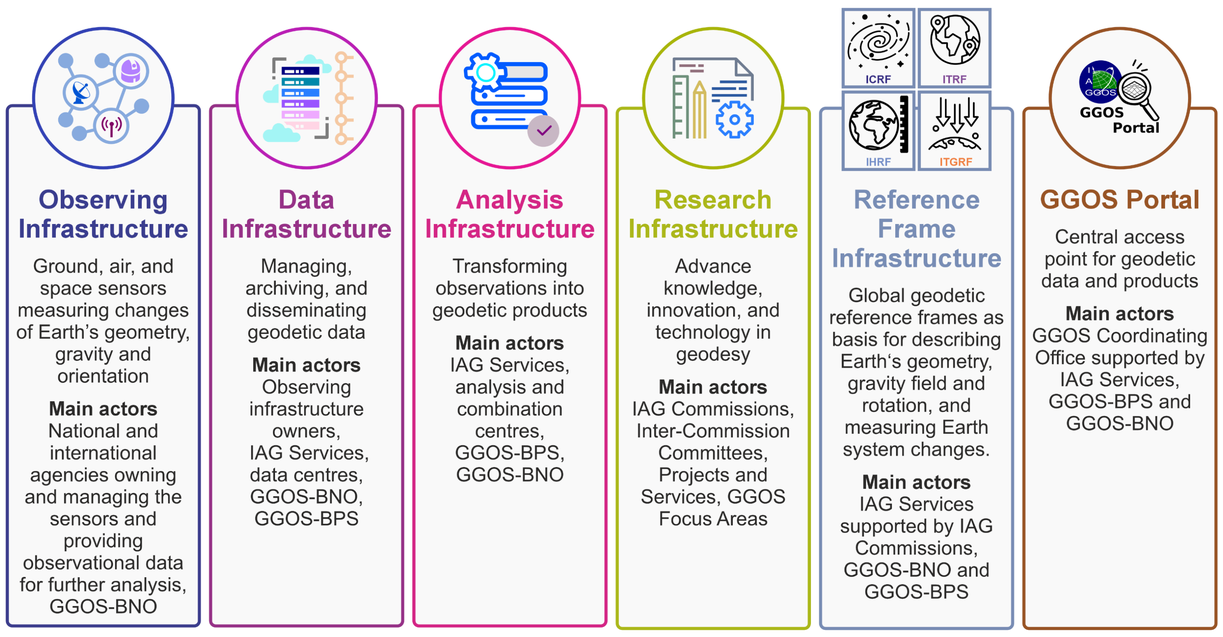
The Global Geodetic Observing System (GGOS):
Strengthening Geodesy for Sustainable Development and Surveying Applications

GGOS, the observing system of the International Association of Geodesy (IAG)

Through GGOS, the IAG provides an integrated framework to encourage, coordinate and facilitate Earth monitoring efforts based on geodesy. GGOS focus is to integrate observations collected by different organisations, raise awareness of geodesy and its products, and make geodetic reference frames accessible. These reference frames form the **fundamental basis for Earth Observation, surveying, geomatics and spatial data management**. In particular, **surveying and geospatial communities rely on GGOS to provide a global reference frame that ensures the interoperability of national geodetic reference systems and supports real-time positioning services**.

GGOS builds upon existing geodetic observation infrastructure and the organisational structure of the IAG. **IAG Commissions, Inter-Commission Committees and Projects** address key scientific issues and innovate methods and technologies in various geodetic fields, **providing the scientific basis for GGOS**. **IAG Services** facilitate the global coordination of activities involved in **collecting and analysing geodetic data with highest accuracy**. They also provide geodetic reference frames and other products to geodesists, Earth scientists, national administrations, and the public.

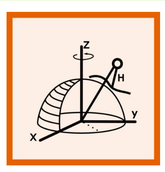
Additional operational elements dedicated solely to GGOS issues ensure the **efficient organisation of GGOS activities** and address challenges that cannot be solved by individual IAG components alone. This contribution summarises the main GGOS activities currently underway.



Building blocks of GGOS and the supporting organisational elements of GGOS and IAG (GGOS-BNO: GGOS Bureau of Networks and Observations; GGOS-BPS: GGOS Bureau of Products and Standards)

Standardisation, Integration, Optimisation

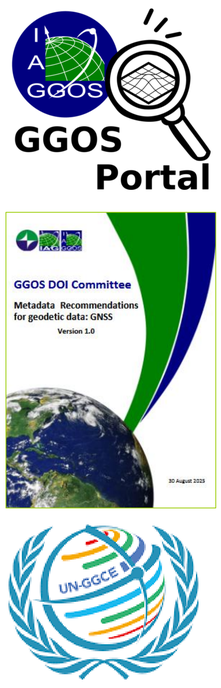
Interacting with IAG Components to provide unique standards and mutually consistent, highly reliable and accessible geodetic products.



- *Keep track of the **standards, constants and conventions** adopted by the IAG for a consistent use in the combination, data analysis and model assimilation of geometric, gravimetric and Earth rotation observations in.*
- *Calculation of a **new reference ellipsoid** based on the most up-to-date estimates to address the misunderstanding caused by multiple inconsistent values for the same parameters, particularly a, f and GM.*
- ***Inventory and characterisation of geodetic products** provided by IAG Services and external stakeholders to support the EGVs.*

Outreach, Policy Networking

Public relations, outreach, and engagement to ensure a long-term sustainable geodetic enterprise.



- ***Comprehensive GGOS website** https://geodesy.science/ggos/ offering accessible explanations of geodetic techniques and operational products, along with an extensive catalogue of sources.*
- *Implementation of the **GGOS Portal** as a unique search and access point (one-stop-shop) for geodetic data and products*
- *Design of strategies for the use of **DOI** as well as **FAIR** and **TRUST** principles in 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.*

Regional GGOS alliances

Interaction with coordination groups involved in the implementation of geodetic infrastructure at regional scales.

- *Fostering **regional alliances** to identify, enable and develop sustained geodetic observations, products and services following regional and national priorities, aligned with the global goals of GGOS.*
- ***GGOS Affiliates** are national or regional geodesy-related organisations that facilitate greater collaboration and promote geodesy in their countries.*
- *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 start-up phase. The first step is to assess geodetic infrastructure and capacity across several African countries. It is funded by the UK Research and Innovation of the Science and Technology Facilities Council (STFC).*

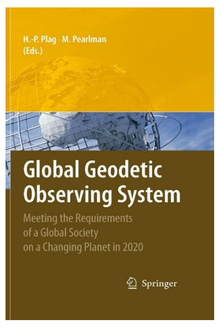
Incubation of new integrated research

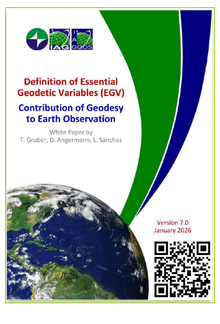
Addressing broader, cross- disciplinary issues to design integrated data analysis and new geodetic products.

- ***Geohazards Monitoring**: Development of methods for the reliable use of GNSS techniques for Tsunami Early Warning Systems (GTEWS) as essential input for the UN Global Assessment Report on Disaster Risk Reduction.*
- ***Geodetic Space Weather Research**: Development of improved models of the ionosphere, plasmasphere and thermosphere, as well as their coupling processes.*
- ***Artificial Intelligence for Geodesy**: Development and evaluation of improved geodetic products based on AI for GNSS remote sensing, predicting Earth orientation parameters, and monitoring of surface deformation, gravity field and mass change.*

Requirements for GGOS and user needs

Meeting accuracy, stability and service levels required by scientific, operational and societal applications.

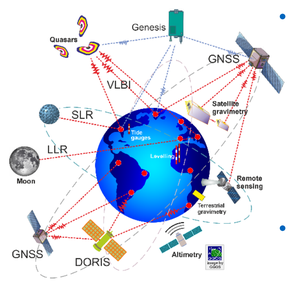


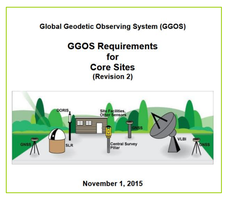


- ***Revision and update of the goals and requirements of GGOS** formalised by the IAG in 2009 in the book "The Global Geodetic Observing System: Meeting the Requirements of a Global Society on a Changing Planet".*
- *The update is structured around **Essential Geodetic Variables (EGVs)**, which clarify geodesy contributions to Earth Observation and everyday applications.*
- *EGVs are based on a **comprehensive inventory of products** provided by the IAG Services and external stakeholders.*
- ***Evaluating the quality, availability, and consistency** of these products supports an informed strategy for future improvement.*

Global Geodetic Infrastructure

Identification of gaps in the geodetic infrastructure and advocacy for modernisation, extension, and maintenance.





- *Assessment of the **robustness of the space geodetic networks** based on existing simulations to identify the impact of ground station removal and equipment degradation, as well as the need to exploit new technologies such as Genesis.*
- *Description of **challenges and practices** required to host and maintain fundamental geodetic stations to support the planning of potential new geodetic observatories.*
- *Update the 2015 document "**GGOS Requirements for Core Sites**" in line with the newest technical developments in the ITRF, IHRF, and ITGRF.*
- ***Standardisation of local tie measurements**, including archiving, analysis procedures and application of new survey techniques.*

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