

# **Standards and Conventions in the Frame of GGOS**



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# Outline

## **1. Introduction**

Nomenclature (Standards, constants, conventions).

## **4. Mission and Objectives**

of a GGOS Bureau on Standards and Conventions.

- **Conclusion and Recommendations**

Next steps to be done.

# 1. Introduction

Clear standards and unique conventions are the basis for the reliability of geodetic products. We shall distinguish

- Standards,
- Standardized units,
- Fundamental physical constants,
- Resolutions,
- Conventions.

GGOS shall ensure the consistency of geometric and gravimetric products in the three fields of geodesy: geometry, orientation and gravity field of the Earth.

→ GGOS must guarantee clear and consistent standards and conventions ***for geometry and gravimetry.***

# 1.1 Standards

Standards are generally accepted specifications and measures for quantitative and qualitative values and their comparisons. We shall distinguish

- **Standard specifications**  
*e.g., measurement performance, required data quality, accuracy requirements of networks and reference frames*
- **Standard methods**  
*e.g., for parameter estimation, statistical tests, quality control and integrity, models for reduction and parameters*
- **Standard procedures**  
*e.g., formal measurement or data collecting procedures, routine derivation of geodetic products*
- **Standard definitions**  
*e.g., geodetic datum, reference ellipsoid  $(a, f)$ , potential  $(W_0)$*

## 1.1 Standards (continued)

Standards are developed and promulgated by international and national organizations. Most important for geodesy:

- ***International Organization for Standardization (ISO)***
  - ***Open Geospatial Consortium (OGC)***
- GGOS must intensively cooperate with ISO and OGC; in ISO mainly in TC 211 “Geographic Information/Geomatics”.
- There are two IAG representatives to ISO (Drewes, Ihde) and one representative of ISO to IAG (Hothem).

Standards may also be released and adopted by national or international organizations, e.g.,

- ***National Institute of Standards and Technology***
- GGOS may become an IAG entity for geodetic standards.

## 1.2 Standardized Units

The value of a quantity is expressed by the product of a number and a unit. Units are used quite heterogeneously in science (e.g., mgal  $\leftrightarrow$  ms<sup>-2</sup>) and society (km  $\leftrightarrow$  miles).

GGOS shall promote the visibility of geodesy and achieve maximum benefit for society, i.e., propagate clear units.

Internationally unified units are promulgated in the

- ***International System of Units (SI) by the International Bureau of Weights and Measures (BIPM).***

Most relevant for geodesy are

- *Length (metre); mass (kilogram); time, duration (second); all other quantities are derived quantities of these.*

→ GGOS must intensively cooperate with BIPM.

## 1.3 Fundamental Physical Constants

A physical constant is a physical quantity that is generally believed to be universal in nature and constant in time.

The US ***National Institute of Standards and Technology (NIST)*** publishes regularly an updated list of constants.

ICSU's ***Committee on Data for Science and Technology (CODATA)*** adopts and publishes a set of constants.

Most important fundamental constants for geodesy are

- the gravitational constant  $G$  ( $6.674\,28\,e-11\,m^3\,kg^{-1}\,s^{-2}$ )
- the speed of light in vacuum ( $299\,792\,458\,m\,s^{-1}$ )
- the standard acceleration of gravity ( $9.806\,65\,m\,s^{-2}$ )
- the standard atmosphere ( $101\,325\,Pa$ )

→ GGOS must intensively cooperate with NIST and CODATA<sub>7</sub>

## 1.4 Resolutions

A resolution is a written motion adopted by a deliberating body. Resolutions are not binding like laws of a legislature, but they are more binding than recommendations.

Resolutions important for geodesy are those adopted by the Councils of the **IUGG** and the **IAG**. They are published in the IUGG Yearbook and the Geodesist's Handbook.

Past IUGG/IAG resolutions on standards refer to

- the Geodetic Reference System 1980 (GRS80),
  - the tide system (permanent tides), 1983,
  - the group refraction index N for microwaves, and refractive index of light, 1999,
  - the Celestial Reference System (IAU2000), 2003,
- GGOS must intensively interact with the Executives and Councils of IUGG and IAG.



## 1.5 Conventions

A convention is a set of agreed, stipulated and generally accepted norms, standards or criteria.

Quantities are called conventions, if they do not represent a natural property, but originate in an agreement.

In geodesy, conventions are normally adopted by the international bodies, e.g., by the components of IAG (Services, Commissions, GGOS). Most common are the ***IERS Conventions***, mainly valid for geometric quantities.

→ GGOS must intensively interact with the IAG Components.

→ GGOS shall encourage ***IGFS Conventions***, valid for gravimetric quantities.

## **2. Mission and Objectives of a GGOS Bureau on Standards and Conventions (BSC)**

### **GGOS Mission:**

- To ensure the stability and monitoring of the three fields of geodesy: Earth geometry, orientation and gravity field.
- To work through the Services and Commissions to collect and archive products and ensure their reliability.
- To identify a consistent set of geodetic products.

### **GGOS Objectives:**

- To maintain the stability of geometric and gravimetric reference frames, and time series of data and products.
- To focus on all aspects to ensure consistency of products.
- To ensure the consistency between the different geodetic standards used in Services and geosciences community.

## **2.1 Synopsis of BSC Terms of Reference**

- The BSC shall keep track of the strict observation of all adopted geodetic standards, standard units, fundamental physical constants, resolutions, and conventions.
- The BSC shall regularly control official geodetic data sets and products with respect to its reliability.
- The BSC shall compare the consistency of heterogeneous products (geometry and gravimetry).
- The BSC shall review, examine and evaluate all actual IAG standards, constants, resolutions and conventions, and make recommendations on the future use or updates.
- The BSC shall identify gaps in standards and conventions and initiate steps to close them, e.g., by IAG resolutions.

## **2.1 BSC Terms of Reference (continued)**

The BSC shall maintain regular contact with all international bodies involved in adoption of standards and conventions.

There shall be a representative of the BSC in these bodies (e.g., ISO, OGC, BIPM, CODATA).

The BSC shall propagate all geodetic standards and conventions in the scientific community and society in general and promote their common use.

Examples for urgently needed resolutions:

- Unified global vertical system (world height system)
- Standard atmosphere (for geometric and gravimetric use)
- Standards for hydrology (ground water, soil moisture, ...)

## 2.2 Membership in the BSC

The BSC shall be composed by each one representative of

- each IAG Technique Service;
- each IAG Commission;
- Inter-commission Committee on Theory;
- external entities adopting standards and conventions.

Associate members may be included for specific issues in particular fields of geodesy (geometry, gravimetry, or combined products).

Regional or national representatives may be included.

The BSC reports regularly to the IAG Executive Committee and – if appropriate – to the IUGG EC.

## 2.3 Interfaces

The BSC is based on the IAG Services. There must be

- permanent contact between components involved in standards and conventions, and analysis groups;
- regular meetings with Services' Directing, Governing Boards or Coordinating Centres, respectively.

There shall be a strong interface with institutions in charge with standards and conventions:

- *International Organization for Standardization (ISO)*
- *Open Geospatial Consortium, Inc.<sup>®</sup> (OGC)*
- *International Bureau of Weights and Measures (BIPM)*
- *Committee on Data for Science and Technology (CODATA)*

### **3 Conclusion and Recommendations**

The GGOS Bureau on Standards and Conventions is an essential component of GGOS and important for all IAG components. It has to play a prominent role for providing reliable and consistent geodetic products.

#### **Next steps to be done:**

- Revision of all standards and conventions used in the geodetic community (in particular the services).
- Revision of all international (external) standards relevant for geodesy.
- Evaluation of all official standards and convention adopted by IAG components.

### **3 Recommendations (continued)**

#### **Next steps to be done (continued):**

- Sensitivity analysis of effects caused by different use of standards and conventions in homogeneous products (geometric or gravimetric, respectively) and in heterogeneous products (different geometric and gravimetric).
- Contact international institutions involved in standards and place representatives.
- Propose necessary standards in internat. organizations for standardization (e.g. ISO): Registration of geodetic products as ISO Standards, e.g., ITRF, IGSN, GGM.
- Propose necessary resolutions of IUGG/IAG, e.g., with respect to a unified vertical reference system (world height system), atmosphere and hydrosphere models.



**Thank you!**