



IUGG



**International Association
of Geodesy**

Newsletter

November 2020

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Contents

General Announcements	3
Geodesists' Handbook 2020.....	3
COST-G – Combination Service for Time-variable Gravity Fields.....	3
Professor in Satellite Geodesy at DTU Space.....	6
Meeting Announcements	6
Meetings Calendar	6
IAG Sponsored Meetings	6
43rd COSPAR Scientific Assembly.....	6
Satellite remote sensing for improving hydro meteorological models.....	6
1. ICCG Workshop	6
EUREF 2021 Symposium	6
19th International Symposium on Geodynamics and Earth Tides (G-ET Symposium 2020).....	6
IAG Scientific Assembly.....	6
The 6th Satellite Soil Moisture Validation and Application Workshop	6
IGS Workshop "IGS 2021: Science from Earth to Space"	6
2nd International Symposium of Commission 4: Positioning and Applications.....	7
IAG Related Meetings	7
AOGS Annual 18th Meeting	7

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

Geodesists' Handbook 2020

The Geodesist's Handbook 2020 is now available online from Springer. You can download it from the webpage

<https://link.springer.com/article/10.1007/s00190-020-01434-z>

or directly using the following link:

<https://link.springer.com/content/pdf/10.1007/s00190-020-01434-z.pdf>

MARKKU POUTANEN
IAG Secretary General

COST-G – Combination Service for Time-variable Gravity Fields



Overview

The International Combination Service for Time-variable Gravity Fields (COST-G) is the Product Center of the International Gravity Field Service (IGFS) for time-variable gravity fields. COST-G provides consolidated monthly global gravity models in terms of spherical harmonic (SH) coefficients and thereof derived grids by combining existing solutions or normal equations (NEQs) from COST-G analysis centers (ACs) and partner analysis centers (PCs).

The NASA/DLR GRACE satellite mission provided 15 years (2002-2017) of observations of the changing Earth masses in the Earth system, e.g. the ice masses in Greenland. Several analysis centers are engaged in the determination of these mass variations, many of them are Analysis or Partner Analysis Centers in COST-G. Its successor mission GRACE-FO, implemented and operated by NASA and the German Research Centre for Geosciences (GFZ), is now in space and continues to provide data of the same quality as GRACE.

Earth observation (EO) satellites yield a wealth of data for scientific, operational, and commercial exploitation. Observations, derived from the Gravity Recovery and Climate Experiment (GRACE) mission, and by GRACE-FO (Follow-on), deliver fundamental insights into the global water cycle, ice mass redistributions, ocean circulation and the solid Earth. For example, changes in continental water storage control the regional water budget and can, in extreme cases, result in floods and droughts that often claim a high toll on infrastructure, the economy and human lives.

Objectives

Due to different processing strategies, individual solutions of the analysis centers may differ in terms of mass variation. COST-G aims at consolidating these monthly global gravity models in terms of spherical harmonic coefficients (Level 2) and derived grids (Level 3) by combining the solutions of the individual centers.

The COST-G ACs adopt different analysis methods but apply agreed-upon consistent processing standards to deliver time-variable gravity field models, e.g. from GRACE/GRACE-FO low-low satellite-to-satellite tracking (ll-SST), high-low satellite-to-satellite tracking (hl-SST) such as for ESA's Swarm mission, Satellite Laser Ranging (SLR).

COST-G recognizes and emphasizes the existence and acknowledges the contribution of every individual AC and PC. Their participation is a crucial and mandatory prerequisite to the consolidation of monthly global gravity fields within COST-G.

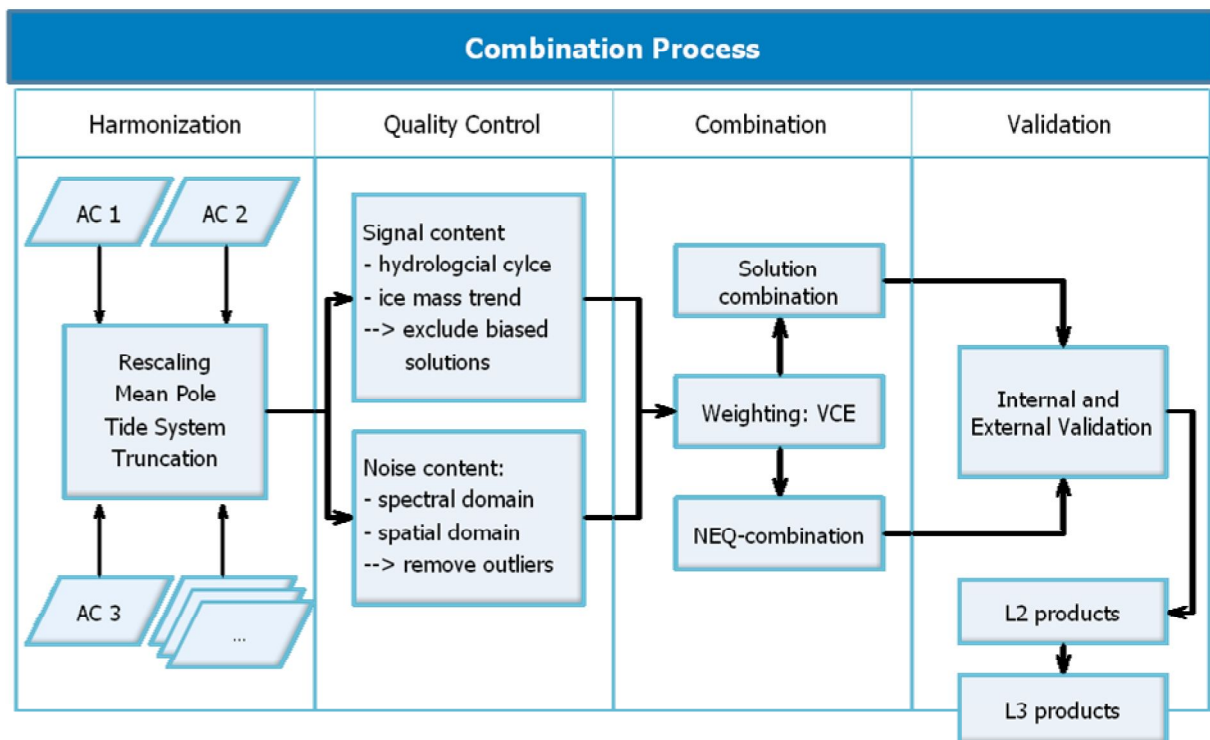
COST-G performs a quality control of the individual contributions before combination. COST-G provides:

- Combined gravity field solutions in SH coefficients (Level-2 products) derived from a weighted combination of individual contributions generated by the different ACs,
- Spatial grids and other high-level products (Level-3 products) of the Combined Solutions for hydrological, oceanic, and polar ice sheets applications.

Services

COST-G combines the gravity field solutions of various analysis centers (ACs). Currently, solutions are provided for GRACE, GRACE-FO and Swarm. The combination procedure consists of four major steps:

1. Harmonization: the various solutions are transformed to a common system
2. Quality control: the signal content as well as the noise content is evaluated in order to eliminate biased solutions and/or outliers.
3. Combination is performed on two levels:
 - a. Solution level, i.e. the spherical harmonic coefficients are combined using variance component estimation (VCE); details can be found in Jean et al. (2018)
 - b. Normal-EQuation-level (NEQ), i.e. the normal equations of the analysis centers are combined; details can be found in Meyer et al. (2019)
4. Internal and external validation ensure the quality of the product



Evaluation of Models

Evaluation of the models is performed in a two-stage process by the validation center and the product evaluation group.

Validation Centers focus on a noise assessment of the derived solutions. Tasks of the VC include:

- Evaluation of the noise of the solutions over dedicated areas of low variability
- Evaluation of the quality of the solutions through comparison with external data sets such as altimetry
- Validation through LEO satellite orbit tests

The Product Evaluation Group focuses on the assessment of the signal contribution. Tasks of the PEG include assessing COST-G products for studying mass variations related to:

- Terrestrial water storage over non-glaciated regions
- Bottom pressure variations in the oceans
- Ice mass changes in Antarctica and in Greenland

Public outreach

The Level-2 products are made available through the International Center for Global Earth Models (ICGEM, <http://icgem.gfz-potsdam.de>).

The Level-3 products by the Information System and Data Center (ISDC, <https://isdc.gfz-potsdam.de>).

The products can be visualized at the COST-G Plotter (<http://cost-g.org/>) and the Gravity Information Service (GravIS, <http://gravis.gfz-potsdam.de>).

Data Policy

Access to global gravity field models, derived products, once offered by the center, shall be unrestricted for any external user.

Reference

Jäggi A. et al. (2020) International Combination Service for Time-Variable Gravity Fields (COST-G). In: . International Association of Geodesy Symposia. Springer, Berlin, Heidelberg. https://doi.org/10.1007/1345_2020_109

Other references:

Jean, Y., Meyer, U. & Jäggi, A. Combination of GRACE monthly gravity field solutions from different processing strategies. J Geod 92, 1313–1328 (2018). <https://doi.org/10.1007/s00190-018-1123-5>

Meyer, U., Jean, Y., Kvas, A. et al. Combination of GRACE monthly gravity fields on the normal equation level. J Geod 93, 1645–1658 (2019). <https://doi.org/10.1007/s00190-019-01274-6>

Staff

COST-G is hosted by the AIUB Bern.

- Chair of the Directing Board: Adrian Jäggi
- Vice-Chair of the Directing Board: Frank Flechtner
- Analysis Center Coordinator: Ulrich Meyer

The staff is allocated part-time and responds to queries on a best-effort basis.

Point of Contact

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MATTHIAS WEIGELT

Professor in Satellite Geodesy at DTU Space

DTU Space, the National Space Institute, seeks a professor in Satellite Geodesy. The position is associated with the Section of Geodesy and Earth Observation that carries out research in the fields of geodesy and geoinformatics (GEO).

The candidate is expected to take a leading role in developing the strategic research within satellite geodesy where real-time robust positioning and methodologies related to reference frames are important focus areas. The candidate will be leading the GNSS research group and be the main driver for the development of the group with about 10 people in total.

Online applications should be submitted no later than **1 February 2021**

Details are available online from www.career.dtu.dk or through the direct [link](#). Further information may be obtained from Michael Schultz Rasmussen, tel.: +45 2053 3230, Email msr@space.dtu.dk

ALAN WERVICK

Meeting Announcements

Meetings Calendar

IAG Sponsored Meetings

43rd COSPAR Scientific Assembly

January 28 – February 4, 2021, Sydney, Australia

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

Satellite remote sensing for improving hydro meteorological models

February 9 –12, 2021, Hobart, Australia

URL: <https://www.aesconvention.com.au/>

1. ICCG Workshop

March 29 - 31, 2021, Germany - online

URL: <https://iccg.iag-aig.org/iccg-workshops/ws21>

EUREF 2021 Symposium

May 26 –28, 2021, Ljubljana, Slovenia

URL: <https://euref2020.si/>

19th International Symposium on Geodynamics and Earth Tides (G-ET Symposium 2020)

June 22 –26, 2021, Wuhan, China

URL: <http://get2020.csp.escience.cn/>

IAG Scientific Assembly

June 28 – July 3, 2021, Beijing, China

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

The 6th Satellite Soil Moisture Validation and Application Workshop

September 14 – 16, 2021, Perugia, Italy

URL: <http://venti-eventi.com/>

IGS Workshop "IGS 2021: Science from Earth to Space"

September 27 – October 1, 2021, Boulder, CO, USA

URL: <https://www.igscb.org/workshop2021/>

2nd International Symposium of Commission 4: Positioning and Applications

September 5 – September 9, 2022, Potsdam, Germany

URL: <https://www.iag-commission4-symposium2022.net/>

IAG Related Meetings

AOGS Annual 18th Meeting

August 1-6, 2021, Singapore

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