A Matlab-based Tool for the Analysis of Global Gravity Effects

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Motivation

Major sources of gravity variations are observed by superconducting and absolute gravimeters are related to atmospheric and hydrological mass variations. The gravity response to these variations must be considered at the regional to global scale. Otherwise, observed and non-observed signals typical for regional variations remain in gravity residuals. The analysis of global hydrological effects is a challenging task, as those signals may be distributed over several months. Nevertheless, there have been major differences between atmospheric effects based on single satellite factors and those considering global weather models. However, the availability of those atmospheric reanalysis is limited to selected groups of sites with superconducting gravimeters maintained within the GGP (Global Geodynamics Project).

The Matlab-based tool for the analysis of global gravity effects, mGlobE, enables the computation of the global contribution of atmospheric, continental water storage and ocean to gravity variation. The mGlobE results are evaluated at three superconducting gravimeter sites (Conrad, Vienna, Sutherland) and compared to data from other sources (ATMACS, GGP/Strasbourg loading service).

Atmosphere

- Input: ERA interim surface pressure and wind fields, reanalysis model pressure levels
- Output: temporal gravity component
- Specific features: ERA coupling and reduced gravity signal model for mean up to 1.5

Water storage

- Input: gridded water storage (sea level, glacier, snow, soil water, continental groundwater, lakes, etc.)
- Output: temporal gravity component
- Specific features: continental and oceanic contributions

References


Conclusions

Main features and benefits of mGlobE:

- Computation of gravity response to large-scale variations for any location worldwide, i.e., suitable for all absolute or superconducting/relative gravimeters
- Implementation of several hydrological models including GRACE, land mass models, and ocean models
- The inclusion of different models allows the uncertainty estimation of gravity response to continental water storage and ocean bottom pressure variations
- Computation of gravity response to large-scale variations for any location worldwide, suitable for all absolute or superconducting/relative gravimeters where seasonal and interannual signals typical for large-scale variations remain in gravity residuals.

mGlobE will be freely available.

Acknowledgement

The authors thank Henryk Dobslaw (GFZ German Research Centre for Geosciences) for the provision of OMCT ocean bottom pressure model. The data used in this study were acquired as part of the mission of NASA's Earth Science Division and archived and distributed by the Goddard Earth Sciences (GES) Data and Information Services Center (DISC). GRACE final data available at http://grace.jpl.nasa.gov/) processing algorithms were provided by San Walker, and supported by the NASA Satellite Program. Monthly ECCO Ocean Bottom Pressure data were acquired from http://gtopo30.gapa.gov.