Establishment of the International Gravity Reference Frame

Web-Meeting of IAG JWG 2.1.1, 20.10.2021

Chair: Hartmut Wziontek, BKG (Germany)

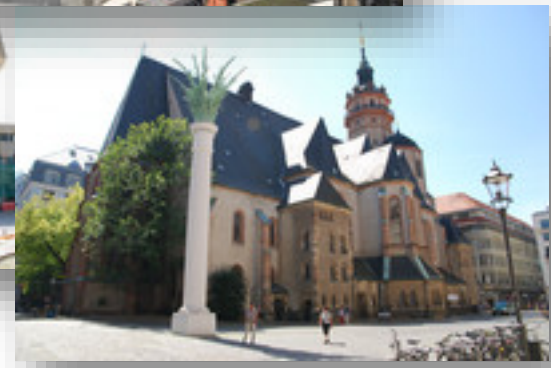
Vice-chair: Sylvain Bonvalot, BGI (France)

Agenda

1. IGRF Workshop 2022 in Leipzig/Germany: 11 – 13. April 2022
2. Best practices in Absolute Gravimetry / IGRF Wiki: https://wiki.gdi-de.org/x/hADLMg
3. Site requirements based on an update of document CCW-WGG/06-24
4. Selection of References sites
5. Discussion:
   - Analysis centres on absolute gravimetry
   - Other topics?

IGRF Workshop 2022 in Leipzig/Germany: 11 – 13. April 2022

- After EGU General Assembly 2022, Vienna:
  Monday afternoon to Wednesday morning
- Location: “Die Tagungslounge”: Roof top convention centre in the city of Leipzig, up to 80 participants
- Supported by BKG: No registration fee
- Hybrid meeting option
- Survey still open:
  https://abstimmung.dfn.de/saf13wkUAFKH9sP1



IGRF Workshop 2022 in Leipzig/Germany: 11 – 13. April 2022

Objective: Discussion on implementation of IGRF

- How to establish first order gravity networks based on absolute gravity observations?
- Site requirements
- Best practices in Absolute Gravimetry:
  - Correction of temporal gravity effects: Understanding tides, ocean tide loading, atmospheric effects...
  - Instrumental properties: clock and laser calibration (A10), systematic effects (diffraction, self-attraction etc.).
  - Vertical gravity gradients: measurements with relative meters (CG5/CG6)
  - Processing of AG observations (understanding effective height etc.).
- Invite institutions, agencies and governmental bodies in charge of geodetic infrastructure, following IAG Resolution No. 4 of 2019
- Suggestion from meeting in March: Hands-on workshop?

Resolution 4: Establishment of the Infrastructure for the International Gravity Reference Frame

The International Association of Geodesy,

Considering,

- The IAG Resolution No. 2 for the establishment of a global absolute gravity reference system released at the 26th IUGG General Assembly in July 2015;

Acknowledging,

- The achievements of
  - JWG 2.1.1 "Establishment of a global absolute gravity reference system",
  - Sub-Commission 2.1 "Gravimetry and Gravity Networks",
  - International Gravity Field Service (IGFS)
- in realizing this resolution;

Noting,

- That the realization of the International Gravity Reference System (IGRS), the International Gravity Reference Frame (IGRF), is based on measurements with absolute gravimeters (AG) monitored at reference stations and during international comparisons, which needs the support of national and international institutions;

Urges,

- International and national institutions, agencies and governmental bodies in charge of geodetic infrastructure to
  - Establish a set of absolute gravity reference stations on the national level,
  - Perform regular absolute gravity observations at these stations,
  - Participate in comparisons of absolute gravimeters to ensure their compatibility,
  - Make the results available open access.

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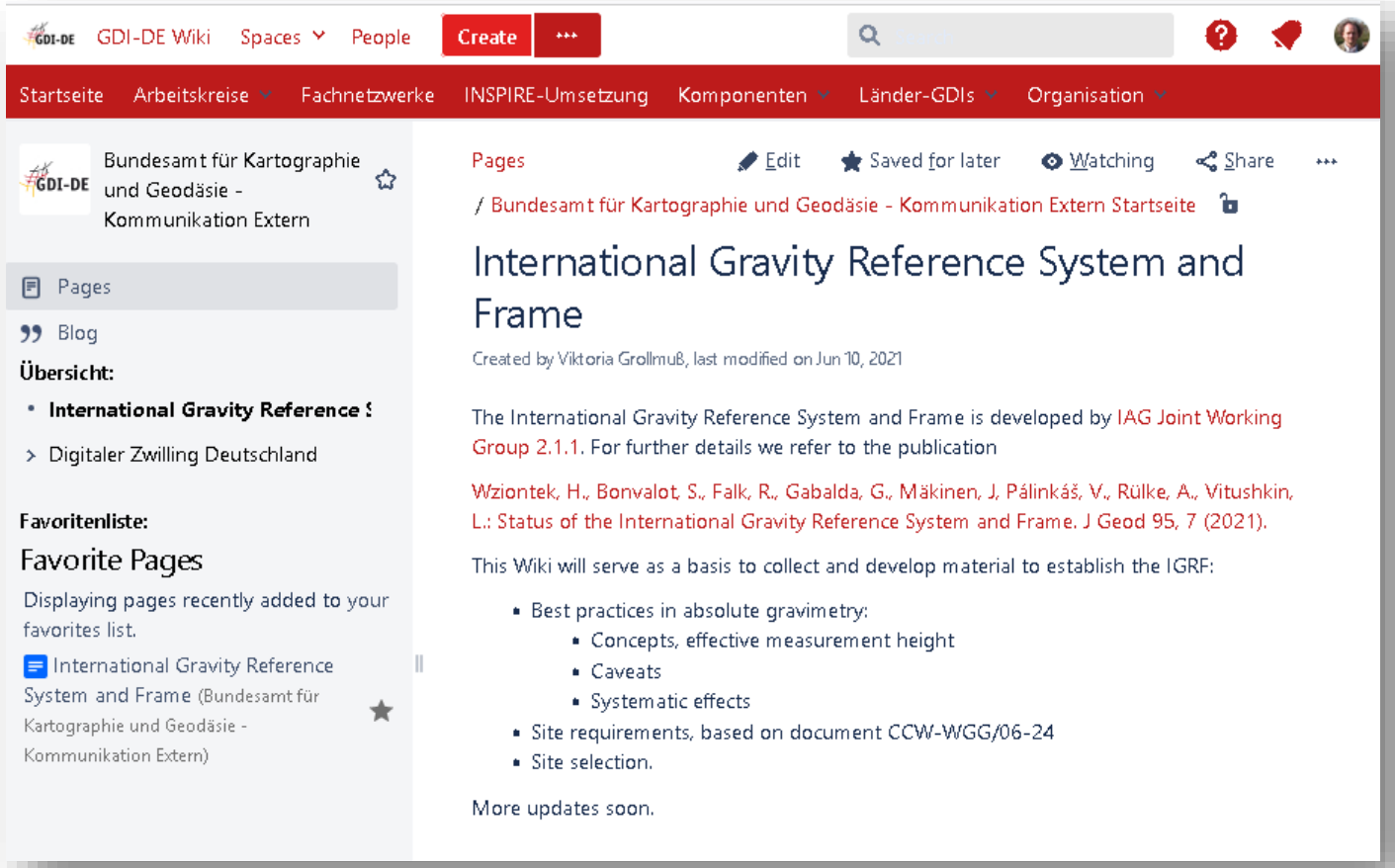
Best practices in Absolute Gravimetry/ IGRF Wiki

- Wiki (based on commercial platform) operated by BKG to coordinate federal activities (GDI-DE, INSPIRE)
- Permanent operation (move to separate instance planned)
- Although German projects, elements in different languages, e.g. English (depending on browser setting)
- Open access, but write access limited to registered users → Please contact me
- Floating development:
  - Summary about IGRS/IGRF
  - Site requirements / Site selection (linked to AGrav)
  - Guides on absolute gravimetry, including links, e.g. publication from NOAA
  - ??

https://wiki.gdi-de.org/x/hADLMg



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Site requirements based on an update of document CCW-WGG/06-24

Meeting at EGU Apr 2019:

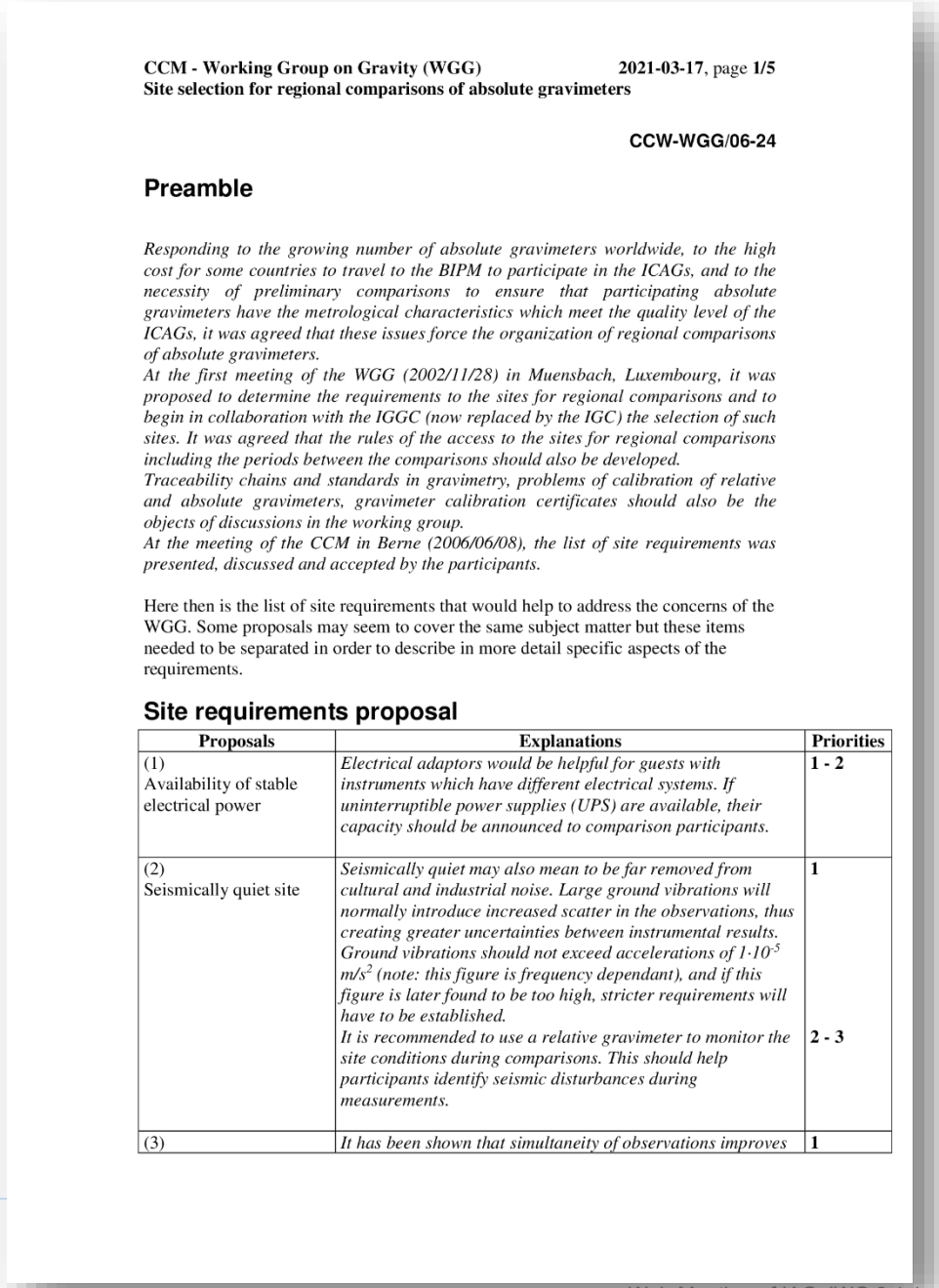
- Several individual pillars instead of one large monument should be recommended for AG comparisons
- Reinforcement seems not necessary, but would have no negative impact

Criteria for the Station Selection contributed by L. Timmen

Further existing documents?

Use of Wiki to document / develop requirements?

Who could take over coordination?



CCM - Working Group on Gravity (WGG) **2021-03-17**, page **1/5**
Site selection for regional comparisons of absolute gravimeters

CCW-WGG/06-24

Preamble

Responding to the growing number of absolute gravimeters worldwide, to the high cost for some countries to travel to the BIPM to participate in the ICAGs, and to the necessity of preliminary comparisons to ensure that participating absolute gravimeters have the metrological characteristics which meet the quality level of the ICAGs, it was agreed that these issues force the organization of regional comparisons of absolute gravimeters.
At the first meeting of the WGG (2002/11/28) in Muensbach, Luxembourg, it was proposed to determine the requirements to the sites for regional comparisons and to begin in collaboration with the IGGC (now replaced by the IGC) the selection of such sites. It was agreed that the rules of the access to the sites for regional comparisons including the periods between the comparisons should also be developed.
Traceability chains and standards in gravimetry, problems of calibration of relative and absolute gravimeters, gravimeter calibration certificates should also be the objects of discussions in the working group.
At the meeting of the CCM in Berne (2006/06/08), the list of site requirements was presented, discussed and accepted by the participants.

Here then is the list of site requirements that would help to address the concerns of the WGG. Some proposals may seem to cover the same subject matter but these items needed to be separated in order to describe in more detail specific aspects of the requirements.

Site requirements proposal

Proposals	Explanations	Priorities
(1) Availability of stable electrical power	*Electrical adaptors would be helpful for guests with instruments which have different electrical systems. If uninterruptible power supplies (UPS) are available, their capacity should be announced to comparison participants.*	**1 - 2**
(2) Seismically quiet site	*Seismically quiet may also mean to be far removed from cultural and industrial noise. Large ground vibrations will normally introduce increased scatter in the observations, thus creating greater uncertainties between instrumental results. Ground vibrations should not exceed accelerations of $1 \cdot 10^{-5}$ m/s^2 (note: this figure is frequency dependant), and if this figure is later found to be too high, stricter requirements will have to be established.* *It is recommended to use a relative gravimeter to monitor the site conditions during comparisons. This should help participants identify seismic disturbances during measurements.*	**1** **2 - 3**
(3)	*It has been shown that simultaneity of observations improves*	**1**

Site selection

Selection/ Identification of

Reference stations: Gravity reference function provides mean absolute level

Comparison stations: reference station with extended facilities to check the compatibility of instruments,

Core stations: Link to space geodetic techniques (GNSS, SLR; VLBI)

- Link to IGETS
- Link to IHRF
- Link to GGOS/ITRF

Collection of site proposals:

Regional coordination (Status Meeting March):

- Scandinavia/NKG: Andreas Engeldt
- Europe: Przemyslaw Dykowsky
- Latin America/SIRGAS: Ezequiel Antokoletz
- North America: Derek van Westrum

Other regions?

Asia: China / Japan / Pacific region etc.

Russia

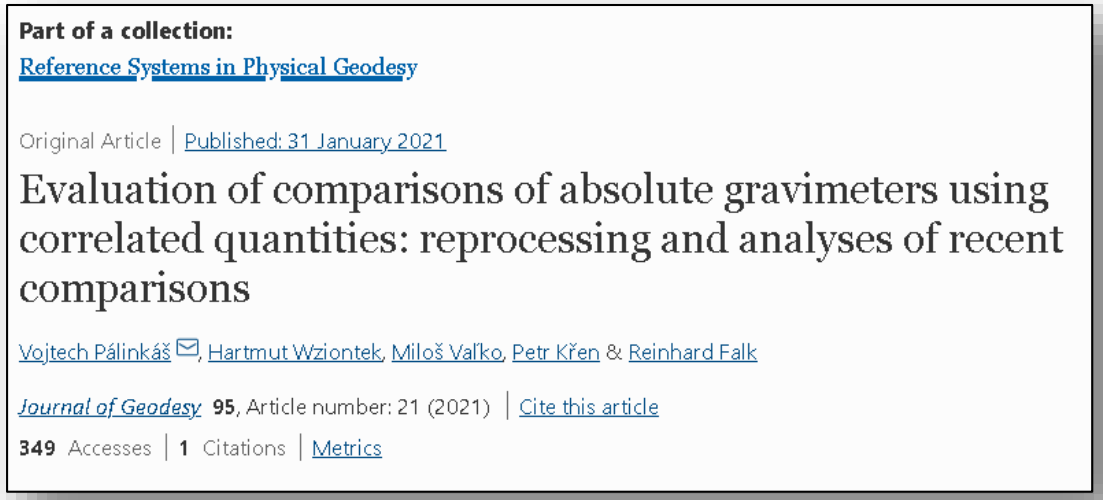
Africa?

Discussion

Analyses Centres for absolute gravity

- Data reprocessing
- Evaluation of AG comparisons
- Software development

Further items?



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