



**International Association
of Geodesy**

Newsletter

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The *IAG Newsletter* is under the editorial responsibility of the *Communication and Outreach Branch* (COB) of the IAG.

It is an open forum and contributors are welcome to send material (preferably in electronic form) to the IAG COB (newsletter@iag-aig.org). These contributions should complement information sent by IAG officials or by IAG symposia organizers (reports and announcements). The *IAG Newsletter* is published monthly. It is available in different formats from the IAG new internet site: <http://www.iag-aig.org>

Each *IAG Newsletter* includes several of the following topics:

- I. news from the Bureau Members
- II. general information
- III. reports of IAG symposia
- IV. reports by commissions, special commissions or study groups
- V. symposia announcements
- VI. book reviews
- VII. fast bibliography

General Announcements

New IAG project on Novel Sensors and Quantum Technology in Geodesy

At the IUGG General Assembly in Montreal, IAG decided to establish a new project on Novel Sensors and Quantum Technology in Geodesy (QuGe) which will be chaired by Juergen Mueller, Germany.

The novel developments in quantum physics of the previous decade, including new technologies and related measurement concepts, will open up enhanced prospects for satellite geodesy, terrestrial gravity sensing and reference systems. In close collaboration between physics and geodesy, this new IAG project shall exploit the high potential of quantum technology and novel measurement concepts for various innovative applications in geodesy.

Climate change often is reflected in mass variations on Earth. And, many mass change processes in the hydrosphere, geosphere and atmosphere are widely imprinted in gravitational data. However, gravitational data with better spatial-temporal resolution and higher accuracy is required, which can only be achieved by employing innovative quantum technology concepts. Highly stable and accurate reference systems provide the fundamental backbone to monitor the change processes in the Earth system, where clocks will play a central role in the future. QuGe will serve as a unique platform for developing and evaluating those novel concepts and observation systems, where also further applications, like in exploration and navigation, may benefit. Technology development and space mission requirements have to be linked to geodetic and geophysical modelling in a synergetic way. Optical ranging between test masses in satellites, atom-interferometric accelerometry and gradiometry, and chronometric levelling with clocks are the needed approaches to overcome the problems of classical concepts in geodesy. With these novel techniques, mass variations on almost all spatial and temporal scales can be observed with unprecedented accuracy and will serve as input for a multitude of applications in geosciences, from the monitoring of smaller groundwater basins and geodynamic effects to the observation of the complex global mass transport processes in the oceans. The combination of expertise from quantum physics and geodesy in QuGe, integrating engineering skills and fundamental research, serves as an excellent basis to advance the frontiers of gravimetric Earth observation and the realization of reference systems.

Objectives

QuGe will put its focus on three major pillars

1) Atom interferometry for gravimetry on ground and in space (quantum gravimetry) will allow for a comprehensive set of applications, such as fast local gravimetric surveys and exploration, or the observation of gravimetric Earth system processes with high spatial and temporal resolution. In space, atom interferometry will enable accelerometry and inertial sensing in a modernistic way. The use of atom interferometry in hybrid systems with electrostatic accelerometers may allow to cover a wide spectral range for future inertial sensing and navigation. It will benefit satellite navigation, but also serve as a basis for developing the next generation of gradiometer missions (GOCE follow-on).

2) Laser-interferometric ranging between test masses in space with nanometer accuracy belongs to these novel developments as well, where technology developed for gravitational wave detection and successfully tested in the LISA/pathfinder mission is being prepared for geodetic measurements. GRACE-FO already demonstrates this new development. Even more refined concepts, like tracking a swarm of satellites, might be realized within the next years. Optical techniques may also be applied for test mass sensing in future accelerometers, and even combined to next generation gradiometry in space.

3) Frequency comparisons of highly precise optical clocks connected by optical links give access to differences of the gravity potential over long distances (relativistic geodesy). In the future, relativistic geodesy with clocks will be applied for defining and realizing height systems in a new way, locally as well as globally. As further application, clock measurements will provide long-wavelength gravity field information. Moreover, accurate clocks help to improve the accuracy of the International Atomic Time standard TAI. They are important for all space geodetic techniques as well as for the realization of reference systems and their connections. Another application example is the possible use of high-performance clock networks to support GNSS.

In all three research areas, along with the research on measurement systems and techniques, the analysis models have to be put on a sound theoretical basis. This requires dedicated geodetic and relativistic modelling of the various involved gravity field quantities and measurement concepts.

Colleagues who are interested to collaborate in the new project or in one of the three Working Groups are very welcome to join the team. Please contact Juergen Mueller (mueller@mbox.ife.uni-hannover.de).

JÜRGEN MÜLLER

A new paper released by Geoscience data Journal and describes the dataset of Belgian relative gravity measurements

To the best of the authors' knowledge, it is the first time an effort is carried out to create a database containing all relative gravity data on a national level, at least as far as the open-access nature of the data is concerned, as well as the compliance with the recently developed metadata structure of the International Association of Geodesy (IAG) and its International Gravity Field Service Central Bureau (IGFS CB).

Data and metadata products based on intensive terrestrial gravity measurements covering the Belgian territory have been established compliant to the new ISO19115-1 profile for gravity-related data.

After an historical introduction on gravity measurements starting with the first gravity measurement in 1892, the paper presents the data, and reports on gravity and spirit levelling measurements executed in 2018 to validate the g-value at the historical reference base station Carte du Ciel at the Royal Observatory of Belgium. Hence, this re-validates and approves the Belgian relative gravity data base for use in future research.

Paper: Verbeurgt J, Van Camp M, Stal C, et al. The gravity database for Belgium. Geosci Data J. 2019;00:1-10. <https://doi.org/10.1002/gdj3.74>

MICHEL VAN CAMP

Meeting Announcements

First One-day Introductory and Refresher Course on Satellite and Lunar Laser Ranging

Sunday, October 20, 2019

German Aerospace Center (DLR), Stuttgart, Germany

The ILRS has scheduled a one-day introductory course to give non-practitioners in SLR an opportunity to broaden their knowledge about laser ranging to Earth-orbiting satellites and the Moon. The course will also provide those with some experience in the field an opportunity to refresh and strengthen their knowledge and increase their appreciation of this powerful measurement technique that supports geoscience and applications. The course is scheduled for Sunday, October 20, 2019, in Stuttgart, Germany, just prior to the 2019 ILRS Technical Workshop. The program for this one-day "SLR School" is provided below.

Talks will be given in a tutorial format, with time for questions and discussion. Interested parties can attend the school with or without participating in the Workshop. Attendees will be charged an entrance fee of 30 Euros to cover lunch and breaks.

Tutorials will differ in length depending on the topic, but each session should leave ample time for questions and discussion. Seminars will be given at the level of a non-expert, recognizing that we expect people to attend who are not currently working in the field, but are curious, as well as people who are newly involved in laser ranging, but need to broadening their current level of understanding.

The one-day SLR School will be a great way for attendees to get an overview of an important component of the space geodesy measurement constellation. Please see the attached PDF for the topics to be covered in the program.

Participants in the 2019 ILRS Technical Workshop can indicate their plans to attend the SLR School during registration (see <http://dlr.de/ilrs2019>). Those wishing to attend only the SLR School should contact the workshop's local organizing committee (ilrs.workshop@dlr.de); arrangements are being made for payment of the one-day fee.

This one-day event is an opportunity for participants to get an overall view of satellite laser ranging and is the first time that such a school has been offered. The school will be held at the:

Pullman Stuttgart Fontana Hotel

Vollmoellerstraße 5, 70563 Stuttgart, Germany

More Information on hotels, transportation, etc., is available on the workshop website at: <http://dlr.de/ilrs2019>.

Please contact Carey Noll (Carey.Noll@nasa.gov) with any questions. Don't miss this opportunity! We hope to see you in Stuttgart.

Best regards,
Mike Pearlman
Director, ILRS Central Bureau

Meetings Calendar

IAG Sponsored Meetings

Ninth Session of UN-GGIM

August 7 – 9, 2019, New York, USA

URL: <http://ggim.un.org/meetings/GGIM-committee/9th-Session/>

Workshop for the Implementation of the GGRF in Latin America

September 16 – 20, 2019, Buenos Aires, Argentina

URL: <http://www.sirgas.org/en/ggrf/>

Munich Remote Sensing Symposium 2019 (MRSS19)

September 18 – 20, 2019, Munich, Germany

URL: www.pf.bgu.tum.de/isprs/mrss19/index.html

CODATA 2019

September 19 – 20, 2019, Beijing, China

Towards next-generation data-driven science: Policies, practices and platforms

URL: https://conference.codata.org/CODATA_2019/

DORIS Analysis Working Group meeting

September 30 – October 1, 2019, Paris, France

URL: <https://ids-doris.org/ids/reports-mails/meeting-presentations/ids-awg-09-2019.html>

ILRS Analysis Standing Committee (ASC) meeting

October 1, 2019, Paris, France

URL: <https://ilrs.cddis.eosdis.nasa.gov/science/awg/awgActivities/index.html>

5th IAG Symposium on Terrestrial Gravimetry: Static and Mobile Measurements

October 1 – 4, 2019, Saint Petersburg, Russia

URL: <http://www.elektropribor.spb.ru/tgsmm2019/eindex>

GGOS/IERS Unified Analysis Workshop

October 2 – 4, 2019, Paris, France

URL: <https://www.iers.org/IERS/EN/NewsMeetings/ForthcomingMeetings/forthcoming.html>

Journées 2019: Astrometry, Earth Rotation and Reference

October 7 – 9, 2019, Paris, France

URL: <https://synte.obspm.fr/astro/journees2019/>

BIPM Workshop on Advanced Time and Frequency Transfer

October 10, 2019, Sèvres, France

URL: <https://www.bipm.org/en/conference-centre/bipm-workshops/advanced-time/>

2019 ILRS Technical Workshop

October 21 – 25, 2019, Stuttgart, Germany

URL: <http://www.dlr.de/ilrs2019>

GGOS Days 2019

November 11 – 14, 2019, Rio de Janeiro, Brazil

URL: <https://iag.dgfi.tum.de/en/meetings-calendar/>

SIRGAS Symposium 2019

November 11 – 14, 2019, Rio de Janeiro, Brazil

URL: <https://iag.dgfi.tum.de/en/meetings-calendar/>

11th IVS General Meeting

March 22 –28, 2020, Annapolis, MD, USA

URL: <https://www.iers.org/IERS/EN/NewsMeetings/ForthcomingMeetings/forthcoming.html>

IGS Workshop "IGS 2020: Science from Earth to Space"

August 10 –14, 2020, Boulder, CO, USA

URL: <https://www.iers.org/IERS/EN/NewsMeetings/ForthcomingMeetings/forthcoming.html>

43rd COSPAR Scientific Assembly

August 15 –23, 2020, Sydney, Australia

URL: <http://www.cospar2020.org/>

22nd meeting of the Consultative Committee for Time and Frequency (CCTF)

October 26 –30, 2020, Sèvres, France

URL: <https://www.iers.org/IERS/EN/NewsMeetings/ForthcomingMeetings/forthcoming.html>

IAG Related Meetings

AOGS 16th Annual Meeting

July 28 – August 2, 2019, Singapore, Singapore

URL: http://www.asiaoceania.org/society/public.asp?view=up_coming

Earth & Geo Science-2019

August 12-13, 2019, Prague, Czech Republic

URL: <https://scientificfederation.com/earth-science-2019/>

First International School on "Geoid Modelling, Gravity Inversion and its Applications"

September 9-13, 2019, Gävle, Sweden

URL: <https://www.hig.se/4.6c77c68166435adf0b3d060.html>

4th Symposium of the Committee on Space Research (COSPAR)

November 4-8, 2019, Herzliya, Israel

URL: <http://www.cospar2019.org/>

Reports

Report on 4th JISDM, Athens, 2019

The 4th Joint International Symposium on Deformation Monitoring (JISDM) was held on May 15th – 17th in Athens, Greece. JISDM carries the 40 years long tradition of the FIG and IAG joint symposia in the field of deformation monitoring and more recently the active sponsorship of ISPRS. The symposium aimed to connect research in deformation measurement / techniques, analysis and interpretation with advanced practice. The *School of Rural and Surveying Engineering (SRSE)* of the *National Technical University of Athens (NTUA)* was the host institution of this event.

During the three days of the symposium 95 oral and 37 poster presentations were given originating from 27 countries from 5 continents. Conference topics were related to core methodological, technical and practical achievements in the field of deformation monitoring. Technical sessions were organized in 13 thematic areas that include: QC/QA and optimization techniques in deformation analysis; new concepts for GNSS-based monitoring; point cloud-based space-temporal deformations; reference frames and geodynamics; vibration monitoring and dynamics; ground and spaceborne radar; monitoring of cultural heritage; deformation monitoring for construction engineering; bridge monitoring; dam monitoring; multi-sensor systems and new concepts for deformation measurements; UAV for change detection and deformation monitoring; monitoring of geohazards.

The authors had the opportunity to submit their paper for a peer-review process resulting in 44 papers successfully passed the review process. After the symposium authors of peer and non-peer-review papers will have the opportunity to submit extended versions of their work for a special issue in widely accepted journals. The organizing committee attached great importance to the active participation of young researchers in the symposium. In this regard, two awards were offered for the best oral and poster student presentations.

During the conference Professor Carmelo Gentile, (Polytechnico di Milano), Dr. Charalampos (Haris) Kontoes (National Observatory of Athens) and Dorota A. Grejner-Brzezinska (The Ohio State University) introduced the latest tendencies in the field of deformation monitoring and shared their vision on the evolution of technologies and methods for monitoring both natural phenomena and man-made structures. The highly interesting topics of the symposium have attracted a large number of sponsorships, including contributions from the construction industry; highway, bridge, dam and renewable energy operators; service companies in the field as well as utility companies. In response, the organizing committee has allocated a special session for technical presentations by the sponsors.

Due to the great success of the conference it was decided to hold the 5th JISDM in two years. The organizers will announce soon the location and time for the next edition.

The 4th JISDM2019 Organizing Committee



Photo of participants