

IAG's Global Geodetic Observing System (GGOS) in its Initial Phase

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Introduction

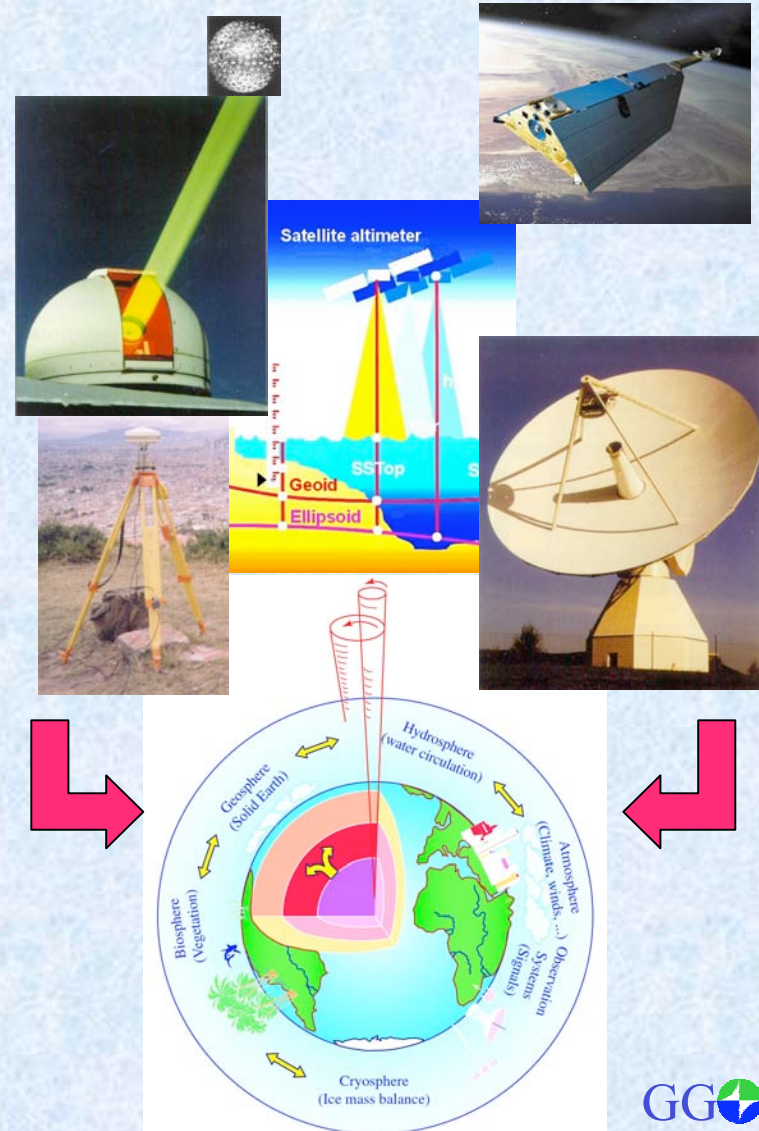
The Global Geodetic Observing System (GGOS) was installed during the XXIII General Assembly of the International Union of Geodesy and Geophysics (IUGG) in Sapporo, Japan, July 2003, as the first and presently only Project of the International Association of Geodesy (IAG).

The Association's Projects are, according to the bylaws of IAG, of broad scope and of highest interest for the entire field of geodesy. They serve as the flagships of the Association for a long period (decade or longer).

The initial phase of GGOS was set up directly after the Sapporo 2003 meeting. The first meeting of the GGOS Project Board took place before the IAG EC Meeting at the EGU General Assembly, Nice, April 24, 2004.

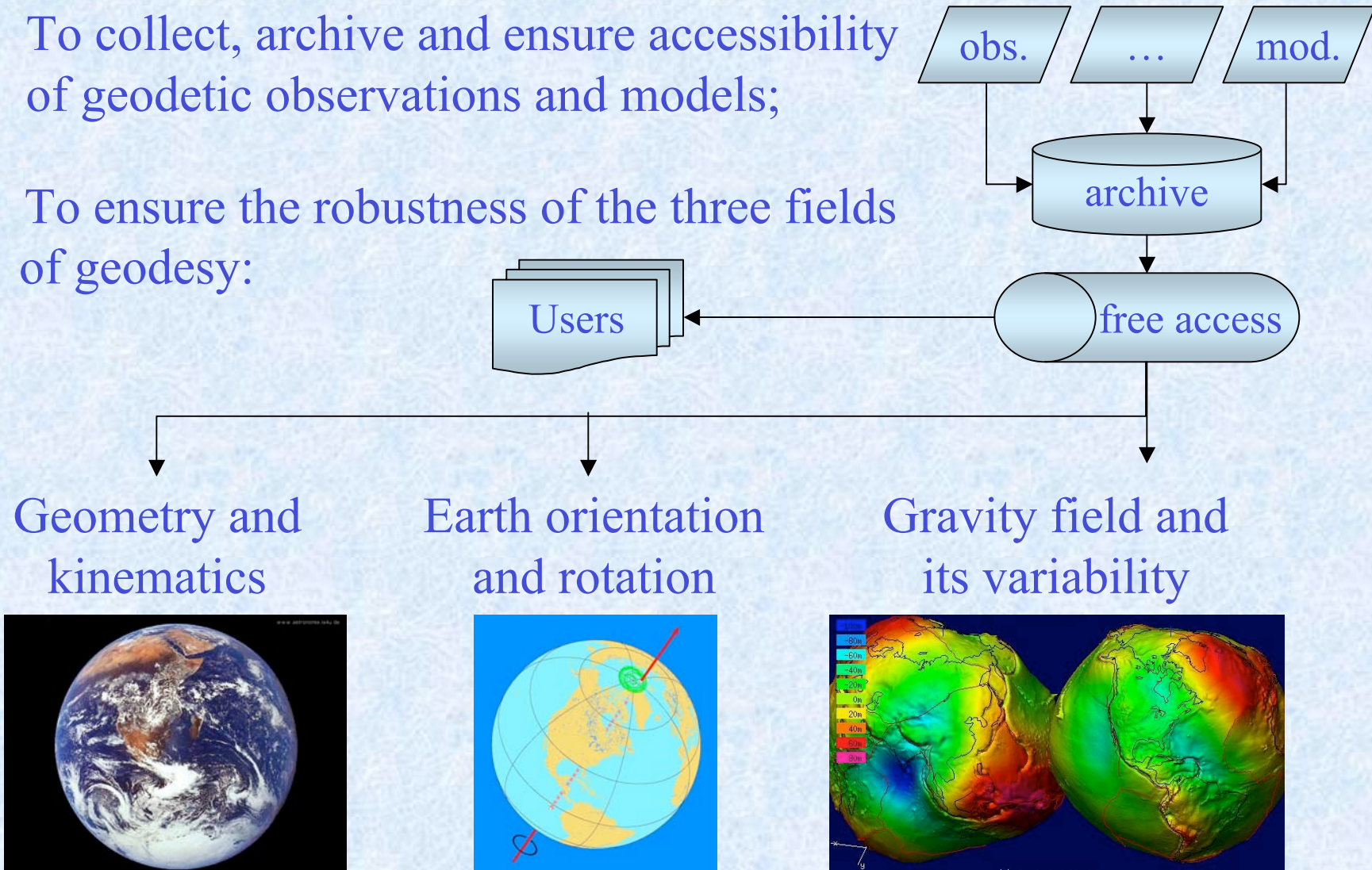
The Vision of GGOS

- GGOS integrates different geodetic techniques, different models, different approaches in order to achieve better long-term consistency, reliability and understanding of geodetic, geodynamic and global change processes.
- GGOS provides the scientific and infrastructure basis for all global change research in Earth sciences.



The Mission of GGOS (1)

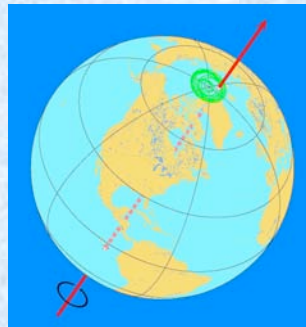
- To collect, archive and ensure accessibility of geodetic observations and models;
- To ensure the robustness of the three fields of geodesy:



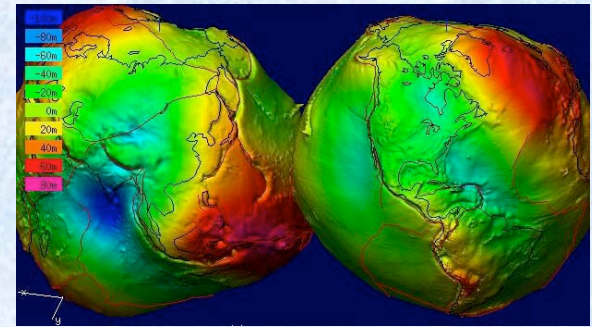
Geometry and kinematics



Earth orientation and rotation



Gravity field and its variability



The Mission of GGOS (2)

- To identify geodetic products and to establish the requirements concerning its accuracy, time resolution, and consistency;
 - What is needed in geodesy, science and society ?
 - Accuracy: 10^{-9} or better for all kinds of GGOS products;
 - Time resolution: hours to decades (depending on products);
 - Use of compatible standards, models, parameters.
- To stimulate close cooperation between IAG services; to identify service gaps and develop strategies to close them, e.g.,
 - Unified global height reference system (global vertical datum),
 - Vertical deformation models (tectonic, isostatic, loading, ...),
 - Global sea level monitoring (satellite altimetry service),
 - Free availability of terrestrial gravity data.

The Mission of GGOS (3)

- To promote and improve the visibility of geodetic research:
 - Let people know that it's geodesy that provides the basis for space research, navigation, engineering, cadastre, global spatial data infrastructure, rural and urban development, ...
 - Publish in popular literature, not only in scientific journals.
- To achieve maximum benefit for the scientific community and for society in general:
 - Exchange data and information with geosciences and other sciences in an easily understandable way;
 - Provide policy makers and publicists with the necessary information for their decisions and reports.

The Objectives of GGOS (1)

- GGOS aims at maintaining the stability of time series of geometric and gravimetric *reference frames*;
- GGOS ensures the consistency between the different geodetic *standards* used in the geo-scientific community;
- GGOS aims at improving the geodetic *models* at the level required by the observations;
- GGOS focuses on all aspects to ensure the consistency of geometric and gravimetric *products*;
- GGOS shall be established as an official partner in the United Nations' *Integrated Global Observing Strategy, IGOS*,
- GGOS shall represent IAG in the inter-governmental ad hoc *Group on Earth Observations, GEO*.

The Objectives of GGOS (2)

Example inconsistencies in geodetic standards, models, products:

geometric

gravimetric

Definition of origin: centre of network

centre of mass

X_0, Y_0, Z_0

C_{10}, C_{11}, S_{11}

... of orientation: rotation axis

axis of inertia

X_P, Y_P, \square_{UT}

C_{12}, S_{12}

... of scale:

c

GM

Models for tides: tide free

zero tide

... for deformation: geometric only

dynamic

Product reference: ITRF, GRS80

variable

... update: regularly

episodic

The Objectives of GGOS (3)

IAG's GGOS may play an important role within United Nations' Integrated Global Observing Strategy (IGOS) because

- It brings together the three Global Observing Systems (G3OS)
 - Global Climate Observing System (GCOS),
 - Global Ocean Observing System (GOOS),
 - Global Terrestrial Observing System (GTOS)
- It is active in various United Nations' organizations and in the International Council for Science (ICSU) bodies, e.g.,
 - UN Cartographic Office
 - Scientific Committee on Antarctic Research (SCAR)
 - Committee on Data for Science and Technology (CODATA)
 - Scientific Committee on the Lithosphere (SCL)
 - Committee on Space Research (COSPAR)

The Scientific Rationale of GGOS

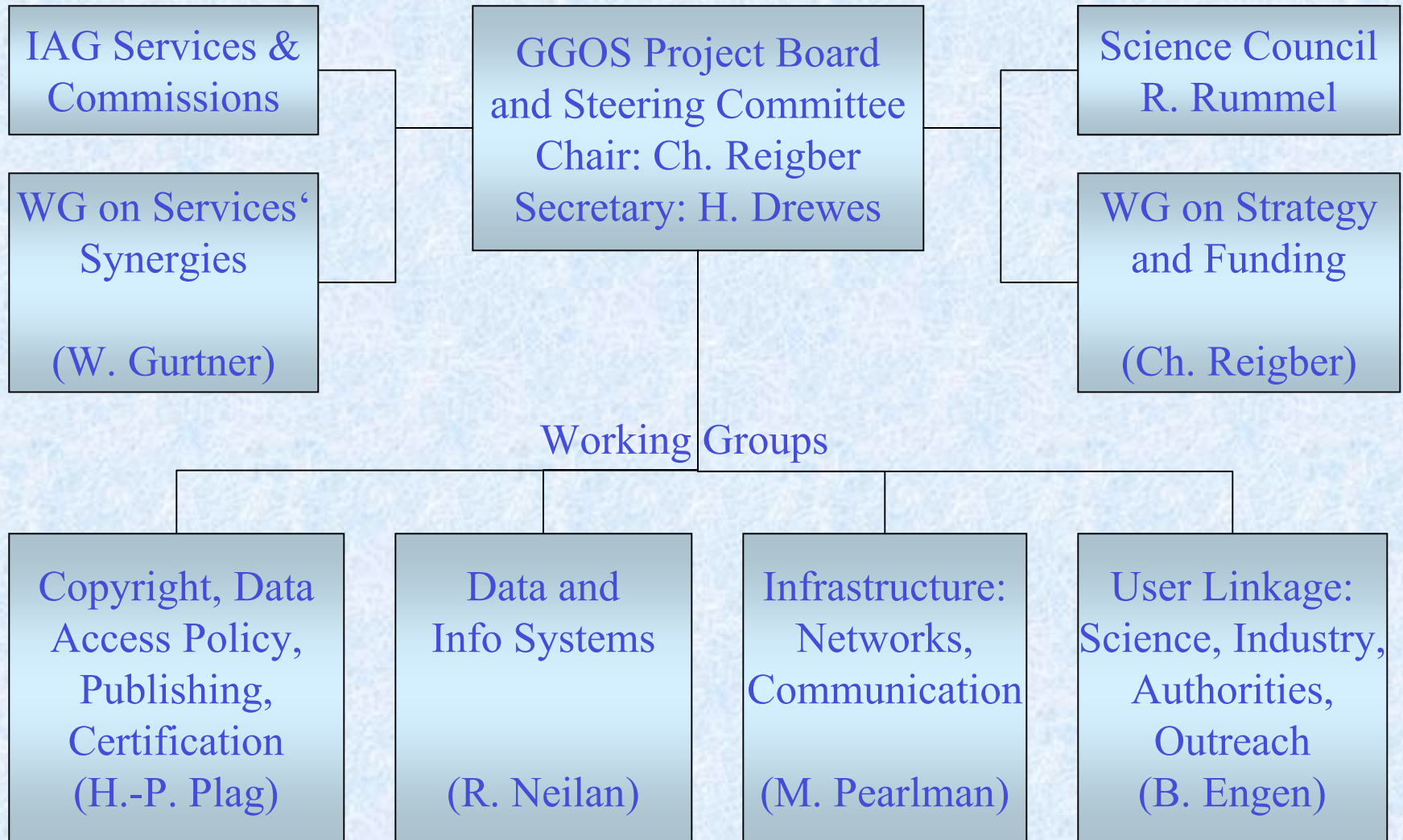
GGOS shall have the *central theme*

“Dynamic Earth“

which includes all the activities of GGOS in the future:

- Global patterns of all kind of tectonic deformation;
- Global pattern of height changes of geodynamic as well as of anthropogenic origin on land, ice covers, and of sea level;
- Deformation due to mass transfer between atmosphere, hydrosphere (including ice) and solid Earth;
- Separation of effects of mass exchange from motion and matter;
- Quantification of angular momentum exchange and mass balance in the system Earth.

The Present Structure of GGOS



Tasks of the Services within GGOS (1)

Internally within Geodesy:

- Use identical standards, models and solved parameters for product generation.
- Integrate all relevant data and metadata provided by other services, and provide them with unique own products.
- Control the consistency of generated products within the individual services and among the different services related to geometry and / or gravity.
- Guarantee state of the art scientific approaches, e.g., by intensive cooperation with IAG commissions.
- Perform sophisticated quality control on all products in order to guarantee reliability and long time stability.

Tasks of the Services within GGOS (2)

Externally for Science and Society:

- Provide products in an easily accessible way, e.g., by web pages in the internet (rather than by ftp).
- Provide the products in an easily understandable way, i.e., clear and unequivocal (avoid specific technical expressions).
- Explain clearly the use of products for further application and interpretation (including realistic uncertainty measures).
- Explain clearly the differences between similar products (e.g., products generated by different analysis centres).
- Evaluate the feedback from external users and cheque the appropriate use of products (read external publications).
- Stay in close contact with all relevant users.

The Specific Role of ILRS Within GGOS

- ILRS products provide some unique benefits for geodesy, e.g.:
 - The geocentric origin of global geodetic reference frames;
 - The calibration of scale for all space techniques;
 - The stability of long-wavelength gravity field parameters.
- ILRS should provide a unique coordinate & velocity solution!
- SLR and LLR contribute essentially to other disciplines:
 - Tracking of a variety of interdisciplinary satellites;
 - Precise data for satellite dynamics (□ COSPAR);
 - Lunar laser tracking for precise determination of ephemeris and libration parameters of the moon (astrometry □ IAU).
- ILRS is a good interdisciplinary representative of geodesy!

Conclusion

- GGOS is planned to be the “flagship“ of IAG.
- The expectations can only be met with the strong support of the services and commissions of IAG.
- GGOS is **not** a “super-service“; it shall not take any functions of the services nor be a supervisor of services.
- GGOS shall coordinate the work of the services where necessary, integrate the various products of different services into the interdisciplinary global change research, and advertise the geodetic products in science and society.

Thank you!