



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

Meeting Announcements

Ilulissat Climate Days 2015 - changes of the Greenland Cryosphere *Ilulissat, Greenland, June 2-5, 2015*

A workshop of current and future changes of the Greenland and Arctic cryosphere will be held in Ilulissat, Greenland, June 2-5, 2015. The workshop will highlight overviews of current changes, as measured from space, airborne and in-situ methods, and future projections of changes. The meeting is a follow up on the similar event *Nuuk Climate Days 2009*, and will involve both scientists and stakeholders in discussions on cryosphere changes, and their effects on the Greenland environment and society.

Ilulissat Climate Days is timed with air connections from Denmark and Iceland, and is arranged by a committee from Danish, Greenlandic and Icelandic organizations. The activities will also include the final conference for the Nordic Centre of Excellence SVALI (Stability and Variations of Arctic Land Ice) as well as meetings related to the ESA Climate Change Initiative.

The workshop will consist of both invited science/stakeholder talks, as well as submitted presentations, and set up together with an International Science Committee (K. Steffen, I Joughin, M Drinkwater, P Wadhams, J Box, J-O Hagen, G Adalgeirsdottir). Deadline for submission of abstracts is January 30, 2015.

For details see the web site

<http://www.polar.dtu.dk/english/Ilulissat-Climate-Days>

RENE FORSBERG

Meetings Calendar

AGU 2014 Fall Meeting

December 15-19, 2014, San Francisco, CA, USA

URL: <http://sites.agu.org/meetings/>

18. Internationale Geodaetische Woche Obergurgl

February 8 – 14, 2015, Obergurgl, Austria

URL: <http://www.mplusm.at/ifg/>

GEOProcessing 2015

February 22 – 27, 2015, Lisbon, Portugal

URL: <http://www.iaria.org/conferences2015/GEOProcessing15.html>

Mapping Water Bodies from Space (MWBS 2015)

March 18 – 19, 2015, Frascati, Italy

URL: <http://due.esrin.esa.int/mwbs2015/>

Munich Satellite Navigation Summit 2015

March 24 – 26, 2015, Munich, Germany

URL: <http://www.munich-satellite-navigation-summit.org>

European Geosciences Union General Assembly 2015

April 12 – 17, 2015, Vienna, Austria

URL: <http://www.egu.eu>

SPACOMM 2015

April 19 – 24, 2015, Barcelona, Spain

URL: <http://www.iaria.org/conferences2015/SPACOMM15.html>

36th International Symposium of Remote Sensing of Environment (ISRSE)

May 11 – 15, 2015, Berlin, Germany

URL: <http://www.isrse36.org/>

8th Workshop on GNSS Reflectometry (GNSS+R 2015)

May 11 – 13, 2015, Potsdam, Germany

URL: <http://www.gnssr2015.org/>

22nd Meeting of the European VLBI Group for Geodesy and Astrometry (EVGA)

May 17 – 21, 2015, Ponta Delgada, Azores, Portugal

URL: <http://evga2015.raege.net/>

Ilulissat Climate Days 2015

June 2-5, 2015, Ilulissat, Greenland

URL: <http://www.polar.dtu.dk/english/Ilulissat-Climate-Days>

TransNav 2015

June 17 – 19, 2015, Gdynia, Poland

URL: <http://transnav2015.am.gdynia.pl>

XXVI IUGG General Assembly

June 22 – July 2, 2015, Prague, Czech Republic

Information about registration and accommodation will be available from June 2014. Call for abstracts will be open during summer 2014. **Deadline for abstract submission is January 31, 2015.**

URL: www.iugg2015prague.com

AOGS 2015

August 2 – 7, 2015, Singapore

URL: <http://www.asiaoceania.org/aogs2015/>

XXIXth IAU General Assembly

August 3 – 14, 2015, Honolulu, Hawaii, USA

URL: http://www.iau.org/science/meetings/future/general_assemblies/1024/

ISDE 2015

October 6 – 10, 2015, Halifax, Nova Scotia, Canada

URL: <http://isde2015halifax.ca/>

Earth Observation for Water Cycle Science 2015

October 10 – 23, 2015, ESA-ESRIN, Frascati, Italy

URL: <http://www.eo4water2015.info/>

2nd Symposium of COSPAR: Water and Life in the Universe

November 9 – 13, 2015, Foz do Iguacu, Brazil

URL: <http://cosparbrazil2015.org/>

18th Geodynamics and Earth Tide Symposium 2016

June 6 – 9, 2016, Trieste, Italy

URL: <http://www.lithoflex.org/g-et/>

41st COSPAR Scientific Assembly

July 30 – August 7, 2016, Istanbul, Turkey

URL: <http://www.cospar-assembly.org/>

Reports

Reference Frames for Applications in Geoscience

Report on the 2014 IAG Commission 1 Symposium: Luxembourg, 13-17 October, 2014

Accurate reference frames are fundamentally important for Earth science studies, satellite navigation, international time transfer, many applications relying on geo-spatial information, and increasingly for demanding commercial applications such as agriculture, aviation, construction, public safety, and transportation.

In October, approximately one hundred geodesists and geoscientists from twenty-four countries met to discuss the role of global and regional reference frames in science and practice. The international symposium, REFAG2014, took place at the Melia Hotel in Kirchberg, Luxembourg. This symposium provided a forum where the developers of the Terrestrial Reference Frames (TRF) and a broad segment of scientific users could discuss the most important questions. The symposium featured sessions on six topics: the theory and concepts in developing reference frames, the space-based geodetic techniques required to generate the reference frames, the theory to tie the terrestrial reference frames to the celestial reference frame (and the associated Earth rotation parameters), regional and national reference frames, the importance of reference frames in the geosciences, and how georeferencing is used in practice. Overall, significant progress was made towards refining space geodetic tools and results to enable more reliable, more accurate, and more sensitive measurements of the Earth's properties and their variations.

Among the most discussed topics at the meeting was the analysis of station positions, velocities, and Earth orientation parameters from the space geodetic measurement techniques that will eventually be incorporated into the next update of the ITRF, ITRF2013. The combination of the input solutions will require improved modeling of non-linear station motions for at least improving the estimation of station linear velocities. The periodic signals present in the time series of station positions will be modelled by a sinusoidal function, while the post-seismic deformation will use parametric models such as logarithmic or/and exponential functions. The individual technique solutions involve a full reprocessing of the complete history of satellite laser ranging (SLR) and very long baseline interferometry (VLBI) data using the latest modeling developments.

The meeting gave researchers the time to investigate, in detail, the background modeling in the data processing. Presentations examined efforts to improve modeling of the neutral troposphere propagation delay and solar pressure models on the satellite orbits, compared error characteristics of station positions from SLR and GPS data, reported on ongoing efforts to measure and improve the inter-station vector ties at ground stations equipped with co-located techniques, and described progress on a proposed space-based mission to link the space geodetic techniques. Ongoing efforts to quantify and validate the displacements of the Earth's surface (mostly height variations) due to motions of the atmosphere, ocean, and land water were a focus of discussions.

The question of the relationship of regional reference frames to the global reference frame was also discussed, in particular, in light of the large-scale effects of mega-earthquakes. The possible use of a "two-frame" geodetic datum was proposed, a system that would benefit from both a time-based reference frame such as ITRF, as well as a plate-fixed datum for local geospatial applications.

Observations of the Earth's orientation in space (EOPs) connect the celestial reference frame (CRF) and the terrestrial reference frame (TRF). Systematic uncertainties inherent to all space geodetic techniques affect the realization of both reference frames and the EOPs connecting them. At present, the CRF is realised through distant extragalactic radio sources, which causes a number of problems. The distribution of these objects around the sky is far from uniform, with a particular weakness in the Southern Hemisphere. In addition, the intrinsic structure of these sources causes frequency and schedule-dependent source position errors. These effects are important at the GGOS-targeted 1 mm level in station positions, and similarly for the CRF and EOPs.

An aspect of high relevance in present studies is the consistency between celestial and terrestrial frames. Dedicated presentations dealt with new results on the combination of Very Long Baseline Interferometry (VLBI)

Reference Frames for Applications in Geodetic Science 12-17 October, 2014 Luxembourg



with Global Navigation Satellite System (GNSS) observations for the determination of celestial reference frames revealing significant impact of the combination on the positions of sources observed in single VLBA Calibrator Survey (VCS) sessions.

Finally, a significant part of the session was devoted to the next realization of the celestial reference frame, the ICRF-3. On behalf of the IAU Working Group on the ICRF-3, Chris Jacobs presented the status and progress in setting up ICRF-3. New features of the ICRF3 comprise observations at other frequencies than at the standard X- and S-bands and their combination of the respective frames, re-observations of the VCS sources, and many new sources in the Southern Hemisphere.

The meeting allowed for an extensive discussion of these issues and feasible mitigation strategies were presented. It was also noted that although combinations of space geodetic techniques can help improve EOPs, technique-specific biases must be identified and corrected. In summary, the presentations and discussions at this meeting have provided a number of promising strategies for improving EOP estimation techniques through targeted observations as well as novel analysis techniques including using complementary non-geodetic data.

Scientific applications, in particular observations of sea level rise, present-day ice mass loss, and elastic ground rebound from local and regional water extraction, place the most stringent demands on the reference frame stability. REFAG2014 provided a forum where scientists and those responsible for developing the reference frame could discuss the requirements of the terrestrial reference frame for scientific applications. The uncertainties in the realization of the international terrestrial reference frame for long-term sea-level rise studies were also presented. The current limitations for separating reference frame effects from climatic signals in the observed geographical pattern of sea-level rise in the 21st Century were exposed. In this regard, the non-linear behaviour of both surface deformations and reference frame origin definition due to mass loading was largely discussed among the meeting participants.

The symposium also provided a forum for attendees to discuss the question of how reference frames are used in practice (for national geodetic/mapping datums and precise positioning). Presenters 1) provided advice to countries with limited geodetic expertise on how to upgrade their national geodetic datum to an ITRF-based one, 2) on how "smart" GNSS receivers could be connected in peer-to-peer networks and cloud-based processing could automatically derive their coordinates in ITRF without the need to run special scientific software with IGS orbits and IGS CORS data, 3) reported on the progress of developing international standards for geodetic concepts and parameters within the ISO's "Registry of Geodetic Codes and Parameters" was reported on, and 4) raised the question of how to incorporate a time-based reference frame in GIS software.

TONIE M. VAN DAM

19th International Laser Ranging Workshop October 27-31, 2014 Annapolis, Maryland, USA

The 19th International Laser Ranging Workshop was hosted by NASA GSFC from October 27-31, 2014 in Annapolis, Maryland. October 31 marks the 50th anniversary of the first successful Satellite Laser Ranging (SLR) measurement which occurred at the Goddard Geophysical and Astronomical Observatory (GGAO) in 1964. The theme for this workshop, "Celebrating 50 Years of SLR: Remembering the Past and Planning for the Future" allowed the community to look back on its many accomplishments and to present plans for future advances in SLR technology and science. Sponsors for the Workshop were NASA, the Smithsonian Astrophysical Observatory (SAO), and the International Laser Ranging Service (ILRS). The Workshop was organized by Carey Noll (NASA GSFC, CDDIS Manager), Jan McGarry (NASA GSFC), Mike Pearlman (SAO) and Stephen Merkowitz (NASA GSFC) and was attended by over 180 participants from 23 countries.

On Monday, the history of SLR was given in a series of six invited talks by the pioneers in the field. The afternoon was devoted to invited science talks showing SLR's positive impact on various NASA and international missions.

In addition to the events in Annapolis, the participants were given a day-long tour of GSFC and GGAO, including tours of the Goddard Visitor's Center, Integration and Testing facilities, James Webb Space Telescope (JWST) integration and testing, and tours of the NASA next generation space geodesy systems at GGAO. A Goddard Joint Engineering and Scientific Colloquium on Wednesday featured a seminar by John Degnan, "A Celebration of Fifty Years of Satellite Laser Ranging." John's talk was introduced with a few words from GSFC Center Director, Chris Scolese.

A new format for a station operations session was introduced at this workshop where ILRS experts met in small groups of station engineers and operators to provide solutions to common station problems, information to maintain station stability, and guidelines for interacting with the analysts in determining station biases. These station clinics were well attended and received by workshop attendees.

A highlight of the Workshop was a speech and question and answer session at Thursday evening's banquet given by Dr. Piers Sellers, GSFC Deputy Director of the Sciences and Exploration Directorate and NASA astronaut.

The workshop program included 81 oral presentations and over 70 posters. The Program section of the workshop website (<http://cddis.gsfc.nasa.gov/lw19/Program/index.html>) includes links to all abstracts, presentations, and posters; the handout is also available.

This workshop in Annapolis and GSFC proved to be a very successful gathering of international experts in the field of satellite laser ranging. The workshop website (<http://cddis.gsfc.nasa.gov>) will soon be updated with additional presentations, posters, summaries, and photos from the week.

CAREY NOLL