Minutes of the Meeting of IAG JWG 2.1.1
Establishment of a global absolute gravity reference system

EGU General Assembly in Vienna, Austria
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Chair: Hartmut Wziontek (Germany)
Vice-chair: Sylvain Bonvalot (France)

The meeting was opened with a summary of the previous meeting held at EGU 2017, introducing the concept of the absolute gravity reference system, which should be based on absolute gravimeters (AG) monitored at reference stations and intercomparisons. The foundation is the Resolution No. 2 of IAG from 2015 and the strategy paper of CCM and IAG. Besides the establishment of a long term stable reference, an easy accessible infrastructure needs to be established to replace IGNS 71.

Reference stations

The selection of reference stations was discussed. To enable a link to space geodetic techniques, GGOS core stations should be included and the operators are encouraged to perform regular absolute gravity observations and establish a continuous monitoring of gravity variations at co-located sites.

The International Geodynamics and Earth Tide Service (IGETS) currently includes 37 active stations where superconducting gravimeters (SG) are operated. However, the instrumental drift of the SG must be determined by AG. Therefore regular observations with AG on IGETS sites are recommended. A service needs to be established to ensure a combination of both observation types to derive a continuous reference function of absolute gravity from SG time series.

The NERC Space Geodesy Facility at Herstmonceux, UK was proposed as reference site. The station operates a satellite laser ranging (SLR) system and GNSS and is an important contributor to the ITRF. Repeated monthly AG observations since 2006 provide reliable information about gravity and its temporal changes. The station servers as a national reference for UK. Further, there plans for a new site in Scotland.

The Canadian Geodetic Survey (CGS) sent a brief report about their infrastructure in Canada prior to the meeting. The CGS has established a national network of more than 60 absolute gravity stations which are revisited on a yearly basis to a maximum of ten years apart. The distribution and description of the stations can be viewed online[1]. The core site for absolute gravimetry is CAGS (Canadian Absolute Gravity Site) located north of Ottawa and is equipped with a SG and four absolute stations. CGS attended International Comparison of Absolute Gravimeters, recently and recently regional comparison in Boulder, Colorado organized by the US National Geodetic Survey (NGS).

The AGrav database, operated by BGI and BKG was developed to host also AG comparison results similar to the KCDB of BIPM and was extended with time series plots of observations and a report function. AGrav will serve as a central archive for the absolute gravity reference system.

Digital object identifier (DOI) will be assigned by BGI for AG observations stored in AGrav based on the prefix `10.18168/BGI.DB_AGrav` in the near future. Suffixes will be directly linked to the database

[1] http://webapp.geod.nrcan.gc.ca/geod/data-donnees/cgsn-rncg.php?locale=en

and will be first implemented for gravity networks. Further suggestions from the working group are welcome.

The selection of reference stations needs to be aligned with the proposals for the International Height References System. Already with status of Apr. 2017, a global set of stations is under discussion without feedback from this joint working group. Further negotiations with IAG JWG 0.1.2 will be necessary.

The AG comparison EURAMET.M.G-K3 Key Comparison and Pilot Study is taking place from April to June 2018 at the Geodetic Observatory Wettzell, Germany. The Pilot laboratory of the comparison is VÚGTK/RIGTC (Czech Republic) and about 16 participants are expected.

Infrastructure

In order to make the gravity reference available, national authorities like Land survey offices need to be contacted and encouraged to provide information about already existing absolute gravity observations. In several countries, contracted institutions conducted AG observations which cannot be made available without permission. A circular letter or template should be prepared by the working group to initiate contacts to national authorities.

Acronym, System and Frame

In accordance with other geodetic reference systems / frames the acronym IGRS/IGRF was fixed for the International gravity reference system/frame.

It was agreed on a discrimination between the system and the frame to separate fundamental definitions from evolving technical and practical matters. The system is defined by the observation of the momentary acceleration of free fall based on the International System of Units (SI) and a set of conventional corrections for the time independent parts of gravity effects. The frame as the realization includes a set of conventional temporal gravity corrections which represent a uniform set of minimum requirements, not necessarily the best possible, which could be adjusted in the future. Furthermore, reliable uncertainty estimates should be included, which allow to categorize the observations.

A set of conventional models for the correction of time variable gravity effects will be proposed modernizing the IAGBN Processing Standards.

Storage format of absolute gravity data and analysis centers

For a complete documentation of absolute gravity measurements, the export to the XML-format generated optionally by recent versions of the g-Software[2] was proposed. This allows not only the access to the raw information of the free fall experiment but also on the setup, like instrumental height, reference air pressure and other specific information. Only with this complete information, an independent reprocessing of absolute gravity observations would be possible.

Further aspects on open source software and data formats were presented by I. Oshchepkov, who proposes a unified data storage format similar to established standards in other disciplines, like RINEX in space geodesy or SEED in seismology. The establishment of a Gravimeter Independent Exchange Format (GINEX) was presented as a long-term project which should be urgently discussed and developed. Further, an open source processing software was suggested. The presentation can be found in the appendix.

Finally, the need in analysis centers for a unified reprocessing of absolute gravity data was stated and should be further discussed.

Further activities

A summary on main objectives of the working group will be published at the BGI/IGETS web page.

The next working group meeting will take place during International Symposium Gravity, Geoid and Height Systems (GGHS), Sept. 17-21 2018 in Copenhagen.

[2] by Micro-g LaCoste

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