

IAG Project:

Integrated Global Geodetic Observing System (IGGOS)

Chair: **Ch. Reigber**, (Germany)
Secretary: **H. Drewes**, (Germany)

Terms Of Reference

Following the IAG ByLaws, IGGOS was developed by a planning group from 2001 to 2003. The proposal prepared by the IGGOS Planning Group was accepted by the IAG Executive Committee and the IAG Council at their meetings at the XXIII IUGG General Assembly in Sapporo in summer 2003. The IGGOS was endorsed by the IUGG through Resolution No. 3 at the same General Assembly.

IGGOS stands for *Integrated Global Geodetic Observing System*. "System" should be understood as the basis on which future advances in geosciences can be built. By considering the Earth system as a whole (including the geosphere, hydrosphere, atmosphere and biosphere), monitoring Earth system components and their interaction by geodetic techniques and studying them from the geodetic point of view, the geodetic community provides the global geosciences community with a powerful tool consisting mainly of high quality services, standards and references, theoretical and observational innovations.

The **vision of IGGOS** may be characterized as follows:

- IGGOS integrates different techniques, different models and different approaches in order to achieve a better consistency, long-term reliability and understanding of geodetic, geodynamic and global change processes.
- IGGOS provides the scientific and infrastructure basis for all global change research in Earth sciences.
- In the frame of IGGOS, the Earth system is viewed as a whole by including the solid Earth as well as the fluid components, the static and time-varying gravity field in its products.
- IGGOS is geodesy's contribution (products and discoveries) to Earth sciences and the bridge to the other disciplines; it asserts the position of geodesy in geosciences.
- IGGOS integrates the work of IAG and emphasizes the complementarity of the broad spectrum of geodetic research and application fields.

The **mission of IGGOS** is:

- to collect, archive and ensure the accessibility of geodetic observations and models;
- to ensure the robustness of the three fundamental fields of geodesy, namely

- *geometry and kinematics*,
- *Earth orientation and rotation*, and
- *gravity field and its variability*;
- to identify a consistent set of geodetic products and to establish the requirements concerning the products' accuracy, time resolution, and consistency;
- to identify IAG service gaps and develop strategies to close them;
- to stimulate close cooperation between existing and new IAG services;
- to promote and improve the visibility of the scientific research in geodesy;
- to achieve maximum benefit for the scientific community and society in general.

IGGOS is geodesy's central interface to the scientific community and to society in general.

Objectives

- IGGOS aims at maintaining the stability of and providing the ready access to the existing time series of geometric and gravimetric reference frames by ensuring the generation of uninterrupted time series of state-of-the-art global observations related to the three pillars of geodesy.
- IGGOS focuses *in the first phase* on all aspects relevant to ensure the *consistency of geometric and gravimetric products*. This includes space-borne and terrestrial aspects.
- The targeted overall accuracy and consistency of IGGOS products is of the order of 10^{-9} or better.
- IGGOS ensures the consistency between the different geodetic standards used in the geosciences community, in agreement with the international unions.
- IGGOS aims at improving the geodetic models at the level required by the observation.
- IGGOS shall be *established* as an official partner in the *IGOS*, the United Nation's *Integrated Global Observing Strategy*.

Science Rationale

IGGOS shall have a *central theme* and a *master product*. The theme **Global deformation and mass exchange**

processes in the System Earth must be scientifically sound, broad and include all the activities IGGOS might envisage in future.

Under the umbrella of *geometry* plus *Earth rotation* plus *gravity field* this theme encompasses virtually all facets of geodesy. In addition, it may easily be translated and broken down into tangible individual sub-themes and -products. From the general theme *one general product* may be derived, encompassing the following scientific questions/areas:

- The global patterns of tectonic deformation (global with, in addition, “enlargements” of regional maps) including inter-plate and intra-plate deformation,
- The global patterns of height changes (in one datum, and on all time scales, of geodynamic as well as of anthropogenic origin) on land, of ice covers (including glaciers), and of sea level,
- Deformation (loading as well as expansion) due to the mass transfer between atmosphere, hydrosphere including ice and solid Earth,
- Separation of effects of mass changes from motion and from thermal expansion,
- Separation of ocean effects from solid earth effects (“absolute” sea level),
- Quantification of angular momentum exchange, and mass transfer,
- Assessment of the angular momentum and mass balances in the Earth system model, and
- Quantification of mass exchange between the components of the System Earth.

The above list is not meant to be final and will be further developed.

The master theme and the results (products) derived from it will address the relevant science issues related to geodesy and geodynamics in the 21st century, but also issues relevant to society (global risk management, natural resources, climate change, ocean forecasting and others). It is an ambitious project of a dimension that cannot be achieved by the geodetic community alone, and which requires a strong cooperation inside and outside this community.

In order to shape IGGOS through its master-theme and its master-products, a sound and comprehensive **IGGOS Science Plan** is required. The IGGOS Science Plan shall provide a logic framework for the work of IGGOS. The master theme and the corresponding product(s) must be put into a broader science and application context. It should also include an analysis of the state-of-art in the science field under discussion, strength and deficiencies, recommendations of what should be done.

The IGGOS Science Plan should serve as the basis for the implementation of IGGOS in 2005. A work plan should be derivable from it. Furthermore it should become an

attractive document for presentation to potential future partners and clients.

Structure

The IGGOS Planning Group proposed to establish the following key elements of IGGOS:

1. The **IGGOS Project Board** as the central oversight entity.
2. **Working Groups**. The tasks of the working groups are to a high degree independent of the tasks of the IAG services.
3. A **Science Council** representing the geodetic and geophysical community.

The proposal was accepted by the IAG Executive Committee.

The IAG ByLaws ask for the establishment of a Steering Committee consisting of members appointed by the commissions, two members at large, and the chairs of the IAG project sub-groups. The Steering Committee is a subset of the IGGOS Project Board. The Steering Committee members are marked by an asterisk in the following list of members of the initial IGGOS Project Board:

IGGOS Project Board and Steering Committee (2003-2005)

- Chair: *Chris Reigber**
- Members related to reference frames: *Claude Boucher, Hermann Drewes (Repr. Commission 1 *)*, *Markus Rothacher*
- Members related to gravity field and sea level: *Rene Forsberg (Repr. Commission 2 *)*, *Reiner Rummel*, *C.K. Shum*
- Members related to Earth rotation and geodynamics: *Veronique Dehant*, *Kosuke Heki*, *Suzanna Zerbini (Repr. Commission 3 *)*
- Members related to services for geometry: *Norman Beck*, *Chopo Ma*, *Mike Pearlman*
- Members related to services for gravity and sea level: *Fernando Sanso*, *Phil Woodworth*, *Mike Watkins*
- Members related to networks: *Wolfgang Schlüter*, *John Manning*, *Ruth Neilan*

The initial composition of the project board is to a large extent the same as the composition of the IGGOS Planning Group (2001-2003).

Working Groups

Setting up the IGGOS working groups the following general principles are observed:

- IGGOS will be based on the existing IAG Services. It is in particular *not* taking over tasks of existing, and well working IAG services. IGGOS will provide a framework for existing or future services and ensure their long-term stability.

- New entities will be established only if there is a stringent requirement.
- IGGOS must be recognized by partners outside IAG, e.g., by UNESCO, ICSU, IGOS, GOOS, GTOS, governments, inter-government organizations, WCRP, IGBP, etc., as geodesy's most important contribution to Earth sciences. For this purpose contacts have to be established to these organizations.
- IGGOS must promote its master product and the related sub-products.
- IGGOS must promote interdisciplinary research in geodesy.

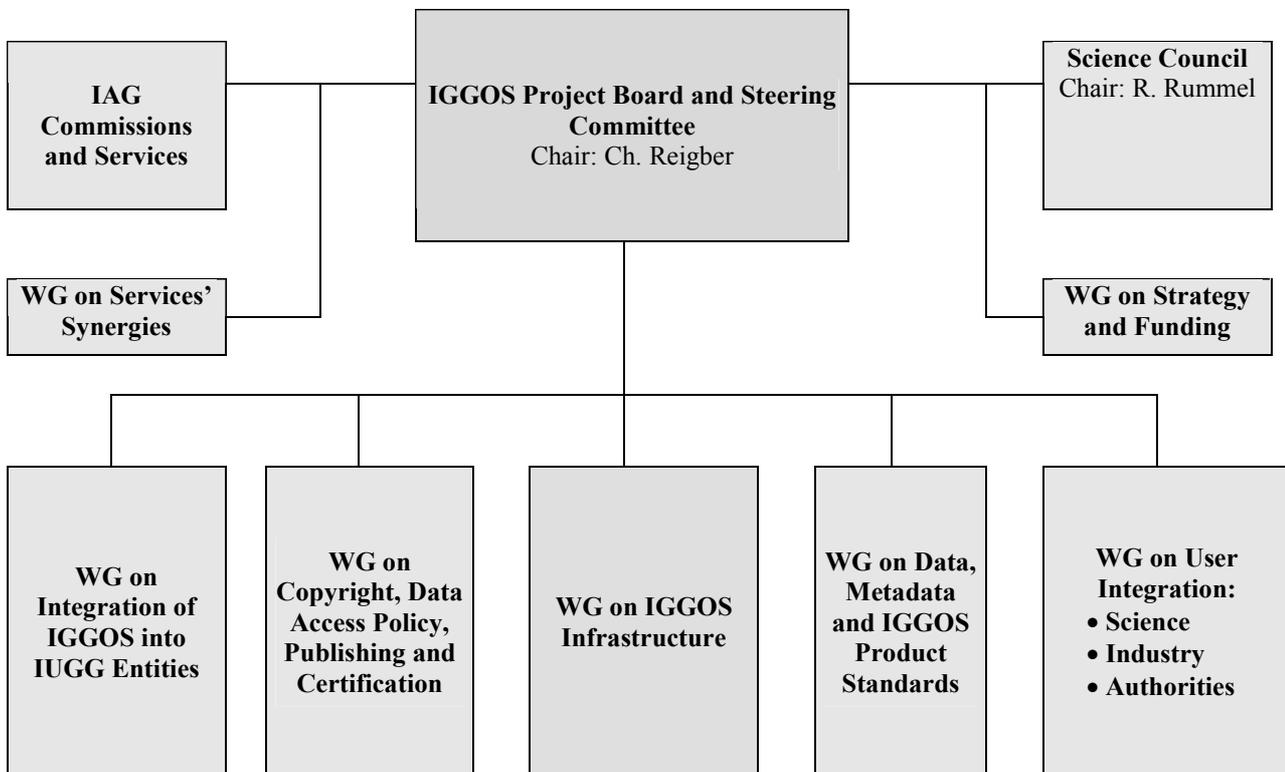
- IGGOS will provide standards and enforce quality management (validation, calibration, ensure the 1 ppb level) either by a new IGGOS entity or by delegating this task to one or several of the existing services.

Science Council

The primary task of the science council is to develop the IGGOS science plan based on the science rationale. The Inter-Commission Committee on Theory shall be represented in the Science Council.

The initial IGGOS structure (for the definition phase 2003-2005) is illustrated by Figure 1.

Figure 1: Initial IGGOS Structure



Program Of Activities

WG on IAG Services' Synergies: The key issue within this WG is a thorough analysis of the existing IAG structure. Does it make sense to combine certain services into one? What new services should be set up? Is it correct to distinguish within IAG between *level 1 services* (e.g., IGS, ILRS, IVS), dealing with raw observations and generating products which are more or less based on these observations only, and *level 2 services* (e.g., IERS) using the products of several level 1 services and generating new

products, which are consistent with all the information from level 1? Shall additional level 2 services be established?

WG on Strategy and Funding: In the long run, funding has to be addressed by all permanent IAG entities requiring a complex infrastructure. As IGGOS per se (at least initially) will be based – exactly like all IAG services – on voluntary contributions of the relevant research organizations in the field, an IGGOS funding strategy must be developed in close coordination with these organizations. It seems therefore appropriate to establish a

working group related to this topic. This aspect is clearly not dealt with at a sufficient rate within the existing IAG services structure.

WG on Integration of IGGOS in IUGG entities: This WG has the task to set up (so-to-speak) the foreign ministry of IGGOS. It must be the goal to have IGGOS acknowledged as a member in the important international programs dealing with global change, etc. The IGOS is but one important example.

WG on Copyright, Data Access Policy, Publishing and Certification: This WG should deal with the consistent assignment of the *Digital Object Identifier* (DOI[®]) framework for IGGOS products and the usage of *Data Set Citation* rules in metadata documents for the definition and realization of copyright, data access, publishing and certification objectives.

WG on Data, Metadata, and IGGOS Product Standards: This WG has to deal with IGGOS products and standardization issues. The definition of IGGOS *Products* consisting of data and metadata, driven by user, application and service requirements using international *Standardization* specifications, constitutes the precondition for the creation of state-of-the-art value-added public and science IGGOS services.

WG on User Integration: This task is in part dealt with by the IAG services. A common policy on the IAG level is, however, missing. This WG must be set up in close cooperation with the services.

Schedule for the Realization of IGGOS

The following plan to develop IGGOS is based on the decisions taken at the last IGGOS planning group meeting in Sapporo.

1. The IGGOS definition phase lasts from 2003-2005. The main tasks are:
 - Definition of the final IGGOS structure
 - Development of the IGGOS Science Plan
2. The “final” IGGOS structure and the science plan will have to be approved by the IAG Executive Committee at the IAG Scientific Assembly in Cairns, Australia.
3. The IGGOS, as IAG’s first project, should become operational in 2005.
4. IGGOS, in particular the science plan developed between 2003 and 2005, will be a central issue of the IAG Scientific Assembly 2005.

Point of Contact:

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