GGOS Outreach Activities

2008/01-2009/03

Hans-Peter Plag & Bente Lilje Bye

- Publications focusing on GGOS
- Stakeholder events
- Web pages
- Blogs
- Web-base TV

Publications on GGOS

- 2007 AOGS

THE GLOBAL GEODETIC OBSERVING SYSTEM

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The Global Geodetic Observing System (GGOS) was established by the International Association of Geodesy (IAG) in July 2003. In April 2004 the IAG, represented by GGOS, became a participating organization of the Group on Earth Observation (GEO) and in May 2006 GGOS was accepted as a member of the Integrated Global Observation Strategy Partnership (IGOS-P).

GGOS is the contribution of geodesy to the Global Earth Observation System of Systems (GEOSS). It provides the reference systems and frames, which are crucial for Earth observing systems. GGOS is built on the IAG Services (IGS, IVS, ILRS, IDS, IERS, IGFS, etc.) and the products they derive on an operational basis for Earth monitoring, making use of space- and ground-based geodetic techniques such as Very Long Baseline Interferometry (VLBI), Satellite and Lunar Laser Ranging (SLR/LLR), Global Navigation Satellite Systems (GNSS), Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS), altimetry, InSAR (Interferometric Synthetic Aperture Radar), gravity satellite missions, and gravimetry, etc. All these observation techniques are considered integral parts of GGOS, allowing the monitoring of the Earth's shape and deformation (including water surface), the Earth's orientation and rotation, and the Earth's gravity field and its temporal variations with an unprecedented accuracy. The observed parameters give direct evidence of many global processes that have a crucial impact on human society such as earthquakes, volcanism, floods, sea level change, climate change, groundwater redistribution, mass balance of the polar ice sheets, etc.

GGOS relies on the observing systems and analysis capabilities already in place in the IAG Services and envisions the continued development of innovative technologies, methods and models to improve our understanding of global change processes. GGOS provides a framework that ranges from the acquisition, transfer and processing of a tremendous amount of observational data

Publications on GGOS

- 2007 AOGS (in press)
- 2008 UNESCO Water conf. (in press)

Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle (IGCP 565 Project)

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ABSTRACT

Geodetic observations of the Earth's gravity field, shape, and rotation and their changes in time (the three fundamental areas of geodesy) capture the signals of variation in the entire fluid envelope of the solid Earth, including the terrestrial water storage. Therefore, the Global Geodetic Observing System (GGOS) has the capability to monitor mass transport particularly in the global water cycle. The IGCP 565 Project aims to utilize this potential and to develop GGOS into a monitoring system for the hydrological cycle on global to regional scales. Key scientific issues addressed are: (1) Development of an integrated dynamic model for the predictions of the geodetic signals of daily to interannual surface mass changes; (2) Inversion algorithms for integrated geodetic observations for surface mass changes; (3) Assimilation of observed surface mass changes in hydrological models; and (4) Development of products relevant for regional water management. The project supports capacity building in space-geodetic data processing, modeling of the hydrological cycle, and interpretation of the observations in terms of terrestrial water storage. A focus is on products for regional water management, particularly in developing countries. Coordination of the research and capacity building is provided through a series of five annual workshops.

Keywords: Monitoring of the Global Water Cycle, Global Geodetic Observing System, Earth Observation, Regional Water Management, Capacity Building

1. INTRODUCTION

Water is essential to life on Earth, which is a unique, living planet due to the abundance and vigorous cycling of water throughout the global water cycle. Water is central to human welfare, progress and sustainable economic growth. Clean, fresh water is arguably the most important resource to human society, as it controls our ability to produce sufficient food to support the human population. In many areas of the world, current demands exceed the supply (as indicated by the water scarcity index, see Oki & Kanae, 2006) and water has to be transported over great distances. This situation is expected to become more severe over the next several decades (see, e.g., EEA, 1999; Lawford et al., 2004; Bernasconi et al., 2005; Oki & Kanae, 2006; United Nations, 2006). However, the water crisis is largely a crisis of governance (United Nations,

Publications on GGOS

- 2007 AOGS (in press)
- 2008 UNESCO Water Conf. (in press)
- 2009 Geomatics World Part 1

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

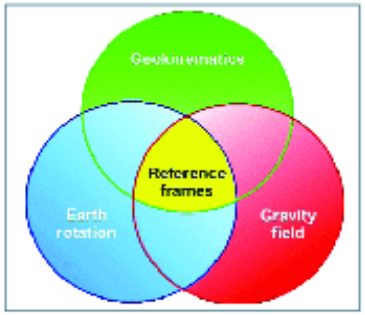
These observations provide critical information on the geodynamic processes that produce geohazards such as earthquakes, volcanic eruptions, landslides, subsidence, changes in the global water cycle such as sea level rise, melting of ice sheets, and changes in land water storage. The accuracy of observations 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

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



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

"GGOS faces the challenge of ensuring. . . that the global geodetic infrastructure is

Publications on GGOS

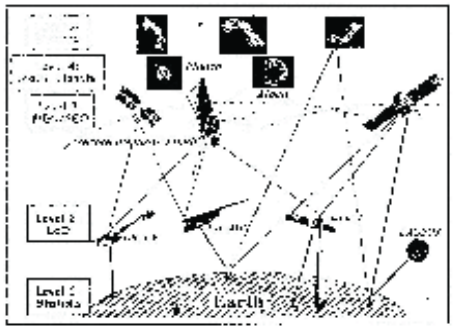
- 2007 AOGS (in press)
- 2008 UNESCO Water conf. (in press)
- 2009 Geomatics World Part 1
- 2009 Geomatics World Part 2

The Global Geodetic Observing System – Part 2, the System

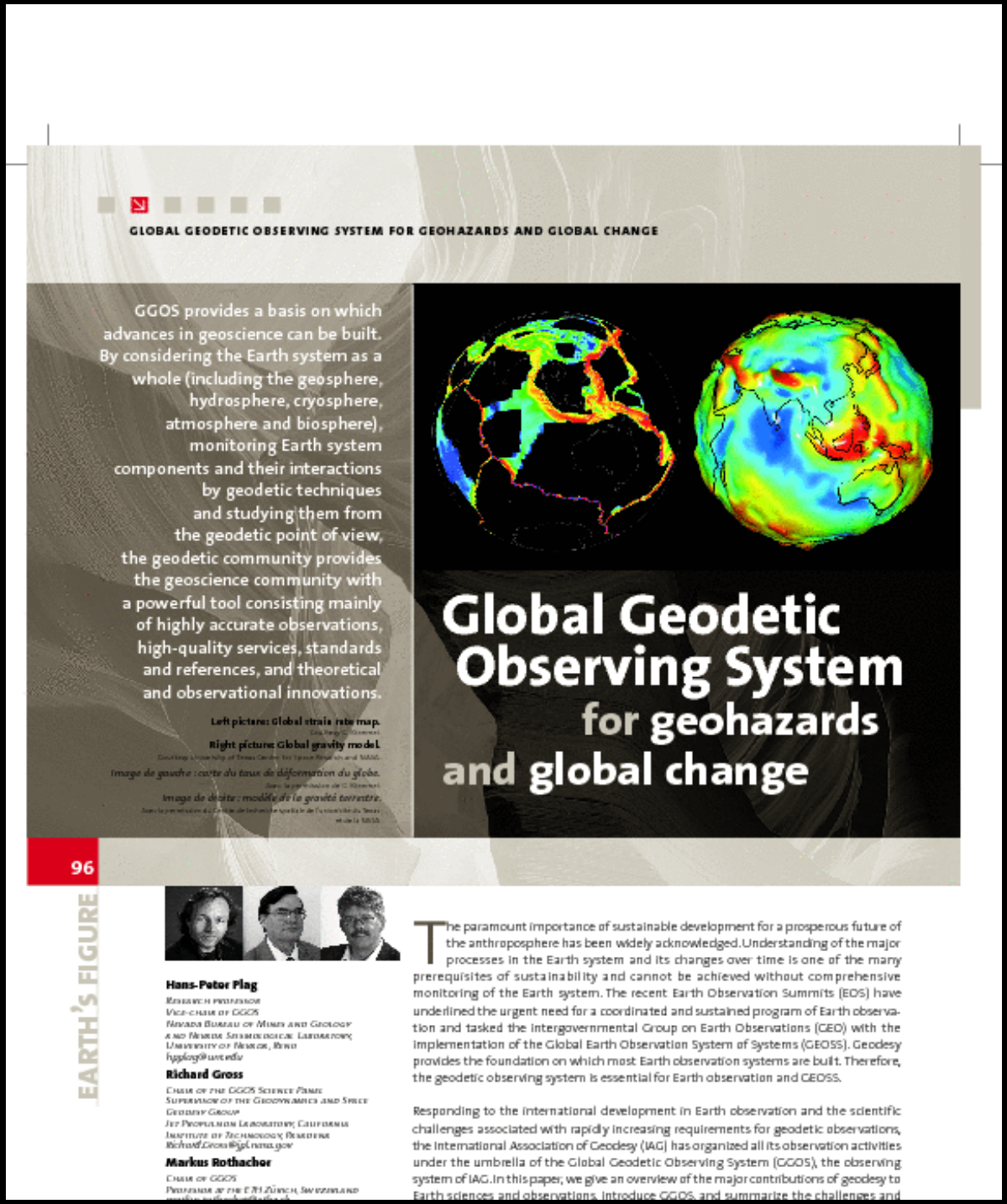
In the first part of this article (GW Jan/Feb 2009), we introduced GGOS as the organisation that provides a coordination structure for the activities of the international geodetic community. In this second part, the authors introduce GGOS as an observing system and illustrate its versatility by describing examples of applications.

A value chain from observations to products

A multi-layered, yet integrated system



Publications on GGOS



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.

Image de gauche : carte du taux de déformation du globe.

Image de droite : modèle de la gravité terrestre.

Global Geodetic Observing System for geohazards and global change

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EARTH'S FIGURE

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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

- 2007 AOGS (in press)
- 2008 UNESCO Water Conf. (in press)
- 2009 Geomatics World Part 1
- 2009 Geomatics World Part 2
- 2009 Geosiences

Publications on GGOS

The Global Geodetic Observing System (GGOS): Detecting the Fingerprints of Global Change in Geodetic Quantities

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ABSTRACT

Modern geodetic observations from a wide range of space and terrestrial technologies contribute to our knowledge of the solid Earth, atmosphere, ocean, cryosphere, and land water storage. These geodetic observations record the "fingerprints" of global change processes and thus are a crucial independent source of high accuracy information for many global change studies. Many of the geodetic techniques require a globally distributed ground infrastructure, and associated space segment elements. In the past decade and half a variety of technique-specific services have been established under the auspices of the International Association of Geodesy (IAG) to facilitate global coordination of geodetic activities and to ensure the generation of high accuracy and reliable geodetic products to support geoscientific research. The Global Geodetic Observing System (GGOS) is an important component of the IAG, and is intended to be an "umbrella" for the IAG Services, with a primary coordinating function to ensure the development of an adequate global geodetic infrastructure, and a suite of integrated multi-technique products, that will meet the needs of scientific users. Coordination means bringing together the different geodetic observing techniques, services and analysis methods so as to ensure that the same standards, conventions, models and parameters are used in the data analysis and modelling of "Earth system" processes. Integration implies the combination of geometric, gravimetric, and rotational observations in data analysis and data assimilation, and the joint estimation and/or modelling of all the necessary parameters representing the difference components of the Earth system. The geodetic observations collected during the last decades have facilitated major scientific discoveries related to geohazards, climate and the global water cycle. Geodesy has the potential to contribute even more to global change studies, particularly if coordination and integration of the geodetic activities are continued.

Keywords: global change, GGOS, geodesy, IAG

1. INTRODUCTION

Humanity is increasingly being confronted with the limitations of a restless planet, with finite resources that cannot meet growing demands and a limited capacity to accommodate the impact of the increasingly dominant anthropogenic factor. The anthroposphere has grown into one of the most powerful factors in the Earth system, which is transforming the Earth's surface layers rapidly [15], and which is capable of changing major system processes. To illustrate the scale of the impact, consider the fact that more than 50% of the ice-free surface of the solid Earth has been transformed by humans. Among experts there is a broad consensus that humanity is changing the planet's climate [5]. One could say that Earth has entered the geological epoch of the Anthropocene.

The Earth system is subject to a variety of dynamic processes driven by interior and exterior forces, operating on a wide range of temporal and spatial scales. As a consequence, large areas of the Earth's surface are exposed to natural hazards, including geohazards, storms, storm surges, and floods. Urban settlements are sprawling into areas at high risk from such natural hazards, thus increasing the vulnerability of society. At the same time,

- 2007 AOGS (in press)
- 2008 UNESCO Water conf. (in press)
- 2009 Geomatics World Part 1
- 2009 Geomatics World Part 2
- 2009 Geosiences
- 2009 EOGS

Stakeholder Events

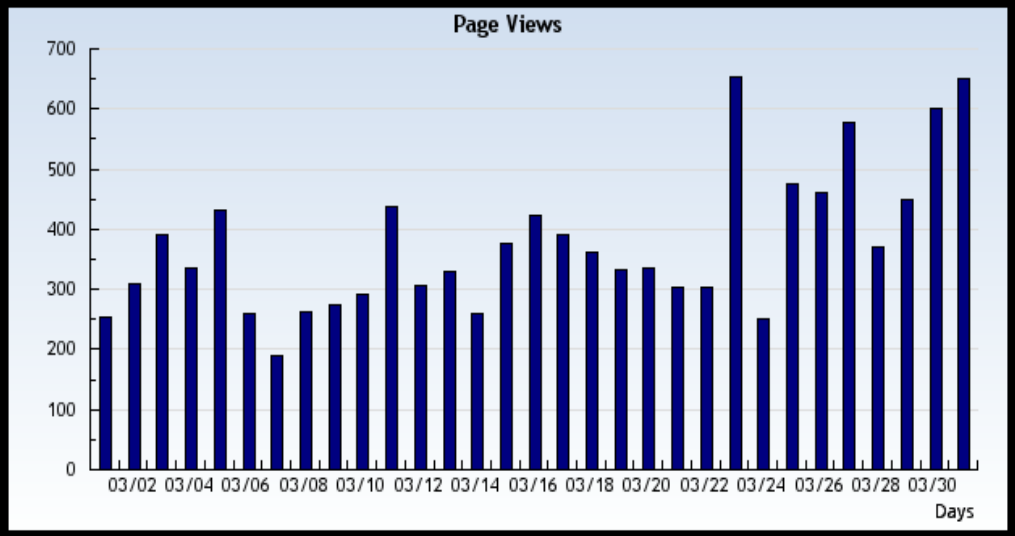
- No specific activities up to now
- Gruenreich-Rummel Conference?
- Next opportunity: IGOS-Symposium, 19 November 2009, Washington D.C.

Web Pages

http://www.ggos.org and http://www.iag-ggos.org point now to the same pages.

"About GGOS" partly developed; more input needed.
"News" informs about recent events; community could make more use of this; could be developed into a Newsletter.
"Products" provides links to the relevant pages of the Services.
"Library" gives access to bibliography, papers, presentations and slide library.
"Workshops" has information on all relevant workshops; in some cases the full workshop pages.

Web Pages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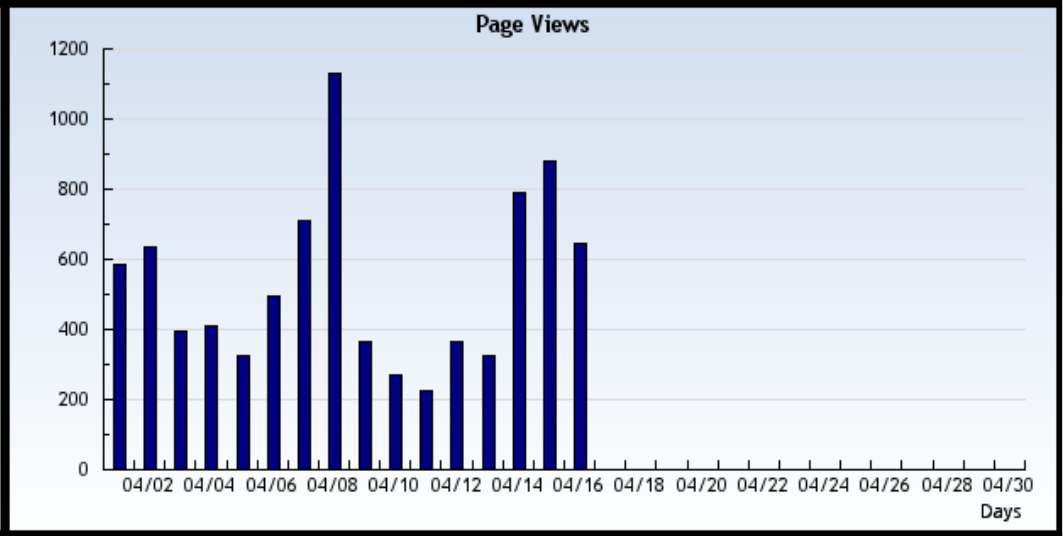
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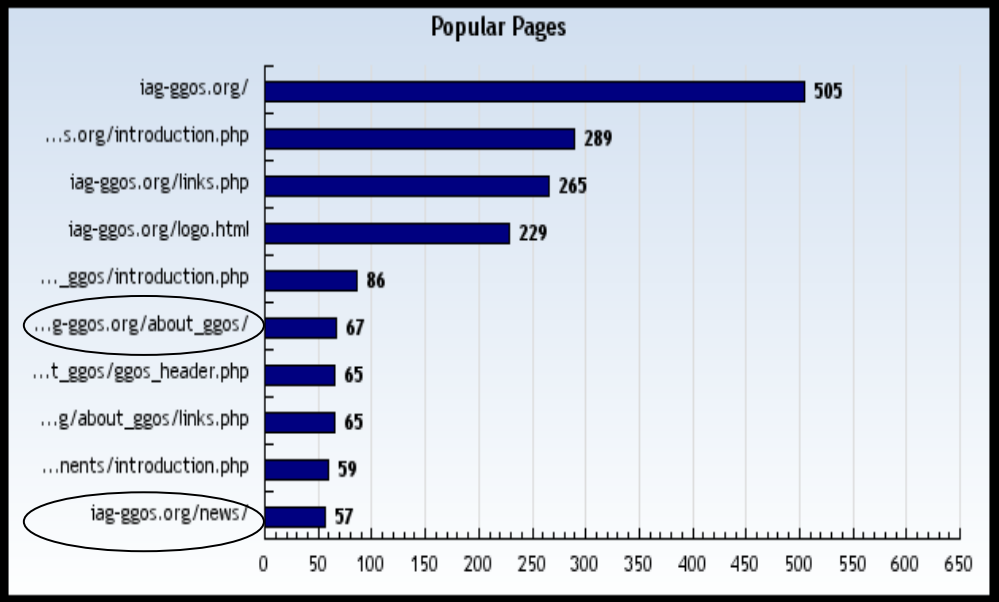
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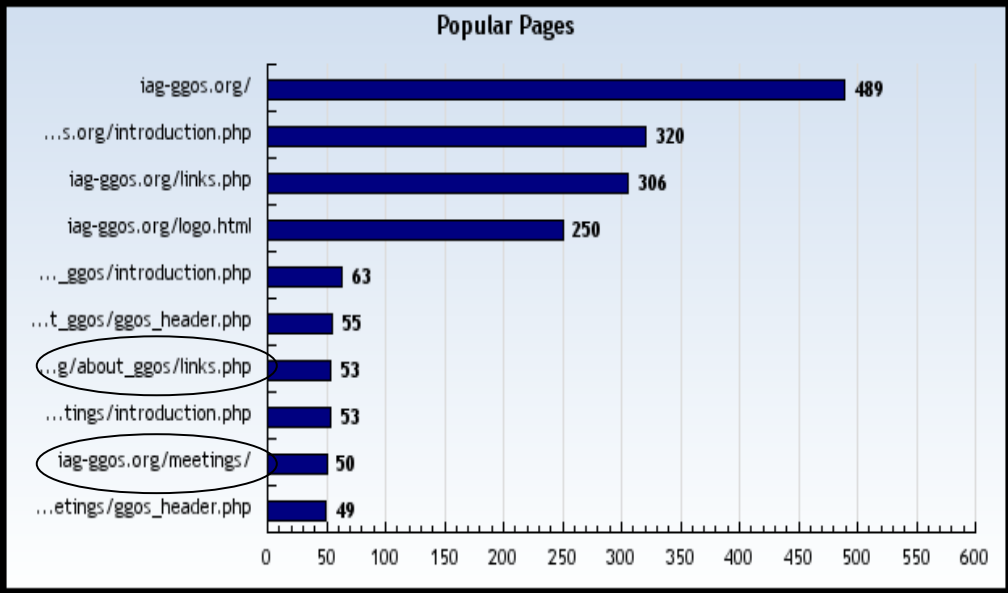
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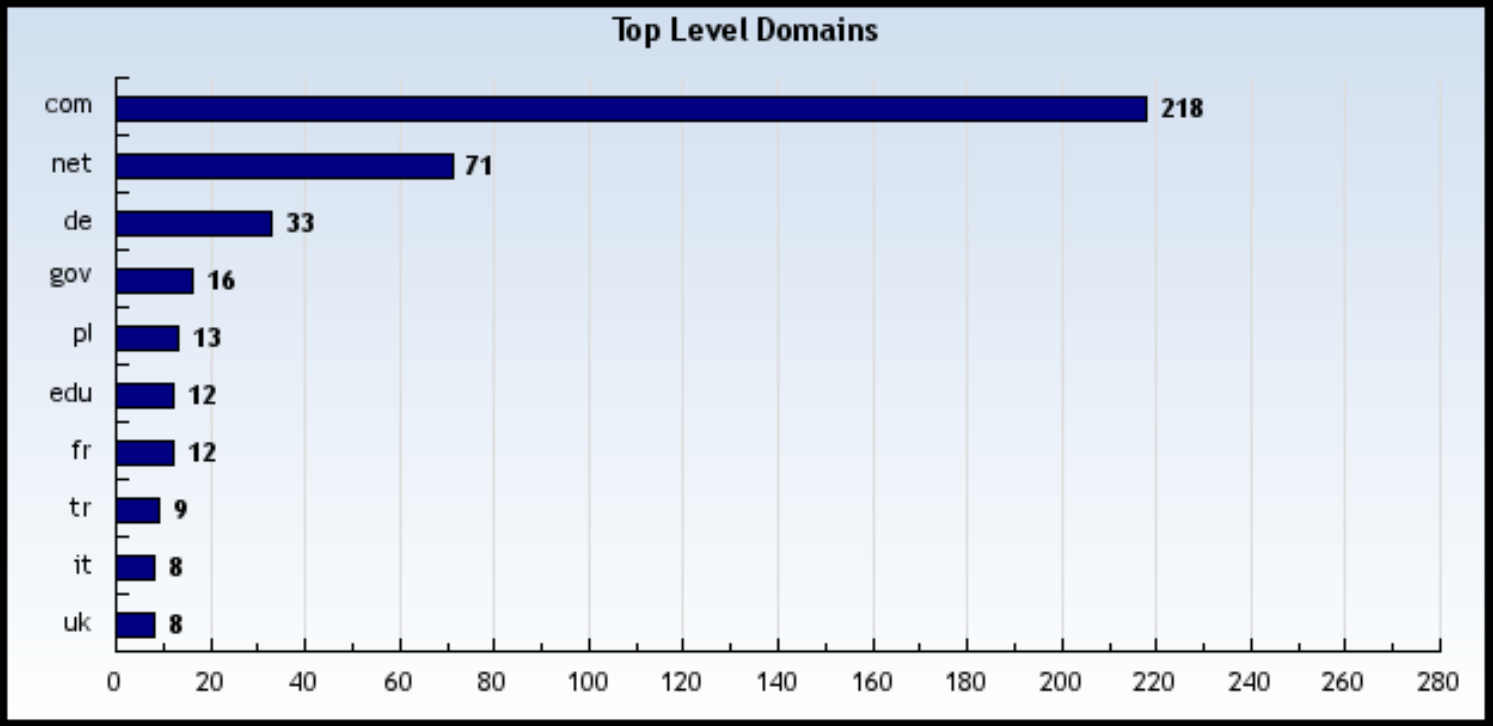
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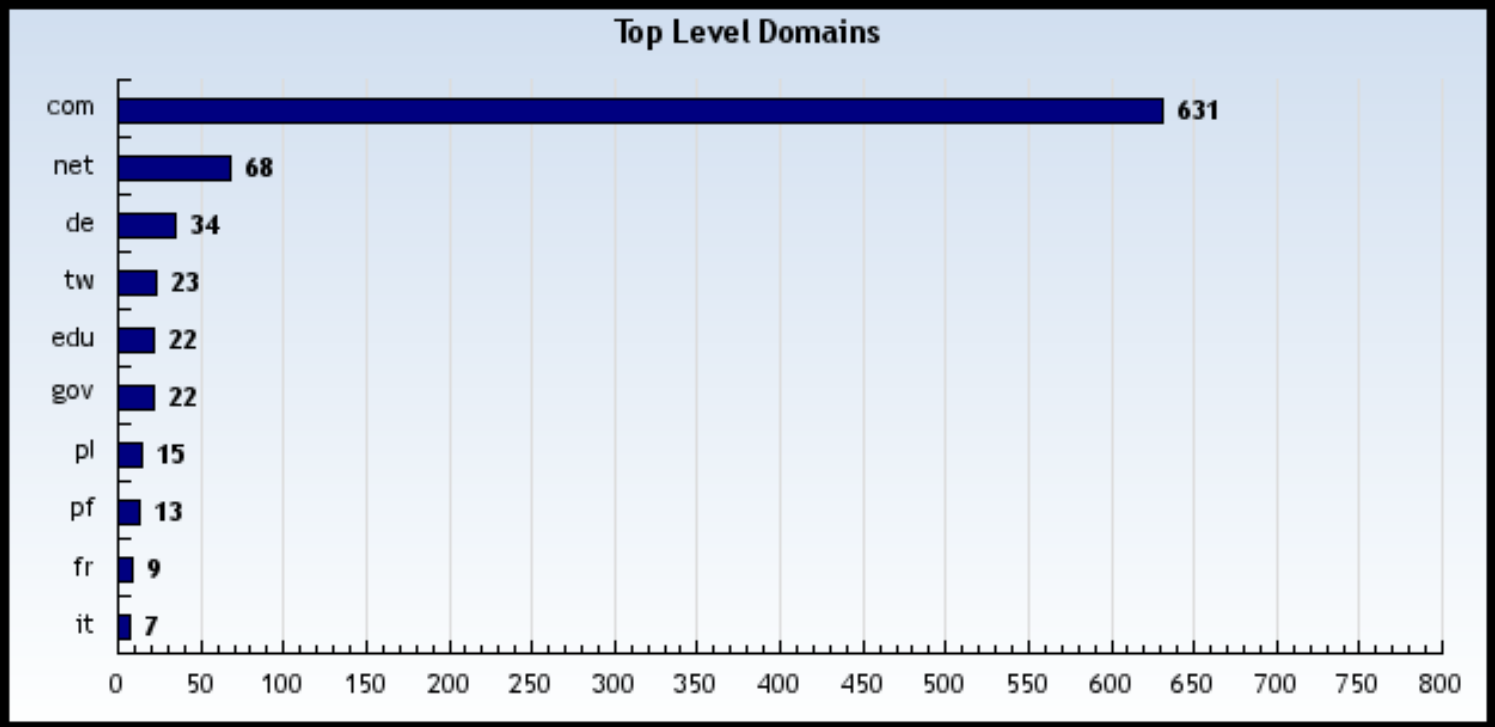
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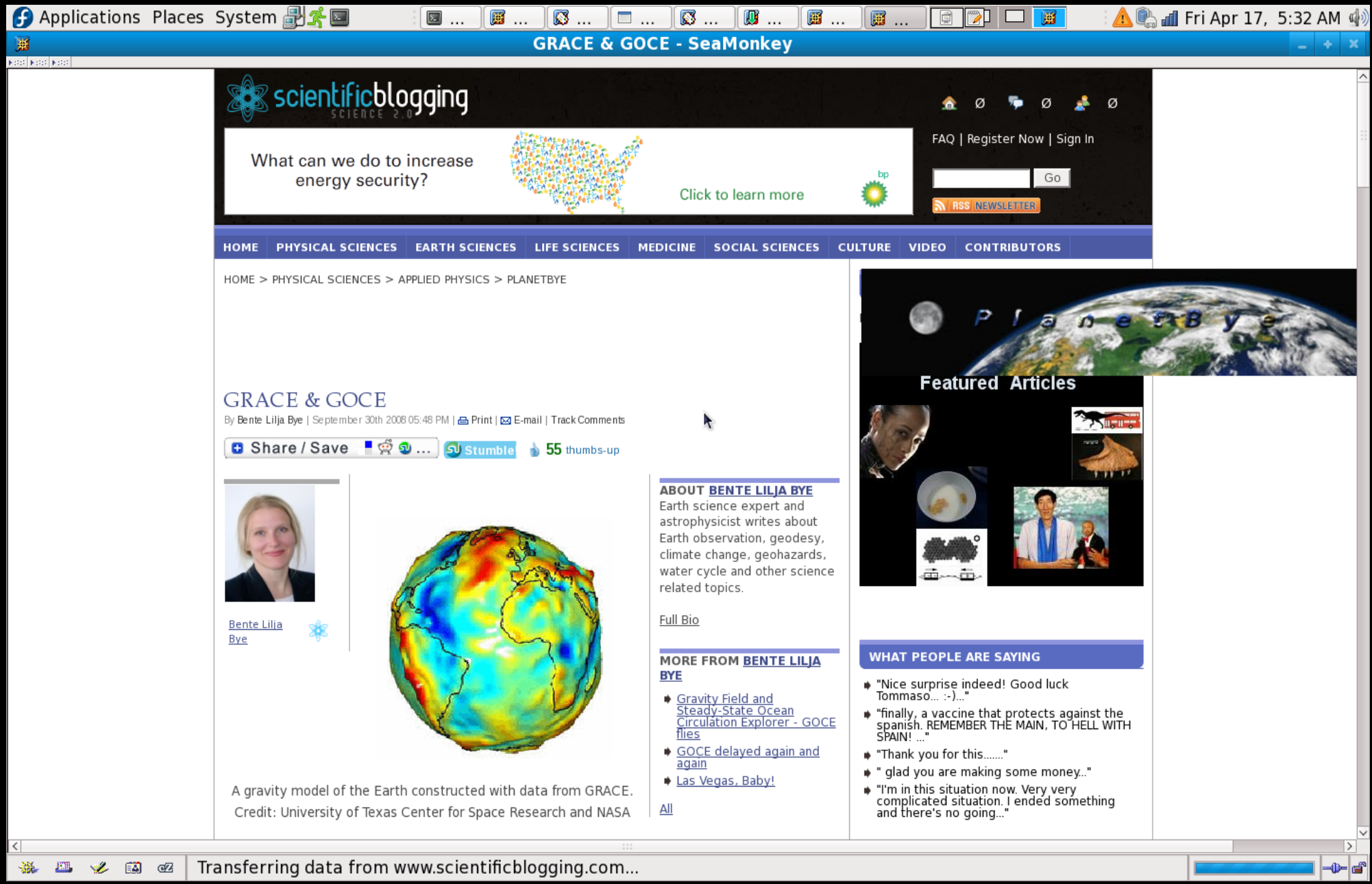
Blogs

http://www.scientificblogging.com/planetbye/: About geodesy ...

(planetbye: Bente Lilja Bye)

Blogs

http://www.scientificblogging.com/planetbye/grace_goce: On GRACE and GOCE ...



Internet TV

Astrocast.tv: Segment producer responsible for “A Green Space - A Green Earth. A Study of Earth from Space.”

- Monthly news report that will in part be included in the general news segment and an extended version on my own segment page.
- Blog, where material in between shows can be posted, My - Segment premiere: 1. May 2009.
- In the future, there is a plan to increase the frequency of shows.

- First show: launch of GOCE
- Next show: Geohazards
- Contributions from the GGOS community are welcome

Link to Astrocast.tv: http://astrocast.tv/

Internet TV


Applications Places System
Fri Apr 17, 5:31 AM
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Astrocast.TV
How Planetary Dynamos Yield Magnetospheres
April 16, 2009
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April 1, 2009 - Episode 13
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