International Centre for Global Earth Models (ICGEM)

web: http://icgem.gfz-potsdam.de

I C G E M

Service Report (2003-2007)

Terms of Reference

The determination of the Earth's global gravity field is one of the main tasks of Geodesy: it serves as a reference for geodesy itself, and it provides important information about the Earth, its interior and its fluid envelope for all geosciences. Thus, it is important to make the models of the global gravity field available to the public as products of geodesy. This becomes increasingly important as time variations of the global gravity field can be measured with better and better spatial and temporal resolution.
The calculation of the different functionals of the geopotential (e.g.: geoid, gravity anomaly, gravity disturbance, equivalent water height) from a defined global model, on a specified grid and with respect to a defined reference system, is far from being trivial and a responsibility of geodesy too.
Additionally, it is important to make the spatial structure and temporal variability of the global gravity field available to the general public in a graphic vivid manner.
In particular for temporal gravity models, aspects of consistency in processing, reference frame, and parameterization are becoming more and more important.
ICGEM has been established in 2003 as a new service under the umbrella of the new International Gravity Field Service (IGFS) as one of six centres.

Objectives

- collecting and long-term archiving of existing global gravity field models
- making them available on the web
- use of standardised format (self-explanatory)
- interactive visualisation of the models
- monthly solutions from GRACE included
- web-interface to calculate gravity functionals from the spherical harmonic models on freely selectable grids (filtering)
- evaluation of the models
- monitor consistency of models
- contribution to IGeS schools

Services

The Models
Currently, 98 models are listed with their references and 79 of them are available in form of spherical harmonic coefficients. If available, the link to the original model web site has been added. Models from dedicated time periods (e.g. monthly solutions from GRACE) of CSR, JPL, CNES/GRGS and GFZ are also available.

The Format
The spherical harmonic coefficients are available in a standardised self-explanatory format which has been accepted by ESA as the official format for the GOCE project.

The Visualisation
An online interactive visualisation of the models (height anomalies and gravity anomalies) as illuminated projection on a freely rotatable sphere is available. Monthly solutions from GRACE are included. Differences of two models, arbitrary degree windows, zooming in and out, are possible. The visualisation of single spherical harmonics is possible for tutorial purposes.

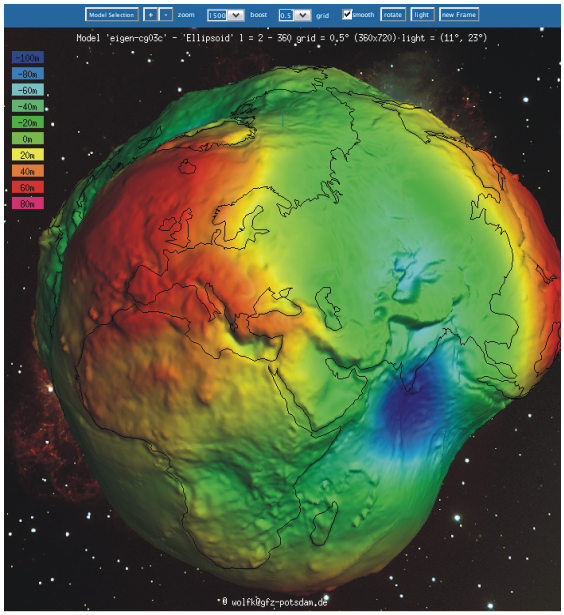

Fig. 1: Visualisation (geoid) of a global gravity field model

The Calculation Service
A web-interface to calculate gravity functionals from the spherical harmonic models on freely selectable grids, with respect to a reference system of the user's choice, is provided. The following functionals are available:
- height anomaly

- geoid height
- gravity disturbance
- gravity disturbance in spherical approximation
- gravity anomaly (classical and modern definition)
- gravity anomaly (in spherical approximation)
- equivalent water height (water column)

Filtering is possible by selecting the range of used coefficients or the filter length of a Gaussian averaging filter. The calculated grids (self-explanatory format) and corresponding plots (postscript) are available for download after some seconds.

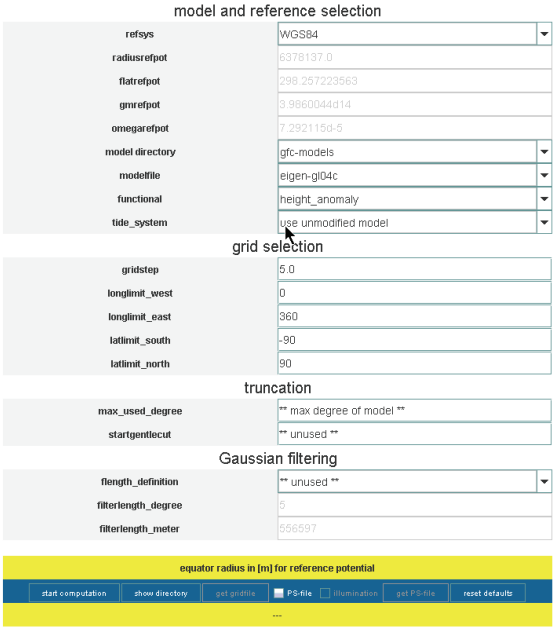

Fig. 2: Input mask of the calculation service

Evaluation

For a concise evaluation of the models, comparisons with GPS-levelling data and with the most recent combination model in the spectral domain are provided.

Root mean square (rms) about mean of GPS / levelling minus gravity field model derived geoid heights [m]

Model	Nmax	USA 6169 points	Canada 1930 points	Europe 186 points	Australia 201 points
ITG-GRACE02S	170	0.638	0.513	0.638	0.499
EIGEN-GL04S1	150	0.642	0.579	0.703	0.473
EIGEN-GL04C	360	0.363	0.261	0.332	0.262
EIGEN-CG03C	360	0.367	0.311	0.397	0.277
GGM02C	200	0.491	0.381	0.492	0.390
GGM02S	160	0.986	1.120	1.282	1.362
EIGEN-CG01C	360	0.374	0.277	0.412	0.281

Fig. 3: Table (truncated) of comparison of the models with GPS-levelling

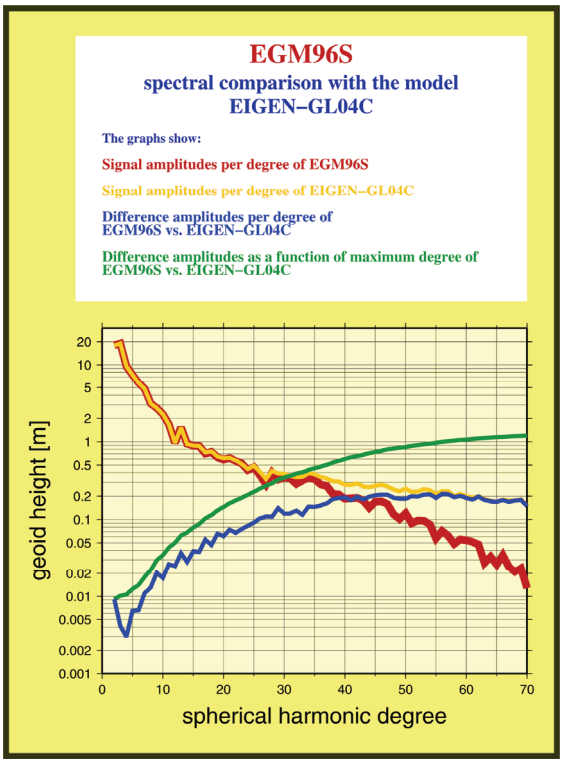

Fig. 4: Comparison of the models (e.g.: EGM96) with the most recent combination model in the spectral domain (e.g. EIGEN-GL04C)

Data Policy

Access to global gravity models, derived products and tutorials, once offered by the centre, shall be unrestricted for any external user.

Staff

ICGEM is hosted by GFZ Potsdam. Its staff consists of
- Jürgen Kusche (Director)
- Franz Barthelmes
- Wolfgang Köhler
- Hartmut Pflug

Point of Contact

Franz Barthelmes
GeoForschungsZentrum Potsdam
Telegrafenberg
D-14473 Potsdam
Germany
E-mail: bar@gfz-potsdam.de