GGOS Overview

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GGOS Overview

- Activities in 2009
- Milestones
- Next Year's Plans

Activities in 2009

GGOS Steering Committee:

April 2009: 15-th Meeting of the GGOS Steering Committee, Vienna, Austria (EGU)

August 2009: 16-th Meeting of the GGOS Steering Committee, Buenos Aires, Argentina (IAG)

GGOS Executive Committee:

Frequent telecons on a two-four weeks basis;

- Preparation of meetings, workshops, ...

- Outreach activities, ...

- GEO participation, ...

- Coordination with Services, ...

Activities in 2009

Workshops and Sessions:

April 20, 2009: GGOS Science Session, EGU, Vienna, Austria

June 23-26, 2009: GGOS Science Workshop 2009: A Joint DynaQlim/GGOS Workshop, Espoo, Finland

September 2, 2009: GGOS Session, IAG, Buenos Aires, Argentina

September 30-October 2, 2009: Towards a Roadmap for Future Gravity Satellite Missions, Graz, Austria, Jointly with IGCP 565 Project, GEO, NASA, ESA

December 11-12, 2009: Second Unified Analysis Workshop, San Francisco, USA

December 16, 2009: GGOS Session at AGU

Activities in 2009

GEO:

Representation of IAG in a number of Committee meetings (STC, UIC, ADC) in Stresa, Italy (May 2009); Melbourne, Australia (Sep. 2009); Washington, D.C. (Nov. 2009).

Input for GEO Work Plan Revision; continuation of DA-09-02c, proposal for new sub-task AR-09-03e:

DA-09-02 c) Global Geodetic Reference Frames

This sub-task is led by IAG (hpplag@unr.edu)

Ensure the availability of accurate, homogeneous, long-term, stable, global geodetic reference frames as a mandatory framework and the metrological basis for Earth observation. Identify steps towards such consistent high-accuracy global geodetic reference frames for Earth observation and the observing systems contributing to GEOSS. Promote the use of common or interoperable reference frames within GEOSS. reference frames within GEOSS.

AR-09-03: Advocating for Sustained Observing Systems

Activities in 2009

GEO:

AR-09-03: Advocating for Sustained Observing Systems

e) Global Geodetic Observing System (GGOS)

This sub-task is led by USA, ESA, and IAG (mpearlman@cfa.harvard.edu)

Promote the further development of sustained infrastructure needed to satisfy the long-term (10-20 years) requirements for the reference frames and the monitoring of global change signals. GGOS provides observations of variations in Earth shape, gravity field and rotation, which are fundamental for monitoring of climate and global change. GGOS observations contribute to at least seven of the SBAs. Moreover, with the global geodetic reference frames (International Terrestrial Reference Frame (ITRF) and International Celestial Reference Frame), GGOS provide the foundation for most Earth observations. Among other components, geodetic monitoring of global change crucially depends on globally sustained geodetic ground networks.

Activities in 2009

GEO:

Participation in the GEO Plenary, Washington, D.C., November 17-18, 2009

Milestones in 2009

GGOS 2020 Book:

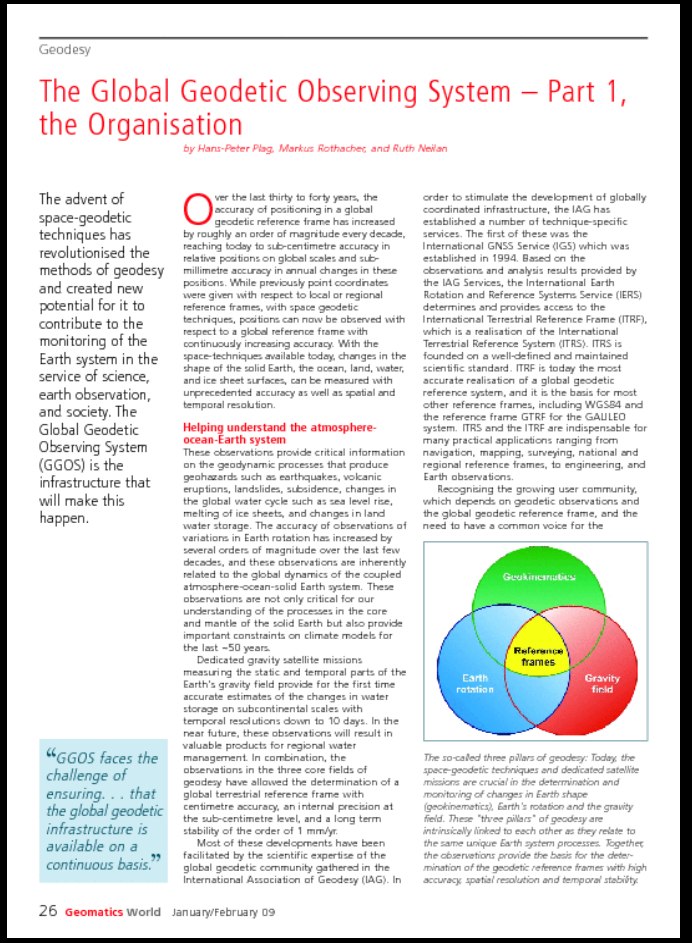
Spring 2009: Finalization of the GGOS 2020 Book; edits according to review results of IAG Executive Committee

July 2009: Publication of the GGOS 2020 Book

Publications on GGOS:

Plag, H.-P., Rothacher, M., Neilan, R., 2009: The Global Geodetic Observing System – Part 1, the Organisation. Geomatics World, January/February 09, 26-28.

Plag, H.-P., Rothacher, M., Pearlman, M., 2009: The Global Geodetic Observing System – Part 2, the System. Geomatics World, March/April 09, 22-25.



Geodesy

The Global Geodetic Observing System – Part 1, the Organisation

by Hans-Peter Plag, Markus Rothacher, and Ruth Neilan

The advent of space-geodetic techniques has revolutionised the methods of geodesy and created new potential for it to contribute to the monitoring of the Earth system in the service of science, earth observation, and society. The Global Geodetic Observing System (GGOS) is the infrastructure that will make this happen.

Over the last thirty to forty years, the accuracy of positioning in a global geodetic reference frame has increased by roughly an order of magnitude every decade, reaching today to sub-centimetre accuracy in relative positions on global scales and sub-millimetre accuracy in annual changes in these positions. While previously point coordinates were given with respect to local or regional reference frames, with space geodetic techniques, positions can now be observed with respect to a global reference frame with continuously increasing accuracy. With the space-techniques available today, changes in the shape of the solid Earth, the ocean, land, water, and ice sheet surfaces, can be measured with unprecedented accuracy as well as spatial and temporal resolution.

Helping understand the atmosphere-ocean-Earth system

These observations provide critical information on the geodynamic processes that produce geohazards such as earthquakes, volcanic eruptions, landslides, subsidence, changes in the global water cycle such as sea level rise, melting of ice sheets, and changes in land water storage. The accuracy of observations of variations in Earth rotation has increased by several orders of magnitude over the last few decades, and these observations are inherently related to the global dynamics of the coupled atmosphere-ocean-solid Earth system. These observations are not only critical for our understanding of the processes in the core and mantle of the solid Earth but also provide important constraints on climate models for the last ~50 years.

Dedicated gravity satellite missions measuring the static and temporal parts of the Earth's gravity field provide for the first time accurate estimates of the changes in water storage on subcontinental scales with temporal resolutions down to 10 days. In the near future, these observations will result in valuable products for regional water management. In combination, the observations in the three core fields of geodesy have allowed the determination of a global terrestrial reference frame with centimetre accuracy, an internal precision at the sub-centimetre level, and a long term stability of the order of 1 mm/yr.

Most of these developments have been facilitated by the scientific expertise of the global geodetic community gathered in the International Association of Geodesy (IAG). In order to stimulate the development of globally coordinated infrastructure, the IAG has established a number of technique-specific services. The first of these was the International GNSS Service (IGS) which was established in 1994. Based on the observations and analysis results provided by the IAG Services, the International Earth Rotation and Reference Systems Service (IERS) determines and provides access to the International Terrestrial Reference Frame (ITRF), which is a realisation of the International Terrestrial Reference System (ITRS). ITRS is founded on a well-defined and maintained scientific standard. ITRF is today the most accurate realisation of a global geodetic reference system, and it is the basis for most other reference frames, including WGS84 and the reference frame GTRF for the GALILEO system. ITRS and the ITRF are indispensable for many practical applications ranging from navigation, mapping, surveying, national and regional reference frames, to engineering, and Earth observations.

Recognising the growing user community, which depends on geodetic observations and the global geodetic reference frame, and the need to have a common voice for the

"GGOS faces the challenge of ensuring. . . that the global geodetic infrastructure is available on a continuous basis."

The so-called three pillars of geodesy: Today, the space-geodetic techniques and dedicated satellite missions are crucial in the determination and monitoring of changes in Earth shape (geokinematics), Earth's rotation and the gravity field. These "three pillars" of geodesy are intrinsically linked to each other as they relate to the same unique Earth system processes. Together, the observations provide the basis for the determination of the geodetic reference frames with high accuracy, spatial resolution and temporal stability.

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GLOBAL GEODETIC OBSERVING SYSTEM FOR GEOHAZARDS AND GLOBAL CHANGE

GGOS provides a basis on which advances in geoscience can be built. By considering the Earth system as a whole (including the geosphere, hydrosphere, cryosphere, atmosphere and biosphere), monitoring Earth system components and their interactions by geodetic techniques and studying them from the geodetic point of view, the geodetic community provides the geoscience community with a powerful tool consisting mainly of highly accurate observations, high-quality services, standards and references, and theoretical and observational innovations.

Left picture: Global strain rate map.

Right picture: Global gravity model.

Global Geodetic Observing System for geohazards and global change

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EARTH'S FIGURE

Hans-Peter Plag

Richard Gross

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The paramount importance of sustainable development for a prosperous future of the anthroposphere has been widely acknowledged. Understanding of the major processes in the Earth system and its changes over time is one of the many prerequisites of sustainability and cannot be achieved without comprehensive monitoring of the Earth system. The recent Earth Observation Summits (EOS) have underlined the urgent need for a coordinated and sustained program of Earth observation and tasked the Intergovernmental Group on Earth Observations (GEO) with the implementation of the Global Earth Observation System of Systems (GEOSS). Geodesy provides the foundation on which most Earth observation systems are built. Therefore, the geodetic observing system is essential for Earth observation and GEOSS.

Responding to the international development in Earth observation and the scientific challenges associated with rapidly increasing requirements for geodetic observations, the International Association of Geodesy (IAG) has organized all its observation activities under the umbrella of the Global Geodetic Observing System (GGOS), the observing system of IAG. In this paper, we give an overview of the major contributions of geodesy to Earth sciences and observations, introduce GGOS, and summarize the challenges and

Next Year's Plans

- February 1-4, 2010: GGOS Retreat and 17-th GGOS Steering Committee Meeting in Miami, Florida: Focus on Implementation
- September-October 2009: Workshop: Separation of Tectonic and hydrological signals; Southwest USA
- October 25-29, 2009: GGOS Science Workshop, Shanghai, China