



IUGG



**International Association
of Geodesy**

Newsletter

March 2018

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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

Centennial celebration of the Finnish Geodetic Institute

The Finnish Geodetic Institute (FGI) was established by Government Decree on 5 July 1918, merely seven months after the independence of Finland in December 1917. The main task of the FGI was the basic mapping of Finland, i.e. first-order triangulation and associated geodetic and astronomical measurements which were urgently needed for the new-born nation. Later on, the precise levelling for the national height system, gravimetric measurements for the gravity system and extensive research in the field of geodesy became in the programme of the FGI.

The first-order triangulation had to start from scratches. It included the selection and reconnaissance of the measurement sites, construction of towers, measurements and computation, astronomical measurements for positioning the network, and baseline measurements to determine the scale of the network. The measurements were started in May 1919, with the last measurements taken in 1987 in Northern Lapland, just at the advent of the GPS era. The towers were visible landmarks and very often became popular viewing places for the local population. Depending on the weather, some observations took several weeks to complete and field expeditions spent months every year on their measurement trips. Ten years after the last triangulation observations, the whole network was replaced by modern technique. GPS and the network of permanent GNSS stations, FinnRef, as a part of the European network EPN are nowadays the basis of the national reference frame created and maintained by the FGI.



Calibration of invar wires at the Nummela Standard Baseline in 1939. (Photo: FGI archives)

Determination of astronomical latitude and longitude, as well as the azimuth between the triangulation points were needed to orientate the network on the surface of the Earth. The scale of the network was obtained with several baselines at different part of the network. The 24 meter long invar wires used in the baseline length measurements were calibrated in the Nummela 864 meter long Standard Baseline. Since 1947 the length of the Nummela Standard Baseline has been measured with the interference of white light, a method developed by academician Yrjö Väisälä. A motion of IAG in 1951 and the resolution of IUGG in 1954 noticed the importance of the Väisälä method, and recommended that similar standard baselines should be measured in many countries to assure a uniform scale of the triangulation networks.

During next decades FGI measured a total of 13 Väisälä baselines, first one in Argentina in 1953, and the last ones in China 1998 and Hungary 1999. Nummela standard baseline in Finland has been regularly maintained with Väisälä method until now, and it has become a standard where the most precise distance meters can be tested and calibrated. It is the world's best known outdoor geodetic baseline with the 0.07 mm uncertainty of its 864 m length. Due to the laborious nature of Väisälä measurement, FGI has developed a method where high-precision EDM instruments are calibrated at Nummela and then used as a transfer standard for scale to other baselines. During last two decades more than 15 such baselines have been measured by FGI.

Due to the Fennoscandian postglacial rebound, land uplift is almost 1 cm per year at the west coast of Finland. Therefore the national height systems must be renewed after a few decades. The FGI has carried out two national first-order levelling, in 1935-1972, and 1978-2006. Simultaneous research e.g. on levelling errors by Professor T.J. Kukkamäki enabled to improve the accuracy and reliability of the precise levelling. These massive endeavours have produced three national height systems, the last one taken in use in 2008. At the same time, precise land uplift values were computed for the whole country. Nowadays, uplift can be measured using the time series obtained from the permanent GNSS stations of the FinnRef network.



Dr Uno Pesonen observing gravity with a pendulum instrument in 1924. (Photo: FGI archives)

The FGI initiated gravity measurements in 1924 using pendulum instruments. Later on, relative gravity measurements were made using spring gravimeters and since late 1980's with an absolute gravimeters based on the free fall experiment. A total of 35 000 gravity points have been measured in Finland and this data base is now used for computation of the gravimetric geoid. Several gravimetric campaigns have been made as a part of international projects throughout the world, from Svalbard to Antarctica and Tibet. FGI is the National Standard's Laboratory of length and acceleration of free fall, which enables FGI to write calibration certificates of their measurements, as well participation on metrological key comparisons of absolute gravimeters. Combination of geodetic and metrological activities is not very common.

World-famous works of Professor Veikko A. Heiskanen on isostasy and global geoid, and becoming the director of the Geodetic Institute in the Ohio State University in 1950 were key elements why FGI became well-known within the geodetic community. His celebrated book *Physical Geodesy* with Helmut Moritz is even today basis of higher geodesy studies. Although Heiskanen was quite short time the director of the FGI, his influence on geodesy in Finland was great.

Over decades the FGI has conducted or participated in several important national and international measurement campaigns. One to mention here was the FGI solar eclipse expedition in 1947 when the distance between South America and Africa was measured to an unequalled accuracy of 141 metre using the total solar eclipse. That was a world record of its time, until in 1960's the artificial satellites revolutionized measurements in geodesy.



Metsähovi Geodetic Research Station of the FGI. (Photo: M. Poutanen / FGI)

Big changes and new science emerged in the FGI in the mid-1970's. Metsähovi Observatory was established and SLR observations were started in 1978. Gradually, Metsähovi developed into a comprehensive geodetic research station with a GPS receiver in the IGS network, a DORIS beacon, a gravity lab, and additionally many auxiliary and environmental monitoring instruments. Latest development in Metsähovi started in 2012 when special investment funds were granted. All major instruments were modernised or renewed, including the SLR and the superconducting gravimeter. A new VGOS compatible radio telescope is under construction, and it is expected to be operational in 2019.



Mobile VLBI near Metsähovi in 1989. This was the beginning of ETRS89 reference system in Europe. VLBI campaign was followed by the EUREF89 GPS campaign. (Photo: M. Poutanen / FGI)

In 1970's started also a development which finally lead to the current FGI. Department of Photogrammetry was established and the number of personnel begun to grow. At the end of 1980's the research field was expanded to incorporate remote sensing. The Department of Cartography was established in 1987, following the need to develop geospatial information research and increasing societal requests for this kind of information. The department was the first unit in Finland devoted for research in cartography and geographic information.

The Sjäkulla photogrammetric test field near Metsähovi was built in the early 1990's for studying the geometry and quality of aerial photographs. With the development of direct georeferencing, aerial photography companies used the test field for calibrating cameras. The reflection and scattering properties of various targets were modelled and rule-based interpretation techniques were developed. Aerial and satellite photographs were used for agricultural applications and radar images were applied in various research projects. Later on this lead to research and use of SAR interferometry.

The new millennium ushered even bigger changes at the FGI, and operations were fully restructured. Four new departments replacing the old ones were established in 2001: Geodesy and Geodynamics, Geoinformatics and Cartography, Remote Sensing and Photogrammetry, and Navigation and Positioning. The number of personnel has grown consistently, from about 45 in 1995 to 140 in 2018.

With these changes, the FGI became a comprehensive research and expert institute covering all fields of geodesy and geospatial related research. The strategic research areas were defined to be Reference systems, Mobile geomatics, Spatial Data Infrastructures, and Changing Earth.

Based on the strategy of the reference systems, FGI maintains, develops and conducts research on reference systems, their connection to international networks and geospatial metrology. Most of these tasks are the continuation of the basic duties of the FGI from its very beginning and defined in the law. Mobile geomatics involves using mobile computing devices and sensors to acquire, process, analyse and visualise the geospatial data with which users can interact via a large variety of applications. These include ubiquitous positioning, mobile mapping, context awareness, and mobile GIS. In the Spatial Data Infrastructures, areas of interest include visualisation and usability of spatial data, network-based processing services, ontology, data harmonisation and standardisation. Changing Earth include updating maps for all conditions, changes in the land cover, topography, and built environment, postglacial rebound and crustal deformation studies, sea level variation, the Earth's orientation in space, gravity changes and environmental aspects.



A GNSS antenna test field in Metsähovi. The dome of the new SLR telescope is at background. (Photo: M. Poutanen / FGI)

Biggest change since the establishment of the FGI happened in 2015 when the Finnish Geodetic Institute was merged to the National Land Survey (NLS) of Finland. At the same time the name was changed to Finnish Geospatial Research Institute FGI. The well-known abbreviation FGI remained, as well tasks and duties of the former FGI. The FGI became a research unit within the NLS. With the support of the NLS, FGI is now bigger and stronger than ever, and ready for challenges of the next century.

MARKKU POUTANEN
FGI

Proceedings of 2016 Earth rotation symposium available under open access

In July 2016, a Joint IAU / IAG / IERS Symposium "Geodesy, Astronomy and Geophysics in Earth Rotation" (GAGER2016) was held in Wuhan, China. Thanks to the organizers, the full special issue of the journal "Geodesy & Geodynamics" (vol. 8, no. 6) that collects papers from this symposium is now available under open access at:

www.sciencedirect.com/journal/geodesy-and-geodynamics/vol/8/issue/6

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Meeting Announcements

ESA/JRC International Summer School on GNSS 2018

The ESA/JRC International Summer School on GNSS is hosted this year by Austria from 16 to 27 July 2018 in Loipersdorf, Austria. It is in cooperation with Stanford University in the United States, the Institut Supérieur de l'Aéronautique et de l'Espace ISAE-SUPAERO in Toulouse, France, Graz University of Technology in Austria and the University FAF Munich in Germany.

The ten-day course will cover all aspects of satellite navigation, up to and including the creation of a satnav-based business.

Supported by Graz University of Technology and the Austrian Institute of Navigation, the Summer School is open to graduate students, PhDs and postdoctoral researchers, as well as young engineers and academics working within industry or agencies, aged 35 or younger.

Register before 15 May 2018 to benefit from an early registration discount. The number of participants is limited to 50, on a first come, first served basis.

Internationally renowned scientists and specialists will be giving lectures as well as overseeing practical exercises and lab work.

Participants will receive a full-spectrum overview of satellite navigation, starting from the theoretical basis of the Global Navigation Satellite System, its signals, the processing performed by signal receivers and how the position-navigation-time solution is worked out.

Discussion will also be made of threats to satnav systems, such as spoofing or jamming, and the countermeasures available against them, along with back-up navigation solutions for a GNSS-denied environment.

Practical exercises will include receiving the various satnav constellations now in orbit – including Europe's Galileo, to give course members direct, hands-on experience.

In addition, lectures will cover business aspects, including patents and intellectual property rights.

The main emphasis of the course will be the development of a group business project, building on an innovative idea to take in the planning of the product or service, its technical realisation and finally its marketing to customers.

For more information see www.esa-jrc-summerschool.org

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Meetings Calendar

IAG Sponsored Meetings

International Review Workshop on Satellite Altimetry Cal/Val Activities and Applications

April 23-26, 2018, Chania, Greece

URL: <http://frm4alt.eu/int-cal-val-review>

UN GGIM AP / IAG / FIG Technical Seminar on Reference Frames in Practice

May 4-5, 2018, Istanbul, Turkey

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

EUREF Symposium 2018

May 30 – June 1, 2018, Amsterdam, The Netherlands

URL: <http://euref2018.nl>

10th IVS General Meeting

June 3-8, 2018, Longyearbyen, Spitsbergen, Norway

URL: <http://www.ivs2018.no>

First Workshop on the International Geodynamics and Earth Tide Service (IGETS)

June 18-20, 2018, Potsdam, Germany

URL: <http://isdc.gfz-potsdam.de/igets-data-base/igets-workshop-2018/>

IX Hotine-Marussi Symposium on Mathematical Geodesy

June 18-22, 2018, Rome, Italy

URL: <https://sites.google.com/uniroma1.it/hotinemarussi2018/>

42nd COSPAR Scientific Assembly (with REFAG2018 and Panel on Satellite Dynamics)

July 14-22, 2018, Pasadena, CA, USA

URL: <http://cospar2018.org/>

8th UN-GGIM Session

August 1-3, 2018, New York, USA

URL: <http://ggim.un.org/meetings/GGIM-committee/8th-Session/>

IAU XXXth General Assembly

August 20-31, 2018, Vienna, Austria

URL: <http://astronomy2018.univie.ac.at/>

19th General Assembly of WEGENER

September 10-13, 2018, Grenoble, France

URL: <https://wegener2018.sciencesconf.org>

GGHS2018

September 17-21, 2018, Copenhagen, Denmark

“Gravity, Geoid and Height Systems 2” Symposium, 2nd joint meeting of the International Gravity Field Service and Commission 2 of the IAG

URL: <http://www.space.dtu.dk/gghs2018>

International DORIS Service (IDS) Workshop

September 24-29, 2018, Ponta Delgada, Azores

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

GGOS Days 2018

October 2-4, 2018, Tsukuba, Japan

URL: <http://176.28.21.212/en/meetings/2018/ggos-days/general/>

IGS 2018 Workshop

October 29 – November 2, 2018, Wuhan, China

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

21st International Workshop on Laser Ranging

November 5-9, 2018, Canberra, Australia

URL: <http://www.serc.org.au/iwlr-2018/>

27th IUGG General Assembly

July 8 – 17, 2019, Montreal, Canada

URL: <http://www.iugg.org/assemblies/>

IAG Related Meetings

EGU General Assembly 2018

April 8-13, 2018, Vienna, Austria

URL: <http://www.egu2018.eu/>

Scientific Congress of the National Geodesy and Geophysics Union of Turkey

May 30 – June 2 , 2018, Izmir, Turkey

URL: <http://www.tujjbkongre2018.org/en/>

AOGS 15th Annual Meeting

June 3-8, 2018, Hawaii, USA

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

Baltic Geodetic Congress 2018

June 21-23, 2018, Olsztyn, Poland

URL: <http://bgc2018.systemcoffee.pl>

ESA/JRC International Summer School on GNSS 2018

July 16-27, 2018, Loipersdorf, Austria

URL: <https://www.esa-jrc-summerschool.org/>

IX International Symposium "Metrology of Time and Space"

September 12-14, 2018, Mendeleevo, Russia

URL: <http://www.vniiftri.ru/index.php/en/news/conferences/741-sym9>

ION GNSS+ 2018

September 24-28, 2018, Miami, Florida, USA

URL: <https://www.ion.org/gnss/>

EVN Symposium and Users' Meeting

October 8-11, 2018, Granada, Spain

URL: <http://evnsymp2018.iaa.es/>

AGU 2018 Fall Meeting

December 10-14, 2018, Washington, D.C., USA

URL: <https://meetings.agu.org/>

EGU General Assembly 2019

April 7-12 , 2019, Vienna, Austria

URL: <http://www.egu2019.eu/>

AOGS 16th Annual Meeting

July 28 – August 2, 2019, Singapore, Singapore

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