

The GGOS Bureau of Products and Standards

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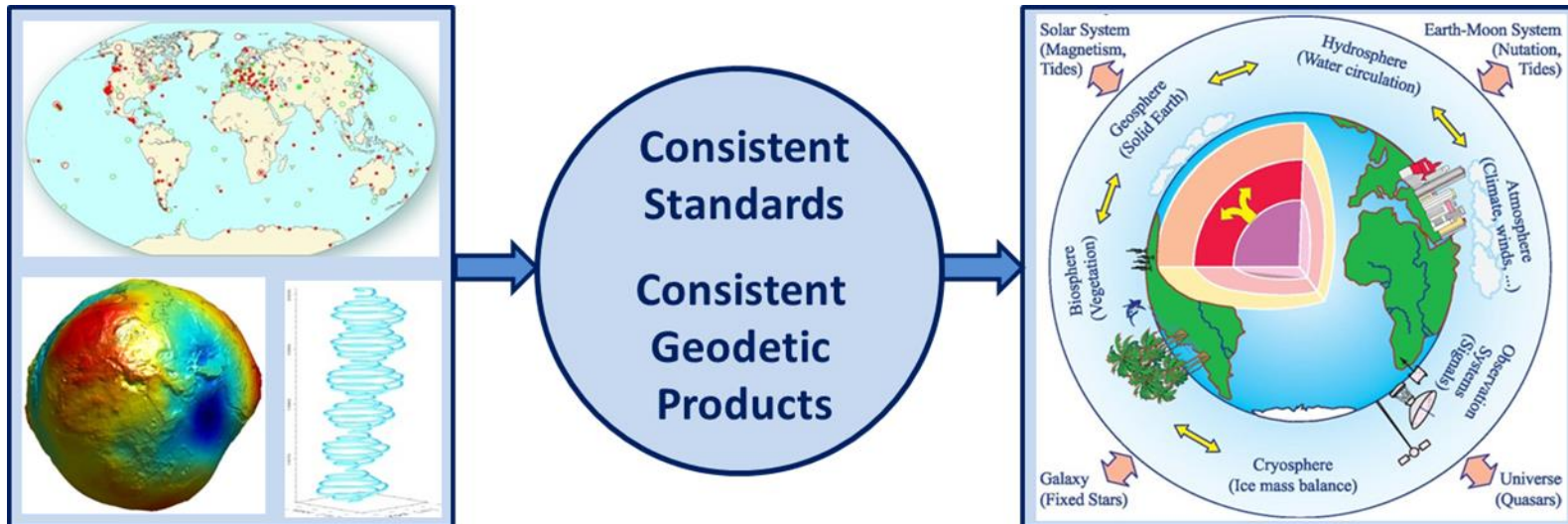
vEGU21: April 19-30, 2021

GGOS Bureau of Products and Standards (BPS)

The BPS supports GGOS in its key goal to obtain consistent products describing the geometry, rotation and gravity field of the Earth.

Mission and objectives

- contact & coordinating point for homogenization of IAG standards and products
- keep track of the adopted geodetic standards and conventions across all IAG components, and initiate steps to close gaps and deficiencies
- integrate geometric and gravimetric parameters, and foster the development of new geodetic products needed for Earth sciences and society



BPS Organizational Structure

- The BPS is hosted at Technical University of Munich
- BPS staff:
 - D. Angermann (Director), T. Gruber (Deputy Director), M. Gerstl, R. Heinkelmann, U. Hugentobler, L. Sánchez, P. Steigenberger
- GGOS components associated to the BPS
 - Committee “**Earth System Modelling**” (Chair: M. Thomas)
 - Committee “**Essential Geodetic Variables (EGVs)**” (Chair: R. Gross)
 - Working Group “**Towards a consistent set of parameters for the definition of a new GRS**” (Chair: U. Marti)
- Associated members of the BPS:
 - ~ 20 representatives designated by the IAG Services and other relevant entities involved in standards and geodetic products

Representatives of IAG Services and other entities

R. Heinkelmann, Germany	International Earth Rotation and Reference Systems Service (IERS)
N. Stamatakos, USA	International Earth Rotation and Reference Systems Service (IERS)
U. Hugentobler, Germany	International GNSS Service (IGS)
E. Pavlis, USA	International Laser Ranging Service (ILRS)
J. Gipson, USA	International VLBI Service for Geodesy and Astrometry (IVS)
F. Lemoine, J. Ries, USA	International DORIS Service (IDS)
J.-M. Lemoine, H. Capdeville, France	International DORIS Service (IDS)
R. Barzaghi, Italy	International Gravity Field Service (IGFS)
S. Bonvalot, France	Bureau Gravimétrique International (BGI)
M. Reguzzoni, Italy	International Service for the Geoid (ISG)
E. S. Ince, Germany	International for Global Earth Models (ICGEM)
K. M. Kelly, Germany	International Digital Elevation Model Service (IDEMS)
H. Wzointek, Germany	International Geodynamics and Earth Tide Service (IGETS)
J. L. Hilton, USA	IAU Commission A3 Representative
M. Craymer, USA	Chair of Control Body for ISO Geodetic Registry Network
L. Hothem, USA	Vice-Chair of Control Body for ISO Geodetic Registry Network
S. Rozsa, Hungary	IAG Communication and Outreach Branch
D. Angermann, Germany	IAG Representative to ISO/TC211
J. Kusche, Germany	Representative of gravity community

Summary of BPS activities

- evaluate the standards and conventions used for the generation of IAG products (interaction with IAG components and other entities)
- contribute to the re-writing/revising of the IERS Conventions (BPS Director has been nominated as Chapter Expert for Chapter 1 “General definitions and numerical standards”)
- focus on the integration of geometric and gravimetric observations and to support the development of integrated products (e.g., GGRF, IHRF, atmosphere products)
- interact with external stakeholders (e.g., ISO, IAU, UN-GGIM, CODATA, BIPM, ...)
- contribute to the UN GGIM Subcommittee on Geodesy (SCoG), IAG representation in GGRF Working Group “Data Sharing and Development of Geodetic Standards”
- contribute to the Committee on Essential Geodetic Variables (EGVs) and to the GGOS Working Group “DOIs for Geodetic Data”
- compile descriptions for geodetic products as input for the new GGOS web site

BPS Implementation Plan 2020-2022

	2020												2021												2022											
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Strategic Planning Phases	for 2020-2022								for 2023-2024																											
Development Implementation Plan																																				
New Implementation Plan									X														X													
Communication & Coordination Activities																																				
EC Monthly Telecon	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
CB Semiannual Meetings (EGU, GGOS Days)					X					X					X						X							X					X			
Consortium Annual Meeting										X											X												X			
BPS Meetings (external)					X					X					X						X							X					X			
BPS Meetings (internal)	X				X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Specific Tasks - Products and Standards																																				
2nd version BPS inventory	←→																																			
Revision BPS inventory	←→																																			
Publication BPS inventory in Geodesist's HB													X																							
Resolving deficiencies (with IAG Services)													←→												←→											
Updating and extending BPS inventory													←→												←→											
Classification and description of products													←→												←→											
Gap analysis regarding products													←→												←→											
Interaction with IAG Services	←→												←→												←→											
Interaction with IAU, UN-GGIM, GGCE, ISO, ...	←→												←→												←→											
Rewriting IERS Conventions (Chapter 1)	←→												←→												←→											
Submission revised Chapter 1 (to IERS CC)																									X											
Outreach Activities																																				
BPS input for new GGOS website	←→																																			
Geodetic products for new GGOS website													←→												←→											
BPS input for GGOS outreach material													←→												←→											
Preparation UAW and GGOS Days 2021													←→												←→											
Co-convenor of GGOS sessions	←→												←→												←→											
Publications and presentations	←→												←→												←→											

BPS inventory of standards and conventions

Inventory of standards and conventions used for the generation of IAG products

- Evaluation of numerical standards (chapter 3)
- Product-based review (chapter 4)
 - Celestial reference systems and frames
 - Terrestrial reference systems and frames
 - Earth Orientation Parameters (EOP)
 - GNSS satellite orbits
 - Gravity and geoid
 - Height systems and their realizations
- Assessment of the present status, identification of gaps and deficiencies, provision of recommendations (interaction with IAG Services)

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Angermann D., Gruber T., Gerstl M., Heinkelmann R., Hugentobler U., Sánchez L., Steigenberger P. (2020): **GGOS Bureau of Products and Standards: Inventory of standards and conventions used for the generation of IAG products**. The Geodesist's Handbook 2020, Eds: Poutanen M., Rózsa S. Journal of Geodesy, <https://doi.org/10.1007/s00190-020-01434-z>.

BPS contributions to new GGOS website „Product pages“

Some general remarks on the GGOS product pages:

- GGOS website should be an “**entrance door**“ to geodetic products
- To satisfy different user needs and communities (e.g., geodesists, geophysicists, users from other disciplines and further customers, ...)
- Classification of geodetic products:
 - Option 1: **Geodetic themes** (Geometry, reference frames, Earth orientation parameters, gravity field, positioning and applications)
 - Option 2: **Earth system components and space** (Outer space, near space, atmosphere, hydrosphere, oceans, cryosphere, solid Earth)
- Option 1 provides the classical geodetic view, whereas option 2 should also attract users from other disciplines
- Descriptions for about 25 geodetic products have been prepared (see next slide)
 - General information on products, including figures (to promote products to different users)
 - Data sources and further information (link to IAG Services and other providers)

Overview of product descriptions (draft)

Reference frames	
	Intern. Celestial Reference Frame Intern. Terrestrial Reference Frame Intern. Gravity Reference Frame Intern. Height Reference Frame
Geometry	
Land surface	Station positions and time variations Digital elevation models Surface deformation models
Ocean surface and lakes	Sea surface heights Dynamic ocean topography models Sea surface change Tide gauge records
Ice surface	Ice sheets and glaciers (see gravity field)

Gravity field	
	Global gravity field models Regional geoid models Terrestrial gravity data Height systems Geodynamics and earth tides Ice sheets and glaciers
Earth orientation	
	Nutation and precession Polar motion UT1-UTC
Positioning and applications	
Atmosphere	Lower neutral atmosphere Ionosphere Thermosphere
GNSS	GNSS orbits and clocks

Product description "ITRF" (Screenshot from GGOS website, draft)

Credit: Martin Sehnal, Director GGOS Coordinating Office

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ITRF

International Terrestrial Reference Frame

The [International Association of Geodesy \(IAG\)](#) recommends the International Terrestrial Reference Frame (ITRF) as the standard terrestrial reference frame for positioning, satellite navigation and Earth science applications, as well as for the definition and alignment of national and regional reference frames (see [IAG Resolution No. 1, 2019](#)). The importance of geodetic reference frames has been recognized by the United Nations, too. In February 2015, the [UN](#) General Assembly adopted its first geospatial resolution “[A Global Geodetic Reference Frame for Sustainable Development](#)”.

ITRF station distribution

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ITRF

The [ITRF](#) provides the fundamental basis to refer the geodetic observations and estimated parameters to a unified global basis. High accuracy, consistency and long-term stability are required for precisely monitoring global change phenomena as well as for precise positioning applications on and near the Earth's surface. The [ITRF](#) comprises concrete points (markers) attached to the solid Earth crust with precisely determined coordinates (mean 3D positions of the stations and their motions).

Read More ...

Data Sources

ITRS CENTRE
The ITRS Centre is responsible for the maintenance of the [International Terrestrial Reference System \(ITRS\)](#) and the [International Terrestrial Reference Frame \(ITRF\)](#). It is maintained by the [IGN](#) in France.

IERS
International Earth Rotation and Reference Systems Service

EUREF - EPN (REGIONAL DENSIFICATION)
The european regional densification is the [EPN](#) (Eurpean Permanent Network) and is coordinated by [EUREF](#) (<http://euref.eu/>).

Product description “Tide Gauge Records” (Screenshot from GGOS website, draft)



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PRODUCTS

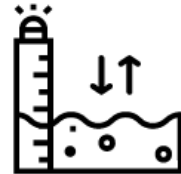
All Geodetic Products



Tide Gauge Records



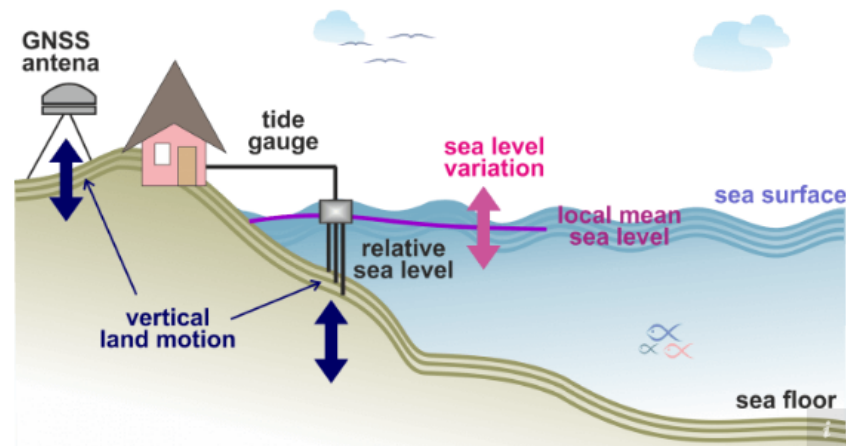
Sea Surface Heights



Tide Gauge Records



Tide gauges (mareographs) record the **height of the water level** with respect to a **local height reference**, but when differences are made to an epoch time, changes in sea level can be measured very accurately. Water level changes inferred from tide gauge registrations are relative changes as they reflect the superposition of absolute water level changes and local or regional vertical movements affecting the mareographs. To obtain **absolute sea level changes** from tide gauge records, they have to be **corrected by vertical land motions**. The vertical land motions are determined using repeated or continuous GNSS positioning.



Sea level monitoring with tide gauges

Final remarks and acknowledgements

- The efforts of the IAG Services and the other data providers for generating the geodetic products and making them openly available are gratefully acknowledged.
- The product descriptions have been generated by the BPS members, supported by the IAG Services and other experts providing valuable input and fruitful comments.
- Many thanks also to Kosuke Heki and the members of the GGOS Science Panel for reviewing the product descriptions and for providing valuable contributions.
- The efforts of Martin Sehnal for implementing the product descriptions at the GGOS website are greatly acknowledged. Please note that the current set of descriptions is still a draft version, which is not openly available. The contents of the new GGOS website will be presented by Martin during the upcoming GGOS Coordinating Board meeting on May 7, 2021.
- Points of contact (for any issues related to the product descriptions and for making them openly available on the GGOS website):
 - GGOS Coordinating Office (E-Mail: martin.sehnal@ggos.org)
 - Bureau of Products and Standards (E-Mail: detlef.angermann@tum.de)