Demonstration of Land-Sea Bouguer and Isostatic Anomalies-Disturbaces Derived from a Geopotential Model

PAGravf4.5; https://www.zcyphygeodesy.com/en/
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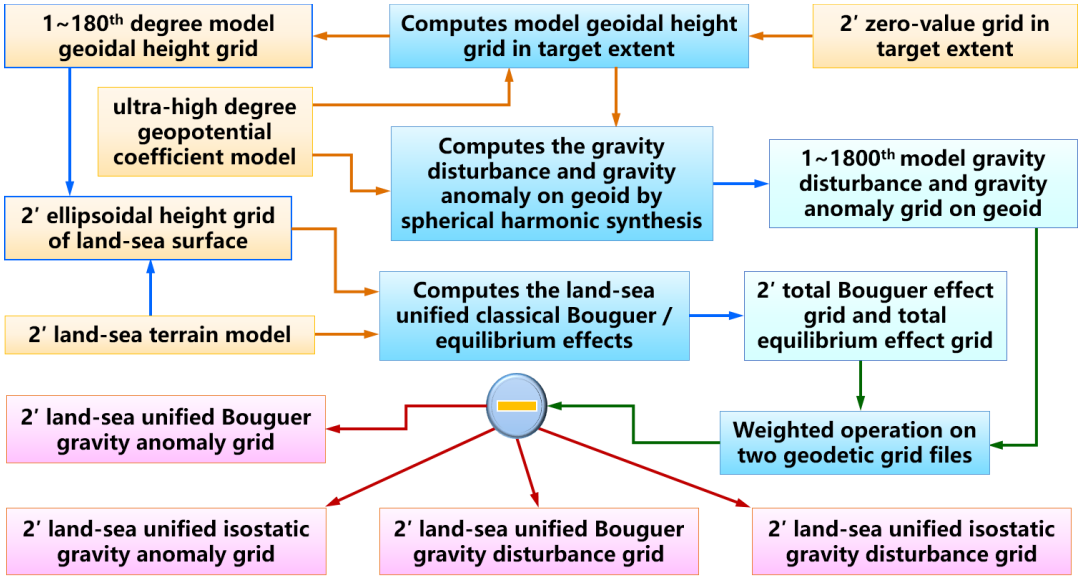
This module demonstrates a rapid workflow for computing classical Bouguer gravity anomalies (or disturbances) and isostatic gravity anomalies (or disturbances) for any global region. Utilizing an Earth geopotential coefficient model and a land-sea terrain mass spherical harmonic coefficient model, the process executes four key steps to synchronously generate unified land-sea anomaly models.



Computation Process of Land-Sea Bouguer and Isostatic Gravity Anomalies/Disturbances Derived from a Geopotential Model

(1) Construction of the Model Geoidal Height Grid (Degrees 1 – 180) as the Reduction Surface

Function Call: [Computation of Gravity Field Elements from a Global Geopotential Model].

Parameters:

- Degree Range: Min = 1, Max = 180.
- Output Type: Height Anomaly (approximating geoidal height in this context).

Inputs:

- Geopotential Model: EGM2008.gfc.
- Target Latitude and Longitude Extent Definition: Zero-value grid file zero2m.dat.

Output File: 2′×2′ Model Geoidal Height Grid: GMgeoidh2m_180.ksi.

Physical Role: This grid serves as the gravity reduction surface and the reference surface for subsequent classical Bouguer and isostatic anomaly computations.

(2) Computation of Gravity Anomaly and Disturbance on the Geoid from a a Global Geopotential Model

Function Call: [Computation of Gravity Field Elements from a Global Geopotential Model].

Parameter Settings:

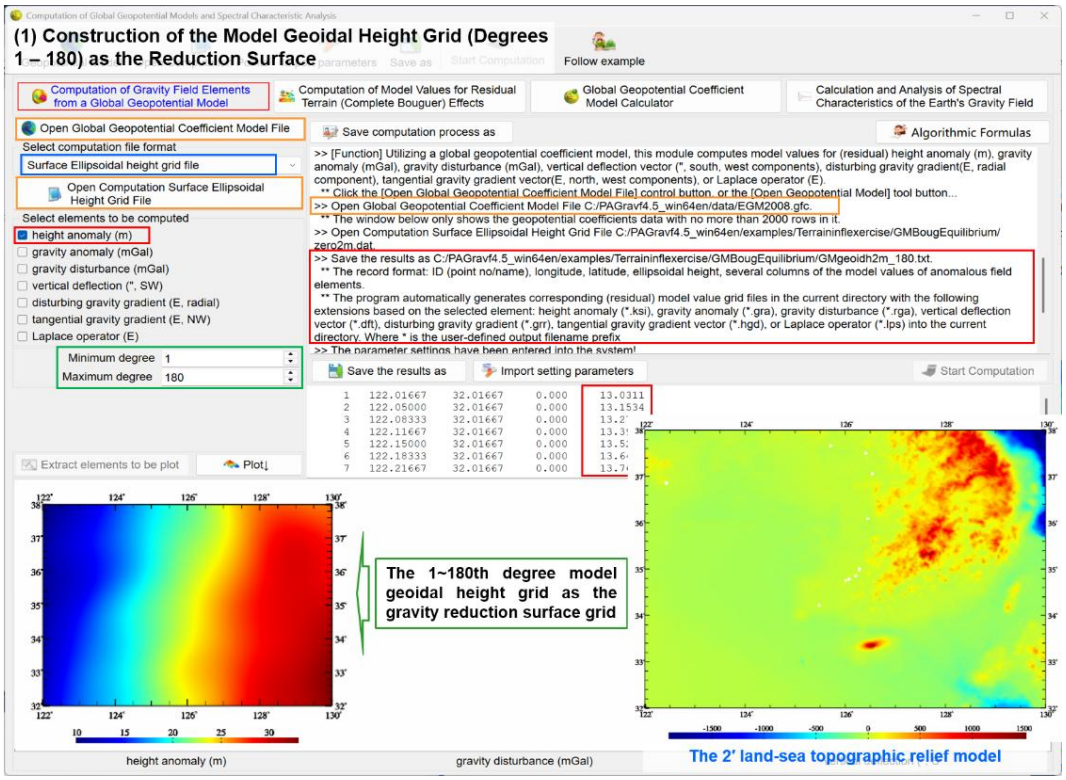
- Degree Range: Min = 1, Max = 1800.
- Output Elements: Select both Gravity Anomaly and Gravity Disturbance.

Input Files:

- Geopotential Model: EGM2008.gfc.
- Computation Surface: The model geoidal height grid GMgeoidh2m_180.ksi generated in Step (1).

Output Files:

- 2′×2′ Gravity Anomaly Grid: EGM2008_2m_1800.gra.
- 2′×2′ Gravity Disturbance Grid: EGM2008_2m_1800.rga.

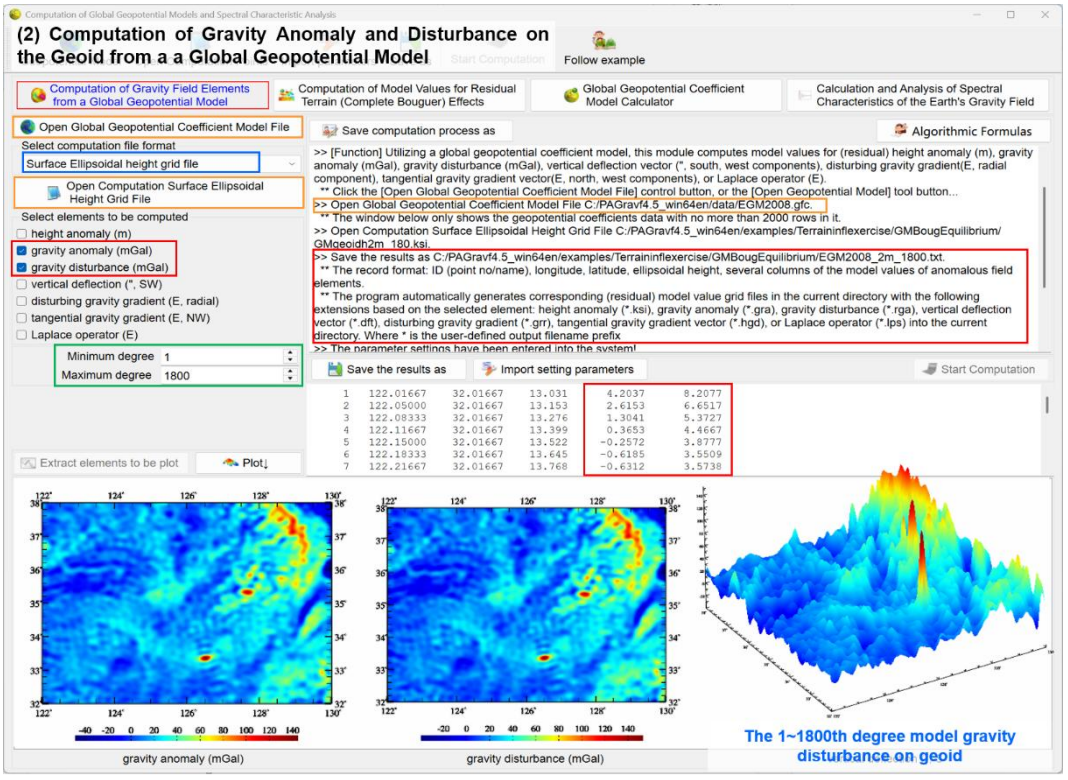


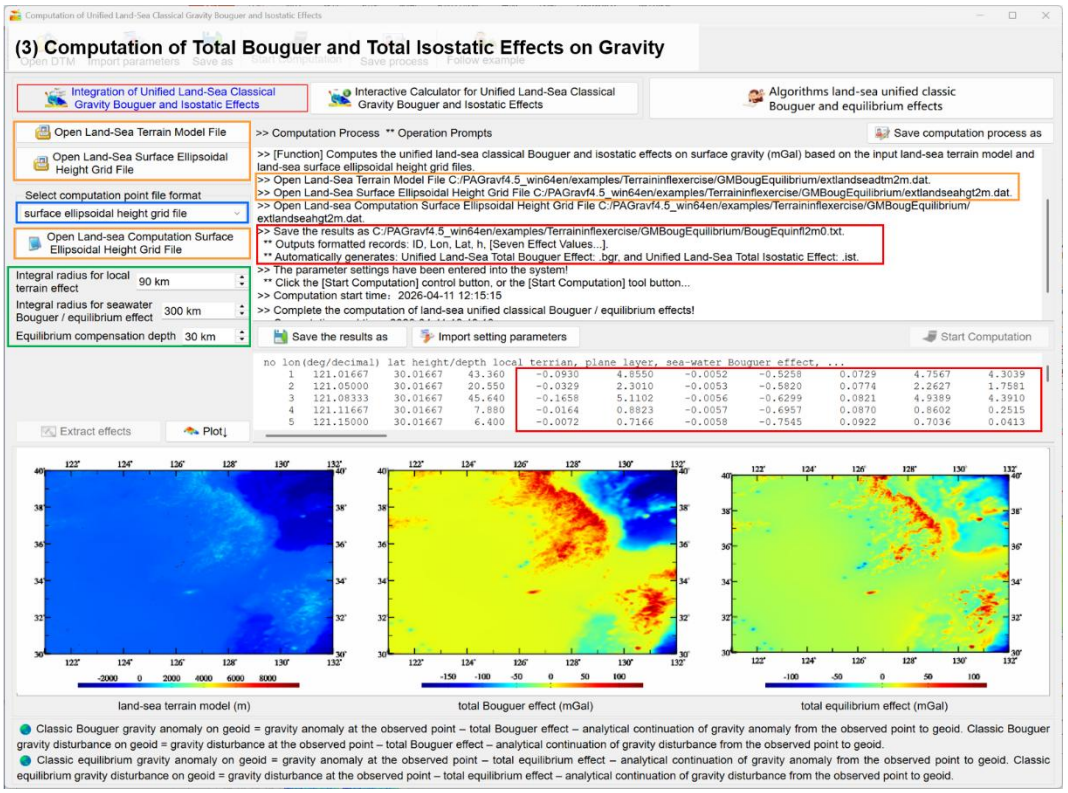
(3) Computation of Total Bouguer and Total Isostatic Effects on Gravity

Function Call: [Integration of Land-Sea Unified Classical Gravity Bouguer / Equilibrium Effect].

Input Files:

- Land-Sea Terrain Model: extlandseadtm2m.dat.
- Land-Sea Surface Ellipsoidal Height Grid: extlandseahgt2m.dat.





Parameter Settings:

- Land Integration Radius: 90 km.

● Sea Integration Radius: 200 km.

● Isostatic Compensation Depth: 30 km.

Output Files:

● 2′×2′ Total Bouguer Effect Grid: BougEquinfl2m.bgr.

● 2′×2′ Total Isostatic Effect Grid: BougEquinfl2m.ist.

Theoretical Note: Given the invariance of the normal gravity field with respect to the chosen reference surface, the computed Bouguer/Isostatic effects are numerically identical for both gravity anomalies and gravity disturbances. Consequently, there is no need to distinguish between these two quantities in the reduction process.

(4) Generation of Land-Sea Unified Classical Bouguer and Isostatic Gravity Anomaly/ Disturbance Grids

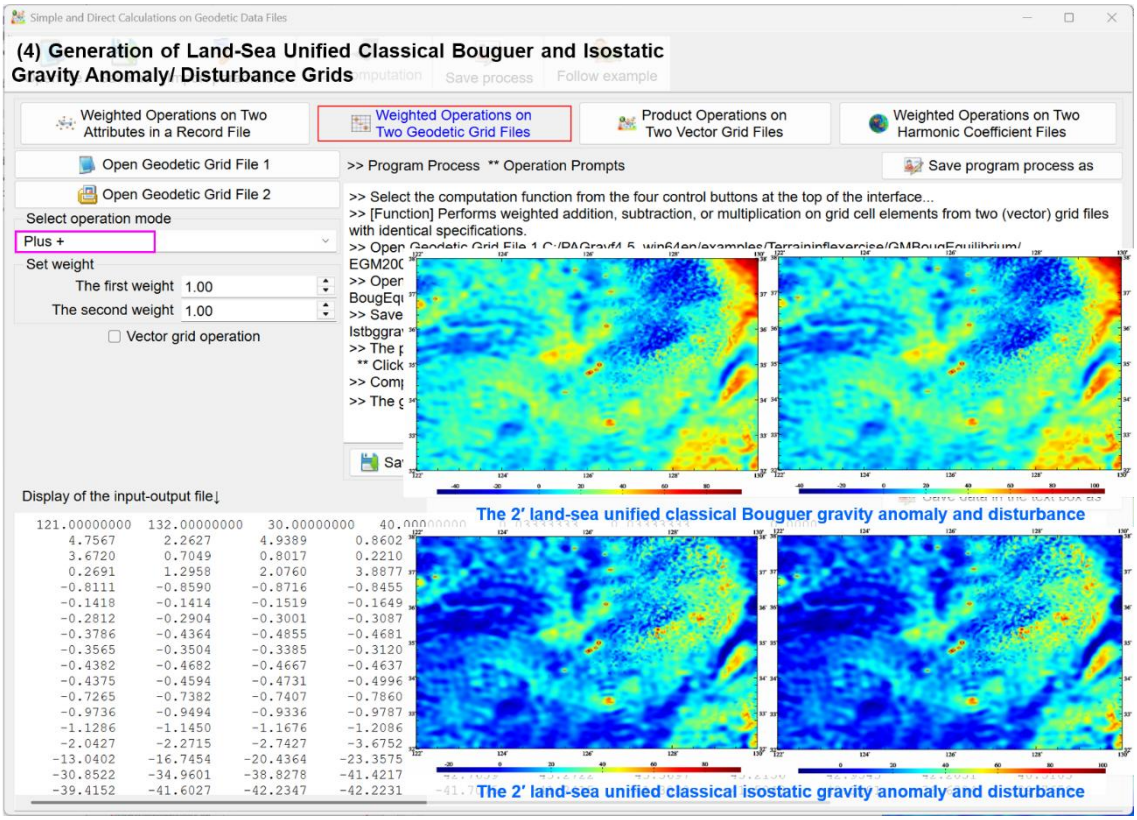
Classical Bouguer Anomalies:

● Operation: Subtract the edge-truncated total Bouguer effect grid (BougEquinfl2m0.bgr) from the geoid-based gravity anomaly (EGM2008_2m_1800.gra) and gravity disturbance (EGM2008_2m_1800.rga) grids, respectively.

● Output Models:

○ Classical Bouguer Gravity Anomaly Model: Clsbggravanom2m.dat.

○ Classical Bouguer Gravity Disturbance Model: Clsbgdistgrav2m.dat.



Classical Isostatic Anomalies:

● Operation: Subtract the edge-truncated total isostatic effect grid (BougEquinfl2m0.ist) from the geoid-based gravity anomaly (EGM2008_2m_1800.gra) and gravity disturbance

(EGM2008_2m_1800.rga) grids, respectively.

- Output Models:
  - Classical Isostatic Gravity Anomaly Model: Istbggravanom2m.dat.
  - Classical Isostatic Gravity Disturbance Model: Istbgdistgrav2m.dat.