Minutes of the Web-Meeting of IAG JWG 2.1.1
Establishment of the International Gravity Reference Frame

Wednesday, 17 Mar. 2021, 14:00 UTC

Chair: Hartmut Wziontek (Germany)
Vice-chair: Sylvain Bonvalot (France)

Agenda

1. Publication in Journal of Geodesy
2. Presentation of IGRS/IGRF at the IAG EC meeting
3. Establishment of the Infrastructure for the IGRF:
    - IAG Res. No. 4 / 2019
    - Activities within SIRGAS (E. Antokoletz)
    - Proposal for a Workshop 2022
    - Site requirements
    - Selection of Reference/Comparison/Core Stations
    - Guide: Best practices in absolute gravimetry
4. CCM comparison 2023 at TMGO/Boulder, CO, USA (V. Pálinkáš)
5. About the IAG working group Quantum gravimetry in space and on ground (M. Van Camp)
6. Correction for the polar motion in IGRS/IGRF (J. Mäkinen)

Due to the pandemic, it was the first meeting of JWG 2.1.1 during the phase 2019-2023. There were no additions to the agenda.

1. Publication in Journal of Geodesy

The paper "Status of the International Gravity Reference System and Frame" authored by members of the JWG has been published in January in Journal of Geodesy[1] as part of the Special Issue "Reference Systems in Physical Geodesy". It describes the definition of the International Gravity Reference System (IGRS) and a concept for its realization (the frame, IGRF). With the IGRS Conventions 2020 the well-established Absolute Gravity Observations Data Processing Standards of the International Absolute Gravity Basestation Network (IAGBN) by Boedecker (1988) are updated and extended. By this, the publication may serve as a basis to adopt the IGRS by IAG.

2. Presentation of IGRS/IGRF at the IAG EC meeting

The status of IGRS and IGRF is planned to be presented by the president of IAG commission 2, A. Jaeggi, to the IAG Executive committee on March 26th 2021, in order to propose to adopt the IGRS definition and IGRS Conventions 2020 by IAG with a resolution at the IAG General Assembly 2023. The

[1] https://doi.org/10.1007/s00190-020-01438-9

slides which are summarizing the published paper were presented and agreed on. It was briefly discussed whether a replacement of IGSN71 should be included. However, this step might be postponed until the IGRF realization is further progressed.

3. Establishment of the Infrastructure for the IGRF

A major challenge in the present phase of the JWG is to establish the infrastructure for the IGRF, based on IAG Resolution No. 4 of 2019. This requires to initiate a cooperation with International and national institutions, agencies and governmental bodies.

A first step within the frame of SIRGAS was an online presentation of IGRS and IGRF in Spanish by E. Antokoletz and H. Wziontek on Mar 5th 2021 under the umbrella of SIGRAS Working Group III, chaired by G. Guimarães. The presentation with the title "El nuevo Sistema de Referencia Internacional de Gravedad (IGRS) y su materialización (IGRF)", which was followed by more the 100 participants, is available at the SIRGAS web page[2] and was summarized by E. Antokoletz. The reception and the support within South America is remarkable and will be further promoted by the JWG, e.g. by guidelines for absolute gravity measurements and a planned workshop at the geodetic observatory AGGO, La Plata, Argentina.

Another proposal is a workshop on the IGRF in Leipzig/Germany before/after the EGU General Assembly in April 2022. Here, details of the implementation of IGRF and the establishment of compatible first order gravity networks based on absolute gravity measurements should be discussed. Institutions, agencies and governmental bodies in charge of geodetic infrastructure are planned to be invited. This proposal was supported by several JWG members, and also a hands-on training with gravimeters was suggested for less experienced users.

Site requirements need to be discussed and updated, based on the document of CCM-WGG. The existing document should be circulated and discussed in a separate meeting.

The accuracy requirements for the position coordinates of absolute gravity points were discussed, also with respect of position changes over time. It was agreed on that existing stations should not be excluded because of less accurate position information, if a marker is established and well documented. Usually a few hundred meters accuracy are sufficient to evaluate gravity corrections, e.g. tides. Minimum requirements need to be defined for the future. The co-location with permanent GNSS was suggested for reference stations, also to monitor station movements, e.g. due to plate tectonics or land uplift. Each gravity observation needs to have an epoch assigned to document long-term gravity changes.

For selection and identification of reference, comparison and core stations of the IGRF, a pre-selection of stations is suggested, which should be coordinated for specific regions by members of the JWG.

Best practices in absolute gravimetry need to be documented, e.g. by a collection of existing material. Several JWG members indicated to contribute with material (e.g. Kennedy et al. 2021), and a Wiki was suggested, too.

4. **CCM comparison 2023 at TMGO/Boulder, CO, USA** (V. Pálinkáš)

V. Pálinkáš informed about the planned CCM comparison of absolute gravimeters in 2023 at TMGO/ Boulder, CO, USA. The proposal by NIST as responsible metrological institution was received by the CCM-WGG in Dec 2019, and no other proposals were made within the deadline. The comparison is coordinated by NGS and further details will be announced during the CCM-WGG meeting in April 2021. It is suggested to organize regional comparisons soon after to link and transfer the comparison reference to other absolute gravimeters. Depending on the final decision of the CCM-WGG, the comparison is planned to be open for all absolute gravimeters, including those operated non-metrological organizations, which is considered as important for the IGRF.

5. **About the IAG working group Quantum gravimetry in space and on ground** (M. Van Camp)

M. Van Camp briefly informed about the new IAG project "Novel Sensors and Quantum Technology for Geodesy (QuGe)"[3]. He informed about a Workshop in May with about 10 invited presentations on

[2] https://sirgas.ipgh.org/en/resources/presentations/
[3] https://quge.iag-aig.org/home

different related topics. He emphasized the importance to collaborate with several working groups and sub-commissions of IAG commission 2.

6. Correction for the polar motion in IGRS/IGRF (J. Mäkinen)

J. Mäkinen discussed the definition of the amplitude factor and the mean pole in the computation of the polar motion effect in gravity. He suggests to keep established parameters and procedures, in favor of continuity with existing observations. He informed about a presentation in the GGOS session of the EGU General Assembly[4].

Participants

Alfredo Esparza, Denizar Blitzkow, Ilya Oshepkov, Ludger Timmen, Ana Matos, Vojtech Palinkas, Sylvain Bonvalot, Vicky Smith, Michel van Camp, Reinhard Falk, Jaakko Mäkinen, Ezequiel Antokoletz, Derek van Westrum, Christian Ullrich, Dan Roman, Mirjam Bilker-Koivula, Rene Reudink, Harald Schuh, Juraj Papco, Jeff Kennedy, Koji Matsuo, Urs Marti, Laura Sanchez, Christian Rothleitner, In-Mook Choi, Feng Jinyang, Janis Kaminskis, Tomasz Olszak, VM Tiwari, Martin Lederer, Marc Veronneua, Jean-Paul Boy, Andreas Engfeldt, Sergio Sainz-Maza, Salle Visio, Christian Rothleitner, Alessandro Germak, Andrea Prato, Domenico Iacovone, Camilo Matiz, Valeria, Olivier Francis, Przemysław Dykowski and Hartmut Wziontek.

References

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Kennedy, J.R., Pool, D.R., and Carruth, R.L., (2021) Procedures for field data collection, processing, quality assurance and quality control, and archiving of relative- and absolute-gravity surveys: U.S. Geological Survey Techniques and Methods, book 2, chap. D4, 50 p., https://doi.org/10.3133/tm2D4

Mäkinen, J. (2021) On the correction for polar motion in gravimetry and in 3-D positioning, EGU General Assembly 2021, EGU21-1853, https://doi.org/10.5194/egusphere-egu21-1853

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[4] https://meetingorganizer.copernicus.org/EGU21/EGU21-1853.html
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