere tidal harmonic constants and construction of global atmosphere tidal load spherical harmonic coefficient model.
>> Computation start time: 2024-10-20 07:59:20
>> 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.
>> Computation end time: 2024-10-20 08:11:22
Degree 360 spherical harmonic coefficient model
Set the results folder
Import
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
proS1_.ini
airptideS1_cs.dat
in-phase amplitude spherical harmonic coefficients model
3.986004418 6378137.00 0.1756 2.893
$GM(10^{14}m^3/s^2)$ a(m) zero-degree term (hPa/mbar), relative erro(%)
1 0 3.2737818185410342E-09 0.0000000000000000E+00
2 0 2.7587345611526482E-09 0.0000000000000000E+00
2 1 3.7664414786858797E-09 -1.5679278417046221E-08
2 2 5.6259795454790081E-10 -8.0822938426465110E-09
5007028E-09 0.0000000000000000E+00
the scale parameter
2140809E-09 8.5243342871089541E-09
3 2 9.8749805288913024E-09 4.2697746192343320E-09
3 3 -7.9484869809999550E-09 4.2160451922288746E-09
4 0 6.1325368377539217E-09 0.0000000000000000E+00
4 1 3.2845793001559087E-09 8.5456114914643217E-10
4 2 5.3621764434892774E-09 7.2233754311287918E-09
4 3 1.2484120370871218E-08 1.8764089211095401E-08
4 4 3.3403899087229966E-09 -3.1081614168687751E-09
5 0 1.6767502798578674E-09 0.0000000000000000E+00
5 1 -2.3752174015164590E-09 6.3407664854698723E-09
5 2 -5.0350543830721095E-09 -5.7620363858752100E-12
5 3 5.1976501472008727E-09 1.1153184597367160E-08
The unit of the tidal constituent harmonic constants is the same as the unit of the tidal load spherical harmoni
atmosphere tidal load spherical harmonic coefficients are hPa or mbar, and the unit of the ocean tidal harmonic const
The Doodson constant (integer, e.g. M_2 tidal Doodson constant is employed to identify the tidal type and frequenc

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	[illegible]
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	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.016359	286.6570
164.556	S1	5	3	0.01540811	0.05344217	0.01772763	-0.01768282	0.055619	16.0830	0.025039	134.9275
164.556	S1	5	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	238.5496	0.028100	42.2838
164.556	S1	5	5	0.06196212	-0.00041678	-0.00316231	0.00014887	0.061964	90.3854	0.003166	272.6952
164.556	S1	6	0	-0.01902007	-0.00031063	-0.01902007	-0.00031063	0.019023	269.0643	0.019023	269.0643
164.556	S1	6	1	0.01292417	0.05007315	-0.01614491	-0.03693554	0.051714	14.4725	0.040310	203.6106
164.556	S1	6	2	-0.02124270	0.00967981	-0.00563026	0.00828166	0.023344	294.4977	0.010014	325.7903

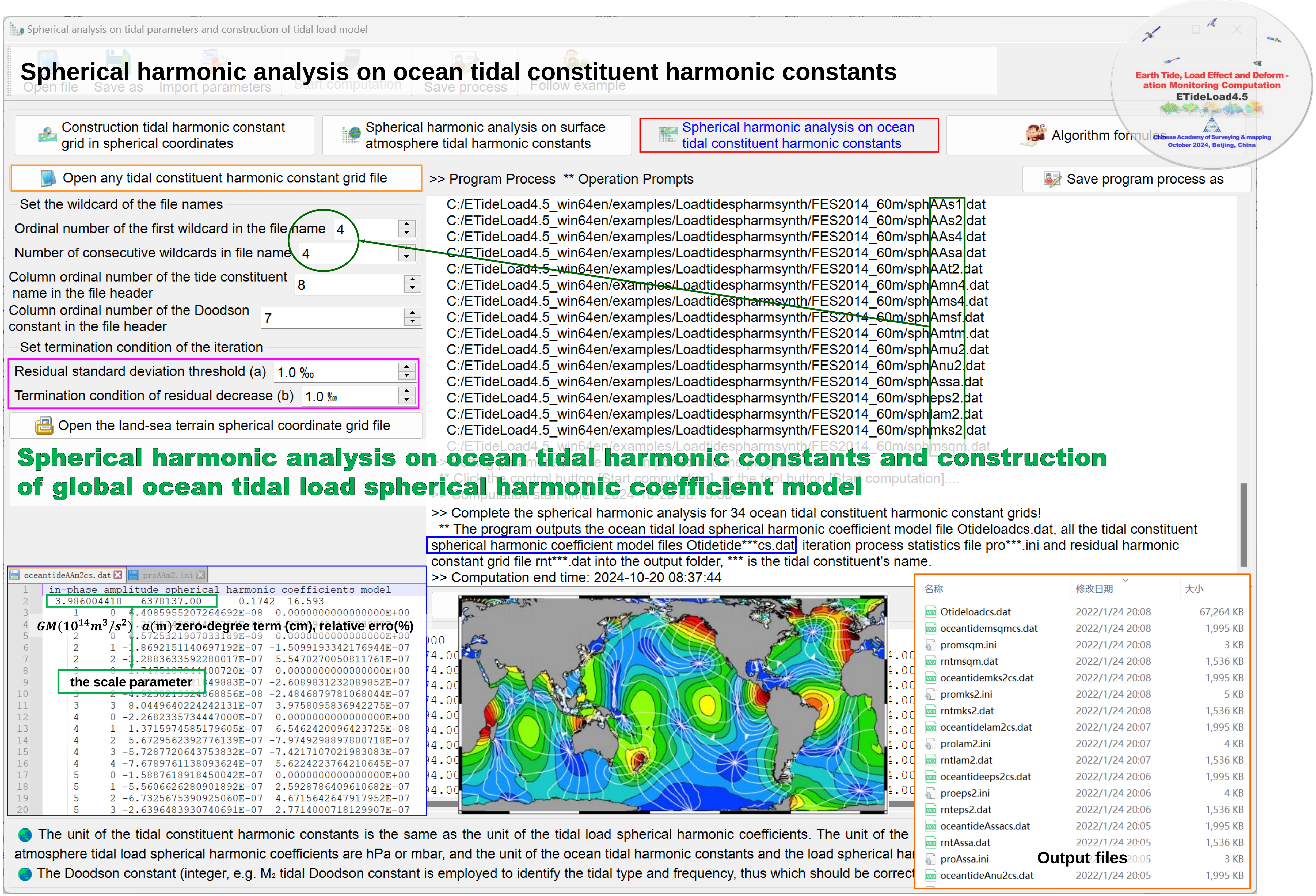
Atmosphere tidal load spherical harmonic coefficient model ECMWF2006cs360.dat constructed by ETideload4.5

airptideS1_cs.dat | proS1_.ini | Airtdloadcs.dat | Otideloadcs.dat | Airtd0ne.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 mass centric variations or all-element geodetic variation effects due to Earth's mass centric variation of atmosphere tide.



Spherical analysis on tidal parameters and construction of tidal load model
Spherical harmonic analysis on ocean tidal constituent harmonic constants
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Construction 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
>> Program Process ** Operation Prompts
Save program process as
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
C:/ETideLoad4.5_win64en/examples/Loadtidespharmsynth/FES2014_60m/sphAAs1.dat
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
Spherical harmonic analysis on ocean tidal harmonic constants and construction of global ocean tidal load spherical harmonic coefficient model
>> 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.
>> Computation end time: 2024-10-20 08:37:44
oceantideAAm2cs.dat
proAAm2.ini
in-phase amplitude spherical harmonic coefficients model
3.986004418 6378137.00 0.1742 16.593
GM($10^{14}m^3/s^2$) a(m) zero-degree term (cm), relative erro(%)
the scale parameter
1 0 6.4085955207264692E-08 0.0000000000000000E+00
2 0 5.5725321907033189E-09 0.0000000000000000E+00
2 1 -1.8692151140697192E-07 -1.5099193342176944E-07
2 2 -3.2883633592280017E-07 5.5470270050811761E-07
3 0 -1.7475107044400720E-07 0.0000000000000000E+00
3 2 -4.9230213324868856E-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 2.5928786409160682E-07
5 2 -6.7325675390925060E-07 4.6715642647917952E-07
5 3 -2.6396483930740691E-07 2.7714000718129907E-07
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
oceantideAnu2cs.dat 2022/1/24 20:05 1,995 KB
Output files
The unit of the tidal constituent harmonic constants is the same as the unit of the tidal load spherical harmonic coefficients. The unit of the atmosphere tidal load spherical harmonic coefficients are hPa or mbar, and the unit of the ocean tidal harmonic constants and the load spherical har
The Doodson constant (integer, e.g. M_2 tidal Doodson constant is employed to identify the tidal type and frequency, thus which should be correct

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	-0.12292118	0.09809027	0.097002	19.2099	0.157262	308.5896
247.455	2N2	5	3	-0.04622506	[illegible]	-0.03229552	[illegible]	0.100551	332.6324	0.039828	234.1757
247.455	2N2	5	4	[illegible]	[illegible]	-0.08015548	0.01815451	0.128829	91.5042	0.082186	282.7617
247.455	2N2	5	5	0.07170340	0.02947675	0.04405895	-0.03476786	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

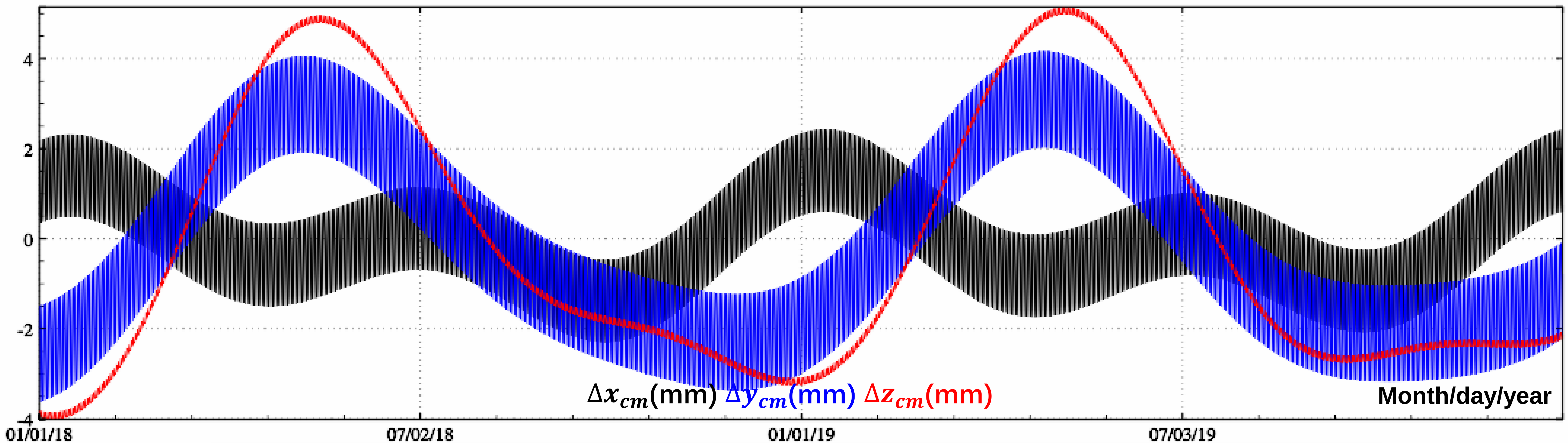
Ocean tidal load spherical harmonic coefficient model FES2014b360cs.dat constructed by ETideload4.5

oceantideA2n2cs.dat | proA2n2.ini | OtideOne.dat

3.986004418 6378137.00

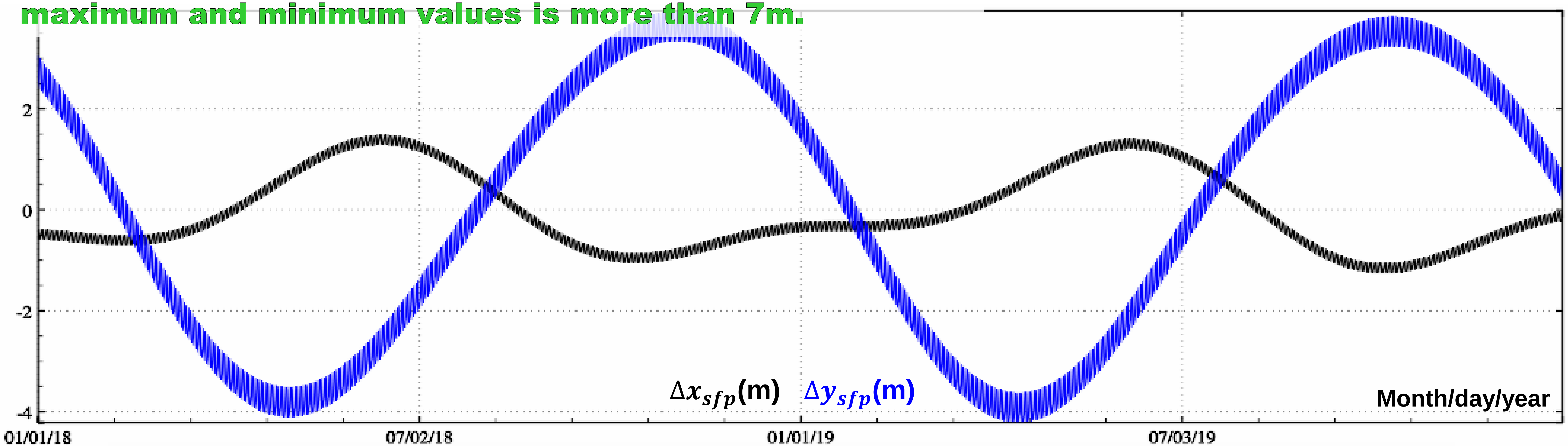
name	Doodson	C10+	C10-	C11+	C11-	S11+	S11-
2N2	247.455	0.14379190E-08	0.72446933E-09	0.45556662E-09	0.50261431E-09	0.98234968E-09	0.28806626E-08
J1	175.455	0.22805765E-08	-0.14599680E-07	0.11146859E-07	0.31354016E-08	0.49073923E-08	0.50239288E-08
K1	165.555	0.65903198E-07	-0.23618735E-06	0.15240517E-06	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	0.16600812E-07	-0.74602430E-07	0.48235157E-07	0.14146460E-07	0.16828410E-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
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]E-09
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	0.50377828E-07	0.49157638E-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 mass centric variations or all-element geodetic variation effects due to Earth's mass centric variation of ocean tide.

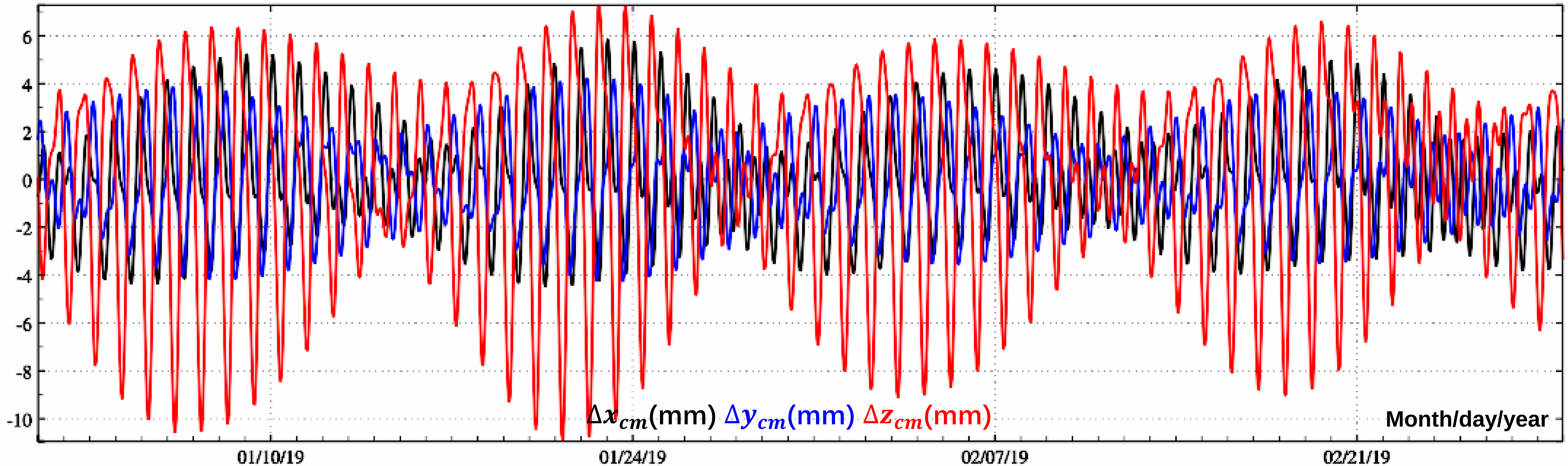


The atmosphere tidal load effect time series on Earth's mass centric variation

The annual amplitude is large, and the difference between maximum and minimum values is more than 7m.

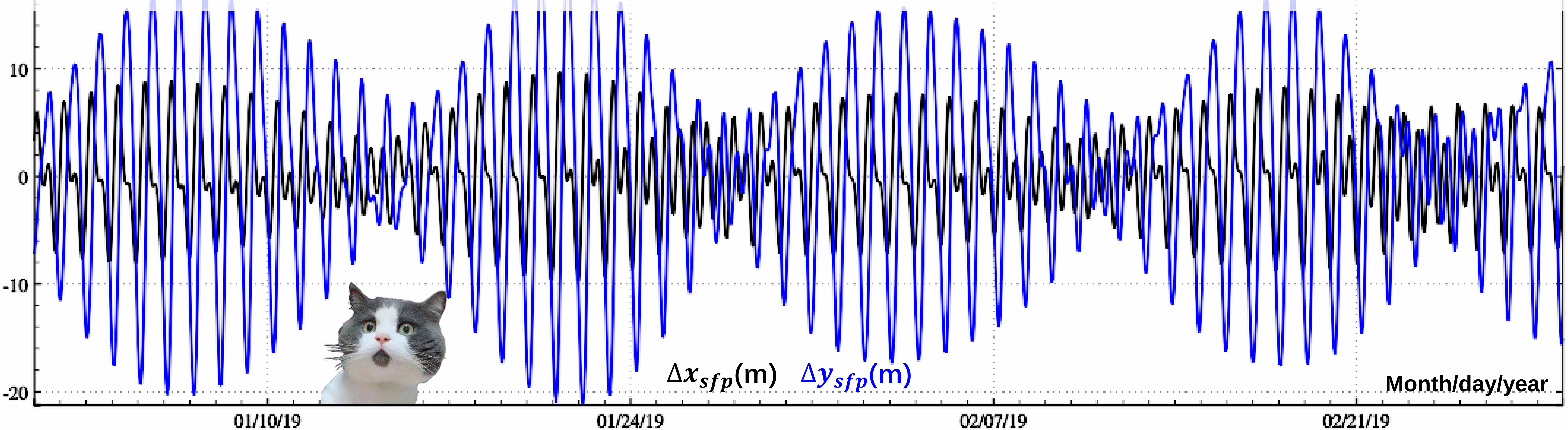


The surface atmosphere tidal load effect time series (m) on Earth's figure polar shifts in ITRS

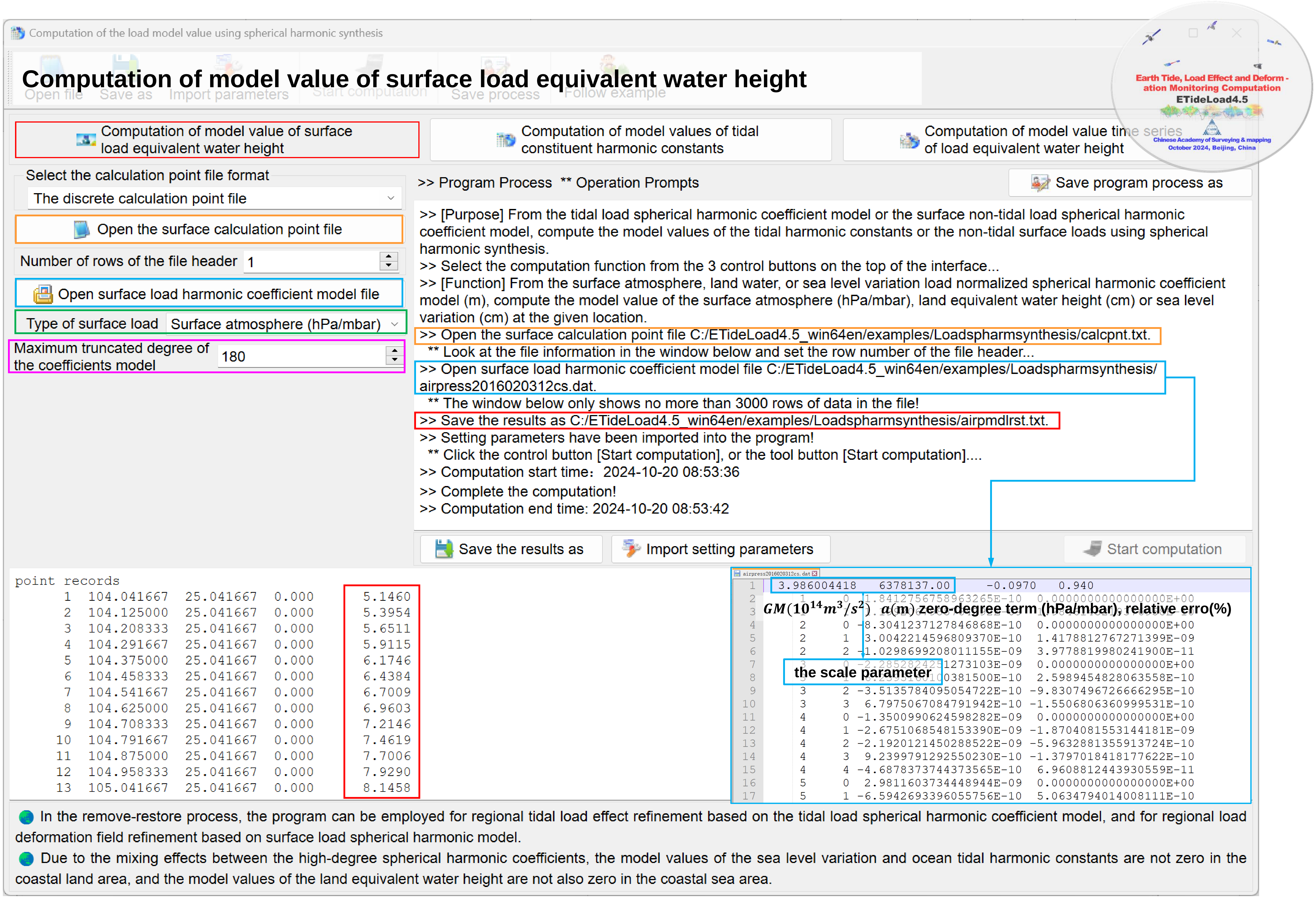


The ocean tidal load effect time series (mm) on Earth's mass centric variations

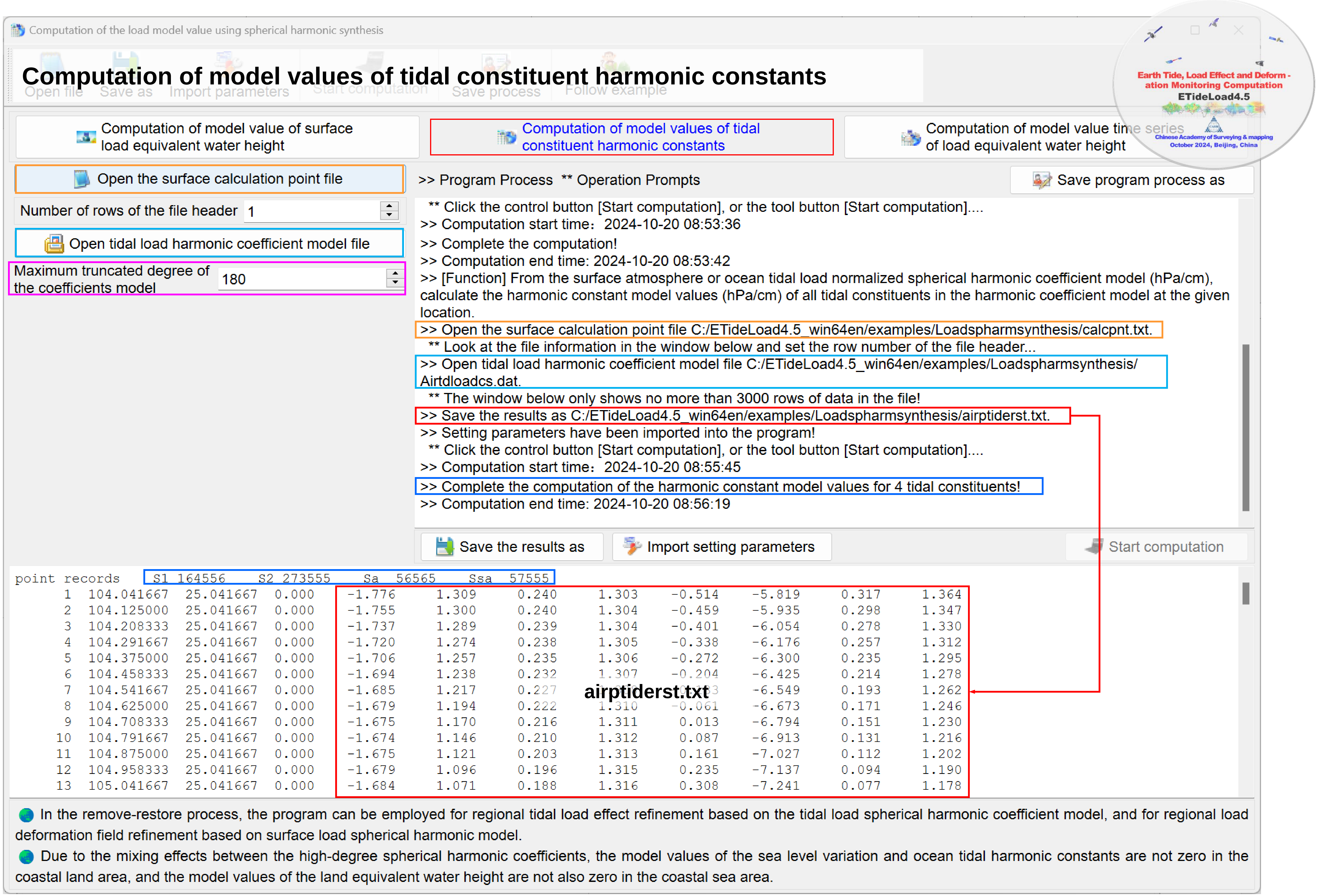
The ocean tidal load effects on the Earth's figure polar shift are dominated by diurnal variation, and the difference between maximum and minimum values can reach 40m in one month.

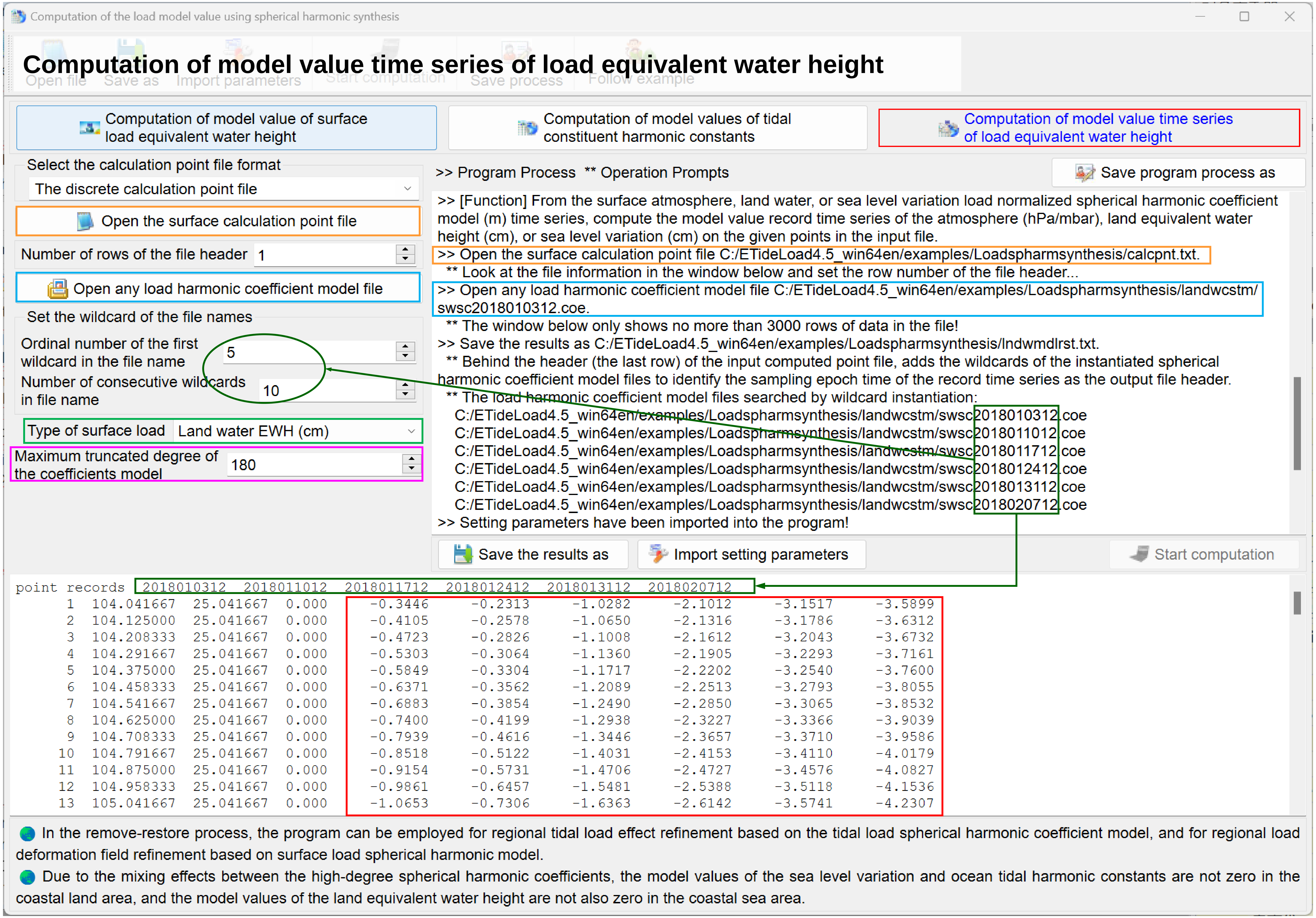


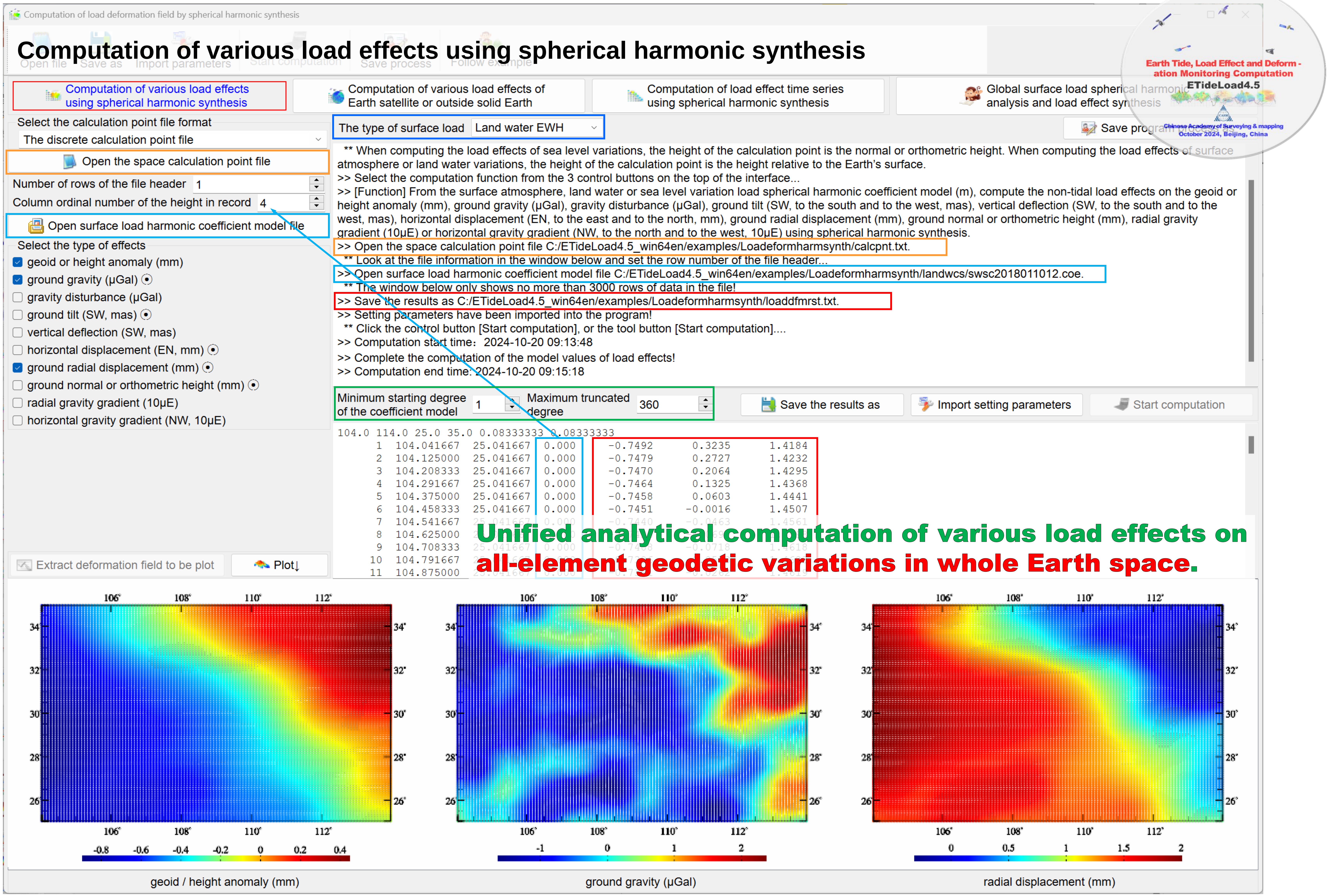
The ocean tidal load effect time series (m) on Earth's figure polar shifts in ITRS

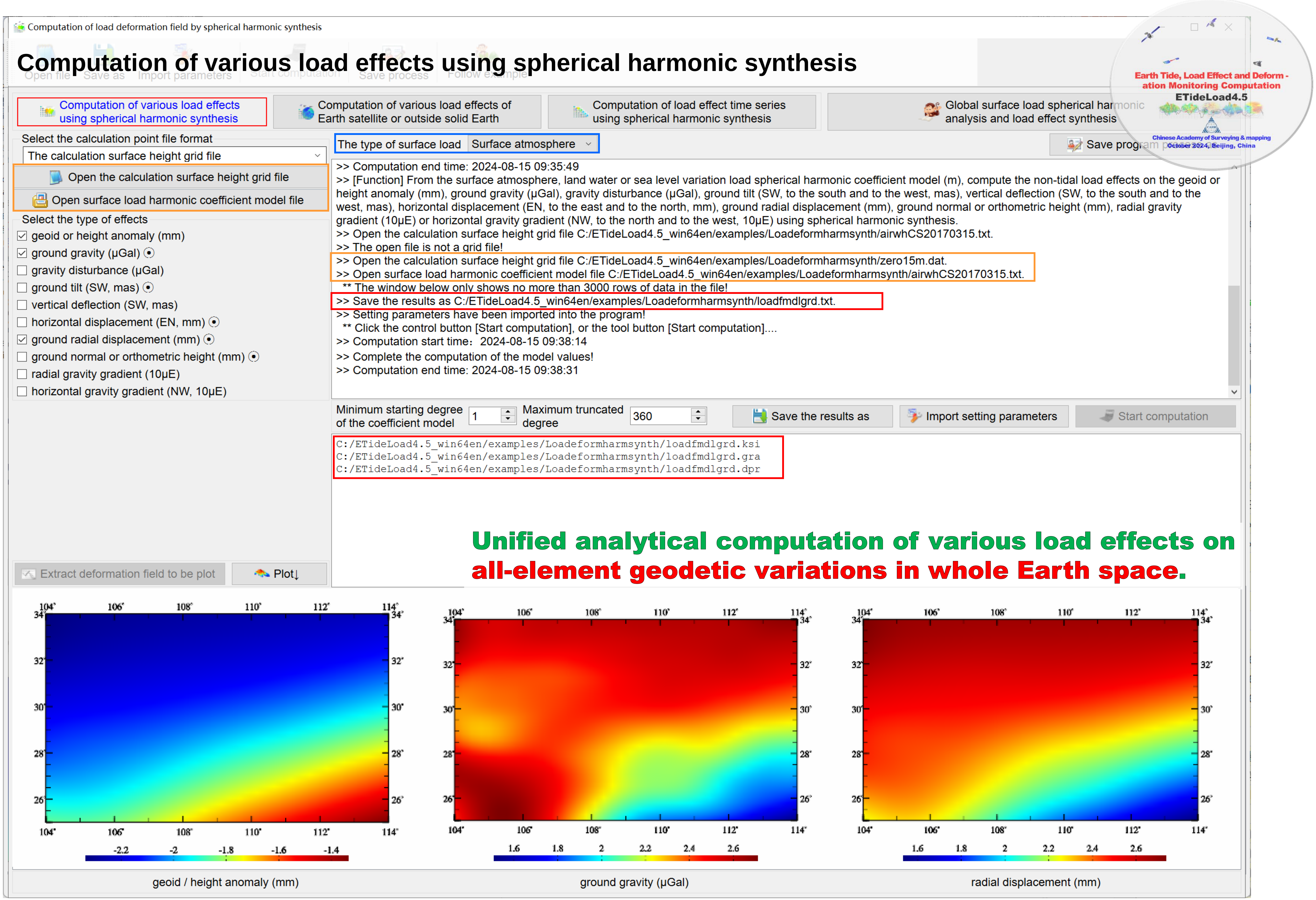


Computation of the load model value using spherical harmonic synthesis
Computation of model value of surface load equivalent water height
Open file
Save as
Import parameters
Start computation
Save process
Follow example
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Computation of model value of surface load equivalent water height
Computation of model values of tidal constituent harmonic constants
Computation of model value time series of load equivalent water height
Select the calculation point file format
The discrete calculation point file
Open the surface calculation 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] From the tidal load spherical harmonic coefficient model or the surface non-tidal load spherical harmonic coefficient model, compute the model values of the tidal harmonic constants or the non-tidal surface loads using spherical harmonic synthesis.
>> Select the computation function from the 3 control buttons on the top of the interface...
>> [Function] From the surface atmosphere, land water, or sea level variation load normalized spherical harmonic coefficient model (m), compute the model value of the surface atmosphere (hPa/mbar), land equivalent water height (cm) or sea level variation (cm) at the given location.
>> Open the surface calculation 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： 2024-10-20 08:53:36
>> Complete the computation!
>> Computation end time: 2024-10-20 08:53:42
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
GM(10^14 m^3/s^2) a(m) zero-degree term (hPa/mbar), relative erro(%)
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
the scale parameter
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
In the remove-restore process, the program can be employed for regional tidal load effect refinement based on the tidal load spherical harmonic coefficient model, and for regional load deformation field refinement based on surface load spherical harmonic model.
Due to the mixing effects between the high-degree spherical harmonic coefficients, the model values of the sea level variation and ocean tidal harmonic constants are not zero in the coastal land area, and the model values of the land equivalent water height are not also zero in the coastal sea area.

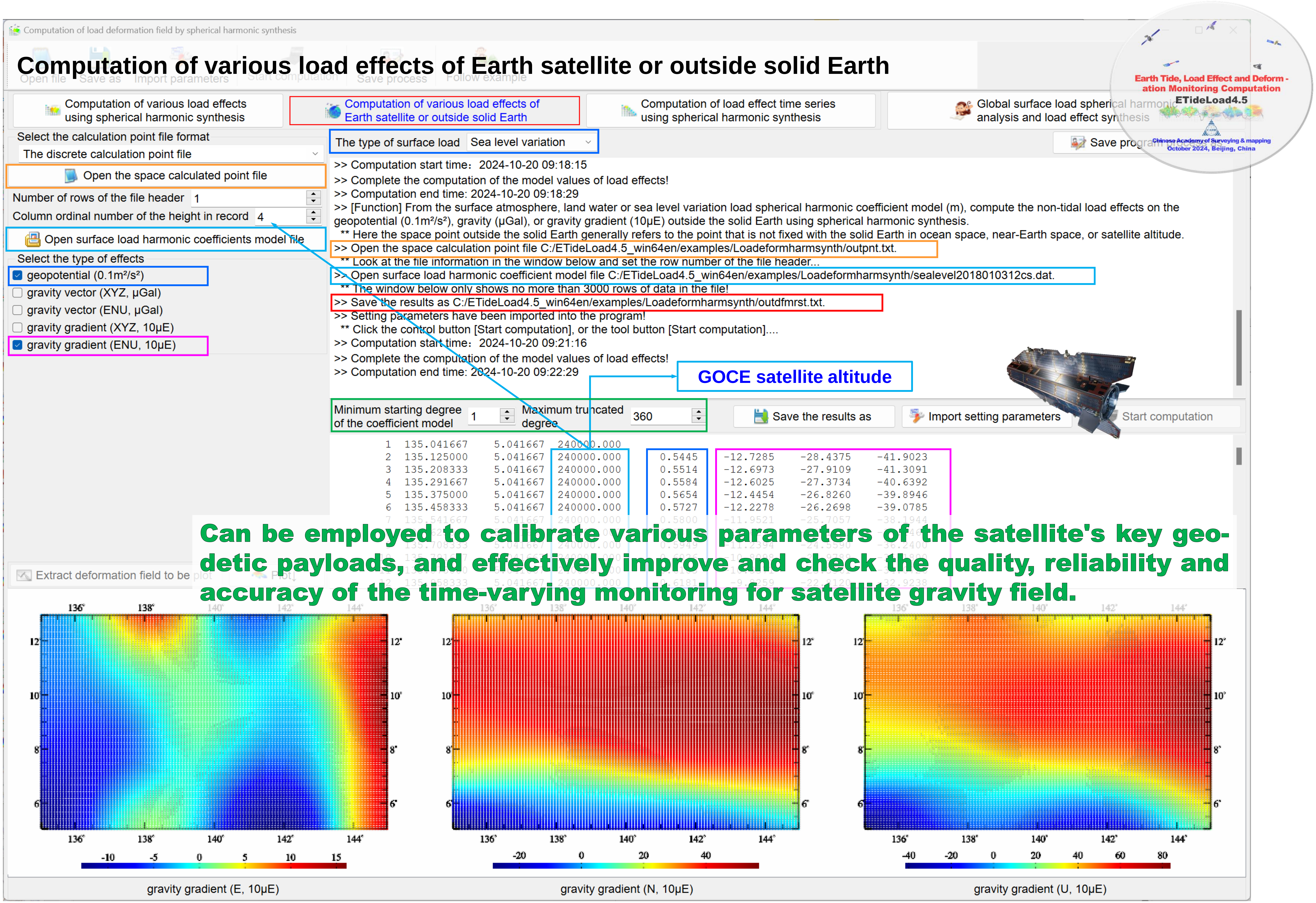

Computation of the load model value using spherical harmonic synthesis
Computation of model values of tidal constituent harmonic constants
Open file
Save as
Import parameters
Start computation
Save process
Follow example
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Computation of model value of surface load equivalent water height
Computation of model values of tidal constituent harmonic constants
Computation of model value time series of load equivalent water height
Open the surface calculation 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
** Click the control button [Start computation], or the tool button [Start computation]....
>> Computation start time: 2024-10-20 08:53:36
>> Complete the computation!
>> Computation end time: 2024-10-20 08:53:42
>> [Function] From the surface atmosphere or ocean tidal load normalized spherical harmonic coefficient model (hPa/cm), calculate the harmonic constant model values (hPa/cm) of all tidal constituents in the harmonic coefficient model at the given location.
>> Open the surface calculation 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: 2024-10-20 08:55:45
>> Complete the computation of the harmonic constant model values for 4 tidal constituents!
>> Computation end time: 2024-10-20 08:56:19
Save the results as
Import setting parameters
Start computation
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 -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
airptiderst.txt
In the remove-restore process, the program can be employed for regional tidal load effect refinement based on the tidal load spherical harmonic coefficient model, and for regional load deformation field refinement based on surface load spherical harmonic model.
Due to the mixing effects between the high-degree spherical harmonic coefficients, the model values of the sea level variation and ocean tidal harmonic constants are not zero in the coastal land area, and the model values of the land equivalent water height are not also zero in the coastal sea area.


Computation of the load model value using spherical harmonic synthesis
Computation of model value time series of load equivalent water height
Open file
Save as
Import parameters
Start computation
Save process
Follow example
Computation of model value of surface load equivalent water height
Computation of model values of tidal constituent harmonic constants
Computation of model value time series of load equivalent water height
Select the calculation point file format
The discrete calculation point file
Open the surface calculation 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
>> [Function] From the surface atmosphere, land water, or sea level variation load normalized spherical harmonic coefficient model (m) time series, compute the model value record time series of the atmosphere (hPa/mbar), land equivalent water height (cm), or sea level variation (cm) on the given points in the input file.
>> Open the surface calculation 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 any load harmonic coefficient model file C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/landwcstm/swsc2018010312.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/Loadspharmsynthesis/lndwmdlrst.txt.
** Behind the header (the last row) of the input computed point file, adds the wildcards of the instantiated spherical harmonic coefficient model files to identify the sampling epoch time of the record time series as the output file header.
** The load harmonic coefficient model files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Loadspharmsynthesis/landwcstm/swsc2018010312.coe
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!
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
In the remove-restore process, the program can be employed for regional tidal load effect refinement based on the tidal load spherical harmonic coefficient model, and for regional load deformation field refinement based on surface load spherical harmonic model.
Due to the mixing effects between the high-degree spherical harmonic coefficients, the model values of the sea level variation and ocean tidal harmonic constants are not zero in the coastal land area, and the model values of the land equivalent water height are not also zero in the coastal sea area.

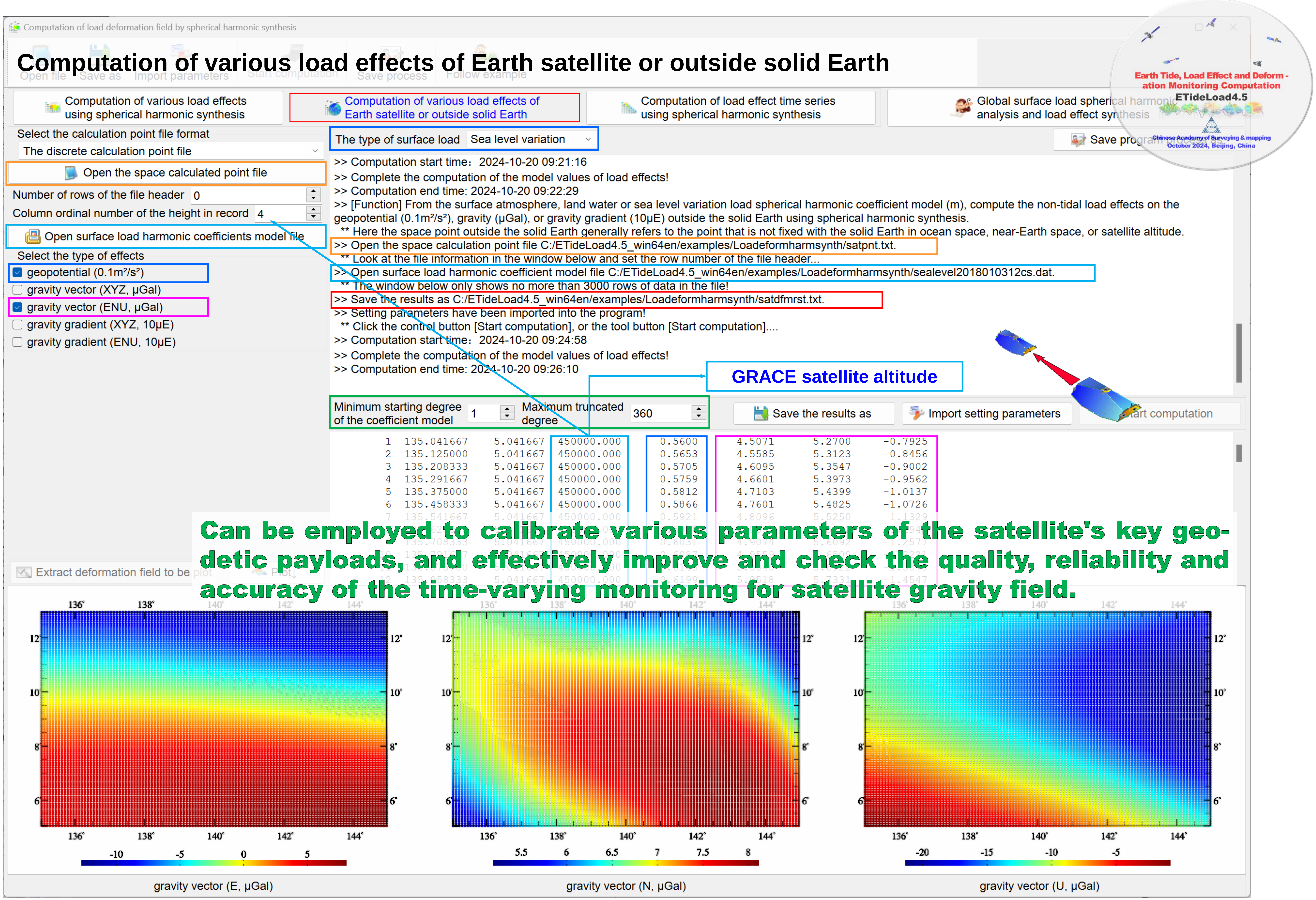

Computation of load deformation field by spherical harmonic synthesis
Computation of various load effects using spherical harmonic synthesis
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Computation of various load effects using spherical harmonic synthesis
Computation of various load effects of Earth satellite or outside solid Earth
Computation of load effect time series using spherical harmonic synthesis
Global surface load spherical harmonic analysis and load effect synthesis
Select the calculation point file format
The discrete calculation point file
Open the space calculation 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
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)
ground normal or orthometric height (mm)
radial gravity gradient (10μE)
horizontal gravity gradient (NW, 10μE)
Extract deformation field to be plot
Plot↓
The type of surface load Land water EWH
Save program process
** When computing the load effects of sea level variations, the height of the calculation point is the normal or orthometric height. When computing the load effects of surface atmosphere or land water variations, the height of the calculation point is the 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 surface atmosphere, land water or sea level variation load spherical harmonic coefficient model (m), compute the non-tidal load 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) using spherical harmonic synthesis.
>> Open the space calculation 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: 2024-10-20 09:13:48
>> Complete the computation of the model values of load effects!
>> Computation end time: 2024-10-20 09:15:18
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
8 104.625000
9 104.708333
10 104.791667
11 104.875000
Unified analytical computation of various load effects on all-element geodetic variations in whole Earth space.
geoid / height anomaly (mm)
ground gravity (μGal)
radial displacement (mm)


Computation of load deformation field by spherical harmonic synthesis
Computation of various load effects using spherical harmonic synthesis
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Computation of various load effects using spherical harmonic synthesis
Computation of various load effects of Earth satellite or outside solid Earth
Computation of load effect time series using spherical harmonic synthesis
Global surface load spherical harmonic analysis and load effect synthesis
Select the calculation point file format
The calculation surface height grid file
Open the calculation surface height grid file
Open surface load harmonic coefficient model file
Select the type of effects
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)
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
>> Computation end time: 2024-08-15 09:35:49
>> [Function] From the surface atmosphere, land water or sea level variation load spherical harmonic coefficient model (m), compute the non-tidal load 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) using spherical harmonic synthesis.
>> Open the calculation surface height grid file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/airwhCS20170315.txt.
>> The open file is not a grid file!
>> Open the calculation 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: 2024-08-15 09:38:14
>> Complete the computation of the model values!
>> Computation end time: 2024-08-15 09:38:31
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
Unified analytical computation of various load effects on all-element geodetic variations in whole Earth space.
Extract deformation field to be plot
Plot↓
geoid / height anomaly (mm)
ground gravity (μGal)
radial displacement (mm)

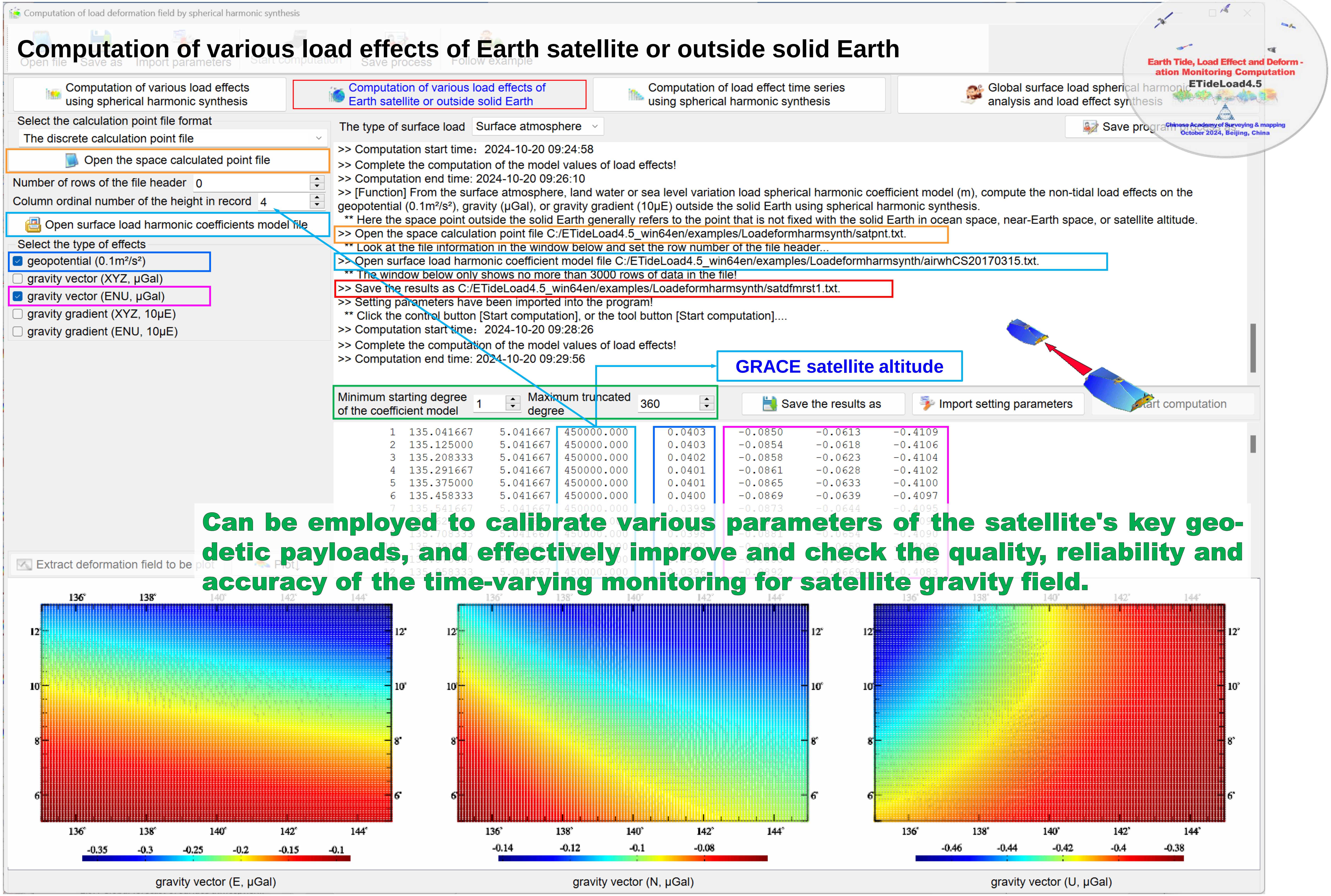
Computation of various load effects of Earth satellite or outside solid Earth



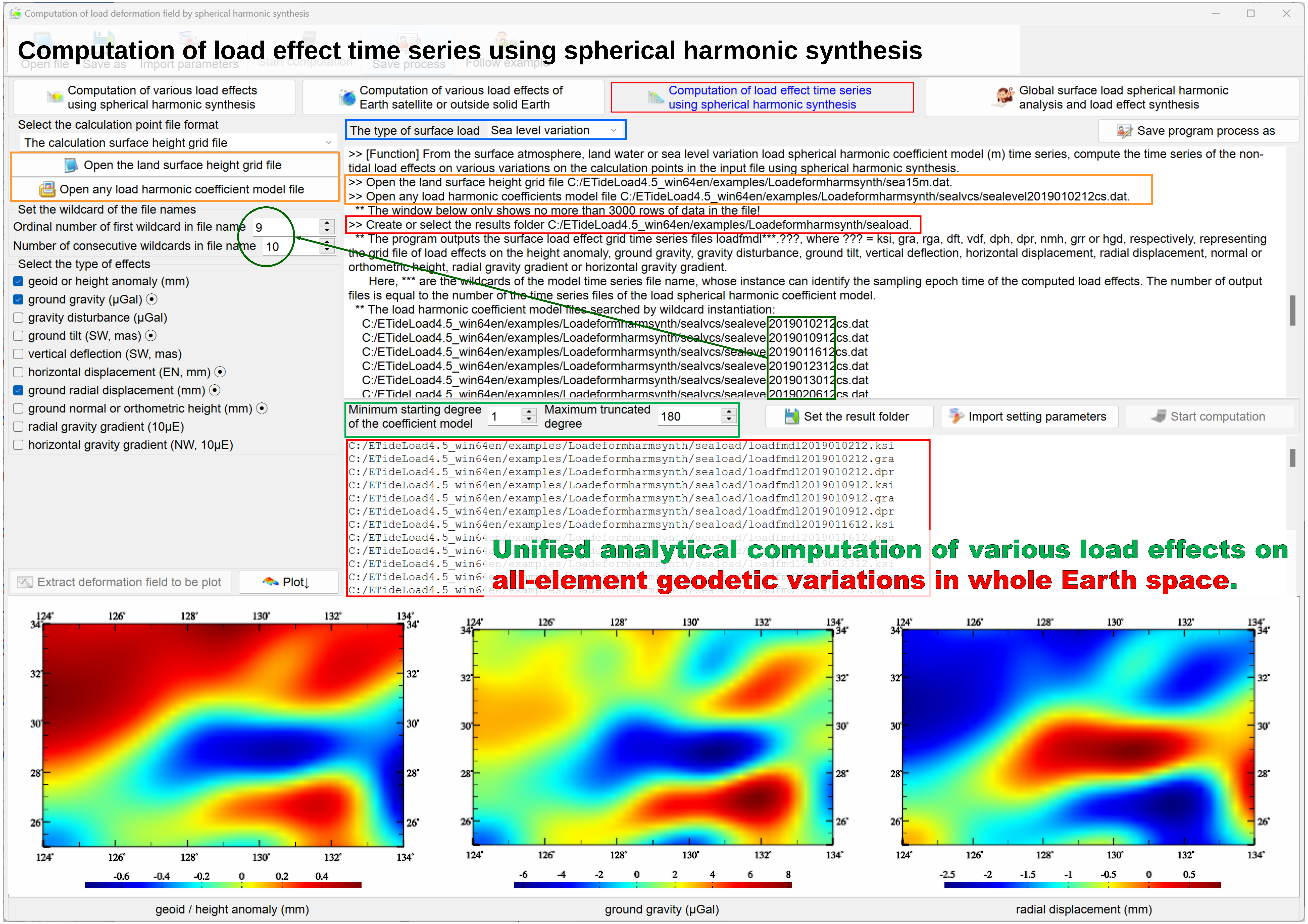
Can be employed to calibrate various parameters of the satellite's key geodetic payloads, and effectively improve and check the quality, reliability and accuracy of the time-varying monitoring for satellite gravity field.

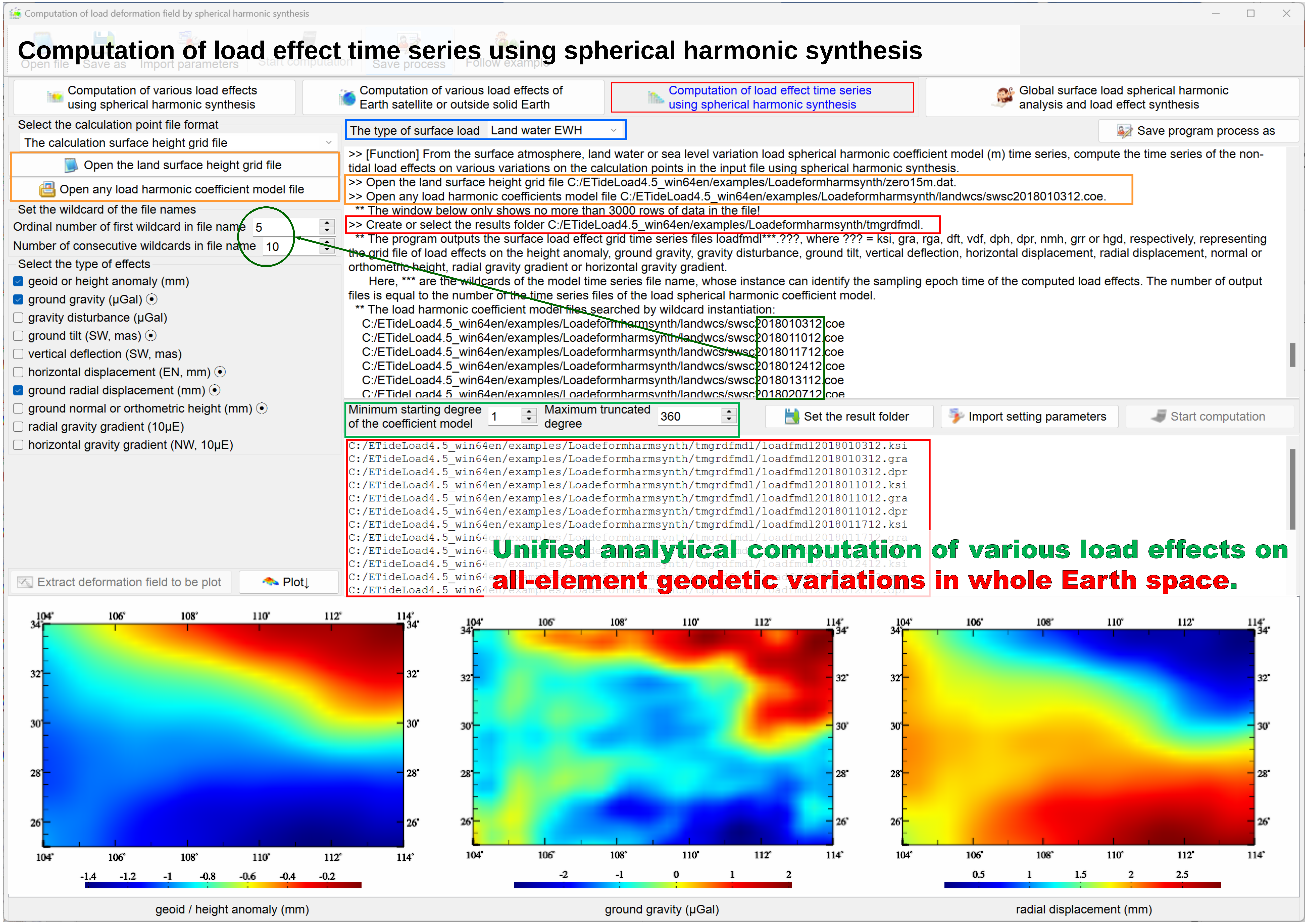

Computation of load deformation field by spherical harmonic synthesis
Computation of various load effects of Earth satellite or outside solid Earth
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Computation of various load effects using spherical harmonic synthesis
Computation of various load effects of Earth satellite or outside solid Earth
Computation of load effect time series using spherical harmonic synthesis
Global surface load spherical harmonic analysis and load effect synthesis
Select the calculation point file format
The discrete calculation point file
Open the space calculated 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
geopotential (0.1m²/s²)
gravity vector (XYZ, μGal)
gravity vector (ENU, μGal)
gravity gradient (XYZ, 10μE)
gravity gradient (ENU, 10μE)
The type of surface load Sea level variation
Save program process
>> Computation start time: 2024-10-20 09:21:16
>> Complete the computation of the model values of load effects!
>> Computation end time: 2024-10-20 09:22:29
>> [Function] From the surface atmosphere, land water or sea level variation load spherical harmonic coefficient model (m), compute the non-tidal load effects on the geopotential (0.1m²/s²), gravity (μGal), or gravity gradient (10μE) outside the solid Earth using spherical harmonic synthesis.
** Here the space point outside 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 calculation 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: 2024-10-20 09:24:58
>> Complete the computation of the model values of load effects!
>> Computation end time: 2024-10-20 09:26:10
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
Extract deformation field to be plot
Can be employed to calibrate various parameters of the satellite's key geodetic payloads, and effectively improve and check the quality, reliability and accuracy of the time-varying monitoring for satellite gravity field.
gravity vector (E, μGal)
gravity vector (N, μGal)
gravity vector (U, μGal)

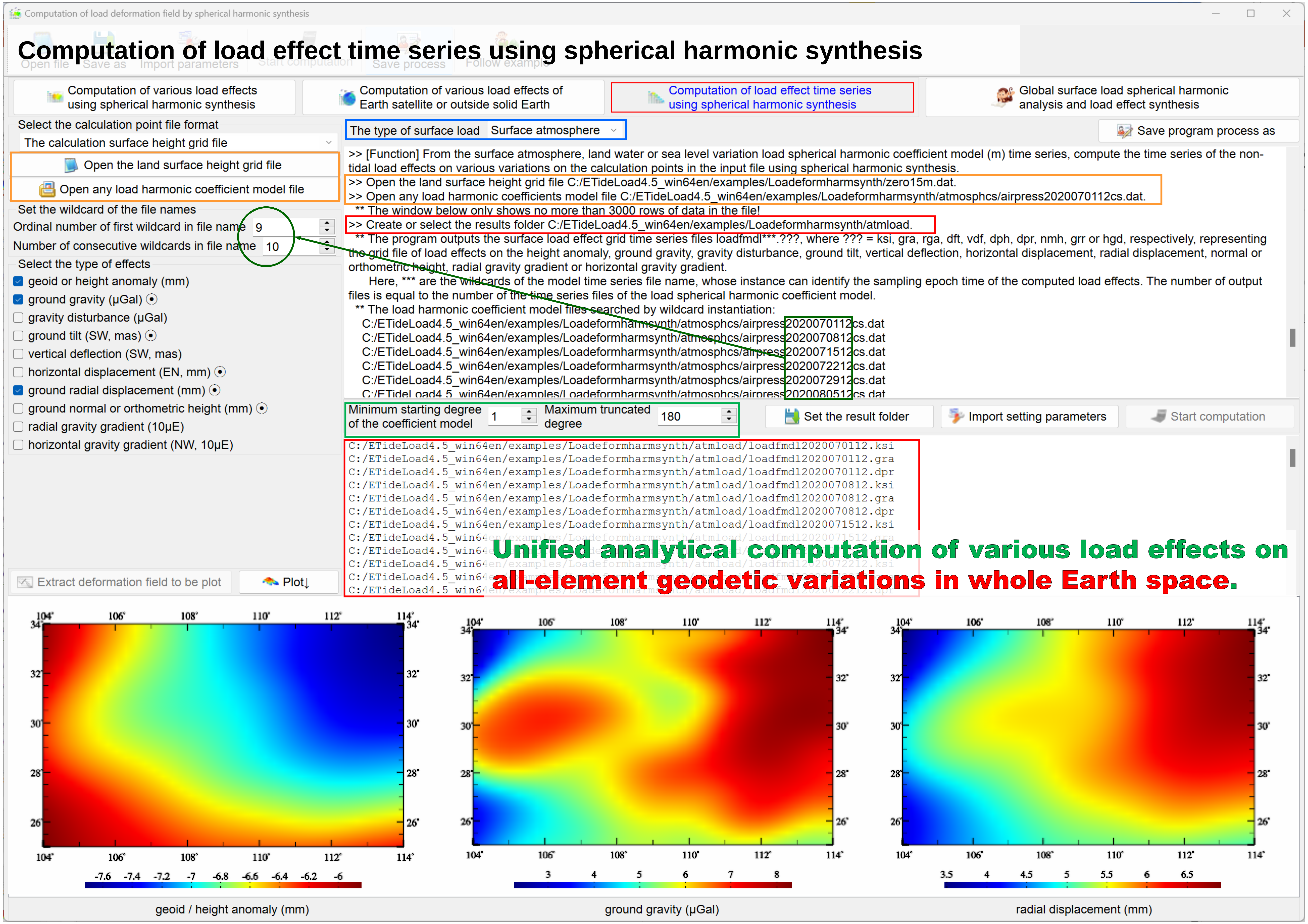
Computation of various load effects of Earth satellite or outside solid Earth



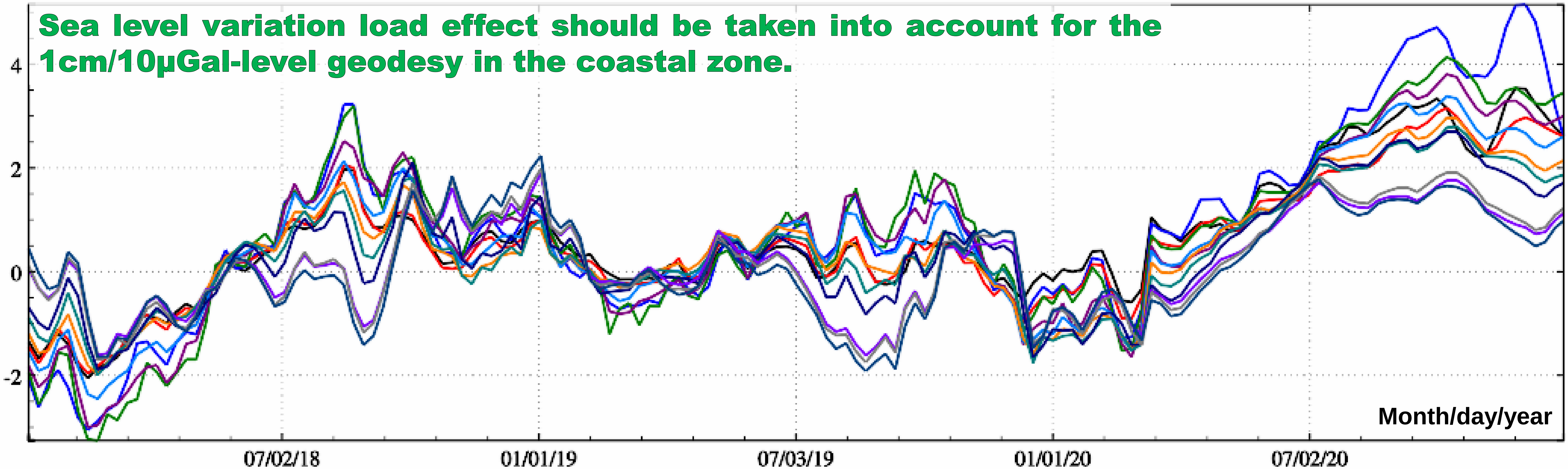
Can be employed to calibrate various parameters of the satellite's key geodetic payloads, and effectively improve and check the quality, reliability and accuracy of the time-varying monitoring for satellite gravity field.


Computation of load deformation field by spherical harmonic synthesis
Computation of load effect time series using spherical harmonic synthesis
Computation of various load effects using spherical harmonic synthesis
Computation of various load effects of Earth satellite or outside solid Earth
Computation of load effect time series using spherical harmonic synthesis
Global surface load spherical harmonic analysis and load effect synthesis
Select the calculation point file format
The calculation 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
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)
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
>> [Function] From the surface atmosphere, land water or sea level variation load spherical harmonic coefficient model (m) time series, compute the time series of the non-tidal load effects on various variations on the calculation points in the input file using spherical harmonic synthesis.
>> Open the land surface height grid file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sea15m.dat.
>> Open any load harmonic coefficients model file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019010212cs.dat.
** The window below only shows no more than 3000 rows of data in the file!
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/seaload.
** The program outputs the surface load effect grid time series files loadfmdl***.???, where ??? = ksi, gra, rga, dft, vdf, dph, dpr, nmh, grr or hgd, 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.
Here, *** are the wildcards of the model time series file name, whose instance can identify the sampling epoch time of the computed load effects. The number of output files is equal to the number of the time series files of the load spherical harmonic coefficient model.
** The load harmonic coefficient model files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019010212cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019010912cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019011612cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019012312cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019013012cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/sealvcs/sealevel2019020612cs.dat
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
Unified analytical computation of various load effects on all-element geodetic variations in whole Earth space.
Extract deformation field to be plot
Plot
geoid / height anomaly (mm)
ground gravity (μGal)
radial displacement (mm)

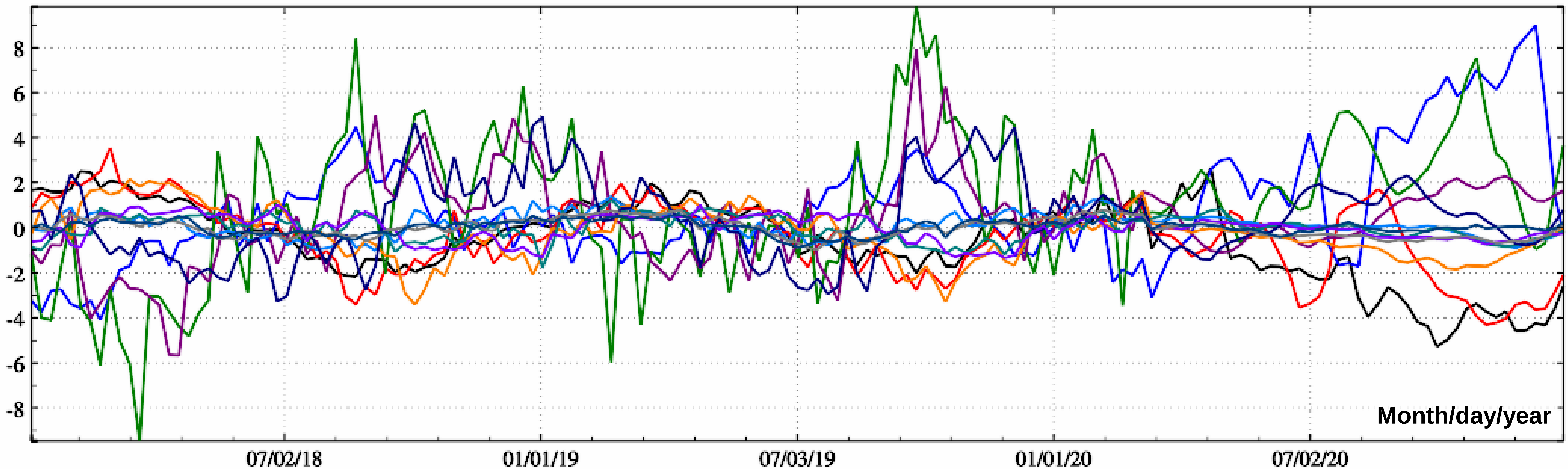

Computation of load deformation field by spherical harmonic synthesis
Computation of load effect time series using spherical harmonic synthesis
Computation of various load effects using spherical harmonic synthesis
Computation of various load effects of Earth satellite or outside solid Earth
Computation of load effect time series using spherical harmonic synthesis
Global surface load spherical harmonic analysis and load effect synthesis
Select the calculation point file format
The calculation 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
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)
ground normal or orthometric height (mm)
radial gravity gradient (10μE)
horizontal gravity gradient (NW, 10μE)
Extract deformation field to be plot
Plot↓
The type of surface load Land water EWH
Save program process as
>> [Function] From the surface atmosphere, land water or sea level variation load spherical harmonic coefficient model (m) time series, compute the time series of the non-tidal load effects on various variations on the calculation points in the input file using spherical harmonic synthesis.
>> Open the land surface height grid file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/zero15m.dat.
>> Open any load harmonic coefficients model file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/landwcs/swsc2018010312.coe.
** The window below only shows no more than 3000 rows of data in the file!
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/tmgrdfmdl.
** The program outputs the surface load effect grid time series files loadfmdl***.???, where ??? = ksi, gra, rga, dft, vdf, dph, dpr, nmh, grr or hgd, 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.
Here, *** are the wildcards of the model time series file name, whose instance can identify the sampling epoch time of the computed load effects. The number of output files is equal to the number of the time series files of the load spherical harmonic coefficient model.
** The load harmonic coefficient model files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/landwcs/swsc2018010312.coe
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/landwcs/swsc2018011012.coe
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
Minimum starting degree of the coefficient model 1
Maximum truncated degree 360
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
Unified analytical computation of various load effects on all-element geodetic variations in whole Earth space.
geoid / height anomaly (mm)
ground gravity (μGal)
radial displacement (mm)



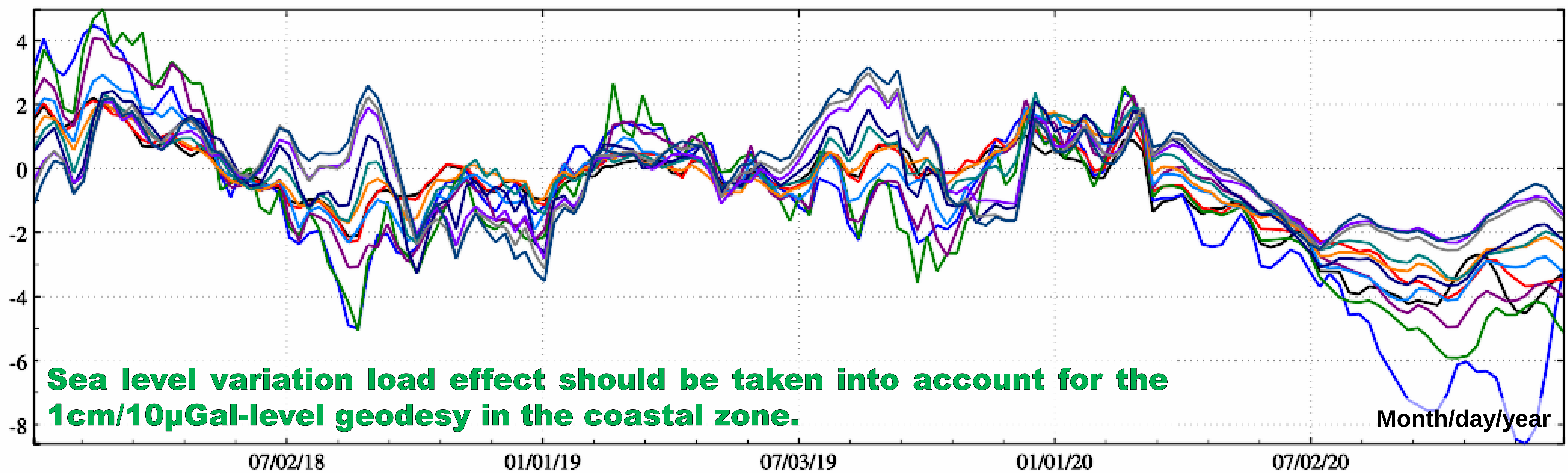
Computation of load deformation field by spherical harmonic synthesis
Computation of load effect time series using spherical harmonic synthesis
Computation of various load effects using spherical harmonic synthesis
Computation of various load effects of Earth satellite or outside solid Earth
Computation of load effect time series using spherical harmonic synthesis
Global surface load spherical harmonic analysis and load effect synthesis
Select the calculation point file format
The calculation 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
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)
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
>> [Function] From the surface atmosphere, land water or sea level variation load spherical harmonic coefficient model (m) time series, compute the time series of the non-tidal load effects on various variations on the calculation points in the input file using spherical harmonic synthesis.
>> Open the land surface height grid file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/zero15m.dat.
>> Open any load harmonic coefficients model file C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmosphcs/airpress2020070112cs.dat.
** The window below only shows no more than 3000 rows of data in the file!
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmload.
** The program outputs the surface load effect grid time series files loadfmdl***.???, where ??? = ksi, gra, rga, dft, vdf, dph, dpr, nmh, grr or hgd, 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.
Here, *** are the wildcards of the model time series file name, whose instance can identify the sampling epoch time of the computed load effects. The number of output files is equal to the number of the time series files of the load spherical harmonic coefficient model.
** The load harmonic coefficient model files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmosphcs/airpress2020070112cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmosphcs/airpress2020070812cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmosphcs/airpress2020071512cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmosphcs/airpress2020072212cs.dat
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmosphcs/airpress2020072912cs.dat
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/atmload/loadfmdl2020070112.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmload/loadfmdl2020070112.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmload/loadfmdl2020070112.dpr
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmload/loadfmdl2020070812.ksi
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmload/loadfmdl2020070812.gra
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmload/loadfmdl2020070812.dpr
C:/ETideLoad4.5_win64en/examples/Loadeformharmsynth/atmload/loadfmdl2020071512.ksi
Unified analytical computation of various load effects on all-element geodetic variations in whole Earth space.
Extract deformation field to be plot
Plot↓
-7.6 -7.4 -7.2 -7 -6.8 -6.6 -6.4 -6.2 -6
geoid / height anomaly (mm)
3 4 5 6 7 8
ground gravity (μGal)
3.5 4 4.5 5 5.5 6 6.5
radial displacement (mm)



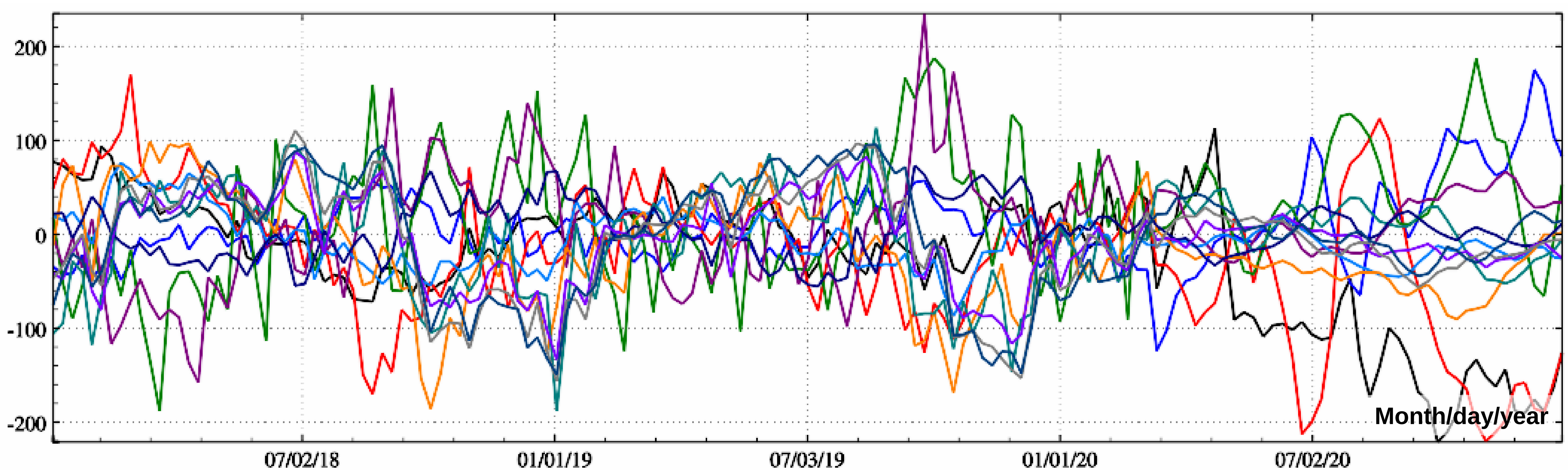
Sea level variation load effect weekly time series on the geoid (mm) at 12 tide gauges along Chinese coast



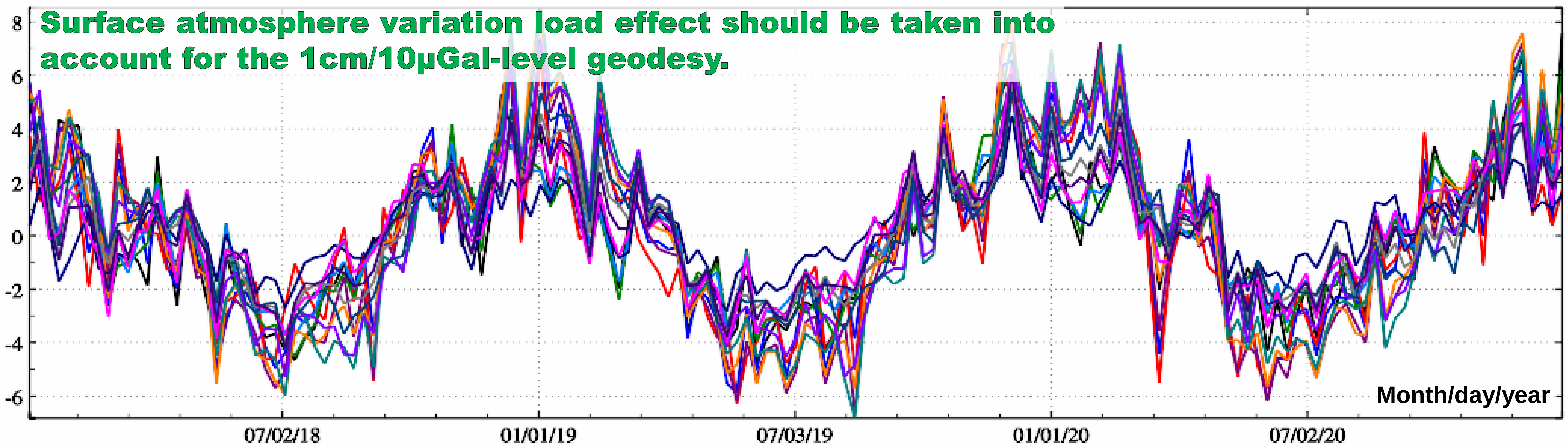
Sea level variation load effect weekly time series on the ground gravity (μGal) at 12 tide gauges along Chinese coast



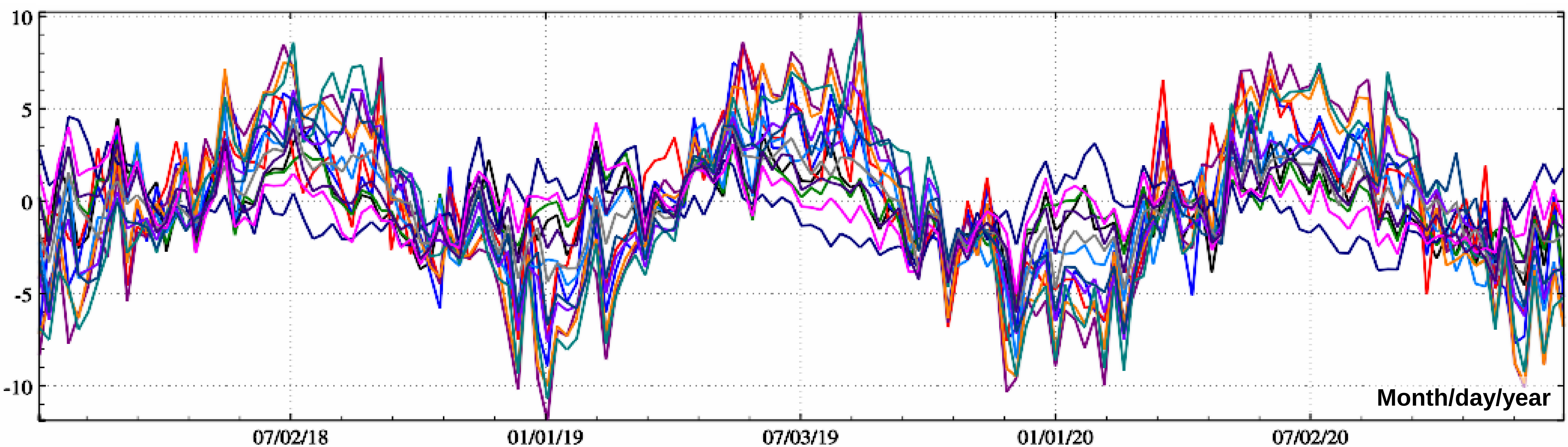
Sea level variation load effect weekly time series on the ellipsoidal height (mm) at 12 tide gauges along Chinese coast



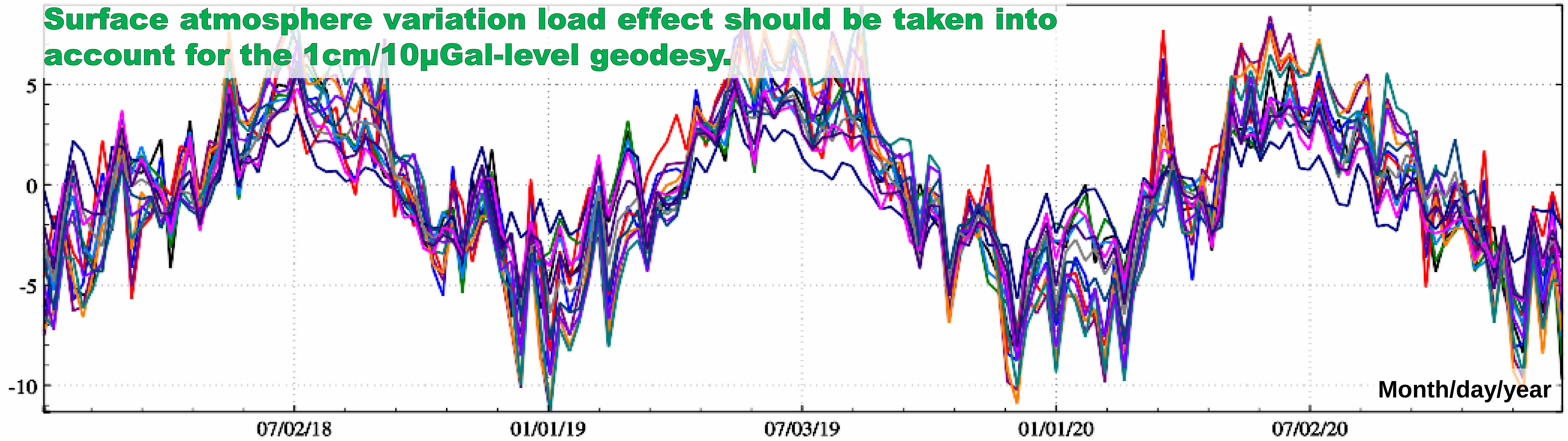
Sea level variation load effect weekly time series on the radial gradient (10μE) at 12 tide gauges along Chinese coast



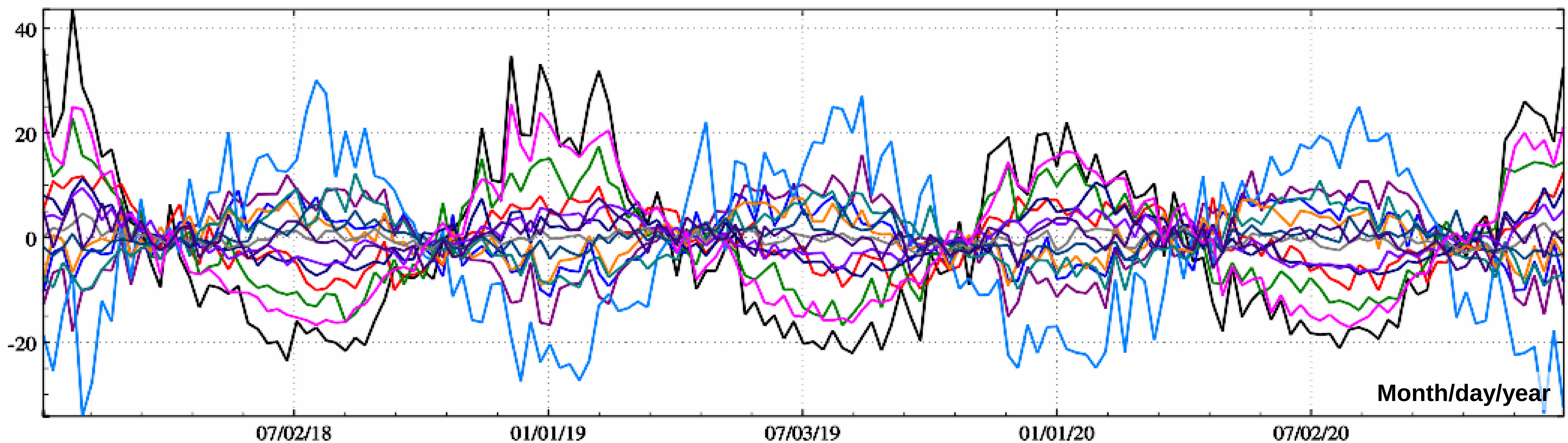
Surface atmosphere variation load effect weekly time series on the geoid (mm) at 14 CORS stations in mainland China



Surface atmosphere variation load effect weekly time series on the ground gravity (μGal) at 14 CORS stations in mainland China

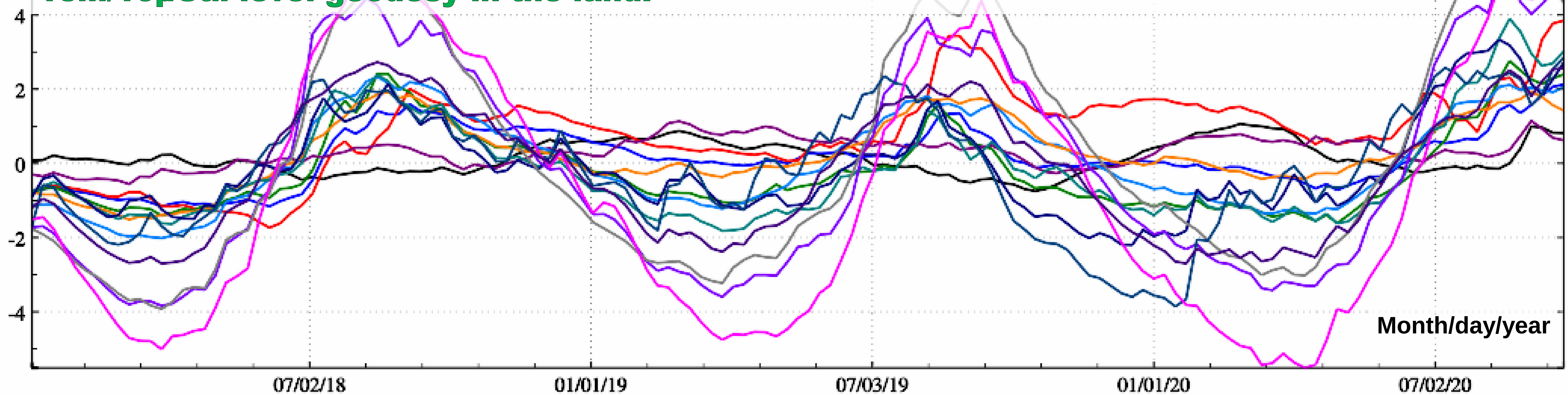


Surface atmosphere variation load effect weekly time series on the ellipsoidal height (mm) at 14 CORS stations in mainland China

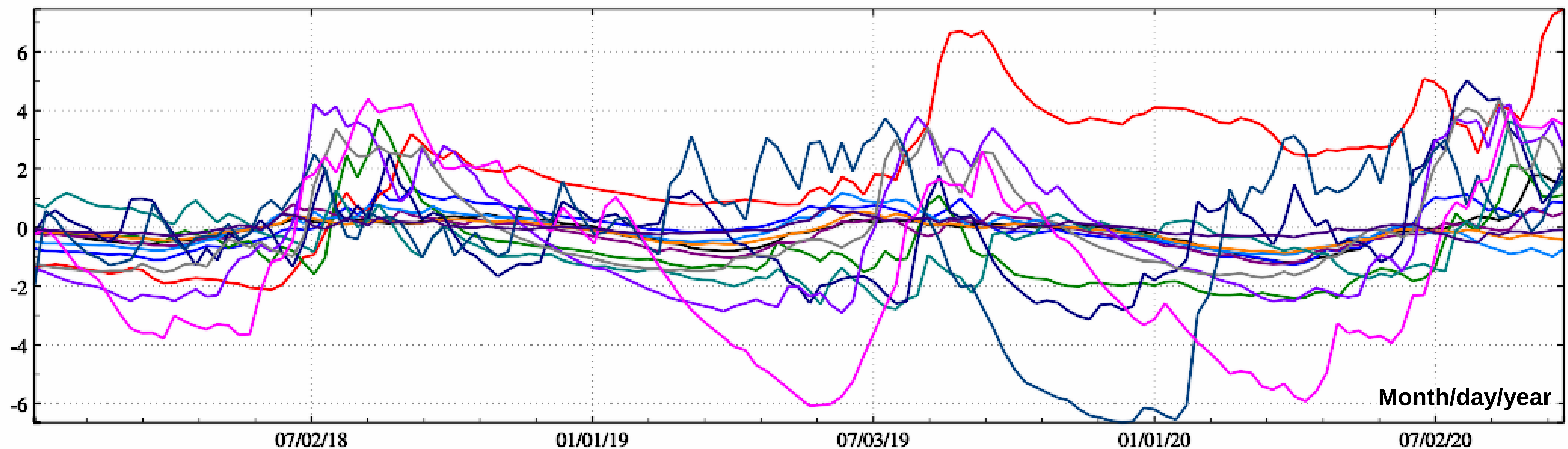


Surface atmosphere variation load effect weekly time series on the radial gradient (10μE) at 14 CORS stations in mainland China

The land water load effect should also be taken into account for the 1cm/10μGal-level geodesy in the land.

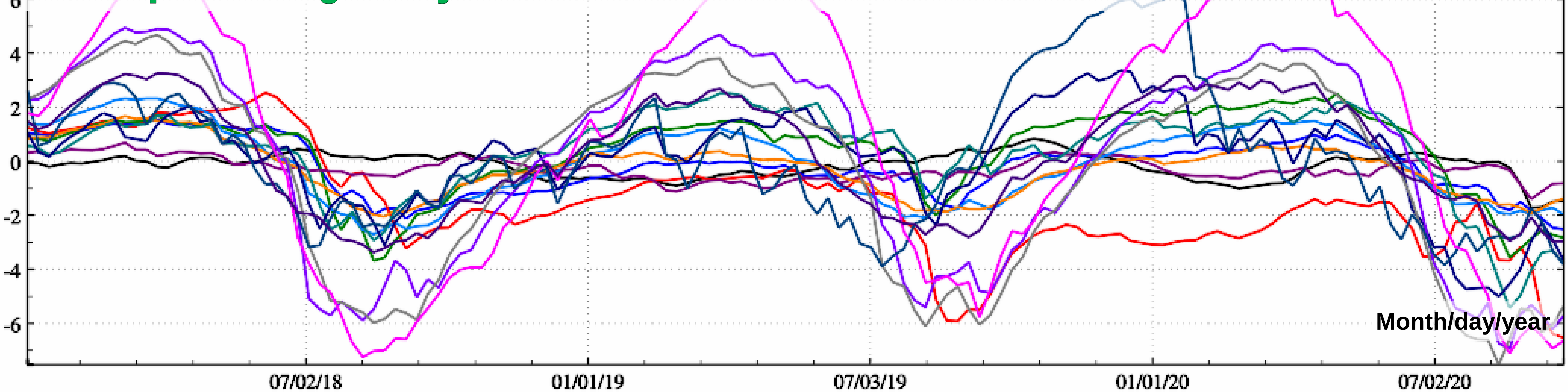


Global land water variation load effect weekly time series on the geoid (mm) at 14 CORS stations in mainland China

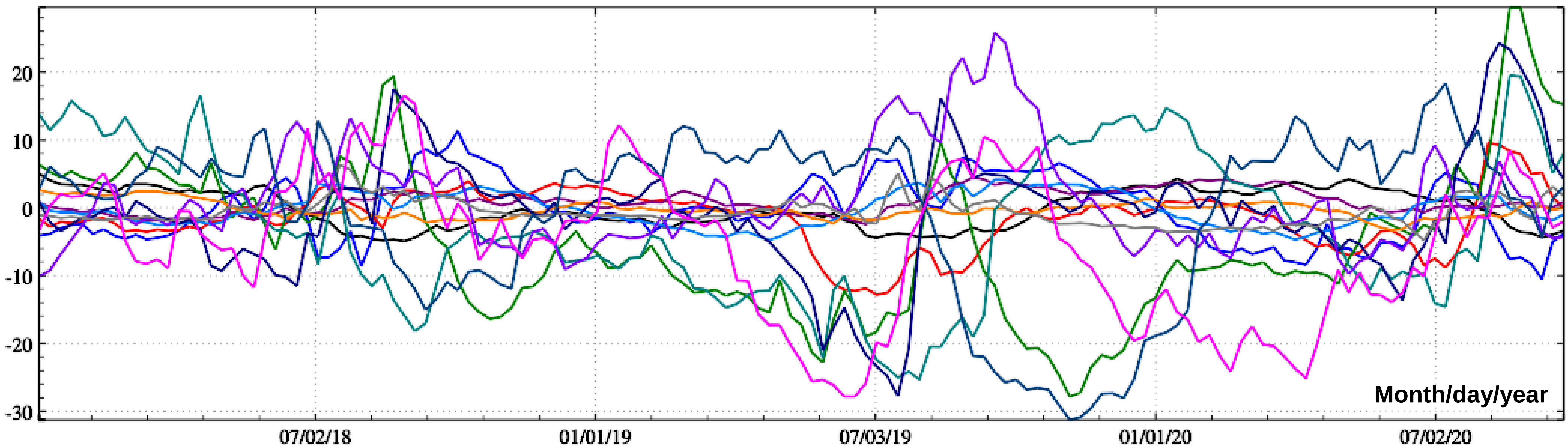


Global land water variation load effect weekly time series on the ground gravity (μGal) at 14 CORS stations in mainland China

The land water load effect should also be taken into account for the 1cm/10μGal-level geodesy in the land.

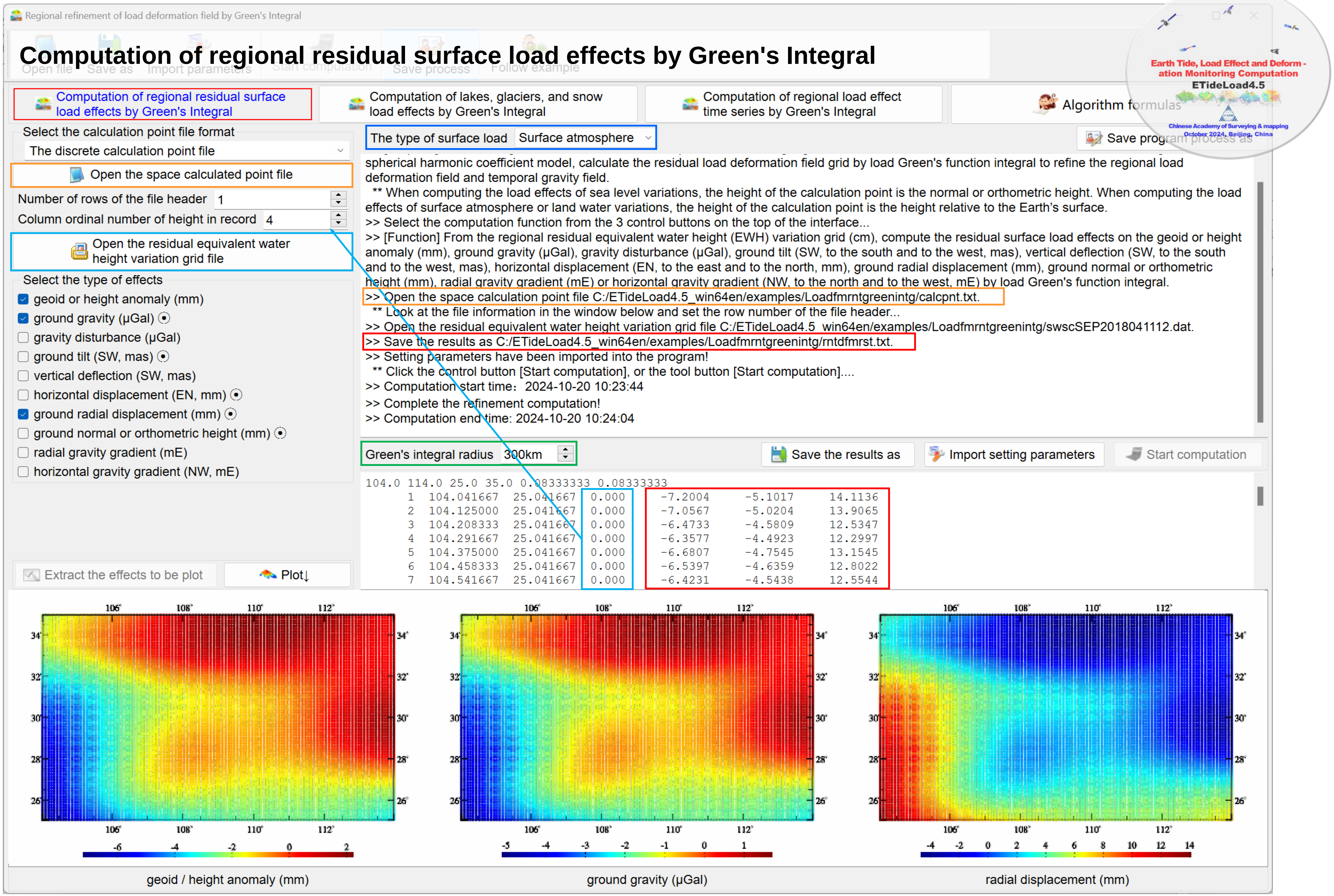


Global land water variation load effect weekly time series on the ellipsoidal height (mm) at 14 CORS stations in mainland China

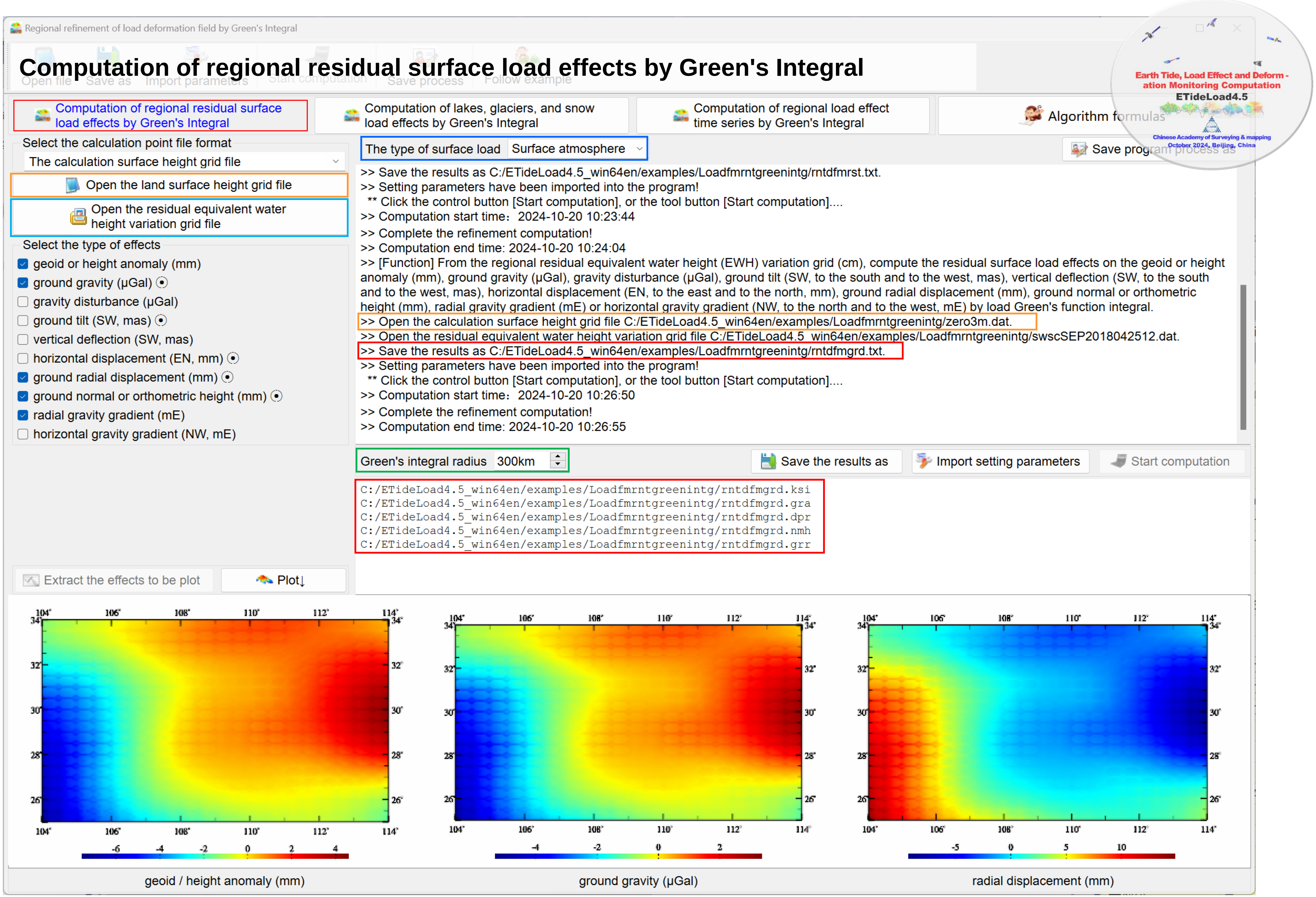


Global land water variation load effect weekly time series on the radial gradient (10μE) at 14 CORS stations in mainland China

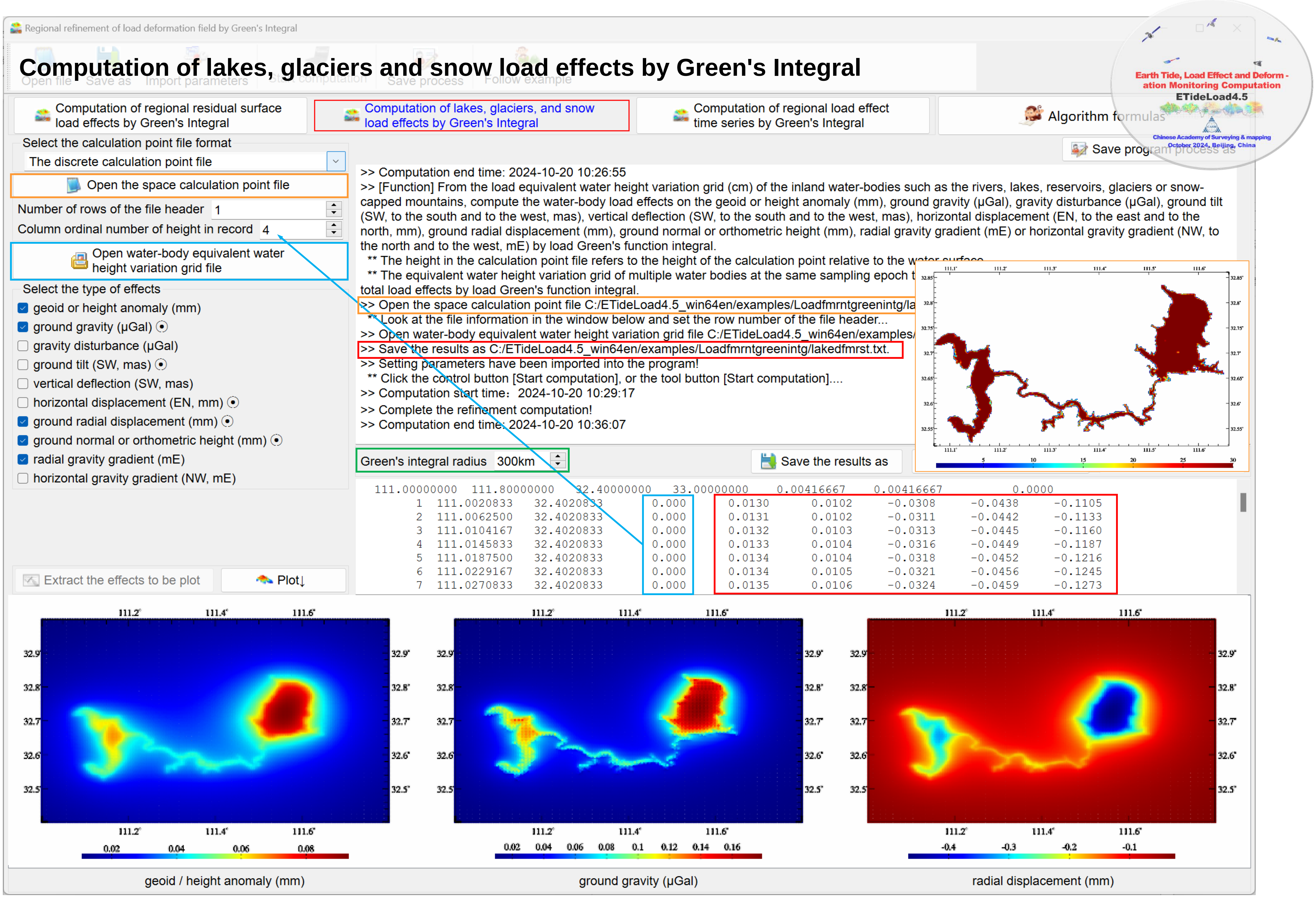
Computation of regional residual surface load effects by Green's Integral



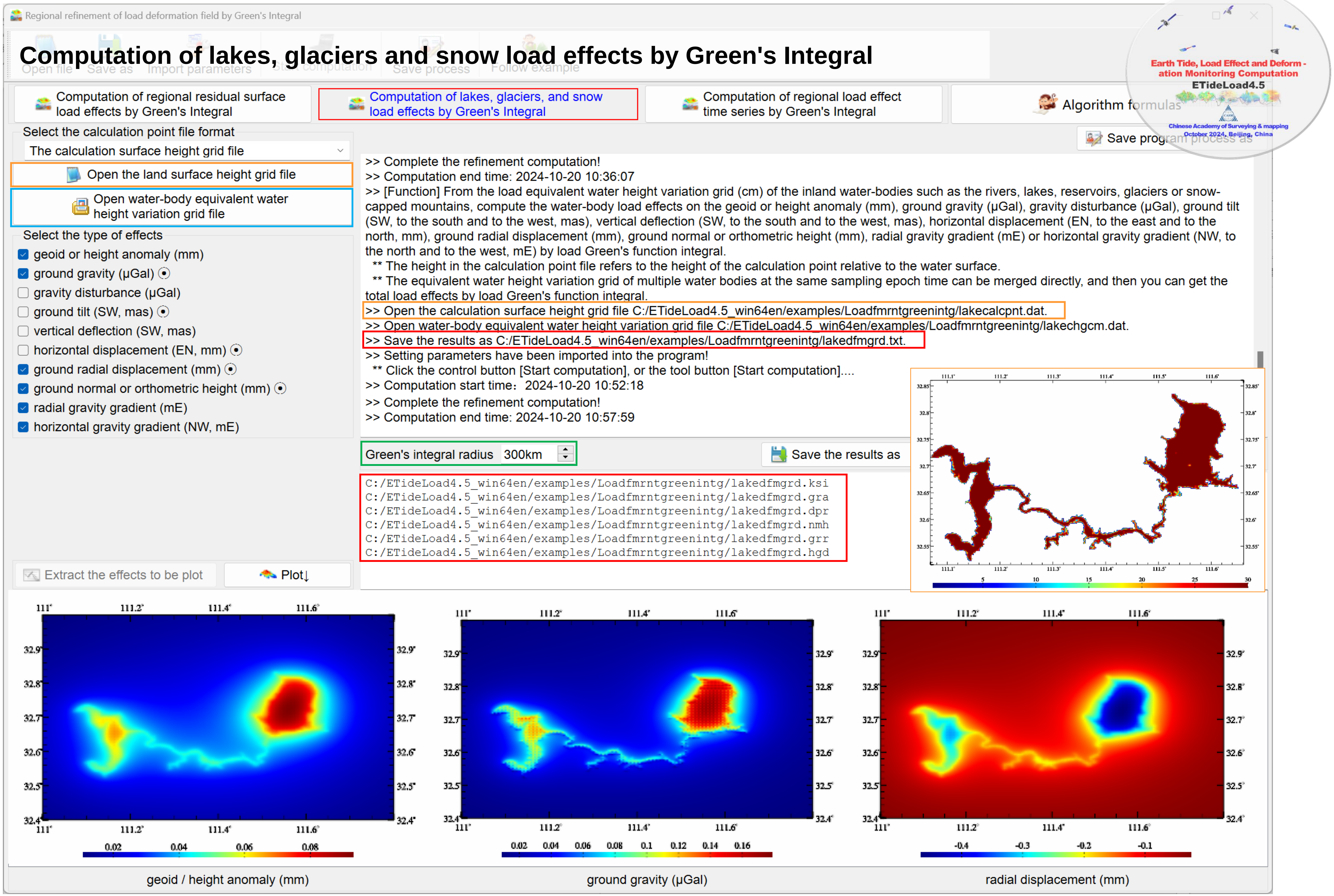
Computation of regional residual surface load effects by Green's Integral



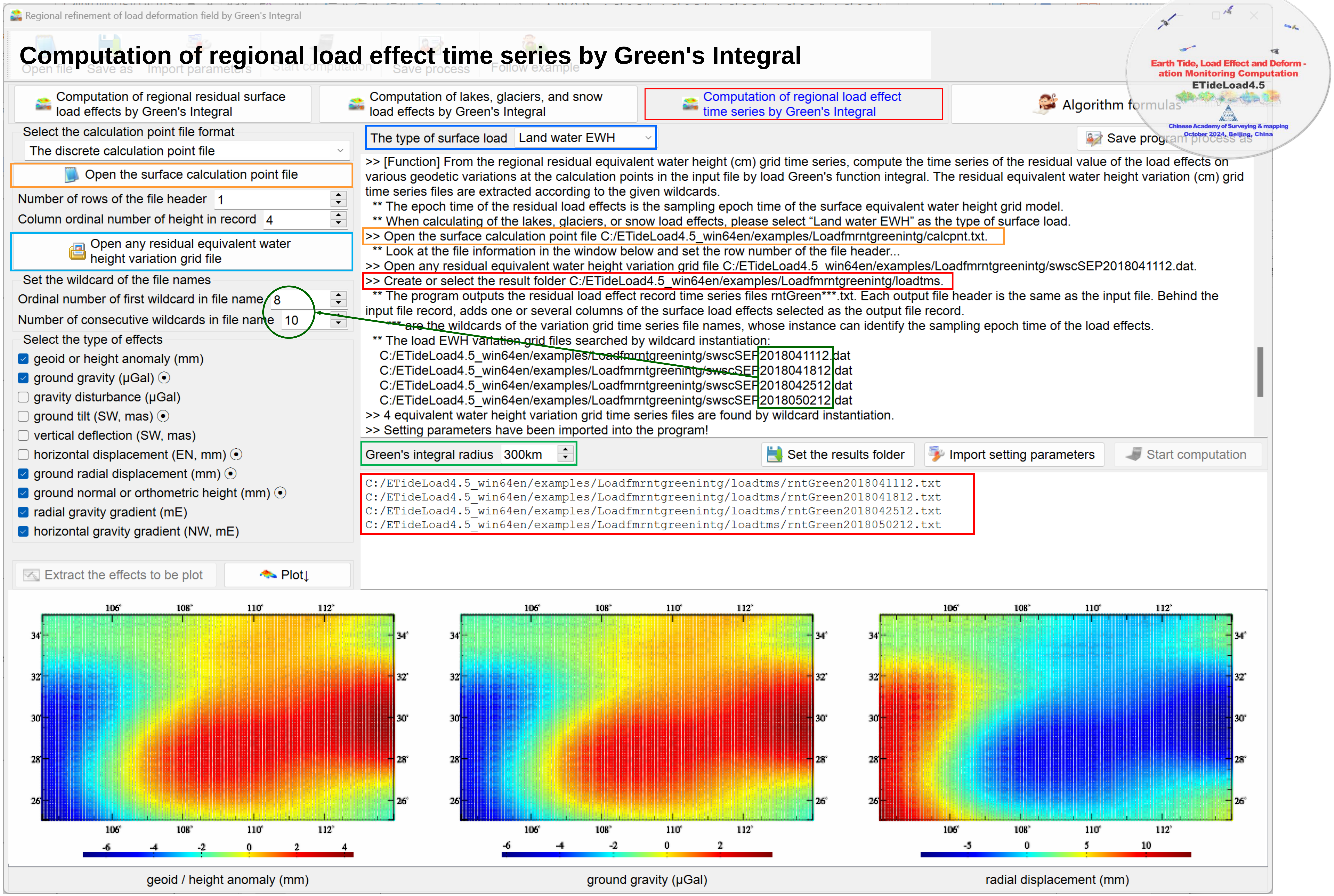
Computation of lakes, glaciers and snow load effects by Green's Integral



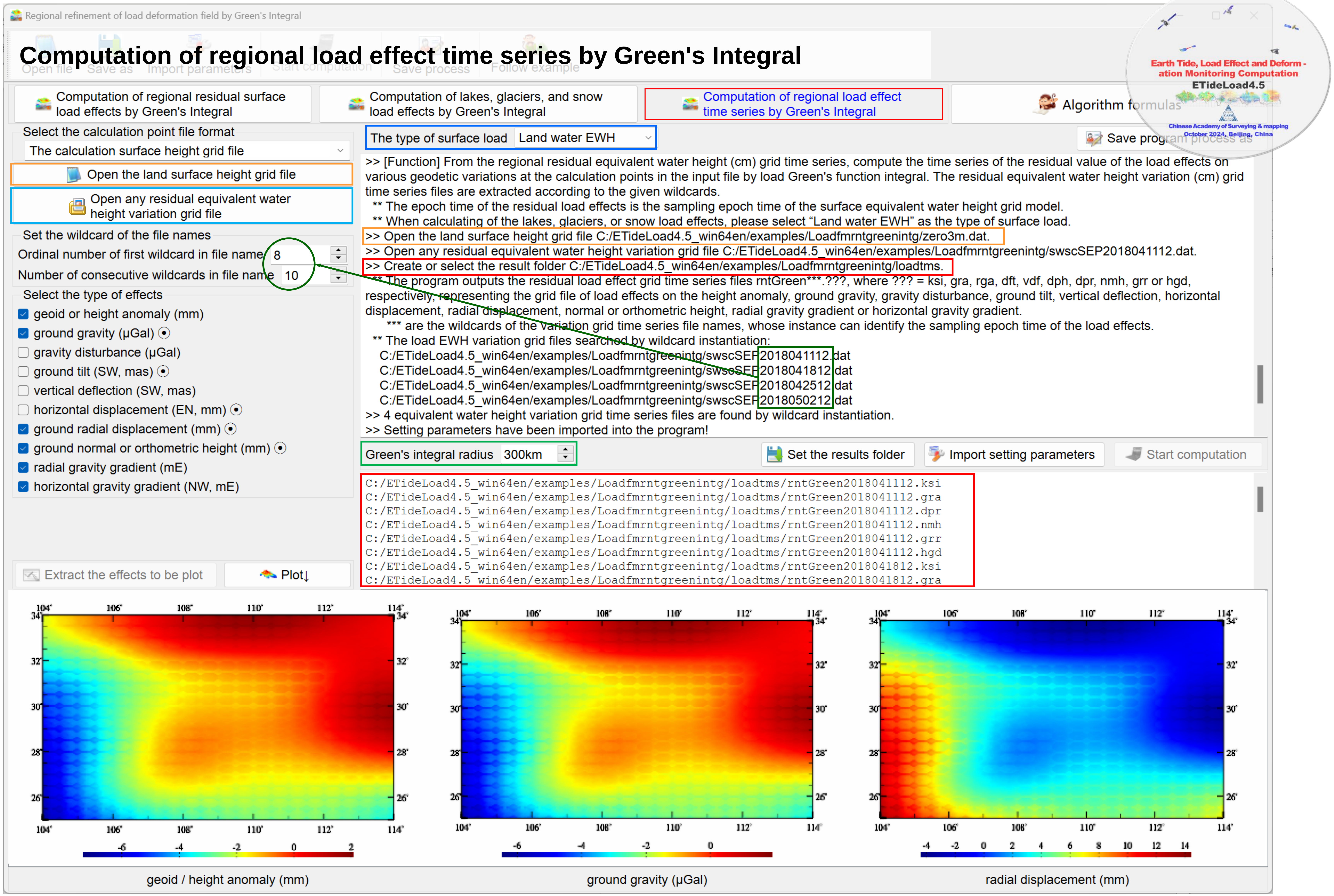
Computation of lakes, glaciers and snow load effects by Green's Integral



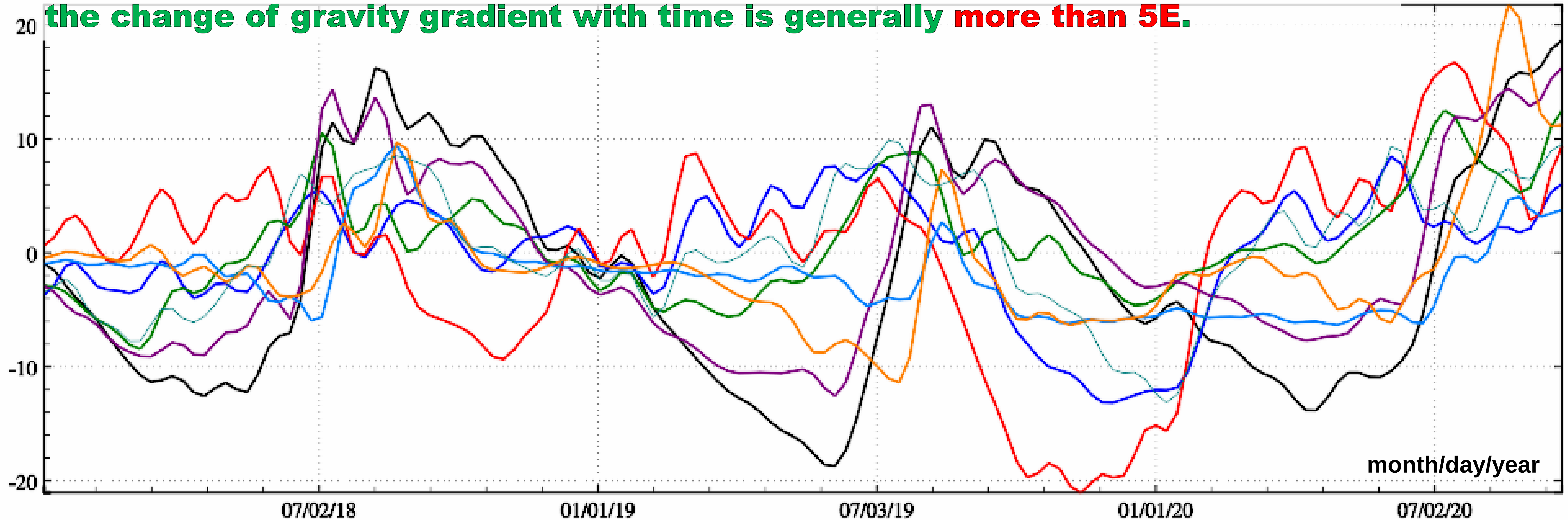
Computation of regional load effect time series by Green's Integral



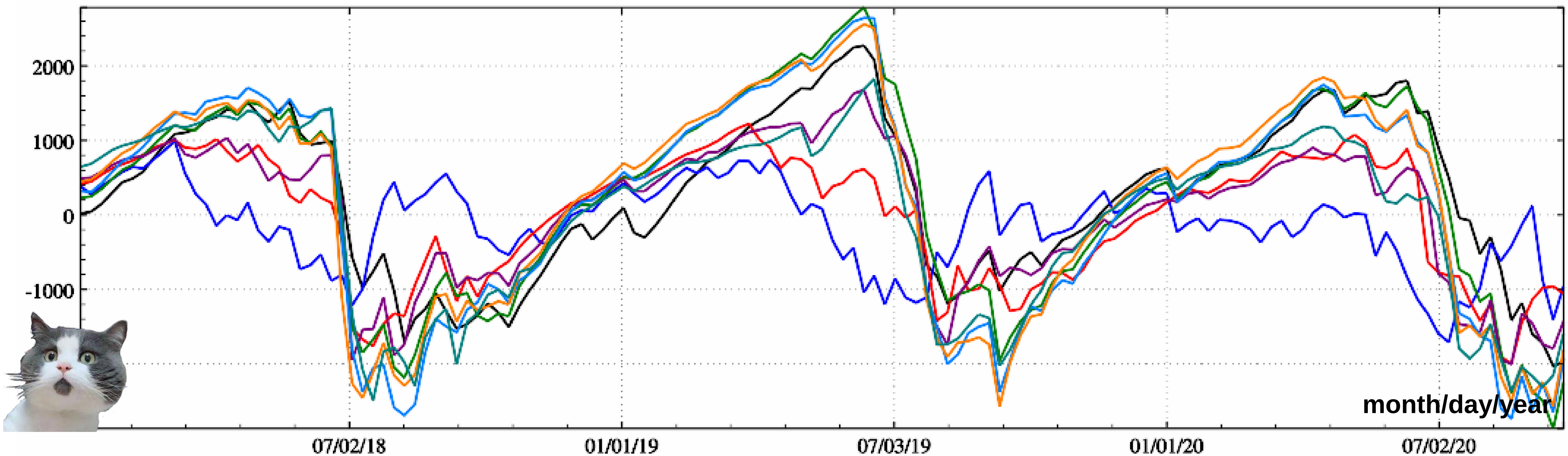
Computation of regional load effect time series by Green's Integral



The change of surface gravity with time is generally more than 20μGal, while the change of gravity gradient with time is generally more than 5E.

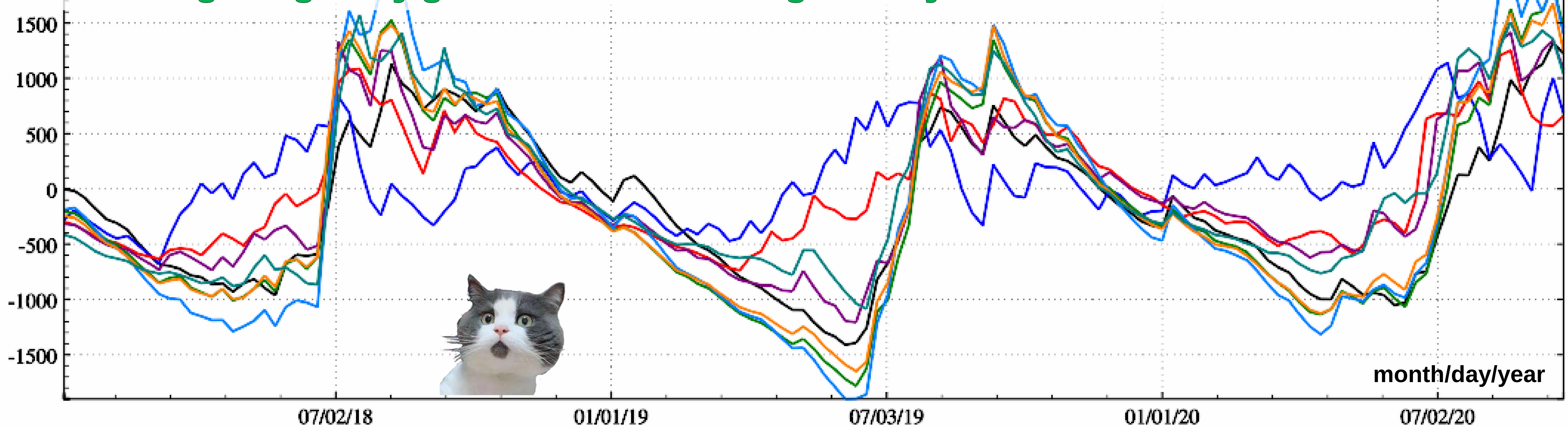


30′×30′ residual soil water load effects in Chinese mainland (Green integral): ground gravity variation (μGal)

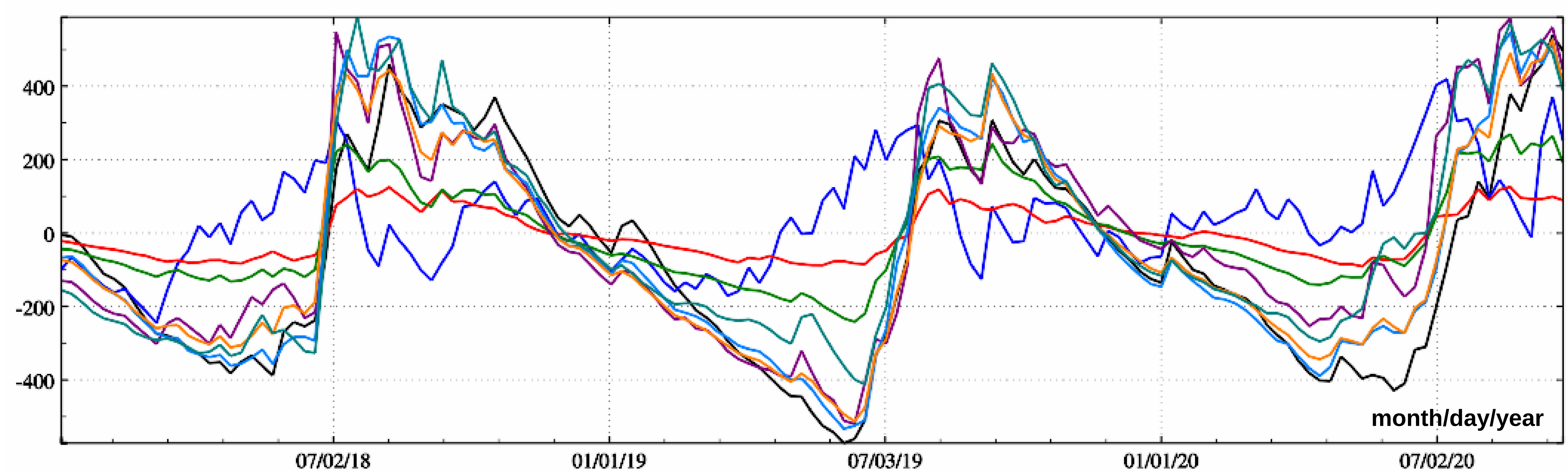


30′×30′ residual soil water load effects in Chinese mainland (Green integral): radial gradient variation (mE)

The change of surface gravity with time is generally more than 20μGal, while the change of gravity gradient with time is generally more than 5E.

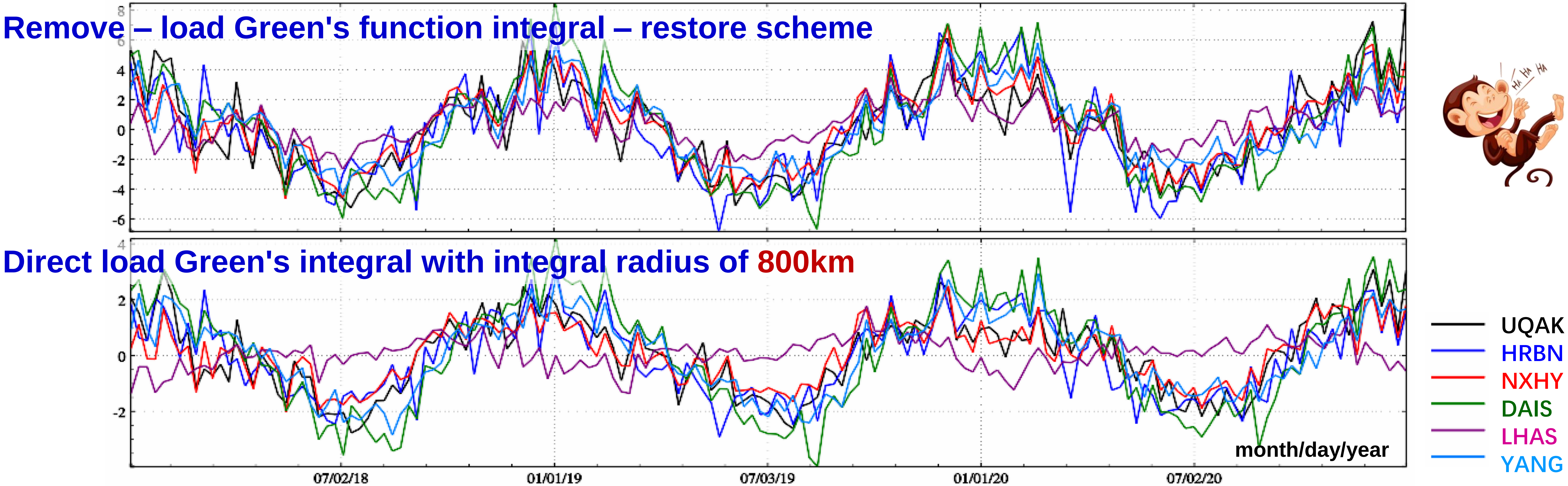


30′×30′ residual soil water load effects in Chinese mainland (Green integral): horizontal gradient variation (N, mE)

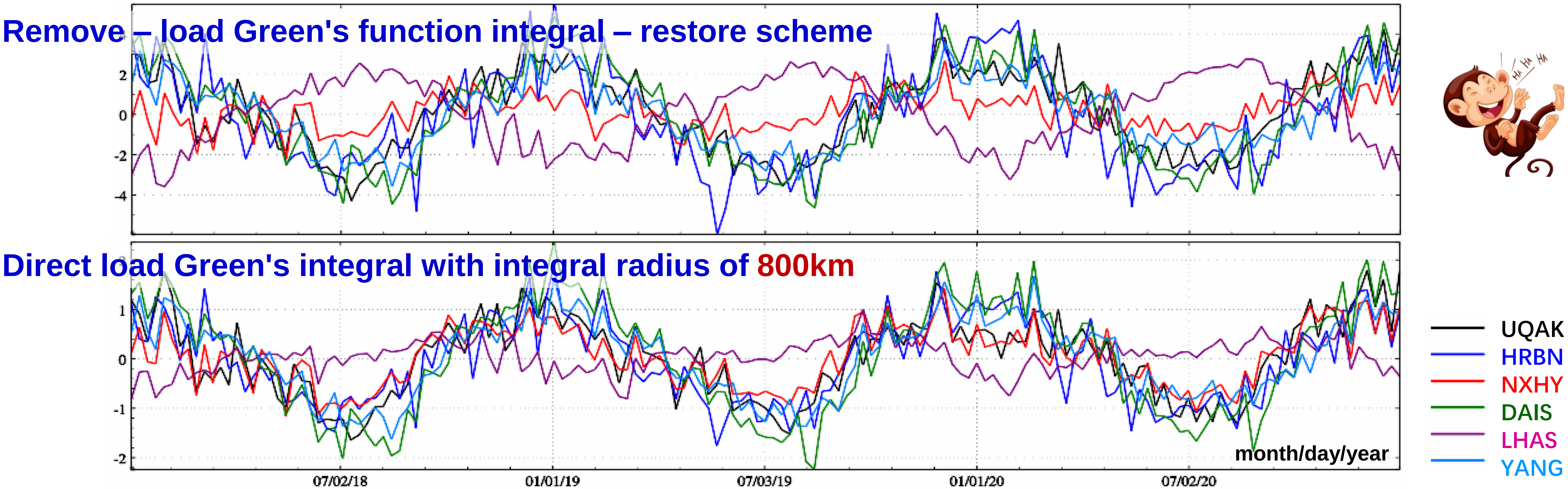


30′×30′ residual soil water load effects in Chinese mainland (Green integral): horizontal gradient variation (W, mE)

The calculated load effect signal by the direct load Green's integral is not sufficient and thus is difficult to meet the high-precision geodesy.

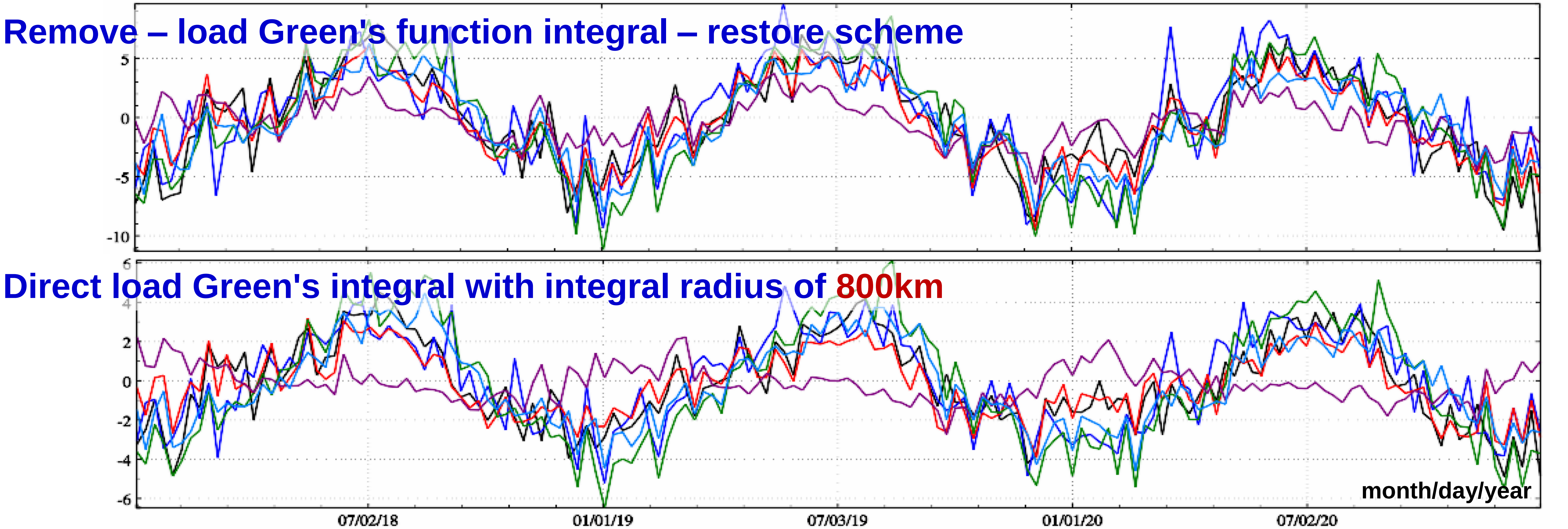


Surface atmosphere load effect time series on geoid (mm) at 6 CORS stations in mainland China using two scheme

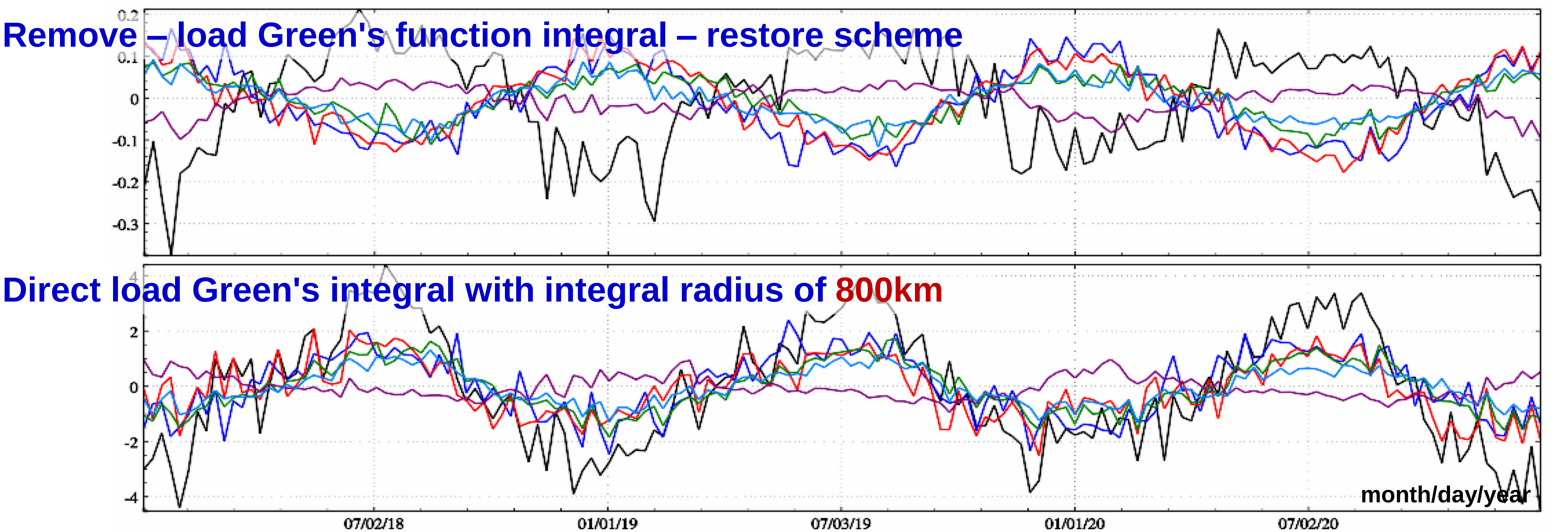


Surface atmosphere load effect time series on ground gravity (mGal) at 6 CORS stations in mainland China using two scheme

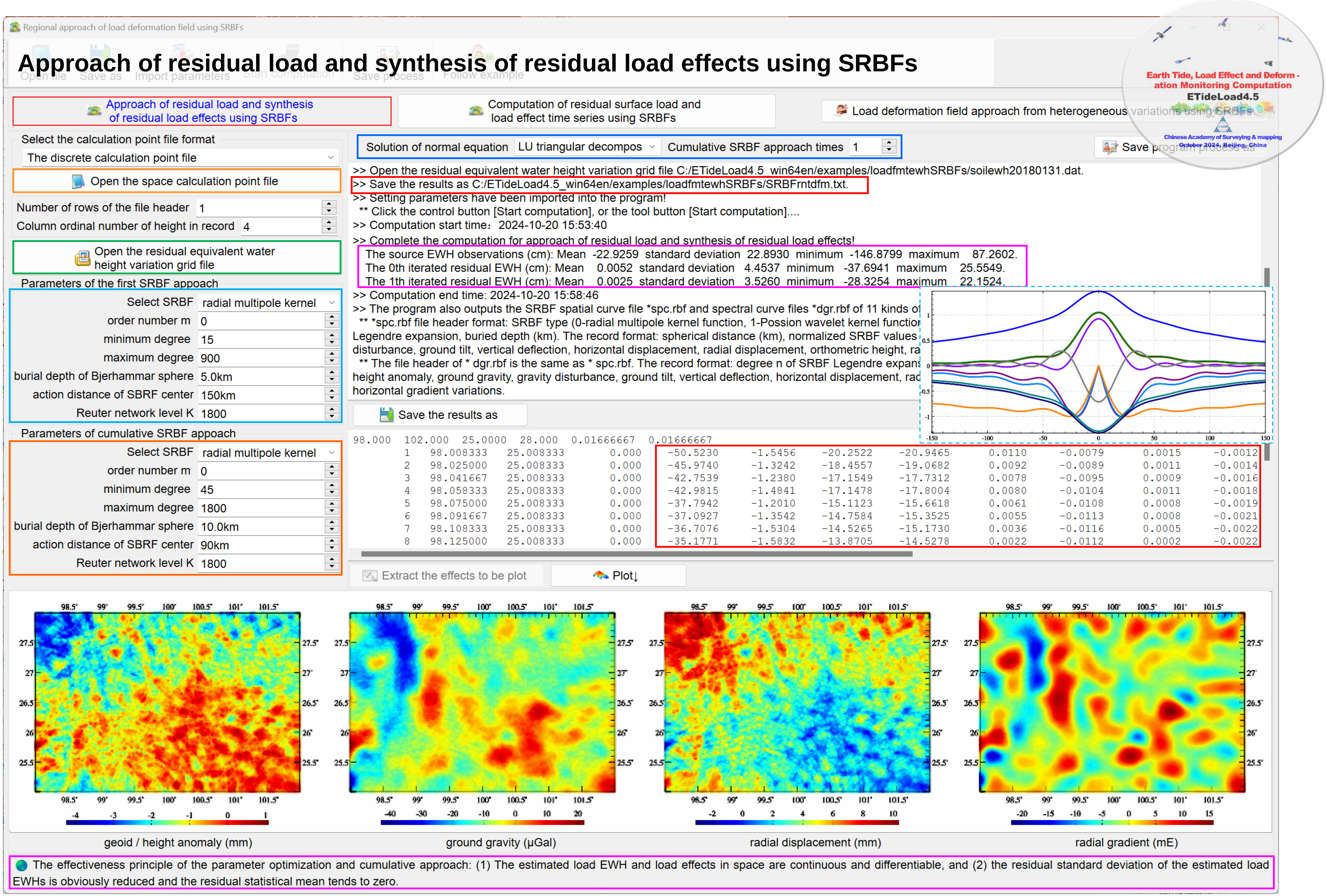
The calculated load effect signal by the direct load Green's integral is not sufficient and thus is difficult to meet the high-precision geodesy.



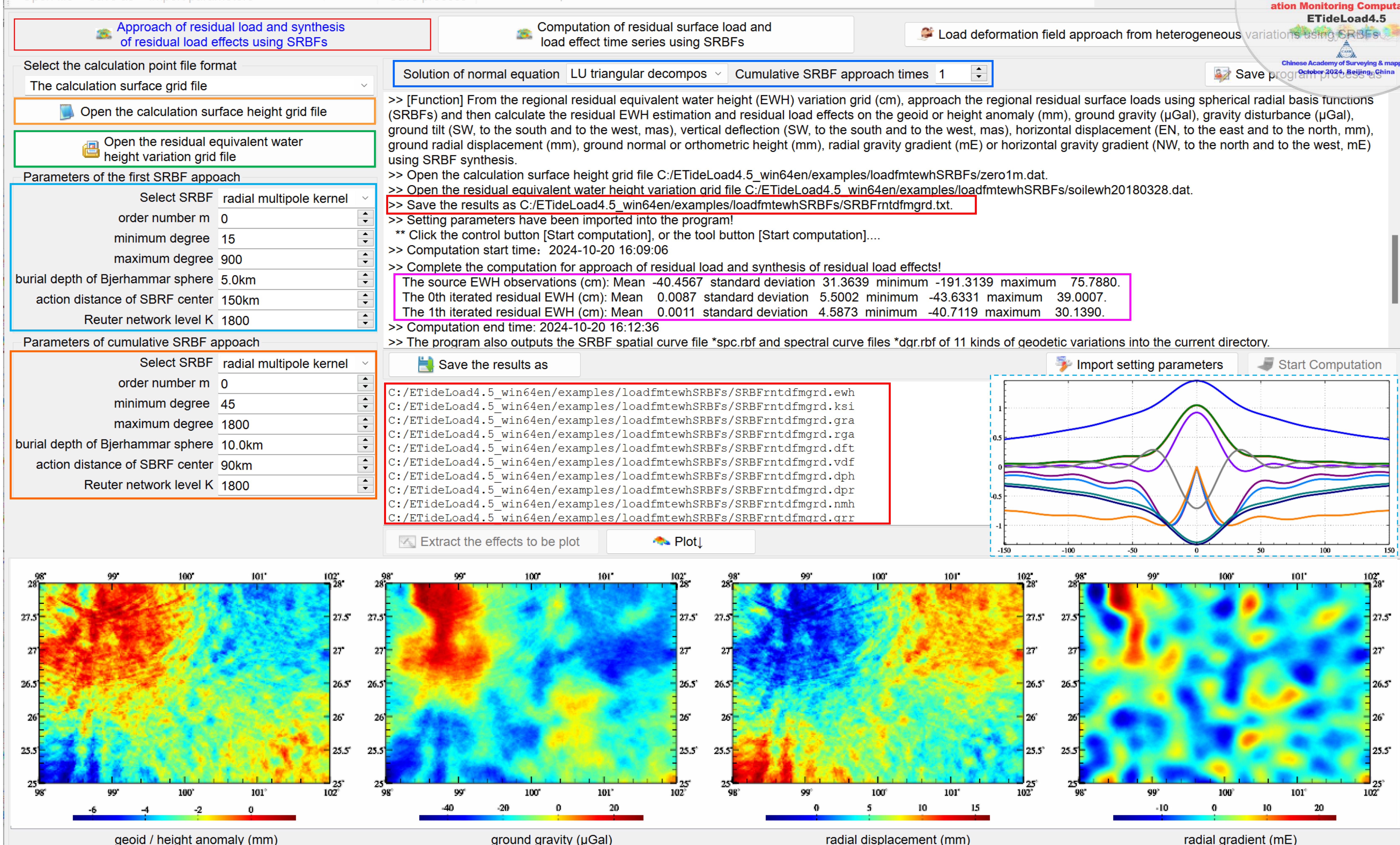
Surface atmosphere load effect time series on ellipsoidal height (mm) at 6 CORS stations in mainland China using two scheme



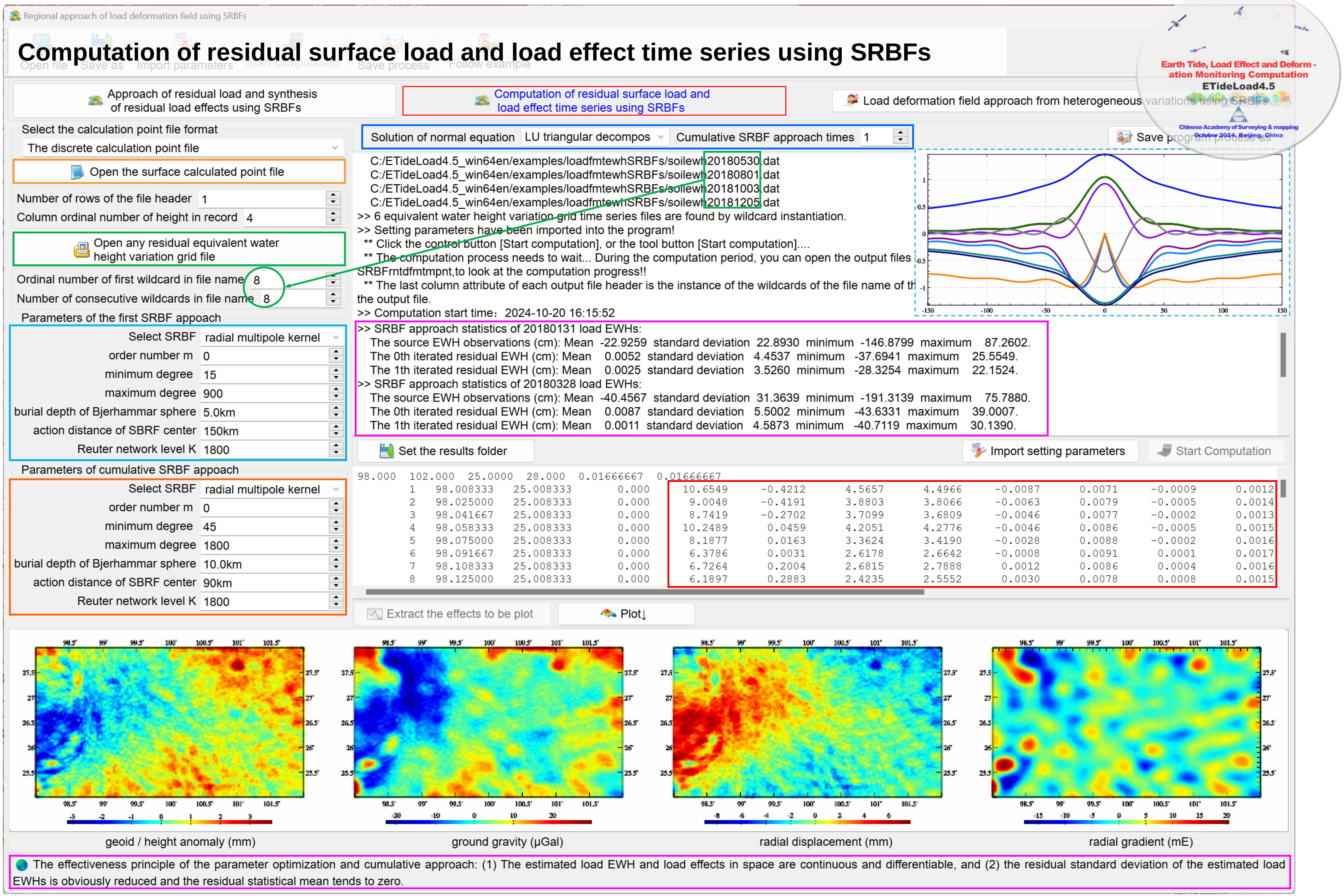
Surface atmosphere load effect time series on radial gravity gradient (mE) at 6 CORS stations in mainland China using two scheme


Regional approach of load deformation field using SRBFs
Approach of residual load and synthesis of residual load effects using SRBFs
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Approach of residual load and synthesis of residual load effects using SRBFs
Computation of residual surface load and load effect time series using SRBFs
Load deformation field approach from heterogeneous variations using SRBFs
Select the calculation point file format
The discrete calculation point file
Open the space calculation 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 K 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 K 1800
Solution of normal equation LU triangular decompos
Cumulative SRBF approach times 1
Save program process as
>> Open the residual equivalent water height variation grid file C:/ETideLoad4.5_win64en/examples/loadfmtewhSRBFs/soilewh20180131.dat.
>> 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: 2024-10-20 15:53:40
>> Complete the computation for approach 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: 2024-10-20 15:58:46
>> The program also outputs the SRBF spatial curve file *spc.rbf and spectral curve files *dgr.rbf of 11 kinds of
** *spc.rbf file header format: SRBF type (0-radial multipole kernel function, 1-Possion wavelet kernel functio
Legendre expansion, buried depth (km). The record format: spherical distance (km), normalized SRBF values
disturbance, ground tilt, vertical deflection, horizontal displacement, radial displacement, orthometric height, ra
** The file header of * dgr.rbf is the same as * spc.rbf. The record format: degree n of SRBF Legendre expans
height anomaly, ground gravity, gravity disturbance, ground tilt, vertical deflection, horizontal displacement, rad
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 -0.0012
2 98.025000 25.008333 0.000 -45.9740 -1.3242 -18.4557 -19.0682 0.0092 -0.0089 0.0011 -0.0014
3 98.041667 25.008333 0.000 -42.7539 -1.2380 -17.1549 -17.7312 0.0078 -0.0095 0.0009 -0.0016
4 98.058333 25.008333 0.000 -42.9815 -1.4841 -17.1478 -17.8004 0.0080 -0.0104 0.0011 -0.0018
5 98.075000 25.008333 0.000 -37.7942 -1.2010 -15.1123 -15.6618 0.0061 -0.0108 0.0008 -0.0019
6 98.091667 25.008333 0.000 -37.0927 -1.3542 -14.7584 -15.3525 0.0055 -0.0113 0.0008 -0.0021
7 98.108333 25.008333 0.000 -36.7076 -1.5304 -14.5265 -15.1730 0.0036 -0.0116 0.0005 -0.0022
8 98.125000 25.008333 0.000 -35.1771 -1.5832 -13.8705 -14.5278 0.0022 -0.0112 0.0002 -0.0022
Extract the effects to be plot
Plot↓
geoid / height anomaly (mm)
ground gravity (μGal)
radial displacement (mm)
radial gradient (mE)
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load effects in space are continuous and differentiable, and (2) the residual standard deviation of the estimated load EWHs is obviously reduced and the residual statistical mean tends to zero.

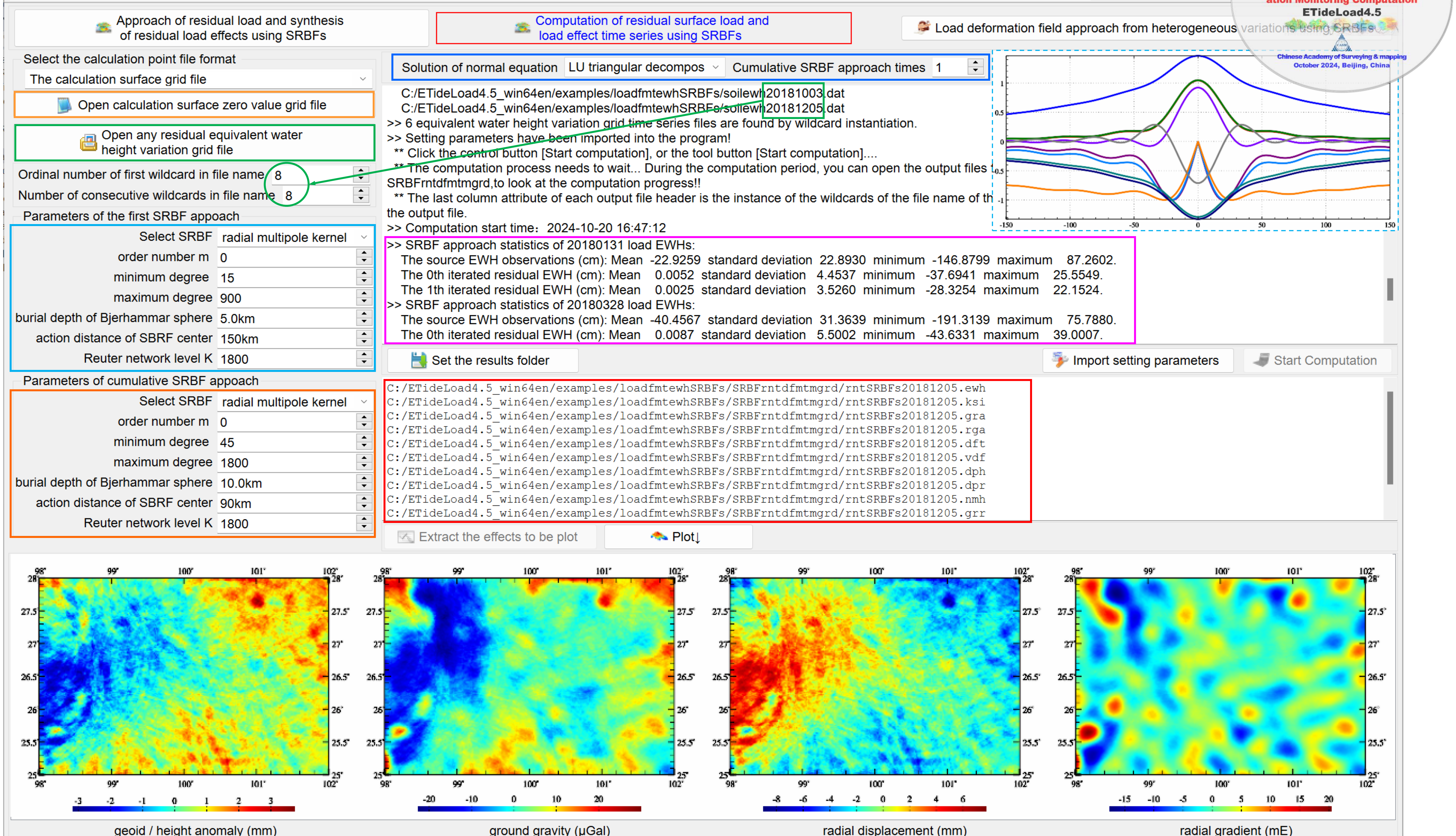
Approach of residual load and synthesis of residual load effects using SRBFs



The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load effects in space are continuous and differentiable, and (2) the residual standard deviation of the estimated load EWHs is obviously reduced and the residual statistical mean tends to zero.

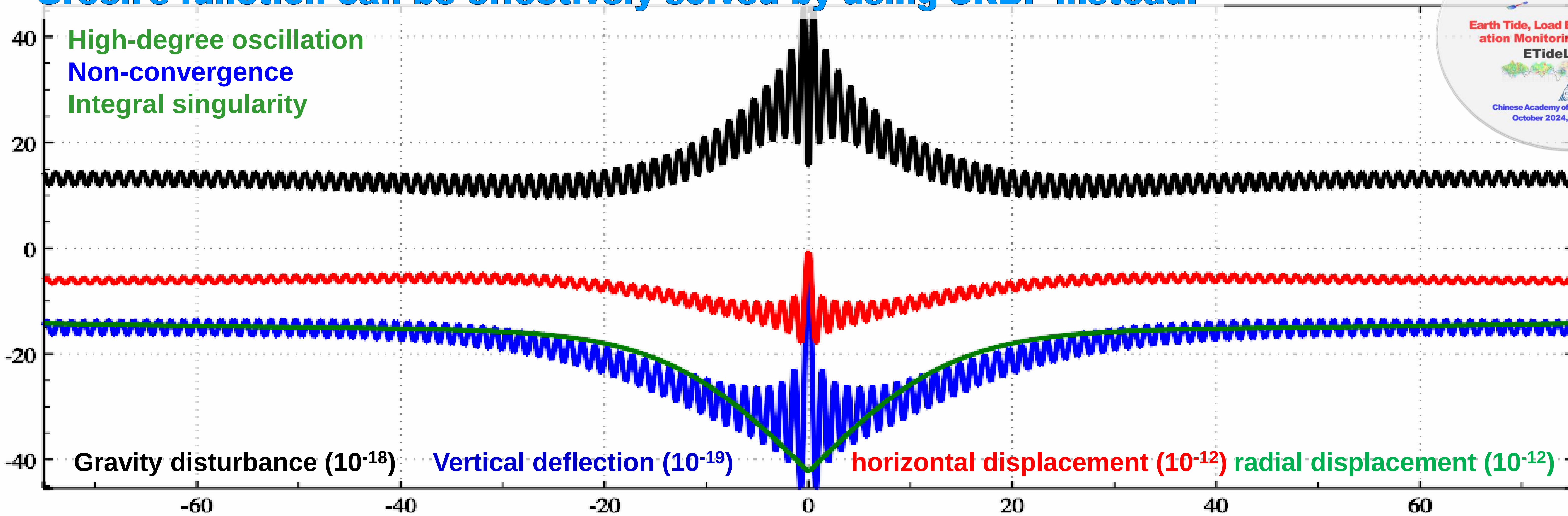

Regional approach of load deformation field using SRBFs
Computation of residual surface load and load effect time series using SRBFs
Open file Save as Import parameters Start computation Save process Follow example
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Approach of residual load and synthesis of residual load effects using SRBFs
Computation of residual surface load and load effect time series using SRBFs
Load deformation field approach from heterogeneous variations using SRBFs
Select the calculation point file format
The discrete calculation point file
Open the surface calculated 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 K 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 K 1800
Solution of normal equation LU triangular decompos
Cumulative SRBF approach times 1
Save program process as
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 needs to wait... During the computation period, you can open the output files SRBFrntdfmtmpnt,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 output file.
>> Computation start time: 2024-10-20 16:15:52
>> SRBF approach 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 approach 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 results 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 0.0012
2 98.025000 25.008333 0.000 9.0048 -0.4191 3.8803 3.8066 -0.0063 0.0079 -0.0005 0.0014
3 98.041667 25.008333 0.000 8.7419 -0.2702 3.7099 3.6809 -0.0046 0.0077 -0.0002 0.0013
4 98.058333 25.008333 0.000 10.2489 0.0459 4.2051 4.2776 -0.0046 0.0086 -0.0005 0.0015
5 98.075000 25.008333 0.000 8.1877 0.0163 3.3624 3.4190 -0.0028 0.0088 -0.0002 0.0016
6 98.091667 25.008333 0.000 6.3786 0.0031 2.6178 2.6642 -0.0008 0.0091 0.0001 0.0017
7 98.108333 25.008333 0.000 6.7264 0.2004 2.6815 2.7888 0.0012 0.0086 0.0004 0.0016
8 98.125000 25.008333 0.000 6.1897 0.2883 2.4235 2.5552 0.0030 0.0078 0.0008 0.0015
Extract the effects to be plot
Plot↓
geoid / height anomaly (mm)
ground gravity (μGal)
radial displacement (mm)
radial gradient (mE)
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load effects in space are continuous and differentiable, and (2) the residual standard deviation of the estimated load EWHs is obviously reduced and the residual statistical mean tends to zero.

Computation of residual surface load and load effect time series using SRBFs

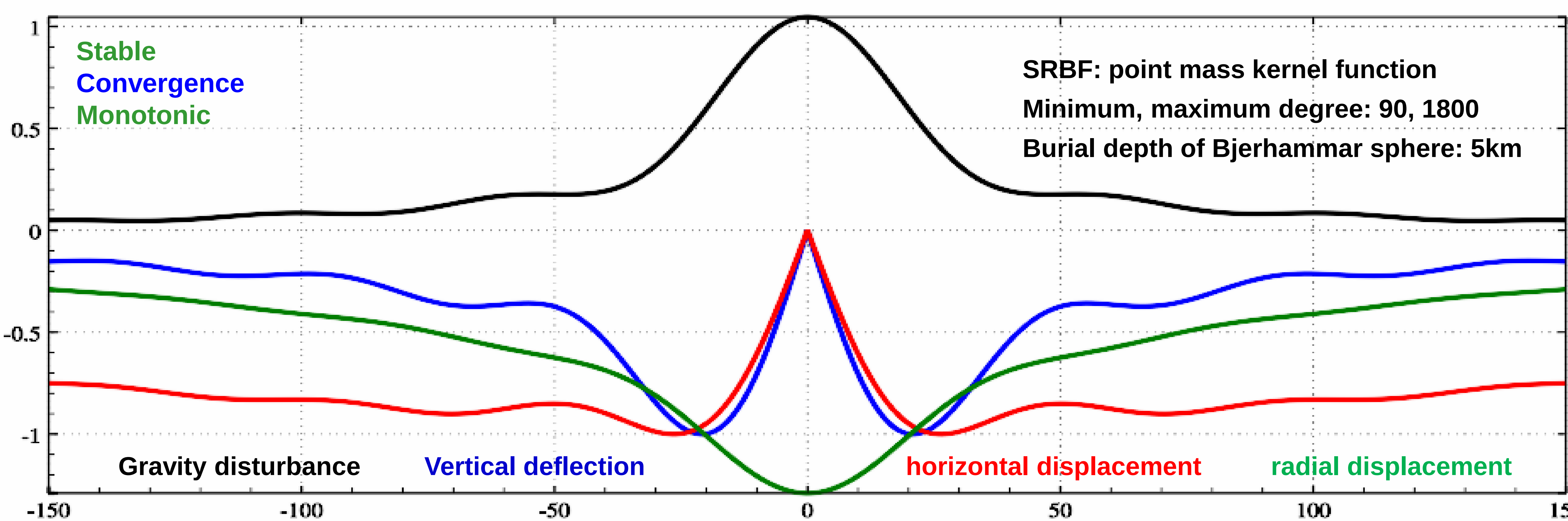


The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load effects in space are continuous and differentiable, and (2) the residual standard deviation of the estimated load EWHs is obviously reduced and the residual statistical mean tends to zero.

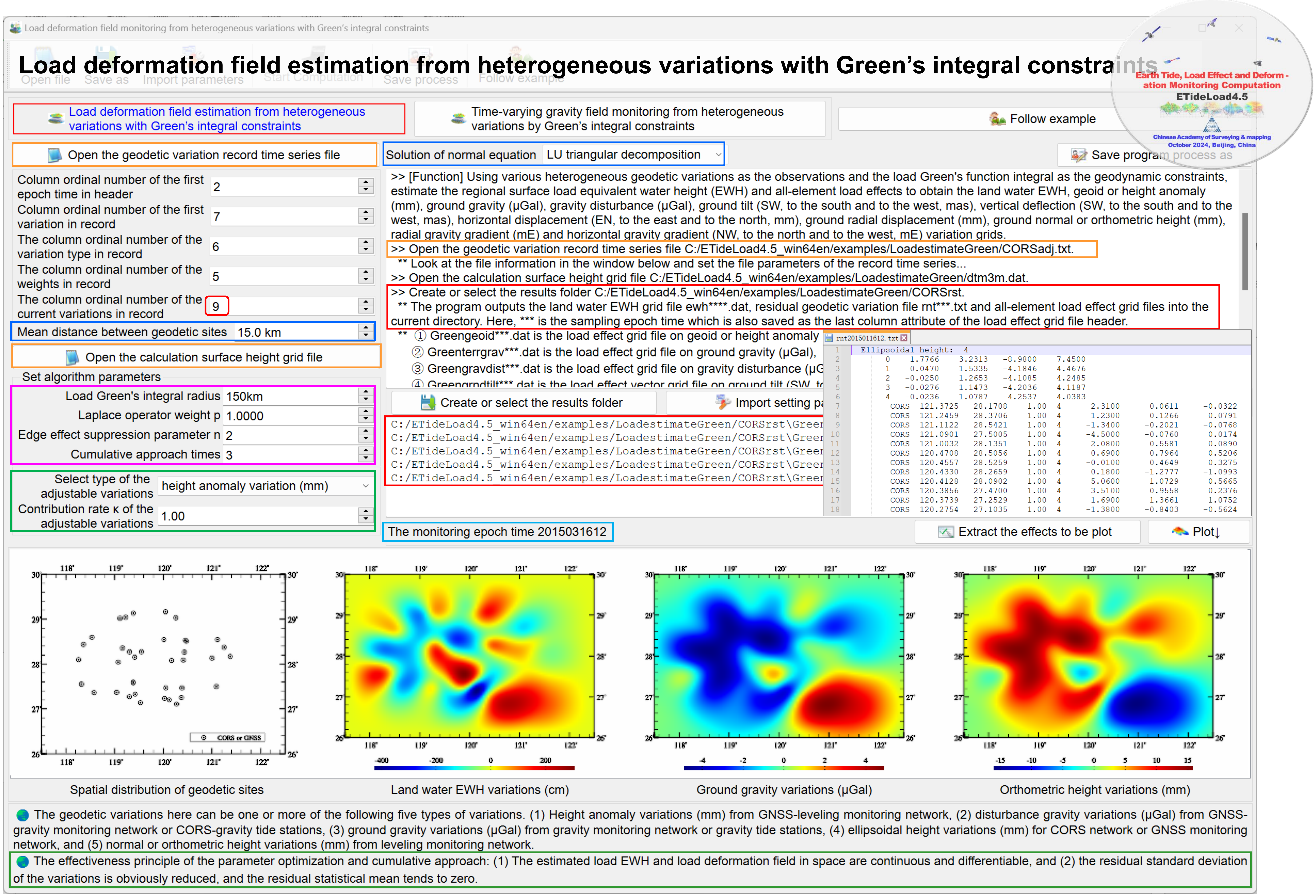
The high-degree oscillation and non-convergence troubles of load Green's function can be effectively solved by using SRBF instead.

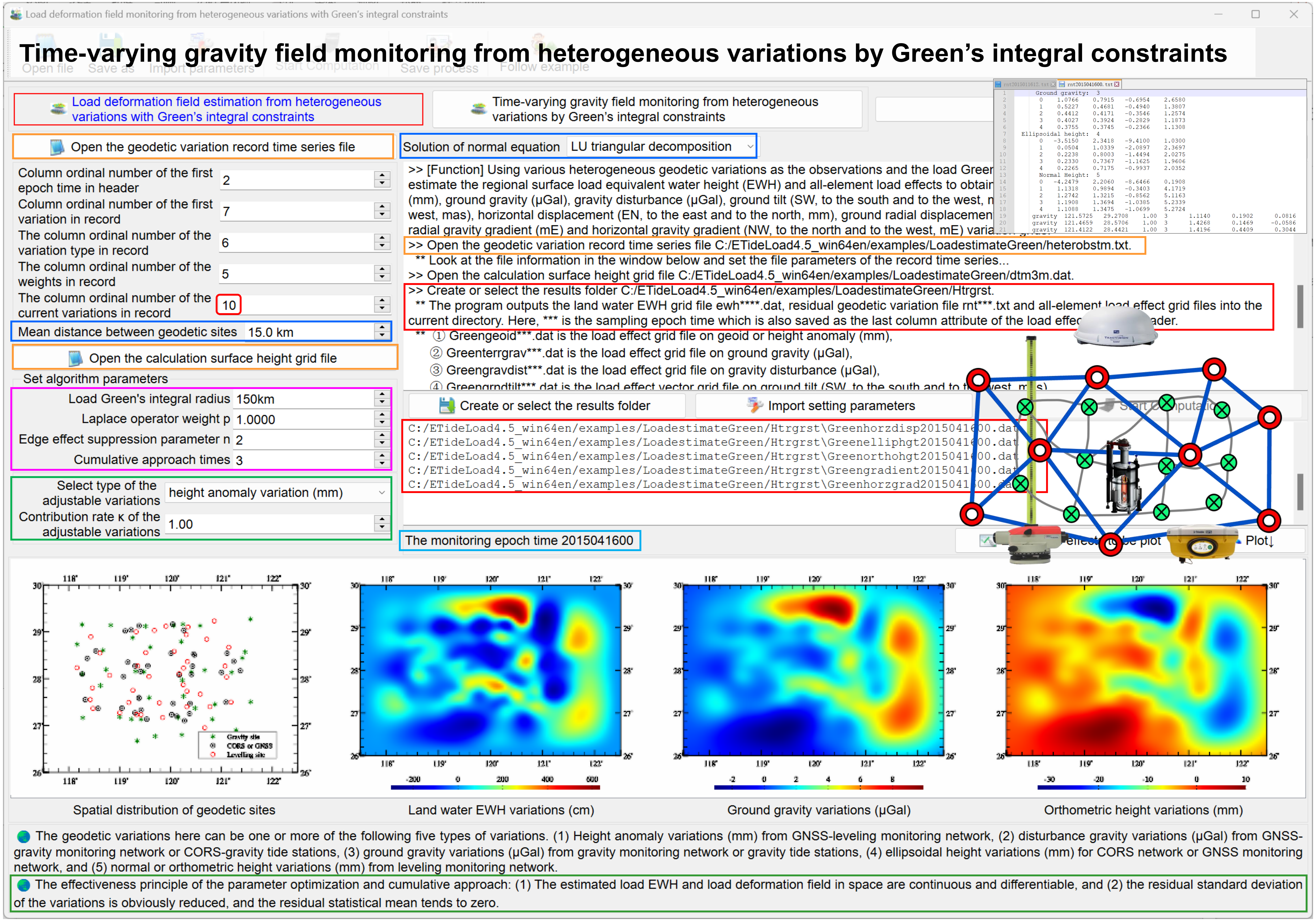


The near-zone characteristics of several load Green's functions (Indirect influence)

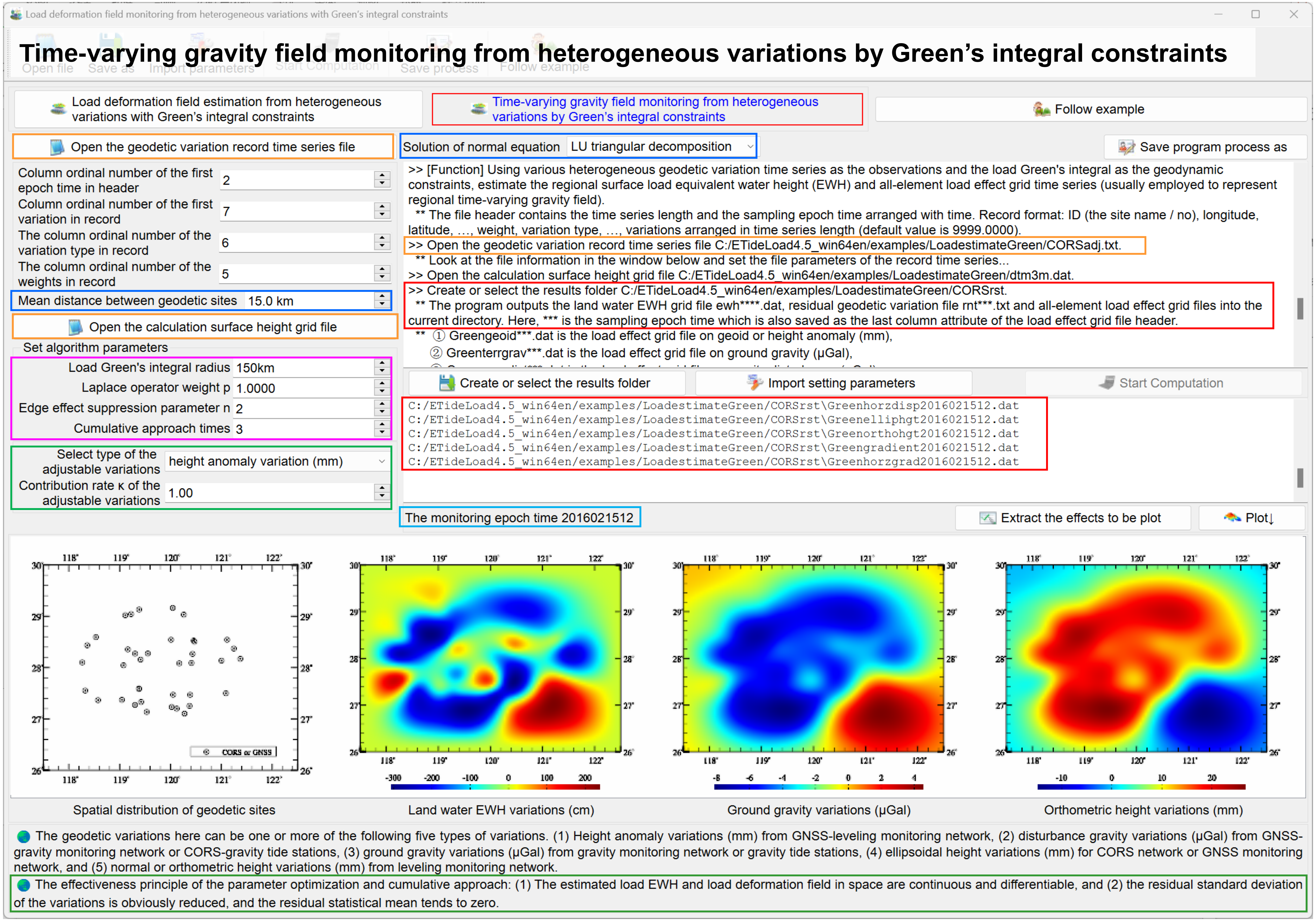


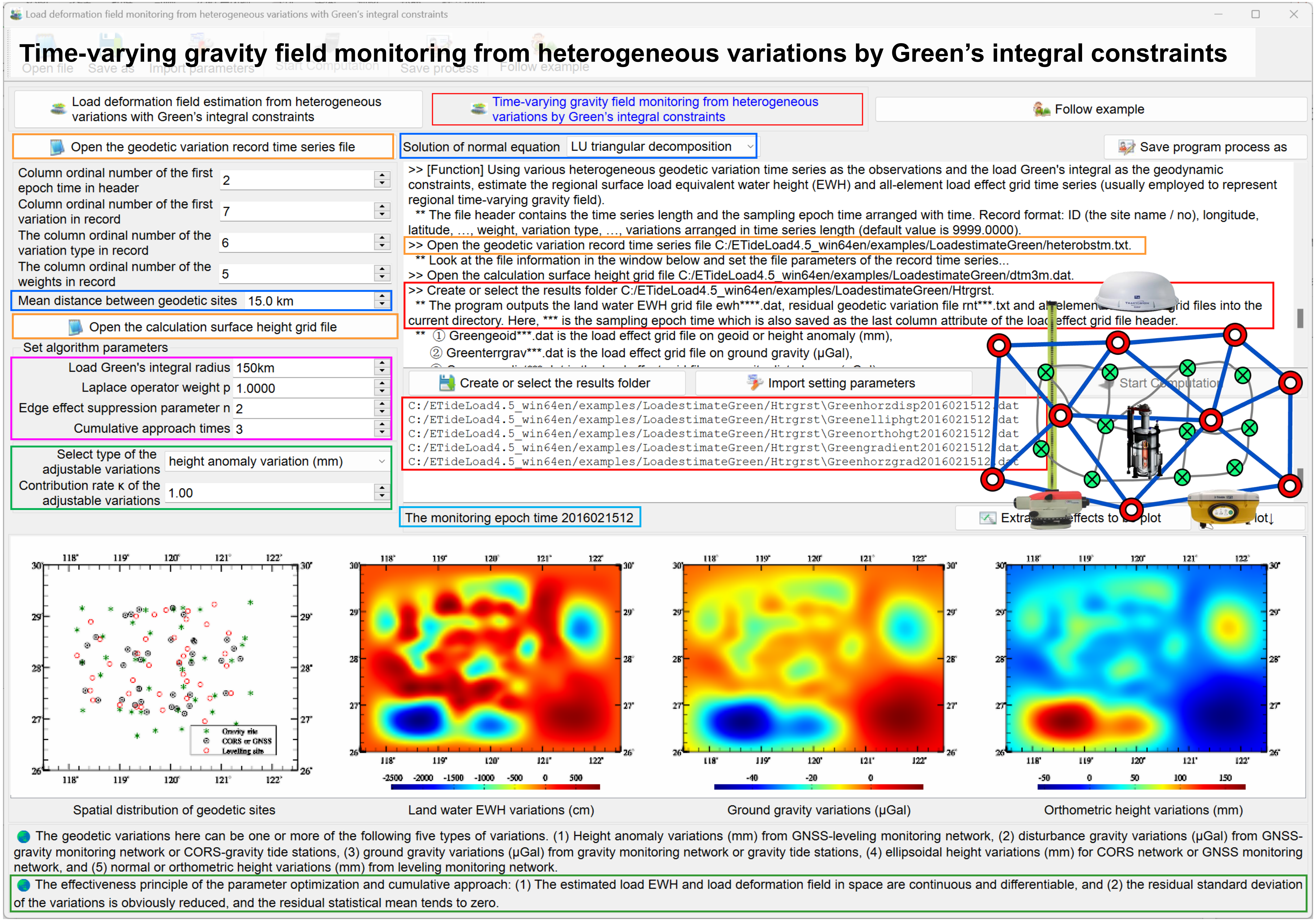
The near-zone characteristics of load effect SRBFs on several geodetic variations

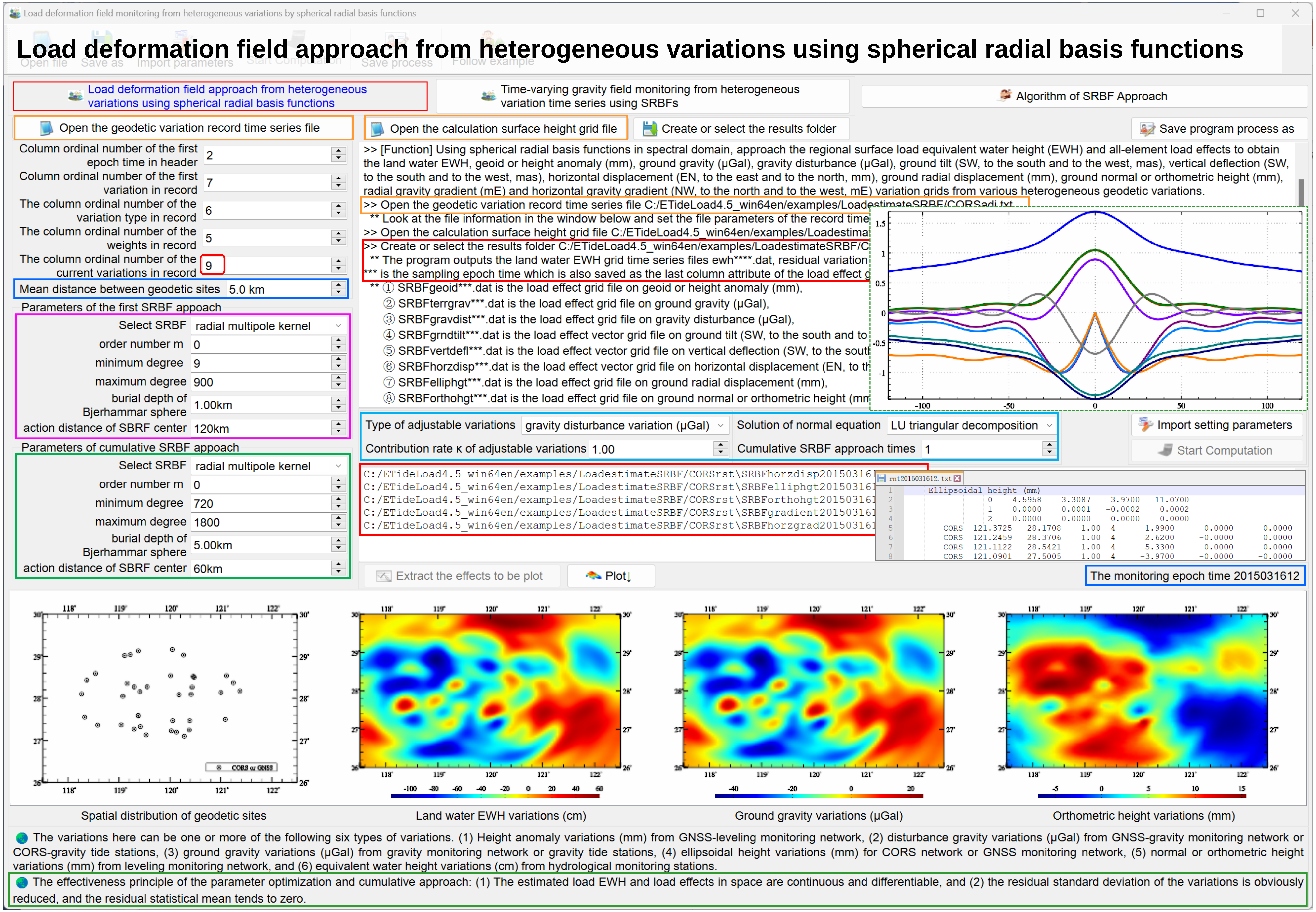

Load deformation field monitoring from heterogeneous variations with Green's integral constraints
Load deformation field estimation from heterogeneous variations with Green's integral constraints
Open file
Save as
Import parameters
Start Computation
Save process
Follow example
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
Load deformation field estimation from heterogeneous variations with Green's integral constraints
Time-varying gravity field monitoring from heterogeneous variations by Green's integral constraints
Follow example
Open the geodetic variation record time series file
Solution of normal equation
LU triangular decomposition
Save program process as
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
9
Mean distance between geodetic sites
15.0 km
Open the calculation 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
>> [Function] Using various heterogeneous geodetic variations as the observations and the load Green's function integral as the geodynamic constraints, estimate the regional surface load equivalent water height (EWH) and all-element load effects to obtain the land water EWH, 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) and horizontal gravity gradient (NW, to the north and to the west, mE) variation grids.
>> 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 calculation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/dtm3m.dat.
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst.
** The program outputs the land water EWH grid file ewh****.dat, residual geodetic variation file rnt***.txt and all-element load effect grid files into the current directory. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.
** ① Greengeoid***.dat is the load effect grid file on geoid or height anomaly
② Greenterrgrav***.dat is the load effect grid file on ground gravity (μGal),
③ Greengravdist***.dat is the load effect grid file on gravity disturbance (μG
④ Greengrndtilt***.dat is the load effect vector grid file on ground tilt (SW, to
Create or select the results folder
Import setting pa
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greer
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greer
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greer
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greer
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst\Greer
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 120.0901 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 2015031612
Extract the effects to be plot
Plot
CORS or GNSS
Spatial distribution of geodetic sites
Land water EWH variations (cm)
Ground gravity variations (μGal)
Orthometric height variations (mm)
The geodetic variations here can be one or more of the following five types of variations. (1) Height anomaly variations (mm) from GNSS-leveling monitoring network, (2) disturbance gravity variations (μGal) from GNSS-gravity monitoring network or CORS-gravity tide stations, (3) ground gravity variations (μGal) from gravity monitoring network or gravity tide stations, (4) ellipsoidal height variations (mm) for CORS network or GNSS monitoring network, and (5) normal or orthometric height variations (mm) from leveling monitoring network.
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load deformation field in space are continuous and differentiable, and (2) the residual standard deviation of the variations is obviously reduced, and the residual statistical mean tends to zero.

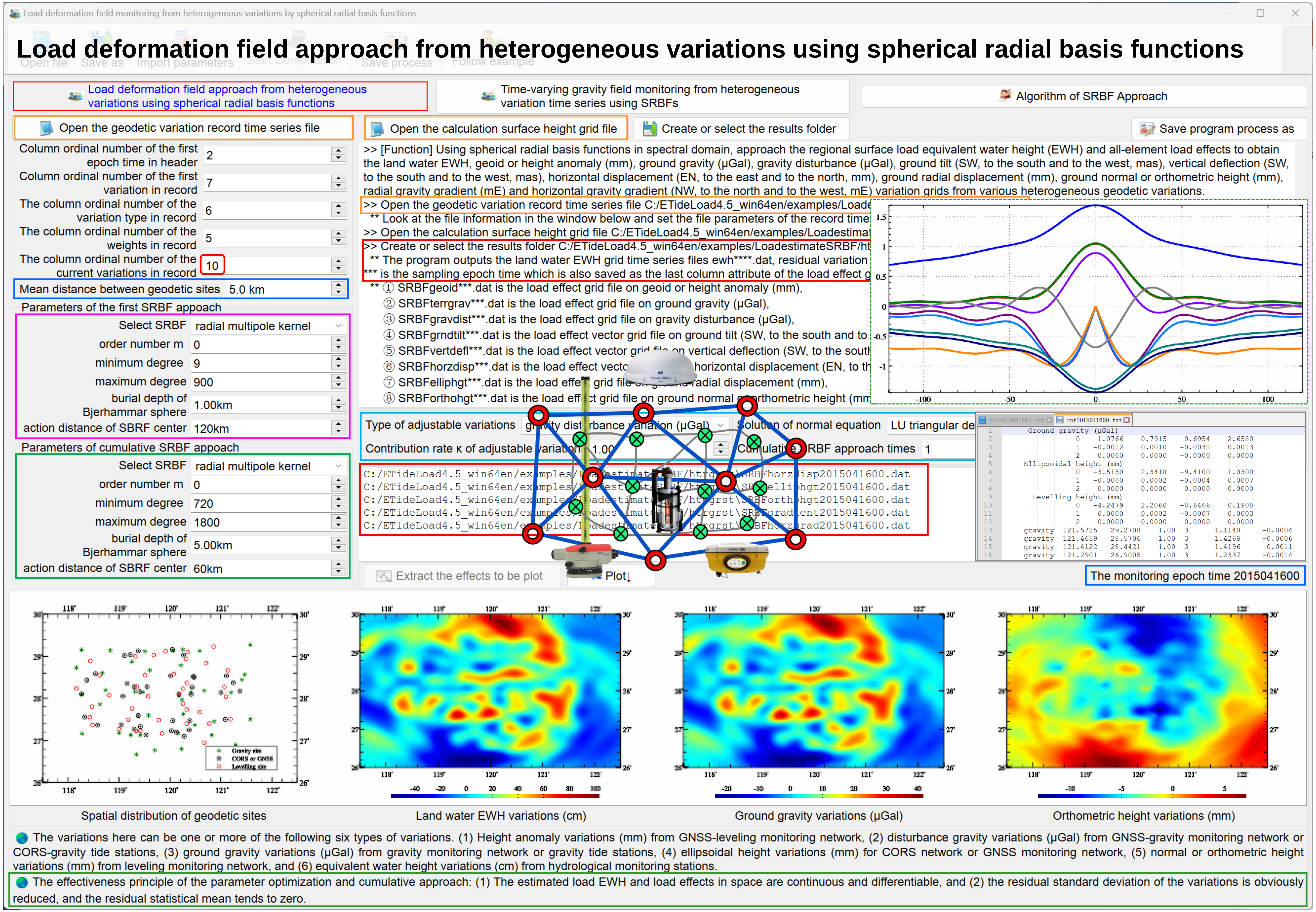


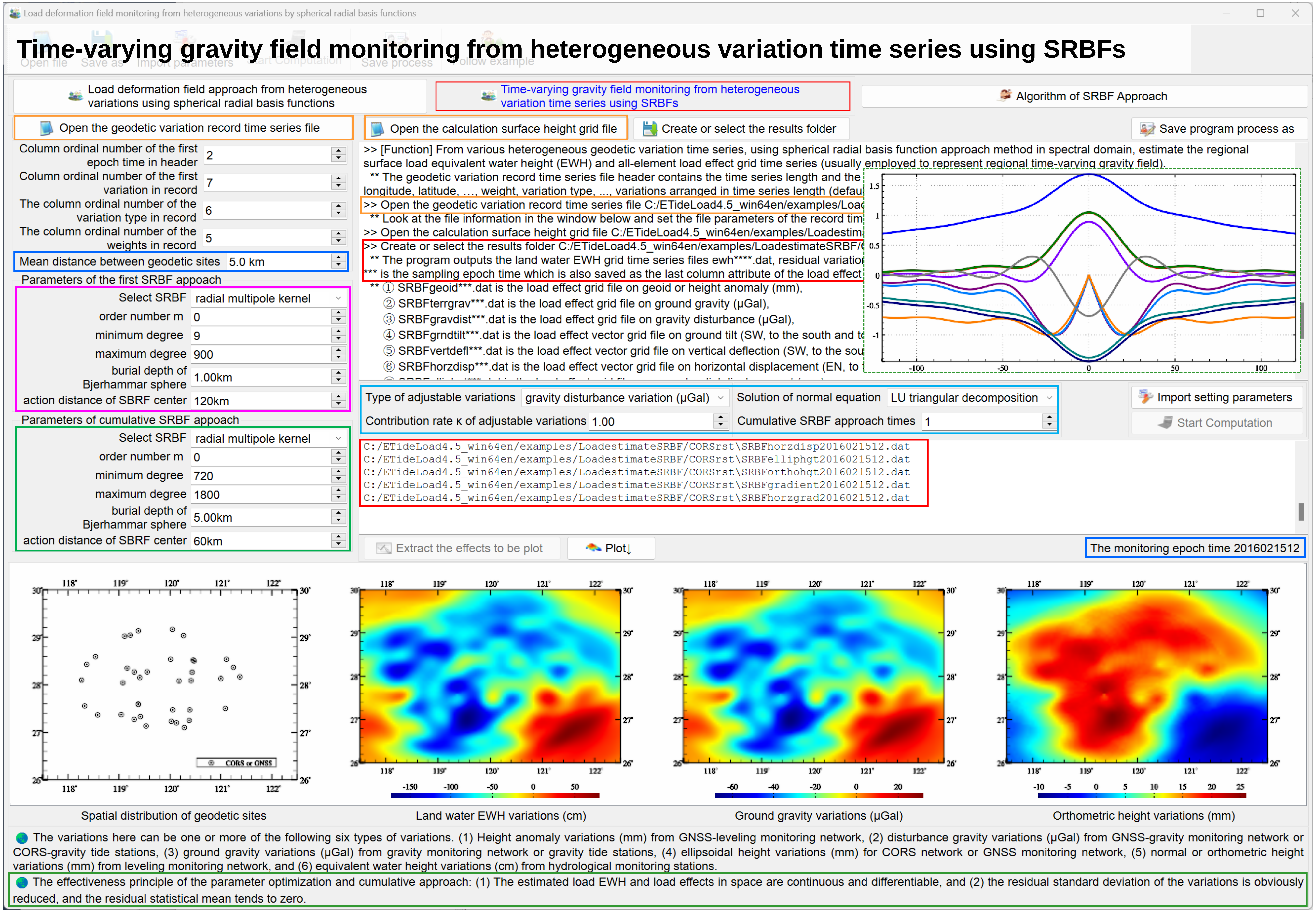
Load deformation field monitoring from heterogeneous variations with Green's integral constraints
Time-varying gravity field monitoring from heterogeneous variations by Green's integral constraints
Load deformation field estimation from heterogeneous variations with Green's integral constraints
Time-varying gravity field monitoring from heterogeneous variations by Green's integral constraints
Open the geodetic variation record time series file
Solution of normal equation
LU triangular decomposition
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
10
Mean distance between geodetic sites
15.0 km
Open the calculation 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
>> [Function] Using various heterogeneous geodetic variations as the observations and the load Green
estimate the regional surface load equivalent water height (EWH) and all-element load effects to obtain
(mm), ground gravity (μGal), gravity disturbance (μGal), ground tilt (SW, to the south and to the west, m
west, mas), horizontal displacement (EN, to the east and to the north, mm), ground radial displacemen
radial gravity gradient (mE) and horizontal gravity gradient (NW, to the north and to the west, mE) varia
>> 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 calculation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/dtm3m.dat.
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst.
** The program outputs the land water EWH grid file ewh****.dat, residual geodetic variation file rnt***.txt and all-element load effect grid files into the
current directory. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effe
** ① Greengeoid***.dat is the load effect grid file on geoid or height anomaly (mm),
② Greenterrgrav***.dat is the load effect grid file on ground gravity (μGal),
③ Greengravdist***.dat is the load effect grid file on gravity disturbance (μGal),
Create or select the results folder
Import setting parameters
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenhorzdisp2015041600.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenelliphgt2015041600.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenorthohgt2015041600.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greengradient2015041600.dat
C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst\Greenhorzgrad2015041600.dat
The monitoring epoch time 2015041600
Plot
Gravity site
CORS or GNSS
Leveling site
Spatial distribution of geodetic sites
Land water EWH variations (cm)
Ground gravity variations (μGal)
Orthometric height variations (mm)
The geodetic variations here can be one or more of the following five types of variations. (1) Height anomaly variations (mm) from GNSS-leveling monitoring network, (2) disturbance gravity variations (μGal) from GNSS-gravity monitoring network or CORS-gravity tide stations, (3) ground gravity variations (μGal) from gravity monitoring network or gravity tide stations, (4) ellipsoidal height variations (mm) for CORS network or GNSS monitoring network, and (5) normal or orthometric height variations (mm) from leveling monitoring network.
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load deformation field in space are continuous and differentiable, and (2) the residual standard deviation of the variations is obviously reduced, and the residual statistical mean tends to zero.

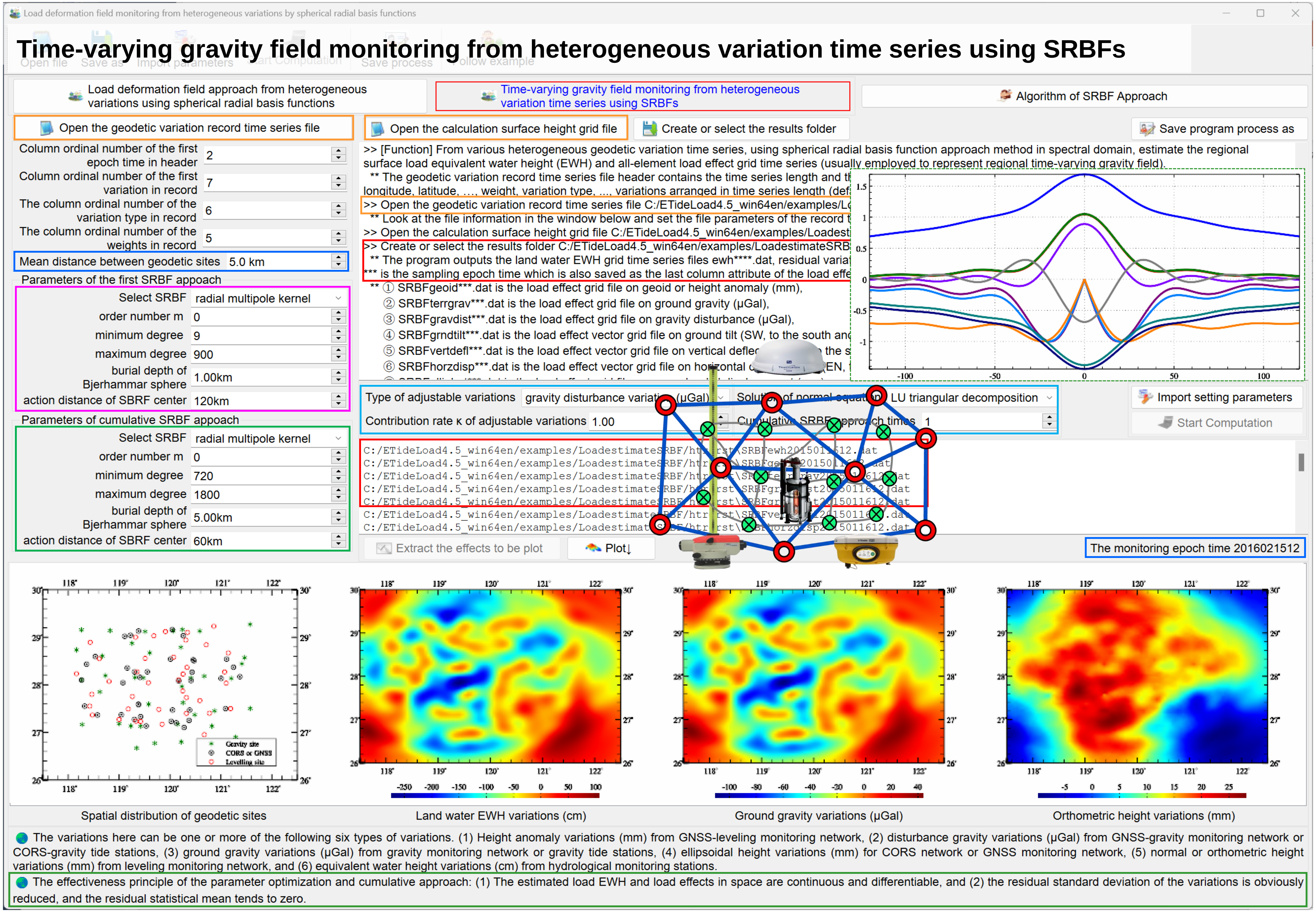

Load deformation field monitoring from heterogeneous variations with Green's integral constraints
Time-varying gravity field monitoring from heterogeneous variations by Green's integral constraints
Load deformation field estimation from heterogeneous variations with Green's integral constraints
Time-varying gravity field monitoring from heterogeneous variations by Green's integral constraints
Follow example
Open the geodetic variation record time series file
Solution of normal equation
LU triangular decomposition
Save program process as
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 calculation 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
>> [Function] Using various heterogeneous geodetic variation time series as the observations and the load Green's integral as the geodynamic constraints, estimate the regional surface load equivalent water height (EWH) and all-element load effect grid time series (usually employed to represent regional time-varying gravity field).
** The file header contains the time series length and the sampling epoch time arranged with time. Record format: ID (the site name / no), longitude, latitude, …, weight, variation type, …, variations arranged in time series length (default value is 9999.0000).
>> 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 calculation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/dtm3m.dat.
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/CORSrst.
** The program outputs the land water EWH grid file ewh****.dat, residual geodetic variation file rnt***.txt and all-element load effect grid files into the current directory. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.
** ① Greengeoid***.dat is the load effect grid file on geoid or height anomaly (mm),
② Greenterrgrav***.dat is the load effect grid file on ground gravity (μGal),
Create or select the results 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↓
CORS or GNSS
Spatial distribution of geodetic sites
Land water EWH variations (cm)
Ground gravity variations (μGal)
Orthometric height variations (mm)
The geodetic variations here can be one or more of the following five types of variations. (1) Height anomaly variations (mm) from GNSS-leveling monitoring network, (2) disturbance gravity variations (μGal) from GNSS-gravity monitoring network or CORS-gravity tide stations, (3) ground gravity variations (μGal) from gravity monitoring network or gravity tide stations, (4) ellipsoidal height variations (mm) for CORS network or GNSS monitoring network, and (5) normal or orthometric height variations (mm) from leveling monitoring network.
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load deformation field in space are continuous and differentiable, and (2) the residual standard deviation of the variations is obviously reduced, and the residual statistical mean tends to zero.


Load deformation field monitoring from heterogeneous variations with Green's integral constraints
Time-varying gravity field monitoring from heterogeneous variations by Green's integral constraints
Load deformation field estimation from heterogeneous variations with Green's integral constraints
Time-varying gravity field monitoring from heterogeneous variations by Green's integral constraints
Follow example
Open the geodetic variation record time series file
Solution of normal equation
LU triangular decomposition
Save program process as
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 calculation 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
>> [Function] Using various heterogeneous geodetic variation time series as the observations and the load Green's integral as the geodynamic constraints, estimate the regional surface load equivalent water height (EWH) and all-element load effect grid time series (usually employed to represent regional time-varying gravity field).
** The file header contains the time series length and the sampling epoch time arranged with time. Record format: ID (the site name / no), longitude, latitude, ..., weight, variation type, ..., variations arranged in time series length (default value is 9999.0000).
>> 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 calculation surface height grid file C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/dtm3m.dat.
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/LoadestimateGreen/Htrgrst.
** The program outputs the land water EWH grid file ewh****.dat, residual geodetic variation file rnt***.txt and all-element load effect grid files into the current directory. Here, *** is the sampling epoch time which is also saved as the last column attribute of the load effect grid file header.
** ① Greengeoid***.dat is the load effect grid file on geoid or height anomaly (mm),
② Greenterrgrav***.dat is the load effect grid file on ground gravity (μGal),
Create or select the results 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
Gravity site
CORS or GNSS
Levelling site
-2500 -2000 -1500 -1000 -500 0 500
-40 -20 0
-50 0 50 100 150
Spatial distribution of geodetic sites
Land water EWH variations (cm)
Ground gravity variations (μGal)
Orthometric height variations (mm)
The geodetic variations here can be one or more of the following five types of variations. (1) Height anomaly variations (mm) from GNSS-leveling monitoring network, (2) disturbance gravity variations (μGal) from GNSS-gravity monitoring network or CORS-gravity tide stations, (3) ground gravity variations (μGal) from gravity monitoring network or gravity tide stations, (4) ellipsoidal height variations (mm) for CORS network or GNSS monitoring network, and (5) normal or orthometric height variations (mm) from leveling monitoring network.
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load deformation field in space are continuous and differentiable, and (2) the residual standard deviation of the variations is obviously reduced, and the residual statistical mean tends to zero.

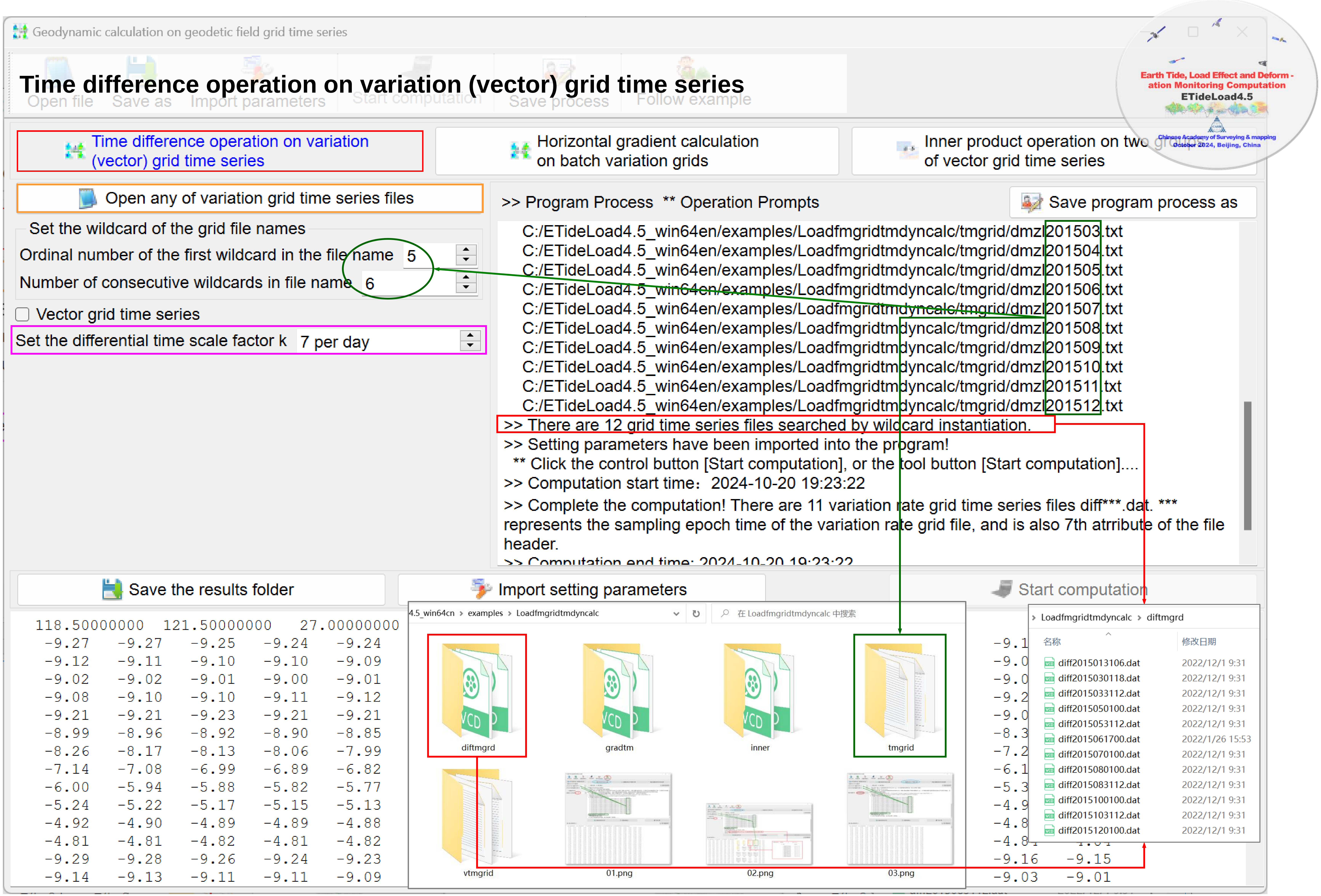

Load deformation field monitoring from heterogeneous variations by spherical radial basis functions
Load deformation field approach from heterogeneous variations using spherical radial basis functions
Load deformation field approach from heterogeneous variations using spherical radial basis functions
Time-varying gravity field monitoring from heterogeneous variation time series using SRBFs
Algorithm of SRBF Approach
Open the geodetic variation record time series file
Open the calculation surface height grid file
Create or select the results 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 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 9
Mean distance between geodetic sites 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
action distance of SRBF center 120km
Parameters of cumulative SRBF appoach
Select SRBF radial multipole kernel
order number m 0
minimum degree 720
maximum degree 1800
burial depth of Bjerhammar sphere 5.00km
action distance of SRBF center 60km
>> [Function] Using spherical radial basis functions in spectral domain, approach the regional surface load equivalent water height (EWH) and all-element load effects to obtain the land water EWH, 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) and horizontal gravity gradient (NW, to the north and to the west, mE) variation grids from various heterogeneous geodetic variations.
>> 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
>> Open the calculation surface height grid file C:/ETideLoad4.5_win64en/examples/Loadestimat
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/C
** The program outputs the land water EWH grid time series files ewh****.dat, residual variation
*** is the sampling epoch time which is also saved as the last column attribute of the load effect g
** ① SRBFgeoid***.dat is the load effect grid file on geoid or height anomaly (mm),
② SRBFterrgrav***.dat is the load effect grid file on ground gravity (μGal),
③ SRBFgravdist***.dat is the load effect grid file on gravity disturbance (μGal),
④ SRBFgrndtilt***.dat is the load effect vector grid file on ground tilt (SW, to the south and to
⑤ SRBFvertdefl***.dat is the load effect vector grid file on vertical deflection (SW, to the sout
⑥ SRBFhorzdisp***.dat is the load effect vector grid file on horizontal displacement (EN, to th
⑦ SRBFelliphgt***.dat is the load effect grid file on ground radial displacement (mm),
⑧ SRBForthohgt***.dat is the load effect grid file on ground normal or orthometric height (mm
1.5
1
0.5
0
-0.5
-1
-100
-50
0
50
100
Type of adjustable variations gravity disturbance variation (μGal)
Solution of normal equation LU triangular decomposition
Import setting parameters
Contribution rate κ of adjustable variations 1.00
Cumulative SRBF approach times 1
Start Computation
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFhorzdisp20150316
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFelliphgt20150316
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBForthohgt20150316
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFgradient20150316
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFhorzgrad20150316
rnt2015031612.txt
Ellipsoidal height (mm)
0 4.5958 3.3087 -3.9700 11.0700
1 0.0000 0.0001 -0.0002 0.0002
2 0.0000 0.0000 -0.0000 0.0000
CORS 121.3725 28.1708 1.00 4 1.9900 0.0000 0.0000
CORS 121.2459 28.3706 1.00 4 2.6200 -0.0000 0.0000
CORS 121.1122 28.5421 1.00 4 5.3300 0.0000 0.0000
CORS 121.0901 27.5005 1.00 4 -3.9700 -0.0000 -0.0000
Extract the effects to be plot
Plot↓
The monitoring epoch time 2015031612
118°
119°
120°
121°
122°
30°
29°
28°
27°
26°
CORS or GNSS
-100 -80 -60 -40 -20 0 20 40 60
-40 -20 0 20
-5 0 5 10 15
Spatial distribution of geodetic sites
Land water EWH variations (cm)
Ground gravity variations (μGal)
Orthometric height variations (mm)
The variations here can be one or more of the following six types of variations. (1) Height anomaly variations (mm) from GNSS-leveling monitoring network, (2) disturbance gravity variations (μGal) from GNSS-gravity monitoring network or CORS-gravity tide stations, (3) ground gravity variations (μGal) from gravity monitoring network or gravity tide stations, (4) ellipsoidal height variations (mm) for CORS network or GNSS monitoring network, (5) normal or orthometric height variations (mm) from leveling monitoring network, and (6) equivalent water height variations (cm) from hydrological monitoring stations.
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load effects in space are continuous and differentiable, and (2) the residual standard deviation of the variations is obviously reduced, and the residual statistical mean tends to zero.

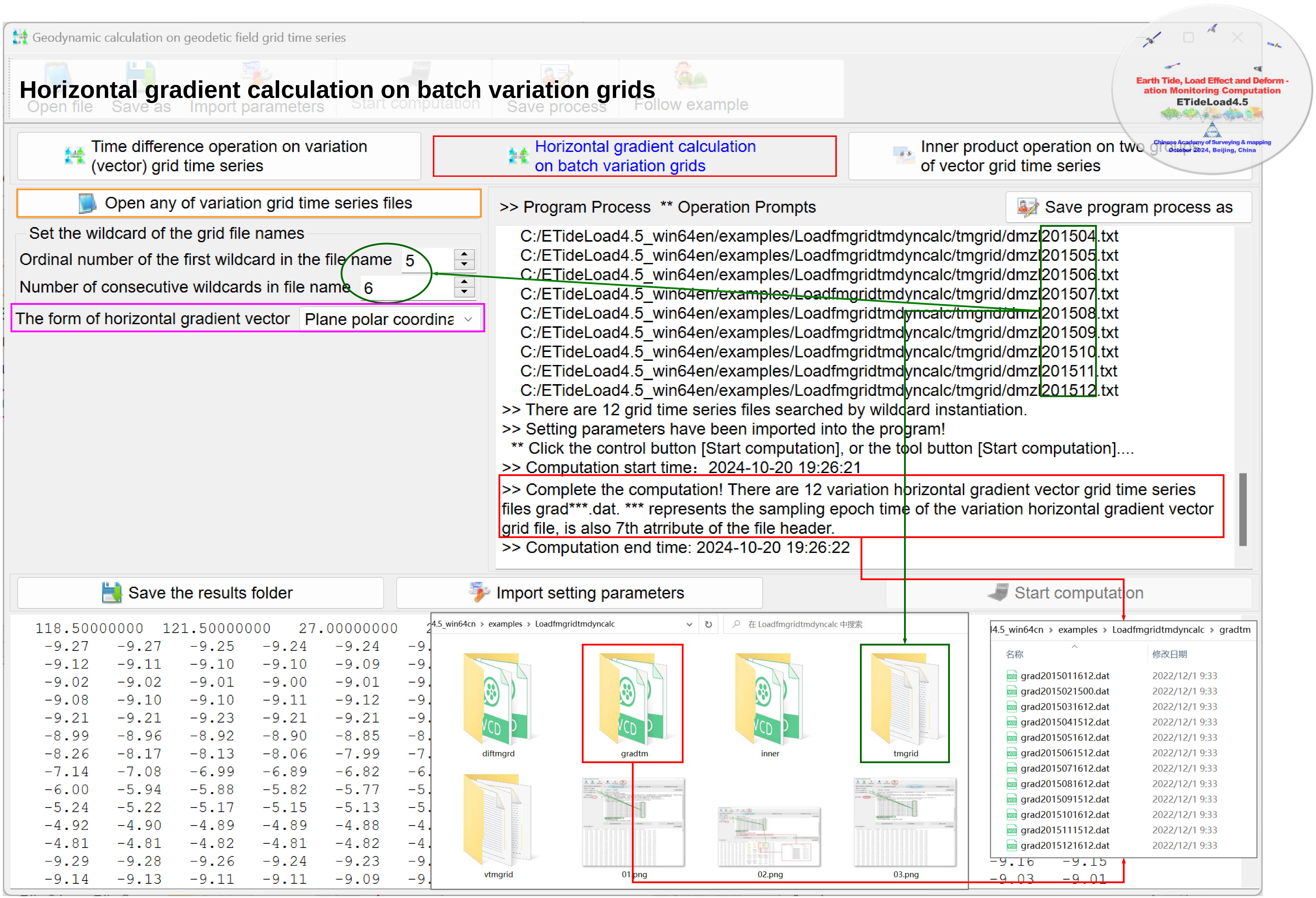

Load deformation field monitoring from heterogeneous variations by spherical radial basis functions
Load deformation field approach from heterogeneous variations using spherical radial basis functions
Load deformation field approach from heterogeneous variations using spherical radial basis functions
Time-varying gravity field monitoring from heterogeneous variation time series using SRBFs
Algorithm of SRBF Approach
Open the geodetic variation record time series file
Open the calculation surface height grid file
Create or select the results 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 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 10
Mean distance between geodetic sites 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
action distance of SRBF center 120km
Parameters of cumulative SRBF appoach
Select SRBF radial multipole kernel
order number m 0
minimum degree 720
maximum degree 1800
burial depth of Bjerhammar sphere 5.00km
action distance of SRBF center 60km
>> [Function] Using spherical radial basis functions in spectral domain, approach the regional surface load equivalent water height (EWH) and all-element load effects to obtain the land water EWH, 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) and horizontal gravity gradient (NW, to the north and to the west, mE) variation grids from various heterogeneous geodetic variations.
>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/Loade
** Look at the file information in the window below and set the file parameters of the record time
>> Open the calculation surface height grid file C:/ETideLoad4.5_win64en/examples/Loadestimat
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/ht
** The program outputs the land water EWH grid time series files ewh****.dat, residual variation
*** is the sampling epoch time which is also saved as the last column attribute of the load effect g
** ① SRBFgeoid***.dat is the load effect grid file on geoid or height anomaly (mm),
② SRBFterrgrav***.dat is the load effect grid file on ground gravity (μGal),
③ SRBFgravdist***.dat is the load effect grid file on gravity disturbance (μGal),
④ SRBFgrndtilt***.dat is the load effect vector grid file on ground tilt (SW, to the south and to
⑤ SRBFvertdefl***.dat is the load effect vector grid file on vertical deflection (SW, to the sout
⑥ SRBFhorzdisp***.dat is the load effect vecto horizontal displacement (EN, to th
⑦ SRBFelliphgt***.dat is the load effe grid file radial displacement (mm),
⑧ SRBForthohgt***.dat is the load eff ct grid file on ground normal orthometric height (mm
Type of adjustable variations gravity disturbance variation (μGal)
Solution of normal equation LU triangular de
Contribution rate κ of adjustable variation 1.00
Cumulative SRBF approach times 1
C:/ETideLoad4.5_win64en/examples/Loadestimate\SRBF/htrgrst\SRBFhorzdisp2015041600.dat
C:/ETideLoad4.5_win64en/examples/Loadestimate\SRBF/htrgrst\SRBFelliphgt2015041600.dat
C:/ETideLoad4.5_win64en/examples/Loadestimate\SRBF/htrgrst\SRBForthohgt2015041600.dat
C:/ETideLoad4.5_win64en/examples/Loadestimate\SRBF/htrgrst\SRBFgradient2015041600.dat
C:/ETideLoad4.5_win64en/examples/Loadestimate\SRBF/htrgrst\SRBFhorzgrad2015041600.dat
Ground gravity (μGal)
Ellipsoidal height (mm)
Levelling height (mm)
Extract the effects to be plot
Plot
The monitoring epoch time 2015041600
Gravity site
CORS or GNSS
Levelling site
Spatial distribution of geodetic sites
Land water EWH variations (cm)
Ground gravity variations (μGal)
Orthometric height variations (mm)
The variations here can be one or more of the following six types of variations. (1) Height anomaly variations (mm) from GNSS-leveling monitoring network, (2) disturbance gravity variations (μGal) from GNSS-gravity monitoring network or CORS-gravity tide stations, (3) ground gravity variations (μGal) from gravity monitoring network or gravity tide stations, (4) ellipsoidal height variations (mm) for CORS network or GNSS monitoring network, (5) normal or orthometric height variations (mm) from leveling monitoring network, and (6) equivalent water height variations (cm) from hydrological monitoring stations.
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load effects in space are continuous and differentiable, and (2) the residual standard deviation of the variations is obviously reduced, and the residual statistical mean tends to zero.

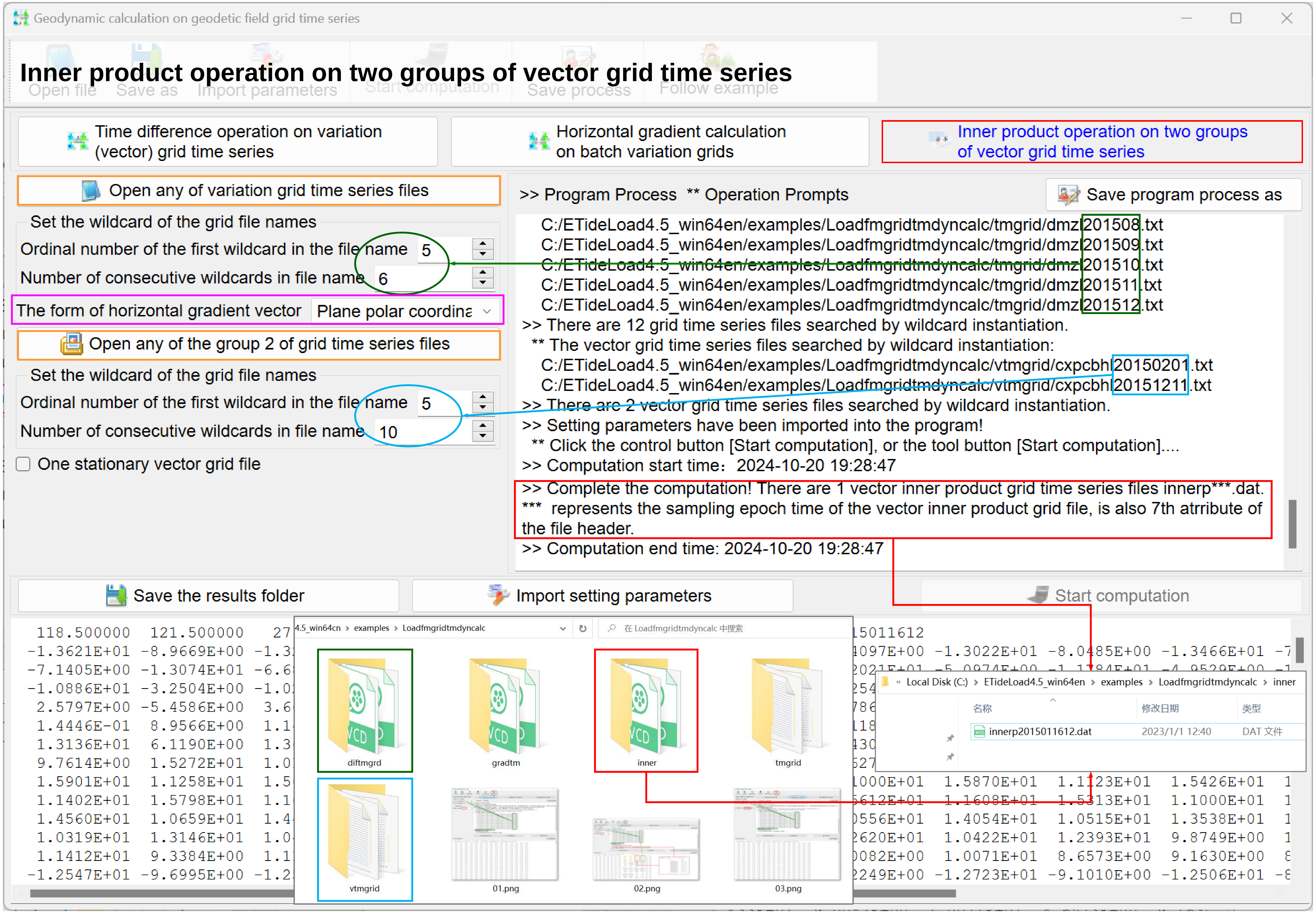

Load deformation field monitoring from heterogeneous variations by spherical radial basis functions
Time-varying gravity field monitoring from heterogeneous variation time series using SRBFs
Load deformation field approach from heterogeneous variations using spherical radial basis functions
Time-varying gravity field monitoring from heterogeneous variation time series using SRBFs
Algorithm of SRBF Approach
Open the geodetic variation record time series file
Open the calculation surface height grid file
Create or select the results 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
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
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
action distance of SRBF center
120km
Parameters of cumulative SRBF appoach
Select SRBF
radial multipole kernel
order number m
0
minimum degree
720
maximum degree
1800
burial depth of Bjerhammar sphere
5.00km
action distance of SRBF center
60km
>> [Function] From various heterogeneous geodetic variation time series, using spherical radial basis function approach method in spectral domain, estimate the regional surface load equivalent water height (EWH) and all-element load effect grid time series (usually employed to represent regional time-varying gravity field).
** The geodetic variation record time series file header contains the time series length and the
longitude, latitude, ..., weight, variation type, ..., variations arranged in time series length (defau
>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/Loa
** Look at the file information in the window below and set the file parameters of the record tim
>> Open the calculation surface height grid file C:/ETideLoad4.5_win64en/examples/Loadestim
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/
** The program outputs the land water EWH grid time series files ewh****.dat, residual variatio
*** is the sampling epoch time which is also saved as the last column attribute of the load effect
** ① SRBFgeoid***.dat is the load effect grid file on geoid or height anomaly (mm),
② SRBFterrgrav***.dat is the load effect grid file on ground gravity (μGal),
③ SRBFgravdist***.dat is the load effect grid file on gravity disturbance (μGal),
④ SRBFgrndtilt***.dat is the load effect vector grid file on ground tilt (SW, to the south and to
⑤ SRBFvertdefl***.dat is the load effect vector grid file on vertical deflection (SW, to the sou
⑥ SRBFhorzdisp***.dat is the load effect vector grid file on horizontal displacement (EN, to
1.5
1
0.5
0
-0.5
-1
-100
-50
0
50
100
Type of adjustable variations
gravity disturbance variation (μGal)
Solution of normal equation
LU triangular decomposition
Import setting parameters
Contribution rate κ of adjustable variations
1.00
Cumulative SRBF approach times
1
Start Computation
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
C:/ETideLoad4.5_win64en/examples/LoadestimateSRBF/CORSrst\SRBFhorzgrad2016021512.dat
Extract the effects to be plot
Plot↓
The monitoring epoch time 2016021512
CORS or GNSS
-150 -100 -50 0 50
-60 -40 -20 0 20
-10 -5 0 5 10 15 20 25
Spatial distribution of geodetic sites
Land water EWH variations (cm)
Ground gravity variations (μGal)
Orthometric height variations (mm)
The variations here can be one or more of the following six types of variations. (1) Height anomaly variations (mm) from GNSS-leveling monitoring network, (2) disturbance gravity variations (μGal) from GNSS-gravity monitoring network or CORS-gravity tide stations, (3) ground gravity variations (μGal) from gravity monitoring network or gravity tide stations, (4) ellipsoidal height variations (mm) for CORS network or GNSS monitoring network, (5) normal or orthometric height variations (mm) from leveling monitoring network, and (6) equivalent water height variations (cm) from hydrological monitoring stations.
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load effects in space are continuous and differentiable, and (2) the residual standard deviation of the variations is obviously reduced, and the residual statistical mean tends to zero.

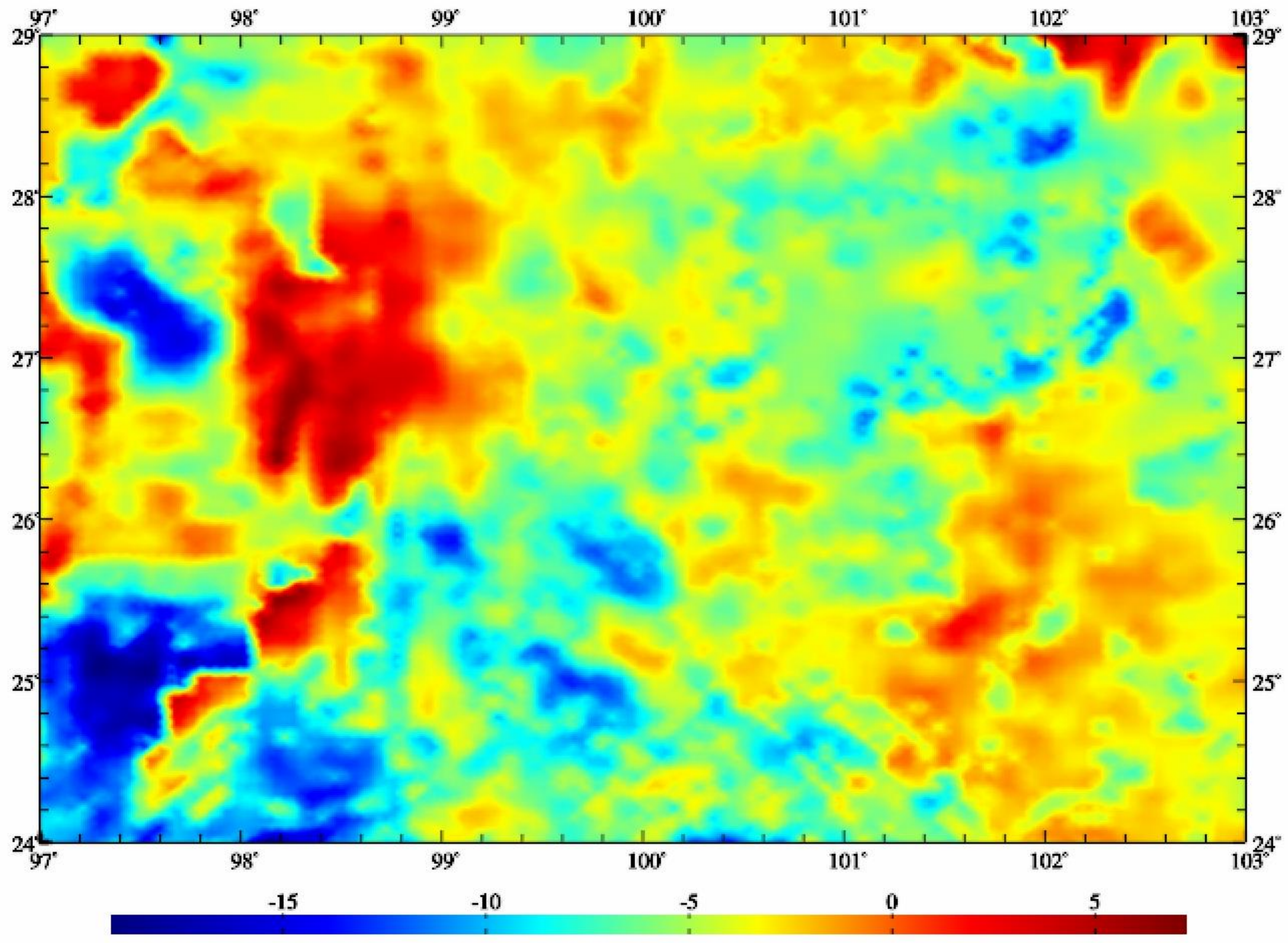


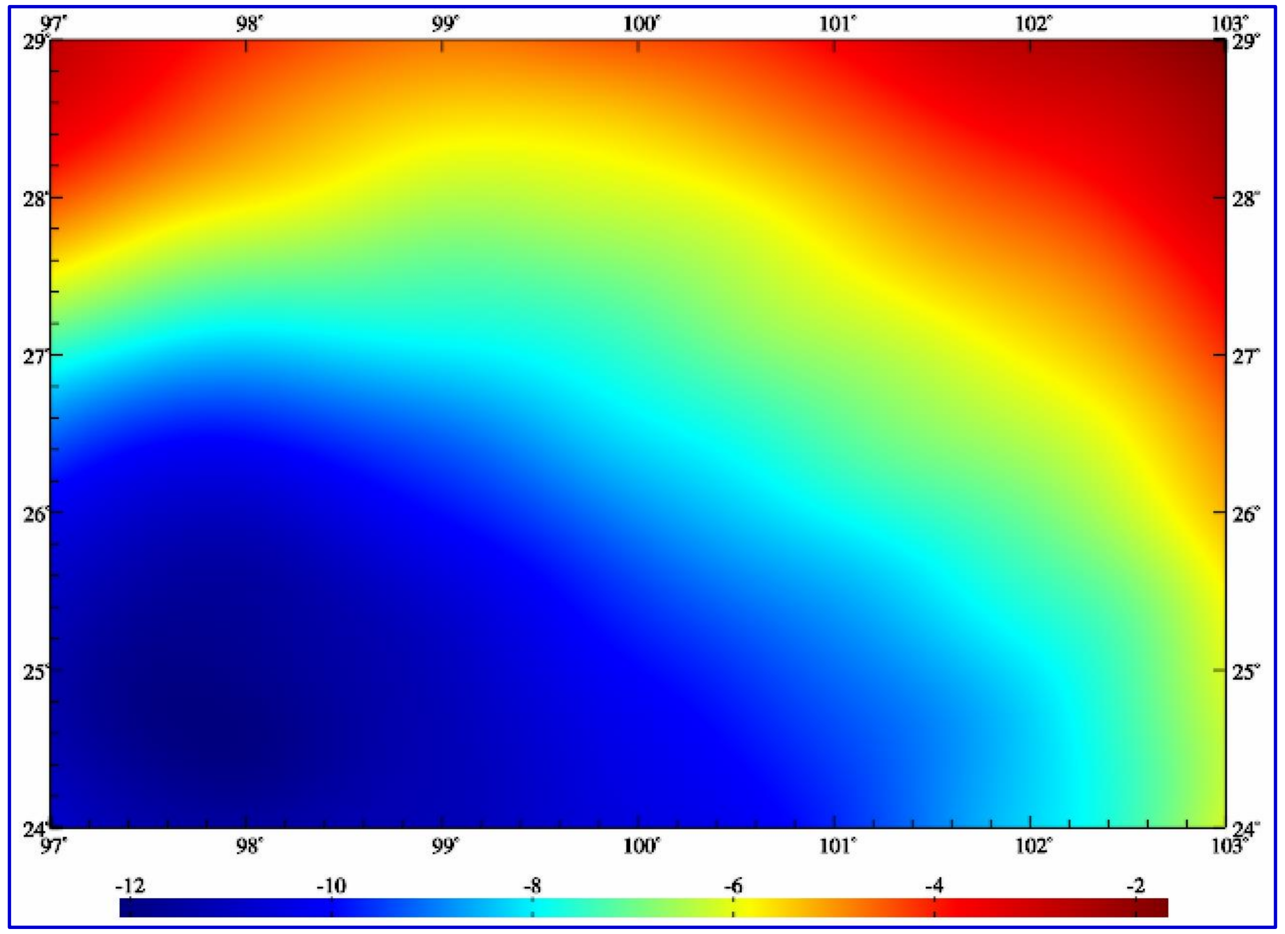
Load deformation field monitoring from heterogeneous variations by spherical radial basis functions
Time-varying gravity field monitoring from heterogeneous variation time series using SRBFs
Load deformation field approach from heterogeneous variations using spherical radial basis functions
Time-varying gravity field monitoring from heterogeneous variation time series using SRBFs
Algorithm of SRBF Approach
Open the geodetic variation record time series file
Open the calculation surface height grid file
Create or select the results 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
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
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
action distance of SRBF center
120km
Parameters of cumulative SRBF appoach
Select SRBF
radial multipole kernel
order number m
0
minimum degree
720
maximum degree
1800
burial depth of Bjerhammar sphere
5.00km
action distance of SRBF center
60km
>> [Function] From various heterogeneous geodetic variation time series, using spherical radial basis function approach method in spectral domain, estimate the regional surface load equivalent water height (EWH) and all-element load effect grid time series (usually employed to represent regional time-varying gravity field).
** The geodetic variation record time series file header contains the time series length and th
longitude, latitude, ..., weight, variation type, ..., variations arranged in time series length (def
>> Open the geodetic variation record time series file C:/ETideLoad4.5_win64en/examples/Lo
** Look at the file information in the window below and set the file parameters of the record t
>> Open the calculation surface height grid file C:/ETideLoad4.5_win64en/examples/Loadest
>> Create or select the results folder C:/ETideLoad4.5_win64en/examples/LoadestimateSRB
** The program outputs the land water EWH grid time series files ewh****.dat, residual varia
*** is the sampling epoch time which is also saved as the last column attribute of the load effe
** ① SRBFgeoid***.dat is the load effect grid file on geoid or height anomaly (mm),
② SRBFterrgrav***.dat is the load effect grid file on ground gravity (μGal),
③ SRBFgravdist***.dat is the load effect grid file on gravity disturbance (μGal),
④ SRBFgrndtilt***.dat is the load effect vector grid file on ground tilt (SW, to the south and
⑤ SRBFvertdefl***.dat is the load effect vector grid file on vertical deflec
⑥ SRBFhorzdisp***.dat is the load effect vector grid file on horizontal
Type of adjustable variations
gravity disturbance variati
(μGal)
Solu
of normal equati
LU triangular decomposition
Contribution rate κ of adjustable variations
1.00
Cumulative SRBF approach times
1
Import setting parameters
Start Computation
Extract the effects to be plot
Plot↓
The monitoring epoch time 2016021512
Gravity site
CORS or GNSS
Levelling site
Spatial distribution of geodetic sites
Land water EWH variations (cm)
Ground gravity variations (μGal)
Orthometric height variations (mm)
The variations here can be one or more of the following six types of variations. (1) Height anomaly variations (mm) from GNSS-leveling monitoring network, (2) disturbance gravity variations (μGal) from GNSS-gravity monitoring network or CORS-gravity tide stations, (3) ground gravity variations (μGal) from gravity monitoring network or gravity tide stations, (4) ellipsoidal height variations (mm) for CORS network or GNSS monitoring network, (5) normal or orthometric height variations (mm) from leveling monitoring network, and (6) equivalent water height variations (cm) from hydrological monitoring stations.
The effectiveness principle of the parameter optimization and cumulative approach: (1) The estimated load EWH and load effects in space are continuous and differentiable, and (2) the residual standard deviation of the variations is obviously reduced, and the residual statistical mean tends to zero.

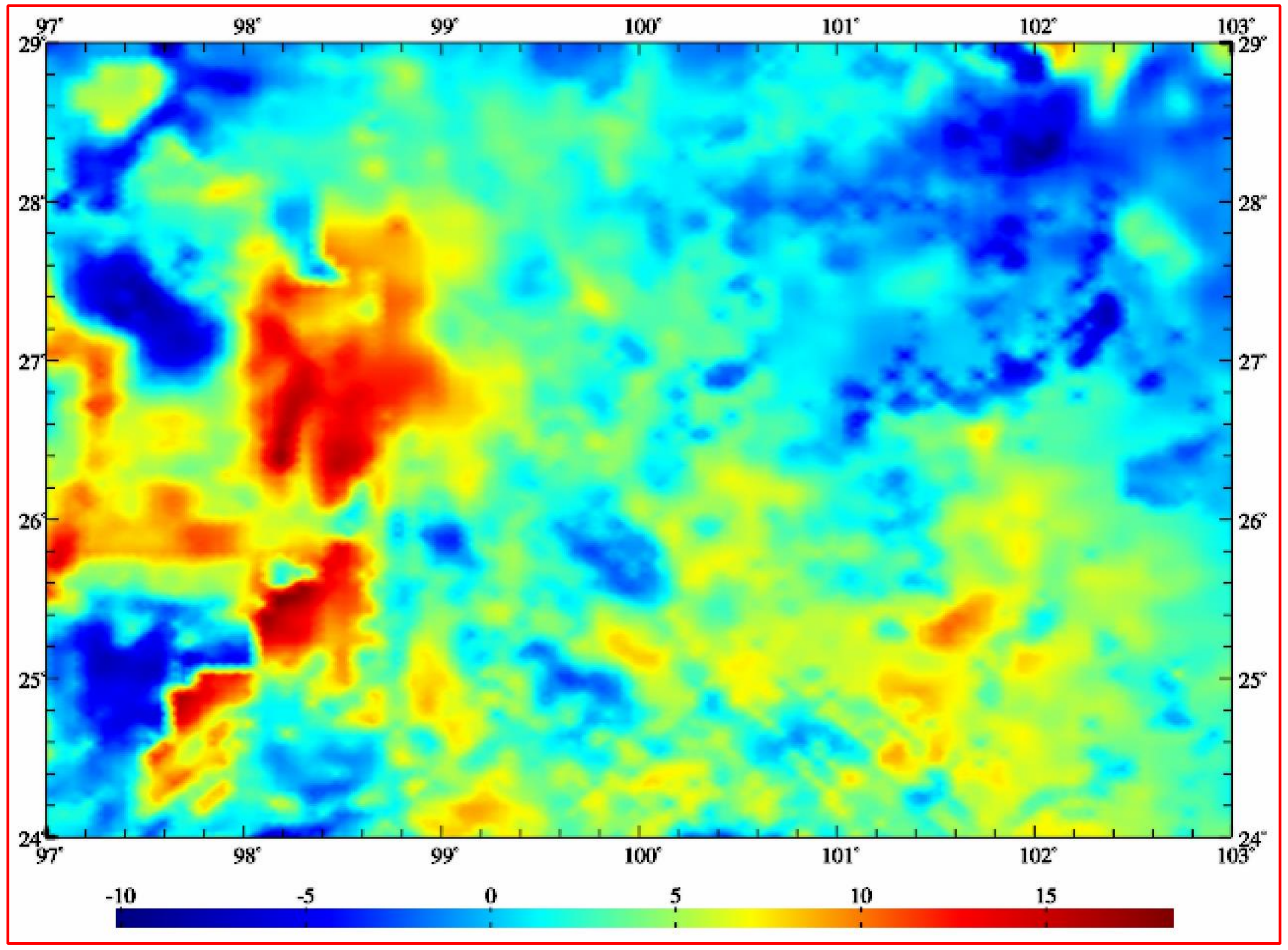

Geodynamic calculation on geodetic field grid time series
Time difference operation on variation (vector) grid time series
Open file
Save as
Import parameters
Start computation
Save process
Follow example
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
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 files
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
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: 2024-10-20 19:23:22
>> 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.
>> Computation end time: 2024-10-20 19:23:22
Save the results folder
Import setting parameters
Start computation
118.50000000 121.50000000 27.00000000
-9.27 -9.27 -9.25 -9.24 -9.24
-9.12 -9.11 -9.10 -9.10 -9.09
-9.02 -9.02 -9.01 -9.00 -9.01
-9.08 -9.10 -9.10 -9.11 -9.12
-9.21 -9.21 -9.23 -9.21 -9.21
-8.99 -8.96 -8.92 -8.90 -8.85
-8.26 -8.17 -8.13 -8.06 -7.99
-7.14 -7.08 -6.99 -6.89 -6.82
-6.00 -5.94 -5.88 -5.82 -5.77
-5.24 -5.22 -5.17 -5.15 -5.13
-4.92 -4.90 -4.89 -4.89 -4.88
-4.81 -4.81 -4.82 -4.81 -4.82
-9.29 -9.28 -9.26 -9.24 -9.23
-9.14 -9.13 -9.11 -9.11 -9.09
4.5_win64cn › examples › Loadfmgridtmdyncalc
在 Loadfmgridtmdyncalc 中搜索
diftmgrd
gradtm
inner
tmgrid
vtmgrid
01.png
02.png
03.png
Loadfmgridtmdyncalc › diftmgrd
名称
修改日期
diff2015013106.dat 2022/12/1 9:31
diff2015030118.dat 2022/12/1 9:31
diff2015033112.dat 2022/12/1 9:31
diff2015050100.dat 2022/12/1 9:31
diff2015053112.dat 2022/12/1 9:31
diff2015061700.dat 2022/1/26 15:53
diff2015070100.dat 2022/12/1 9:31
diff2015080100.dat 2022/12/1 9:31
diff2015083112.dat 2022/12/1 9:31
diff2015100100.dat 2022/12/1 9:31
diff2015103112.dat 2022/12/1 9:31
diff2015120100.dat 2022/12/1 9:31
-9.16 -9.15
-9.03 -9.01


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
Earth Tide, Load Effect and Deformation Monitoring Computation
ETideLoad4.5
Chinese Academy of Surveying & mapping
October 2024, Beijing, China
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 files
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 coordina
>> Program Process ** Operation Prompts
Save program process as
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: 2024-10-20 19:26:21
>> 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.
>> Computation end time: 2024-10-20 19:26:22
Save the results folder
Import setting parameters
Start computation
118.50000000 121.50000000 27.00000000
-9.27 -9.27 -9.25 -9.24 -9.24
-9.12 -9.11 -9.10 -9.10 -9.09
-9.02 -9.02 -9.01 -9.00 -9.01
-9.08 -9.10 -9.10 -9.11 -9.12
-9.21 -9.21 -9.23 -9.21 -9.21
-8.99 -8.96 -8.92 -8.90 -8.85
-8.26 -8.17 -8.13 -8.06 -7.99
-7.14 -7.08 -6.99 -6.89 -6.82
-6.00 -5.94 -5.88 -5.82 -5.77
-5.24 -5.22 -5.17 -5.15 -5.13
-4.92 -4.90 -4.89 -4.89 -4.88
-4.81 -4.81 -4.82 -4.81 -4.82
-9.29 -9.28 -9.26 -9.24 -9.23
-9.14 -9.13 -9.11 -9.11 -9.09
4.5_win64cn › examples › Loadfmgridtmdyncalc
在 Loadfmgridtmdyncalc 中搜索
diftmgrd
gradtm
inner
tmgrid
vtmgrid
01.png
02.png
03.png
4.5_win64cn › examples › Loadfmgridtmdyncalc › gradtm
名称
修改日期
grad2015011612.dat 2022/12/1 9:33
grad2015021500.dat 2022/12/1 9:33
grad2015031612.dat 2022/12/1 9:33
grad2015041512.dat 2022/12/1 9:33
grad2015051612.dat 2022/12/1 9:33
grad2015061512.dat 2022/12/1 9:33
grad2015071612.dat 2022/12/1 9:33
grad2015081612.dat 2022/12/1 9:33
grad2015091512.dat 2022/12/1 9:33
grad2015101612.dat 2022/12/1 9:33
grad2015111512.dat 2022/12/1 9:33
grad2015121612.dat 2022/12/1 9:33
-9.16 -9.15
-9.03 -9.01

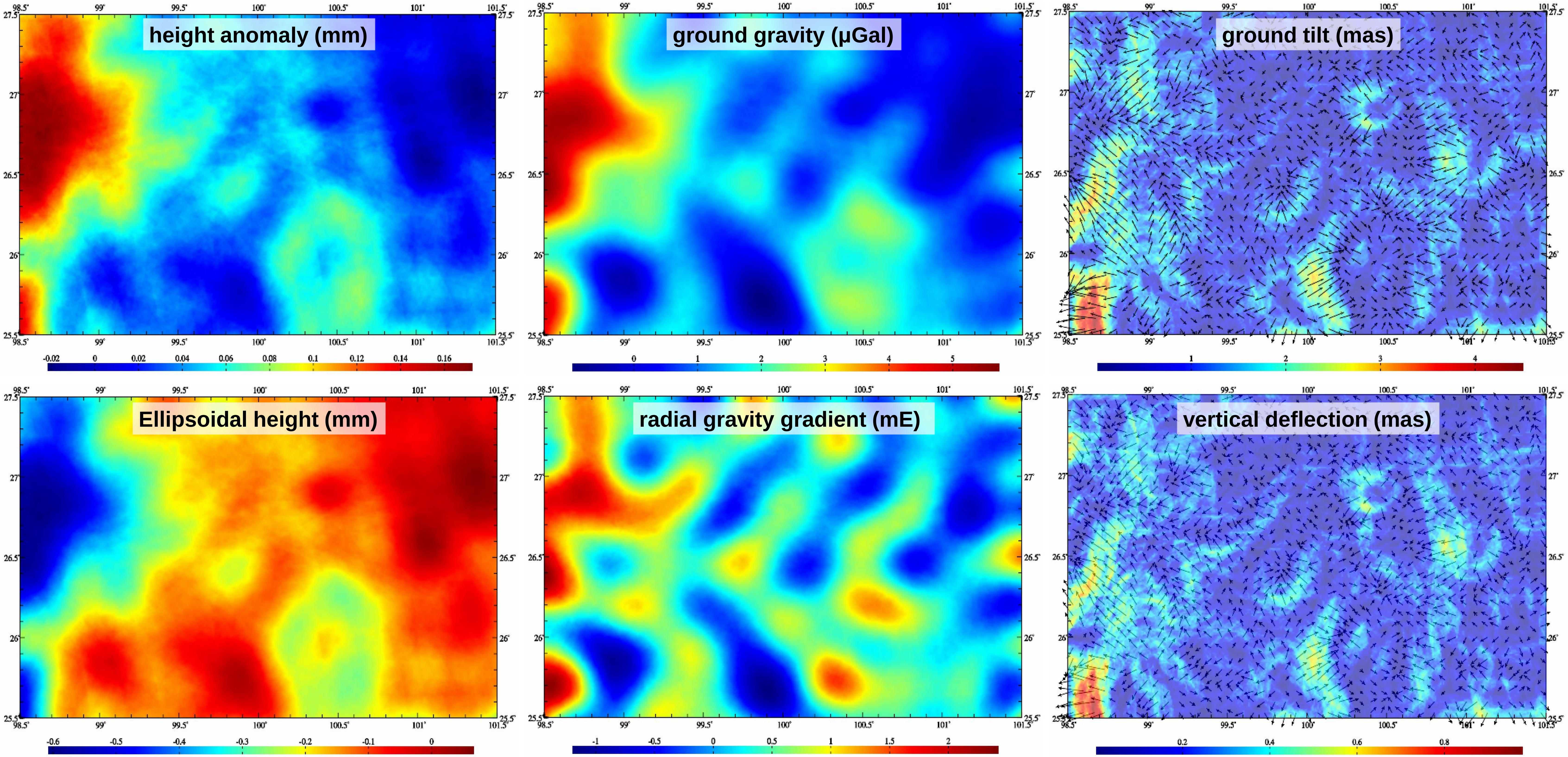

Geodynamic calculation on geodetic field grid time series
Inner product operation on two groups of vector grid time series
Open file
Save as
Import parameters
Start computation
Save process
Follow example
Time difference operation on variation (vector) grid time series
Horizontal gradient calculation on batch variation grids
Inner product operation on two groups of vector grid time series
Open any of variation grid time series files
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 coordina
Open any of the group 2 of grid time series files
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/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.
** The vector grid time series files searched by wildcard instantiation:
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/vtmgrid/cxpcbhl20150201.txt
C:/ETideLoad4.5_win64en/examples/Loadfmgridtmdyncalc/vtmgrid/cxpcbhl20151211.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: 2024-10-20 19:28:47
>> Complete the computation! There are 1 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.
>> Computation end time: 2024-10-20 19:28:47
Save the results folder
Import setting parameters
Start computation
4.5_win64cn › examples › Loadfmgridtmdyncalc
在 Loadfmgridtmdyncalc 中搜索
diftmgrd
gradtm
inner
tmgrid
vtmgrid
01.png
02.png
03.png
Local Disk (C:) › ETideLoad4.5_win64en › examples › Loadfmgridtmdyncalc › inner
名称
修改日期
类型
innerp2015011612.dat
2023/1/1 12:40
DAT 文件
118.500000 121.500000 27
-1.3621E+01 -8.9669E+00
-7.1405E+00 -1.3074E+01
-1.0886E+01 -3.2504E+00
2.5797E+00 -5.4586E+00
1.4446E-01 8.9566E+00
1.3136E+01 6.1190E+00
9.7614E+00 1.5272E+01
1.5901E+01 1.1258E+01
1.1402E+01 1.5798E+01
1.4560E+01 1.0659E+01
1.0319E+01 1.3146E+01
1.1412E+01 9.3384E+00
-1.2547E+01 -9.6995E+00
15011612
-1.3022E+01 -8.0485E+00 -1.3466E+01
1.5870E+01 1.1123E+01 1.5426E+01
1.1608E+01 1.5313E+01 1.1000E+01
1.4054E+01 1.0515E+01 1.3538E+01
1.0422E+01 1.2393E+01 9.8749E+00
1.0071E+01 8.6573E+00 9.1630E+00
-1.2723E+01 -9.1010E+00 -1.2506E+01



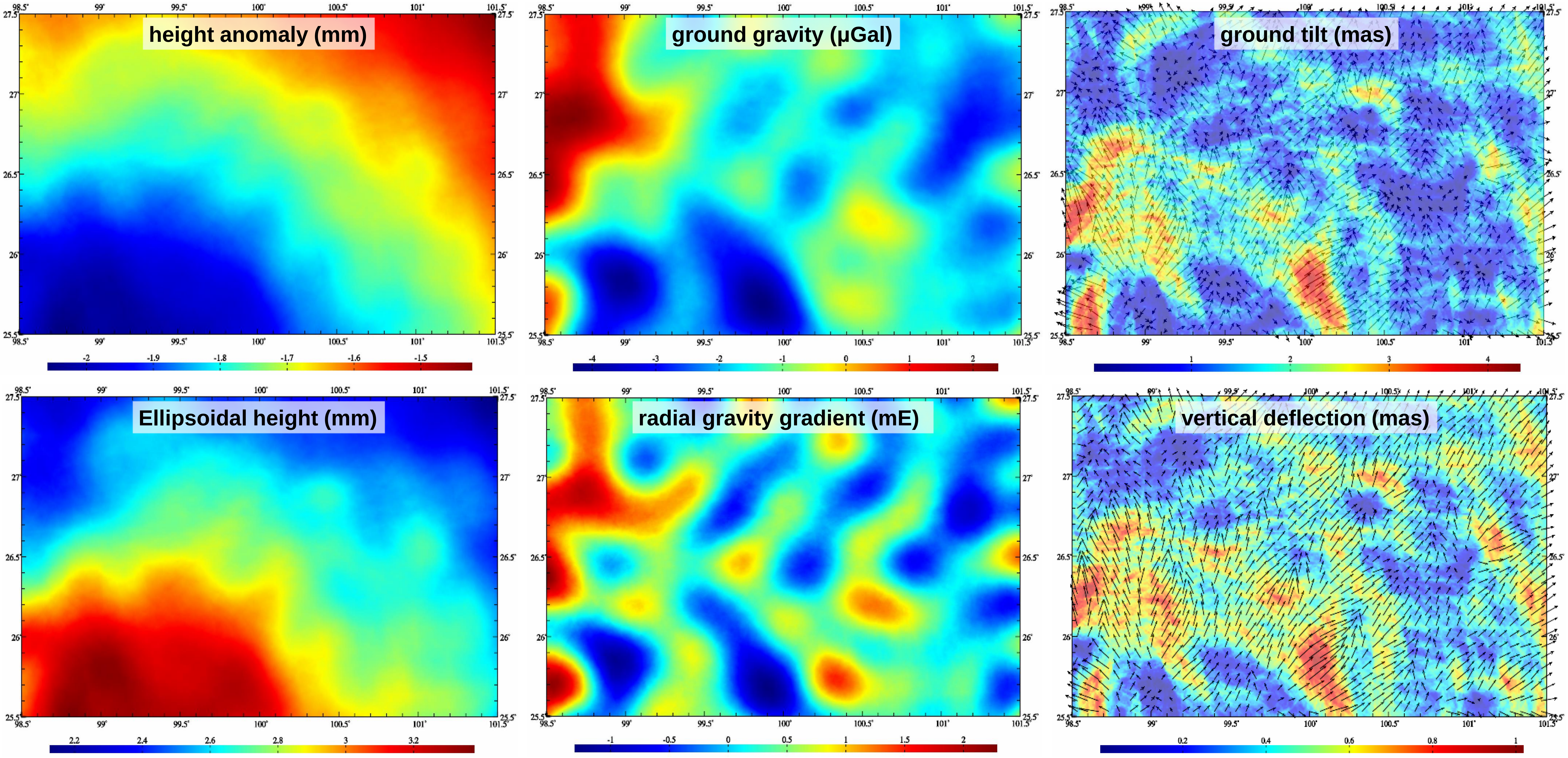




The 1′×1′ land water EWH variation observation, model value and residual grid in the calculation area

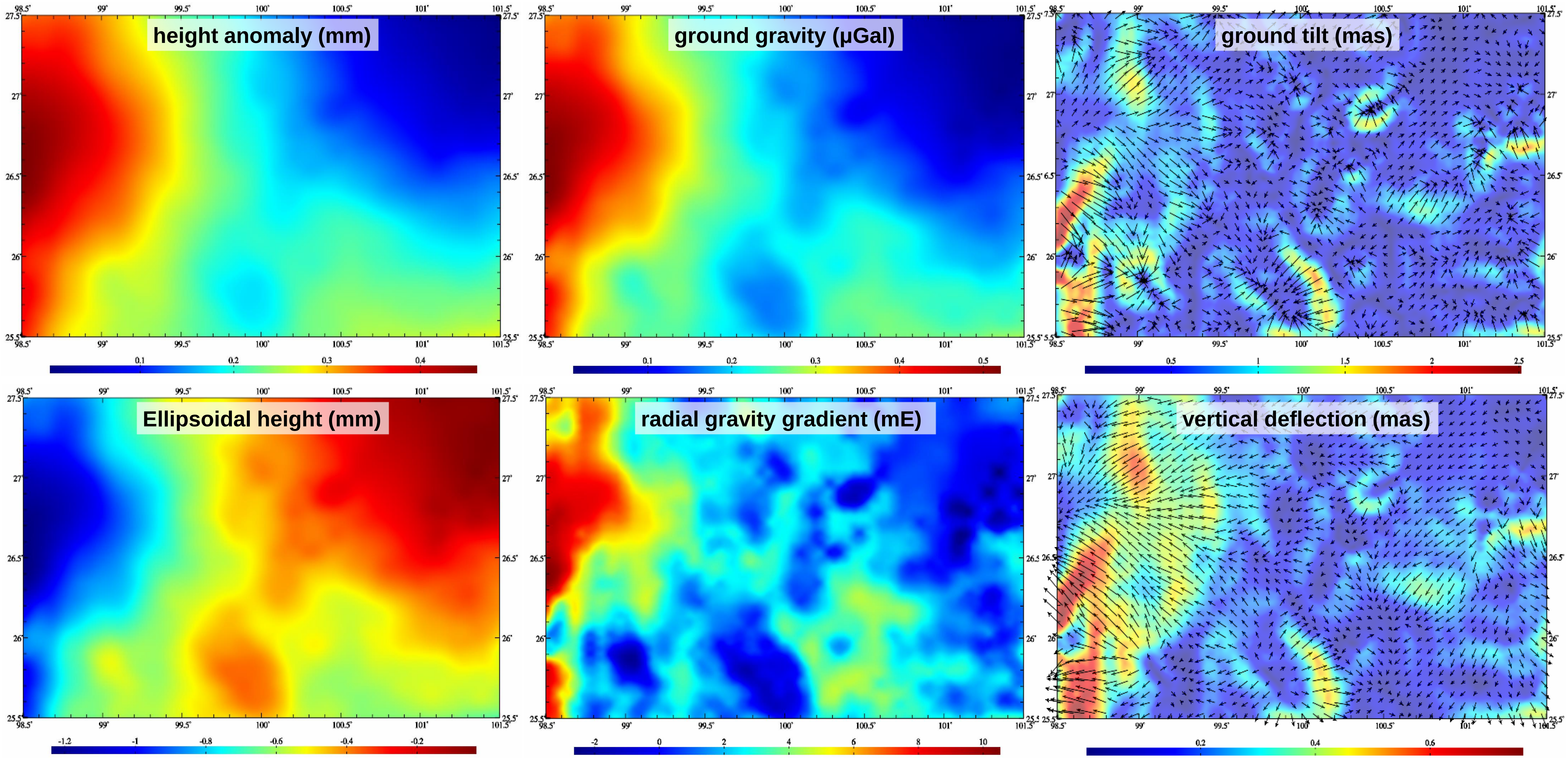


The 1′×1′ land water load deformation field residual value grid using load SRBF approach



The 1′×1′ land water variation load deformation field grid refined using SRBFs in the result area

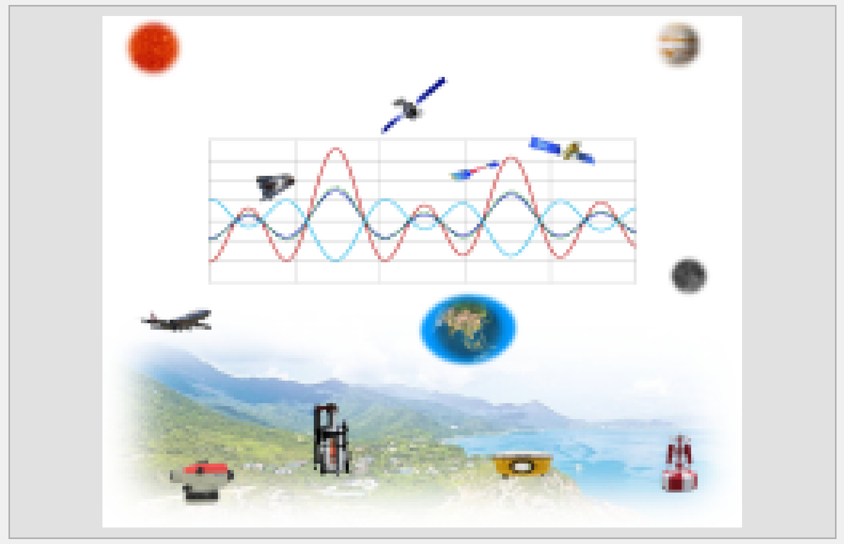
The numerical results by the load Green's function integral are larger, and the spatial short-wave structure of numerical results by the load SRBF approach are richer. The spatial distribution characteristics of various geodetic variations of load effects calculated by the two schemes are all similar.



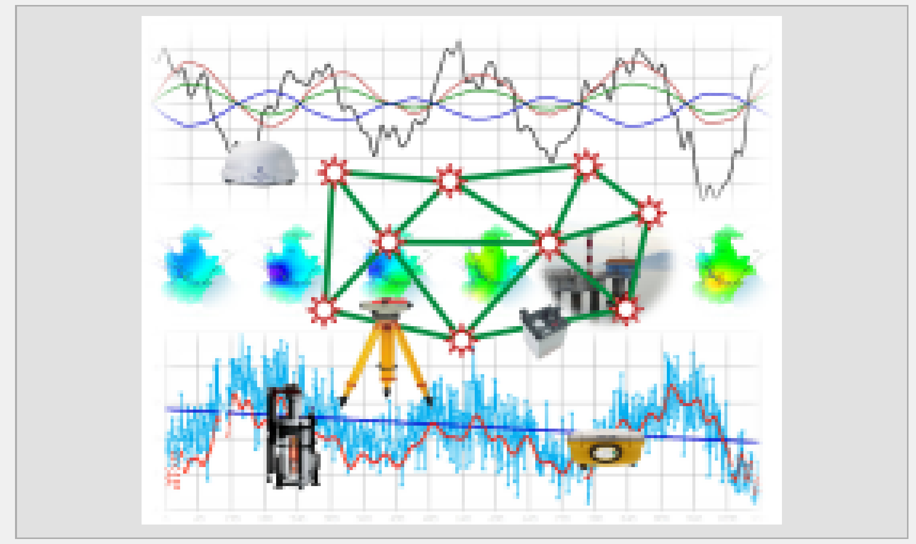
The 1′×1′ land water load deformation field residual value grid using load Green's integral in the result area

Earth Tide, Load Effects and Deformation Monitoring Computation 4.5

Summary, parameter settings and visualization for ETideLoad4.5



Computation of various tidal effects on all-element geodetic variations



Processing and analysis on non-tidal geodetic variation time series

- Analytically compatible geodetic and geodynamic algorithm package using the numerical standards unified and geophysical models coordinated
- Compatible with and improving of IERS conversations, relevant geodetic concepts clarified, algorithm formulas derivated and verificated completely
- Uniform computation of solid tidal, load tidal, polar shift and mass centric variation effects on all-element geodetic variations in whole Earth space
- Analytical computation of surface load effects on all-element geodetic variations and collaborative monitoring of time-varying Earth gravity field
- Geodetic monitoring of the surface hydrological environment and ground stability variations and prediction of their spatio-temporal evolution

www.zcyphygeodesy.com/en/

ETideLoad4.5 organization structure

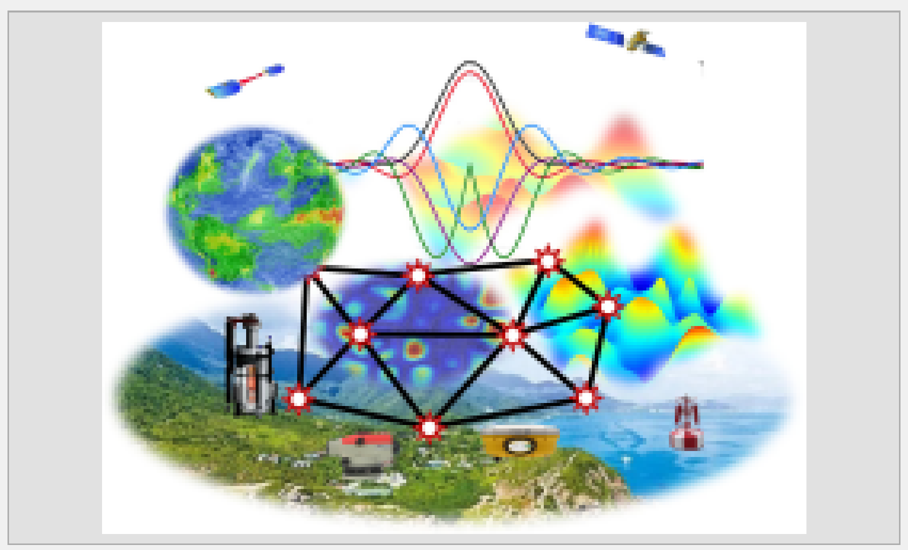
☆ Includes the basic principles, main formulas and important methods of geodesy on the deforming Earth to improve higher education environment.

☆ Can be employed to construct scientifically the technology environment for the deep fusion of multi-source heterogeneous earth data and collaborative monitoring of multiply heterogeneous geodetic system.

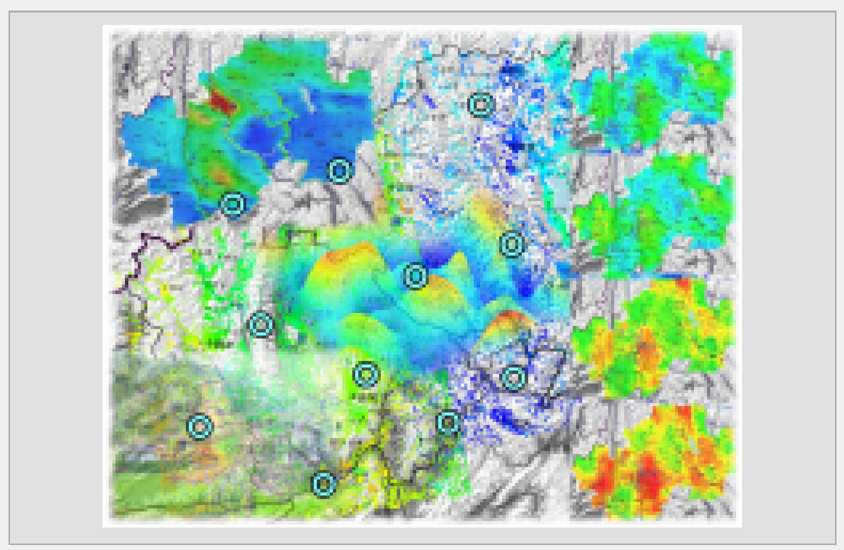
☆ There are the example files saved in the folder C:\ETideLoad4.5_win64en\examples\ for each Win64 program. It will take about 7 working days to complete all the example exercises. Thereafter, you can use ETideLoad4.5 alone.

Models and numerical standards

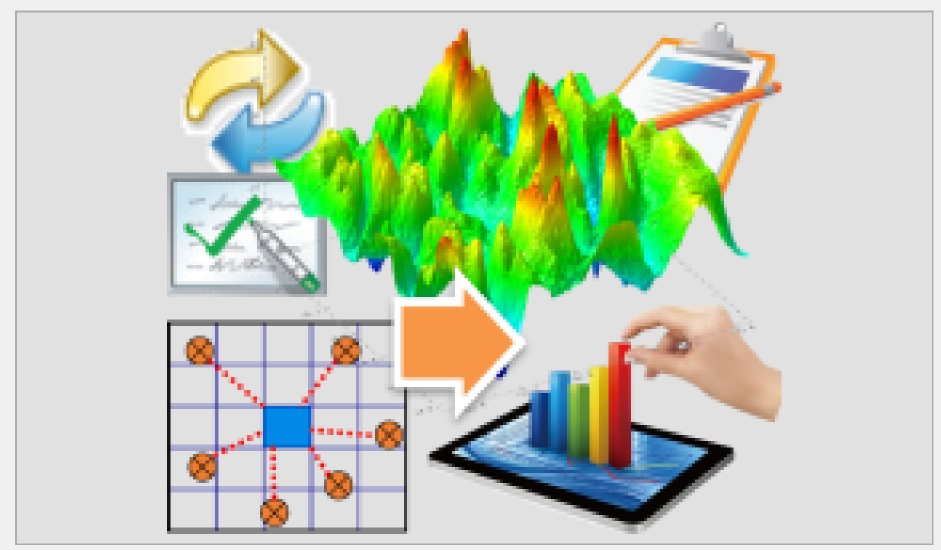
Geodetic variations in ETideLoad



Load deformation field approach and monitoring from heterogeneous variations



CORS/InSAR collaborative monitoring and ground stability estimation



Editing and calculation tools for geodetic data files

Classroom Teaching, Self-Exercise, Science Research and Engineer Computing