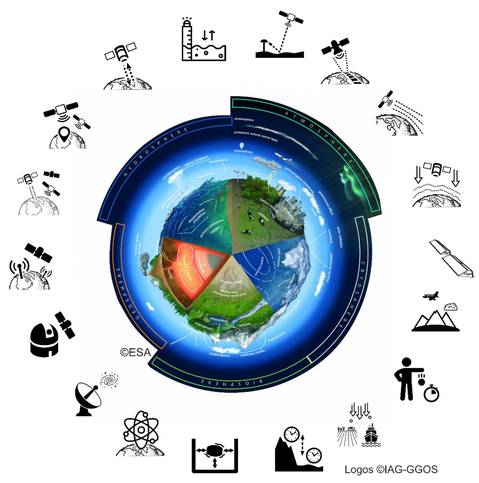
GGOS: The Global Observing System of the International Association of Geodesy

A - What is GGOS?



The Global Geodetic Observing System (GGOS) is the response of the international geodetic community, organised under the International Association of Geodesy (IAG), to the need to continuously monitor the Earth system. GGOS observes the time-varying shape, rotation and gravity field of the Earth with respect to precise and long-term stable geodetic reference frames. Changes to these characteristics are inherently related to changes occurring within and between the Earth's components (the geosphere, atmosphere, hydrosphere, cryosphere and biosphere). GGOS provides the essential framework for accurate measurements and consistent modelling and interpretation of Earth system processes and interactions, including global change, Earth deformation, and mass exchange across Earth's spheres.

B - GGOS goals

The IAG established GGOS with the vision of using geodetic data and products to serve science and society beyond the traditional task of measuring and mapping the Earth's surface. The main goal is to realise an integrated framework that combines technique-specific products into comprehensive, consistent products as the basis for reliable modelling and interpretation of Earth system processes and interactions.

Observing infrastructure
Identifying gaps in the global geodetic infrastructure and advocating for its modernisation, extension and maintenance.

Consistent analysis
Ensuring that the same standards, conventions, models and parameters are used in all data analysis and modelling of Earth system processes.

Integrated analysis and interpretation
Combining geometric, gravimetric and Earth rotation observations in data analysis and data assimilation for comprehensive Earth system modelling.

Serving science and society
Defining requirements for geodetic products based on scientific and societal needs as well as identifying and addressing service gaps.

Raising awareness
Promoting geodesy by improving the accessibility and visibility of data and products.

C - GGOS organisational elements

GGOS is built as much as possible on existing geodetic networks, data management, analysis and distribution facilities, both operational and research-based, as well as on further improvements developed by the IAG components. Specific GGOS organisational elements have been introduced to provide an overarching framework across the different geodetic research areas and IAG components, as well as to address the GGOS goals.

GGOS Bureau of Networks & Observations (GGOS-BNO)
focuses on the global geodetic infrastructure.It assesses the status of the existing infrastructure and advocates its modernisation, expansion and maintenance by means of simulation studies.It coordinates and promotes the GGOS co-located station network integrating geometric and gravimetric techniques.

GGOS Bureau of Products & Standards (GGOS-BPS)
focuses on standardisation, integration and optimisation of geodetic products. It keeps track of the adopted standards and conventions in all IAG Components and proposes actions to address inconsistencies or gaps. It promotes and identifies (new) products that could meet emerging needs. It is working towards the definition and adoption of Essential Geodetic Variables (EGVs).

GGOS Coordinating Office (GGOS-CO)
is responsible for outreach, communication and the GGOS Portal.It hosts activities related to the use of DOIs and FAIR practices in geodesy. It is essential for the communication and dissemination of geodetic results so that other sciences and communities recognise the monitoring of the Earth system by geodesy. It also coordinates the administrative workflow within GGOS.

GGOS Focus Areas (GGOS-FAs)
address broader issues that require the convergence of different IAG components to solve. They are interdisciplinary, designed to address gaps and required future geodetic products, and are incubators for new research topics. Current GGOS-FAs concentrate on
- Geohazards Monitoring,
- Geodetic Space Weather Research, and
- Artificial Intelligence for Geodesy.

GGOS Affiliates
are national or regional geodesy-related organisations that enable greater collaboration across regions, communities and new technologies. Current GGOS Affiliates are
- GGOS Japan,
- GGOS D-A-CH (Germany, Austria, Switzerland), and
- GGOS IberAtlantic (Spain and Portugal).
- A GGOS Affiliate for Africa is in the implementation phase.

D - GGOS building blocks

GGOS would not be possible without the expertise of the IAG and its components. The IAG Commissions, Inter-Commission Committees and Projects address key scientific issues and provide the necessary research infrastructure to advance the science of geodesy. The IAG Services facilitate global coordination of geodetic activities and ensure the generation of reliable, high-accuracy geodetic products.

Observing Infrastructure
Ground, air, and space sensors measuring changes of Earth's geometry, gravity and orientation
Main actors
National and international agencies owning and managing the sensors and providing observational data for further analysis, GGOS-BNO

Data Infrastructure
Managing, archiving, and disseminating geodetic data
Main actors
Observing infrastructure owners, IAG Services, data centres, GGOS-BNO, GGOS-BPS

Analysis Infrastructure
Transforming observations into geodetic products
Main actors
IAG Services, analysis and combination centres, GGOS-BPS, GGOS-BNO

Research Infrastructure
Advance knowledge, innovation, and technology in geodesy
Main actors
IAG Commissions, Inter-Commission Committees, Projects and Services, GGOS Focus Areas

Reference Frame Infrastructure
Global geodetic reference frames as basis for describing Earth's geometry, gravity field and rotation, and measuring changes to the Earth system
Main actors
IAG Services supported by IAG Commissions, GGOS-BNO and GGOS-BPS

GGOS Portal
Central access point for geodetic data and products
Main actors
GGOS Coordinating Office supported by IAG Services, GGOS-BPS and GGOS-BNO

E- Current challenges

To meet the GGOS goals, the observing infrastructure and expertise in geodesy as well as multidisciplinary research must be in place. Following challenges are in focus:

- Infrastructure gaps, ageing instruments, global data disparities.
- Limited funding for satellite missions and ground stations.
- Reference geodetic products on a best-effort basis (long-term operational activities not ensured).
- Challenging transition from research to operational services.
- Decreasing human resources and limited new talent (fewer university students in geodesy).
- Lack of awareness in the policy arena, international high-level initiatives, other Earth sciences and industry.
- Difficulty in translating technical geodetic information into actionable insights for decision-makers and the public.

F - Actions in progress

Continue to advance geodesy by:
- Providing a comprehensive, unified global geodetic frame of reference for geometry, gravity field, and orientation/rotation.
- Ensuring an integrated geodetic monitoring/ observation system, rather than a multitude of technique-dependent products

Opportunities
- A central interface between science and society.
- A transformative role for geodesy.
- Geodetic data and products serve science and society far beyond the usual applications of mapping, positioning, navigation and timing.
- Geodesy is critical for monitoring the Earth system and tracking global change with unprecedented precision.

Defining Essential Geodetic Variables (EGVs) to leverage the use of geodesy in broader international and multidisciplinary Earth observation initiatives.

Opportunities
- Geodesy shares a common language with other Global Observing Systems.
- Clearer communication of geodesy's vital role in monitoring the Earth system, as envisioned by the IAG, as well as the socio-economic system, as envisioned by the UN-GGCE.
- Increased visibility of geodesy within the geosciences, government institutions and policy-making bodies.
- The requirements for supporting EGVs provide a strategic approach to improving the precision, reliability and timeliness of geodetic data and products.

Supporting the UN Global Geodetic Centre of Excellence (UN-GGCE) in the implementation of the UN Resolution 69/266 "A Global Geodetic Reference Frame for Sustainable Development" by identifying tangible geodetic contributions to UN Sustainable Development Goals

Opportunities
- Geodesy in the policy arena.
- Geodesy infrastructure critical for sustainable development.
- Strengthen the geodetic community, infrastructure, and its visibility in policy making.
- A call for sustained investment in geodesy.

Find out more:
https://geodesy.science/ggos/