International Centre for Global Earth Models (ICGEM)

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

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Overview

The ICGEM service which was established in 2003 as a new service of International Gravity Field Service (IGFS) continues to make the global gravity field models available to public. The service does not only provide the model coefficients publicly available but also presents an interactive platform for the interested users to calculate and visualize the global gravity field functionals and also a discussion forum for users to raise their questions or convey their messages and feedback. Since the beginning of the service, the user profile has changed and widely expanded. Now, users practicing other disciplines (e.g., planetary science, geology) or users working in industry, mapping companies and agencies are also interested in ICGEM products and they communicate ICGEM team closely for further information and analyses.

In order for users to benefit the current ICGEM products and coming GRACE-FO mission products more efficiently, ICGEM has launched the new ICGEM service which is designed to improve the users experience with the service outcomes. Also, the new service is more flexible from the point of administration and promises continuous improvement. The new ICGEM website is designed to encourage the researchers to use the latest model products for education and research purposes. The complete list of ICGEM service products can be found in Geodesist's Handbook 2016 and recently published Frequently Asked Questions of ICGEM Service. Below is a summary of the activities that have been initiated and performed during 2016-2017.

Services

New ICGEM Server

The ICGEM Service has been renewed from technical, administration and presentation perspectives which was a very important step to develop a new flexible platform for future applications and plans particularly applicable to GRACE-FO mission. The programs used in the calculation service have not been changed. Therefore, the calculations in the new platform are identical to the calculations of previous service settings. Following up the launch of GRACE-FO, new products are planned to be made available under the same environment.

Models and their Evaluations

Apart from the 153 static models that was previously available through the ICGEM service, 8 new models have been added to the list. Similar to the previous ones, these models are provided in the standardised self-explanatory format and in the form of spherical harmonic coefficients with DOI numbers assigned to each.

The static models, temporal models as well topography related models can be found under Gravity Field Models. Figure 1 shows a screenshot of the table of the static models. User can access the reference of the model that was provided to ICGEM on the same page and access to the links to download the model coefficients, calculate the gravity functionals and also to visualize the geoid and gravity anomalies.

Spectral comparisons of the models with respect to one of the latest combined models, EIGEN-6C4 can be found under "Evaluation of Models". Moreover, user can access the overall root mean square results of the model-derived geoid comparisons with respect to GNSS/levelling-derived geoid undulations as presented in Figure 2. The columns can be reordered by simply clicking on the title of the column. The comparisons are limited to 6 different regions (USA, Canada, Europe, Australia, Japan, and Brazil) at the moment and will be extended as the GNSS/levelling data from other countries become available.

Figure 1: A screenshot from the table of static models in the new website.

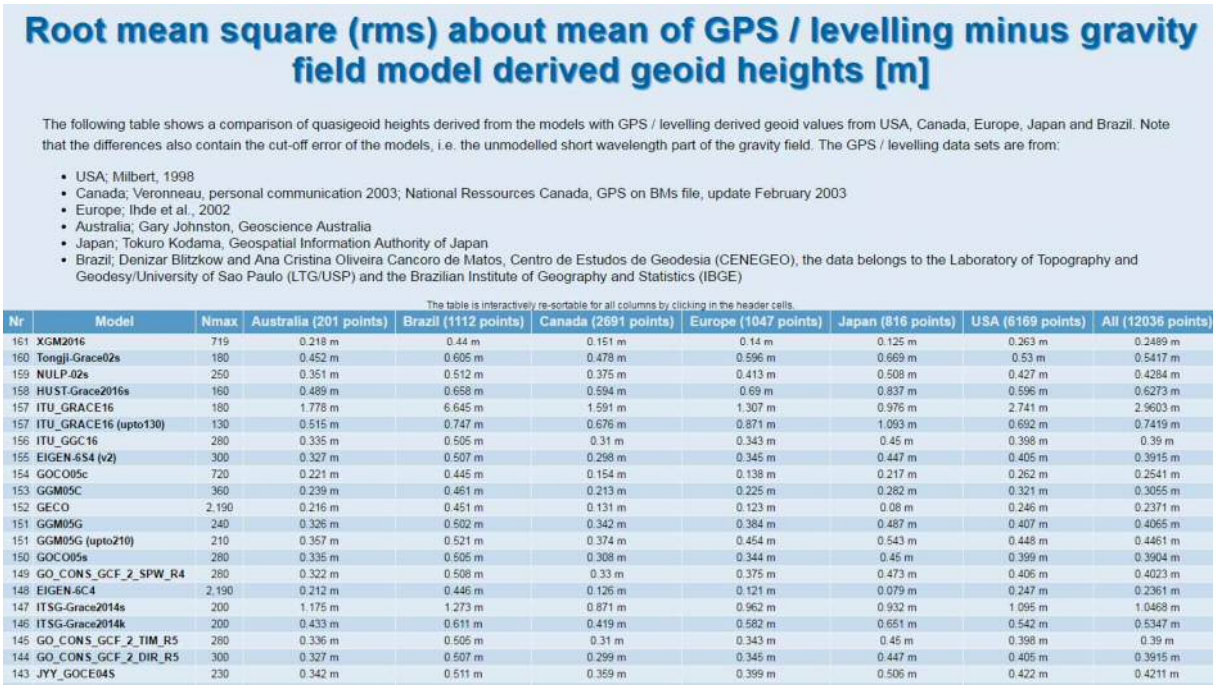

Figure 2: Evaluation of the models in 6 countries and all data available areas wrt to GNSS/levelling derived geoid undulations.

The Calculation Service

An improved user-friendly 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 for gravity field model computations:

- pseudo height anomaly on the ellipsoid (or at arbitrary height over the ellipsoid)
- height anomaly (on the Earth's surface as defined)
- geoid height (height anomaly plus spherical shell approximation of the topography)
- gravity disturbance
- gravity disturbance in spherical approximation (at arbitrary height over the ellipsoid)
- gravity anomaly (classical and modern definition)
- gravity anomaly (in spherical approximation, at arbitrary height over the ellipsoid)
- simple Bouguer gravity anomaly
- gravity on the Earth's surface (including the centrifugal acceleration)
- gravity on the ellipsoid (or at arbitrary height over the ellipsoid, including the centrifugal acceleration)
- gravitation on the ellipsoid (or at arbitrary height over the ellipsoid, without centrifugal acceleration)
- potential on the ellipsoid (or at arbitrary height over the ellipsoid, without centrifugal potential)
- second derivative in spherical radius direction of the potential (at arbitrary height over the ellipsoid)
- equivalent water height (water column)

Filtering is possible by selecting the maximum degree of the used coefficients or the filter length of a Gaussian averaging filter. The models from dedicated time periods (e.g. coefficients of monthly solutions from GRACE) are also available after non-isotropic smoothing (decorrelation).

A screenshot of the new interface is presented in Figure 3. Now the user can select the calculation area using the grid selection tool by simply changing the boundaries of the area on the figure visually or enter exact latitude and longitude values to the boxes provided under the figure. The calculated grids (self-explanatory format) and corresponding plots (See Figure 4) are available for download after a few seconds or a few minutes depending on the functional, the maximum degree expansion chosen and the number of grid points.

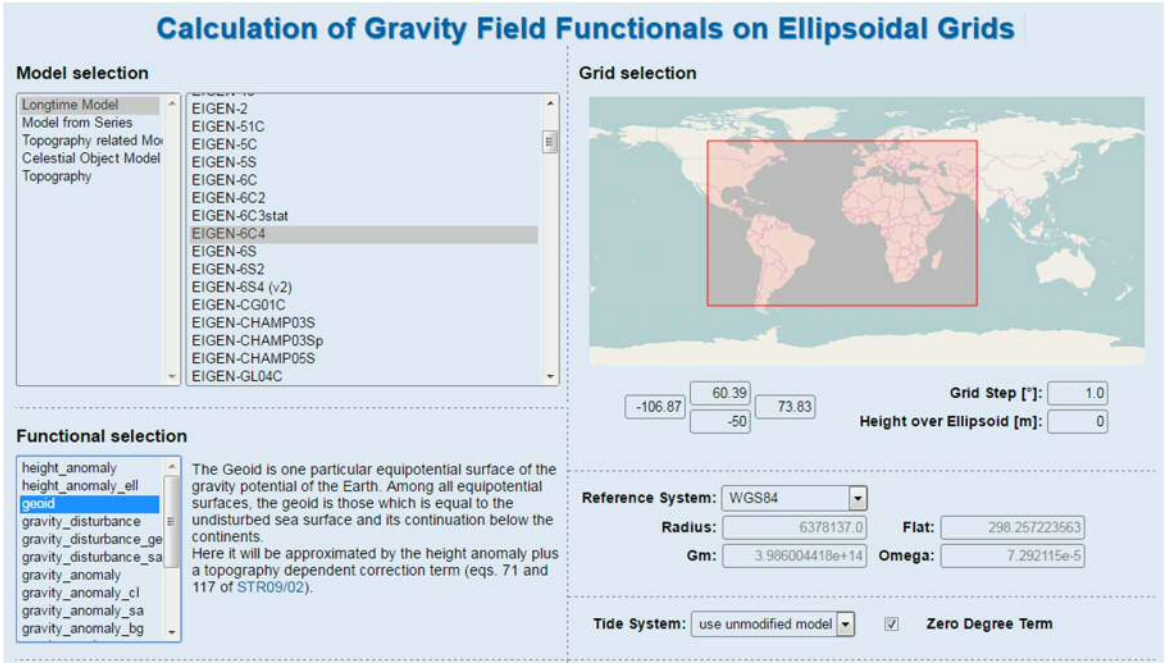

Figure 3: A screenshot of the calculation service with the improved function of grid selection.

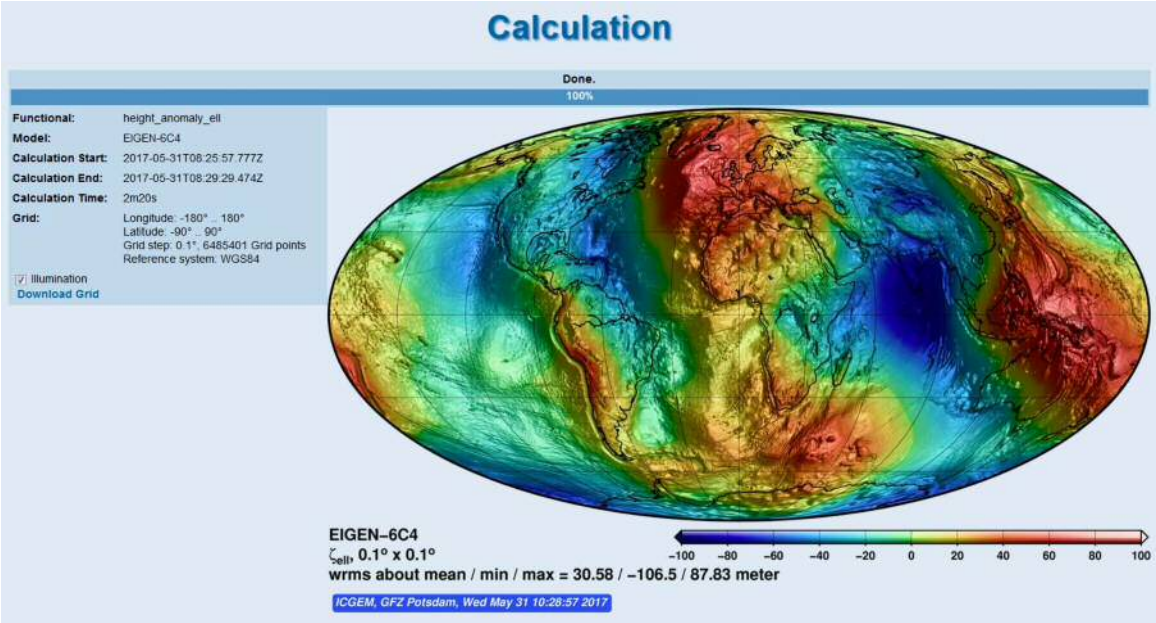

Figure 4: An example of geoid undulation computed using the calculation service.

3D Visualization

An online interactive visualisation of the static models (height anomalies and gravity anomalies), temporal models, trend and annual amplitude and spherical harmonics as illuminated projection on a freely rotatable sphere is available on the new server too (See Figure 5). Static model visualization enables to visualize the differences of two models with a selected grid interval and spherical harmonic degree expansion. Zoom in and out functions are available.

Visualization of temporal models provide computation of geoid undulation and water column from different daily and monthly models with an option of unfiltered or filtered model coefficients. The visualization tool can be used for animation purposes. Visualization of trend and annual amplitude of GRACE measurements that are collected between 2002 and 2015 are also available. Lastly, visualization of spherical harmonics with selected degree and order and rotation option is available for educational purposes.

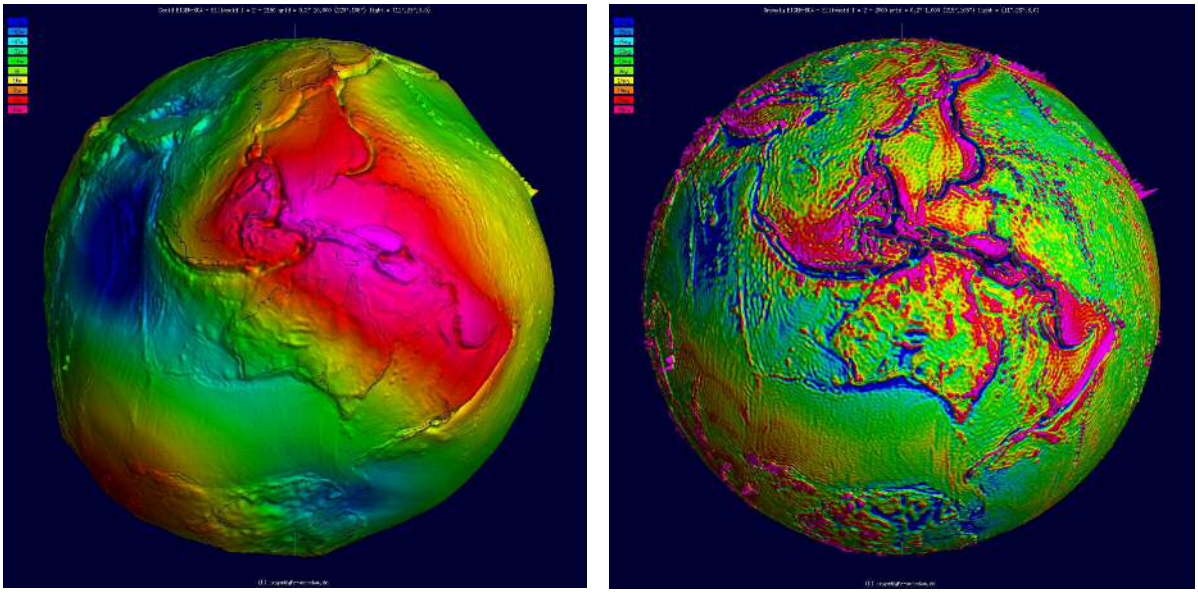

Figure 5: Visualization of geoid undulations (left) and gravity anomalies (right) that are computed based on one of the recent combined global gravitational field model EIGEN-6C4 expanded up to its highest degree and order.

Discussion Forum
Since the interaction between the users and ICGEM team members involves extensive communications via the service and as well as e-mails, the definition of the guest book needs to be redefined. The old guest book is modified as a forum which represents the current status of the platform better.

The new version of this page should give the users the opportunity to discuss things among themselves or answer each other's question as it is the case in most of the forums. In the following stages, sub-sections for different topics will be created.
Anyone without any registration requirement should still be able to write comments in the forum. However, an approval from the ICGEM team is required in order the comment to be available on the website.

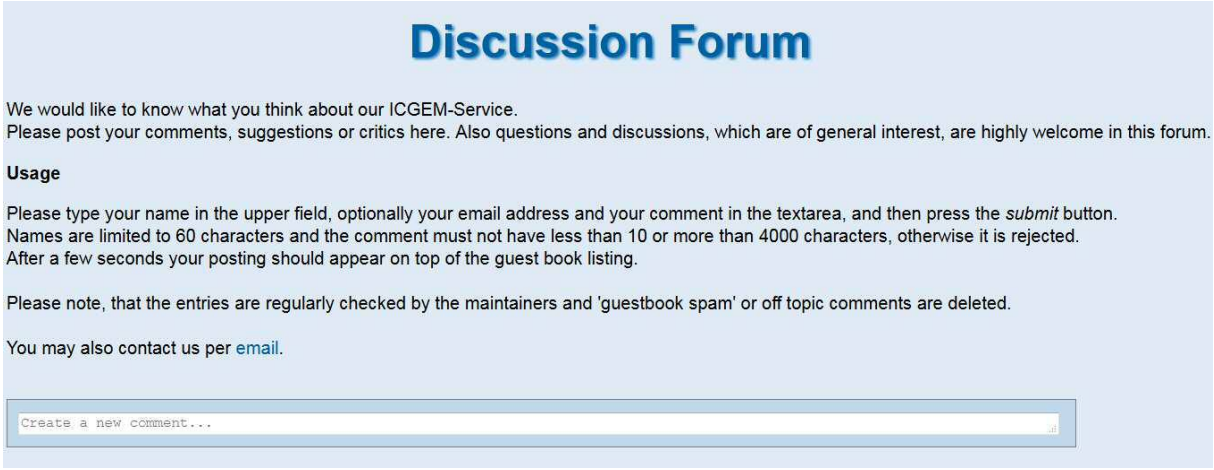

Figure 6: A snapshot from the new interface of the discussion forum.

FAQs (Frequently Asked Questions)
Apart from the discussion forum, FAQs selected from the users' most frequently asked questions are listed and prepared as a pdf document for the users' convenience. The questions are answered to meet the needs of both the users from different disciplines and industry related background, as well the ones who are expert in the field of physical geodesy. Eventually, the FAQs can be expanded and modified depending on the users' interest and responses. The last version of the FAQs can be accessed via http://icgem.gfz-potsdam.de/faq.

Data Policy

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

ICGEM Team

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Publications

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