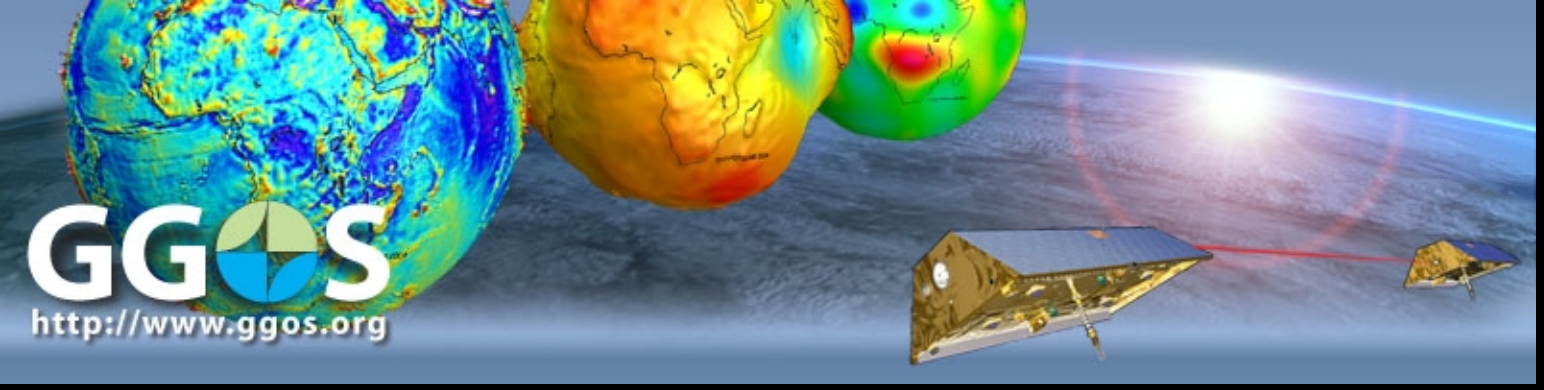


IGCP 565 Project:
Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

Hans-Peter Plag, Richard S. Gross, Norman L. Miller,
Markus Rothacher, Susanna Zerbini

The Global Geodetic Observing System

GGOS Vision:
Empowering with geodesy the advancement of society

GGOS is the flagship component of the IAG whose goal is to advance geodetic observing methods for Earth and planetary system science and applications.

The GGOS Mission is to:

define the geodetic infrastructure that is needed to meet scientific and societal requirements;

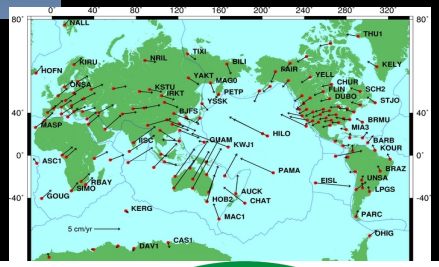
advocate for the establishment and maintenance of this geodetic infrastructure;

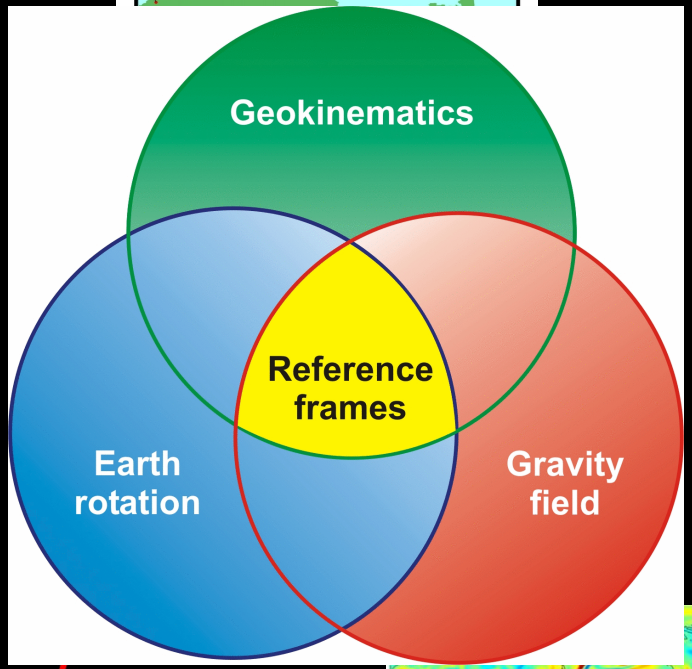
improve the quality of and accessibility to geodetic observations and products;

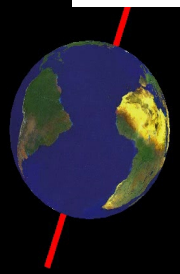
coordinate interaction between the IAG Services, Commissions, and stakeholders;

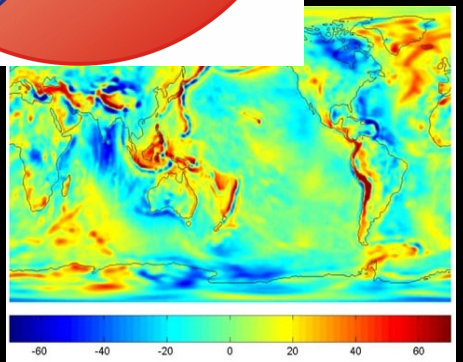
educate the scientific community about the benefits of geodetic research and the public about the fundamental role that geodesy plays in society.

The Global Geodetic Observing System









The 'three pillars of geodesy':

- Earth's Shape (Geokinematics)
- Earth's Gravity Field
- Earth Rotation

Output:

- Reference Frame
- Observations of the Shape, Gravitational Field and Rotation of the Earth

Challenges:

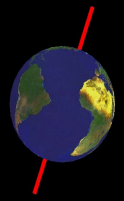
- Consistency of the three pillars
- Global change effects are small
- Reference frame available anywhere, any time

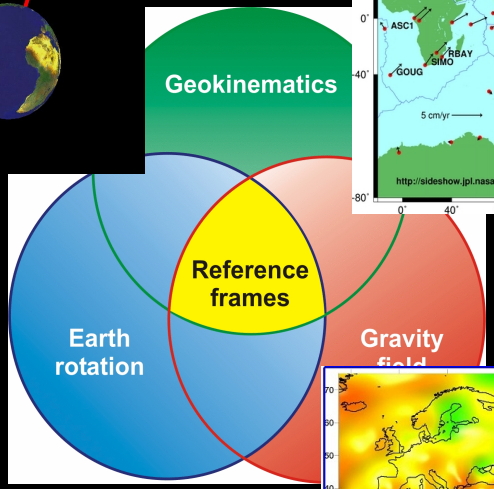
Solutions:

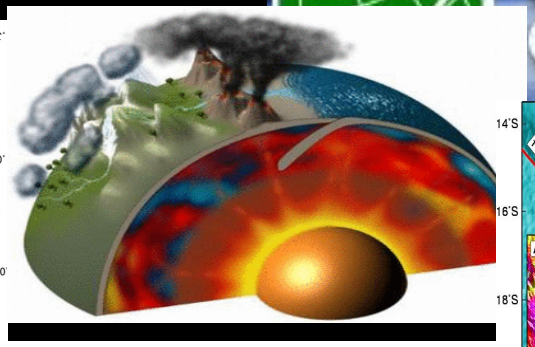
- Integration of Systems, Observations, Analysis, and Models

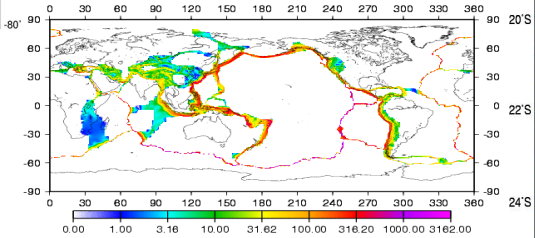
The Global Geodetic Observing Sy

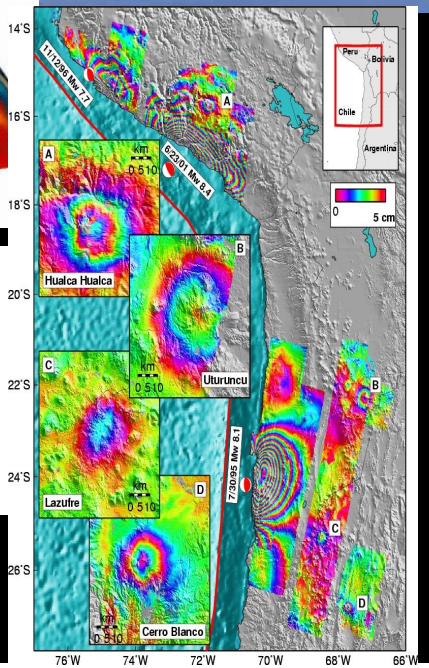
International Association of Geodesy

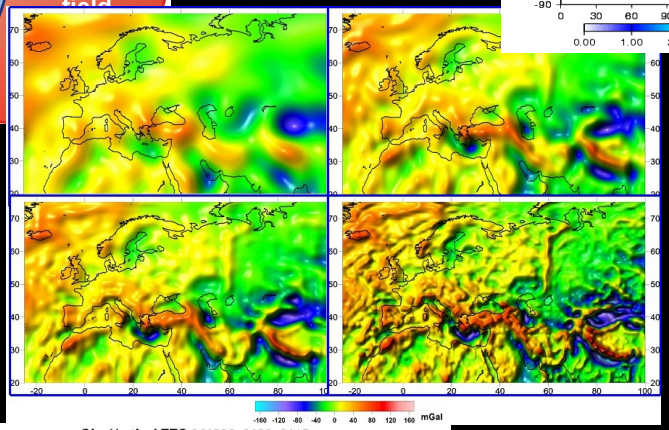


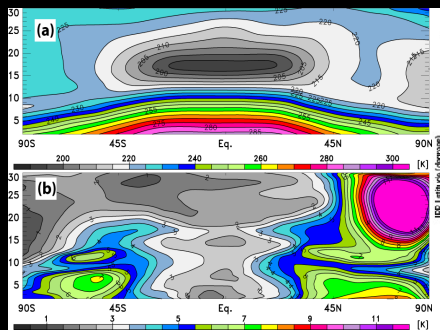


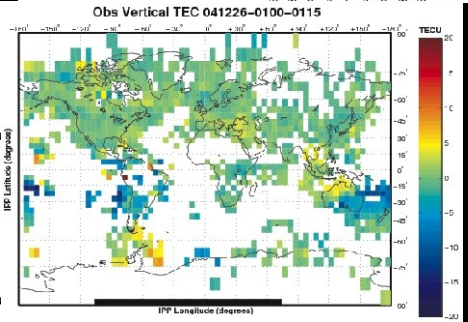


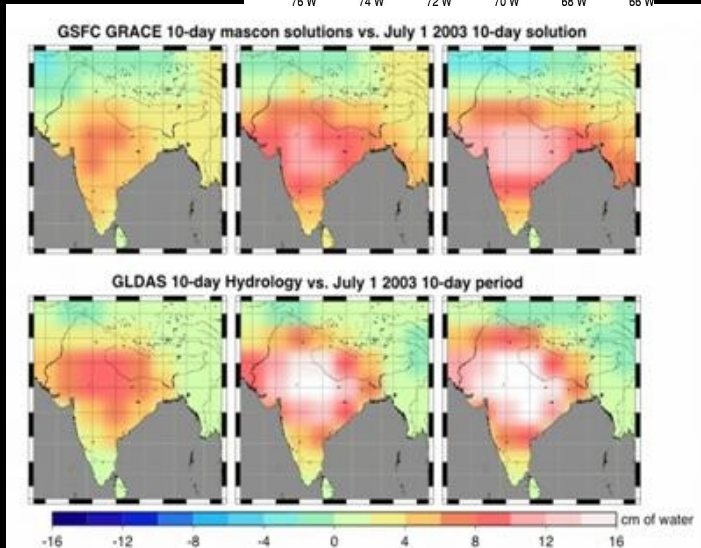




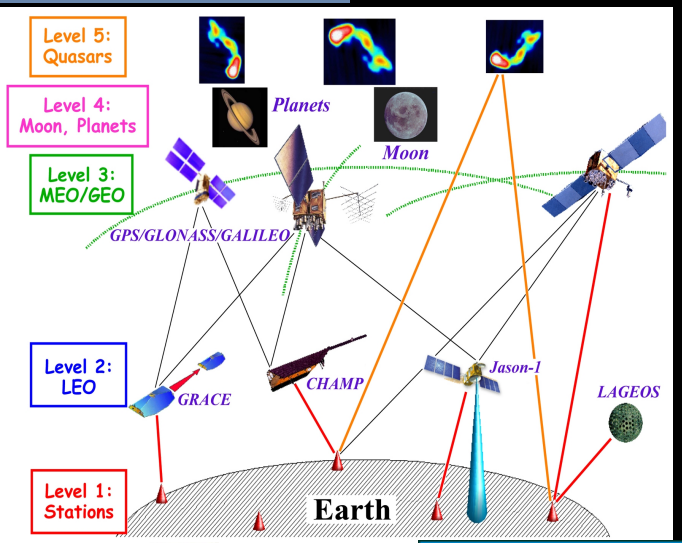


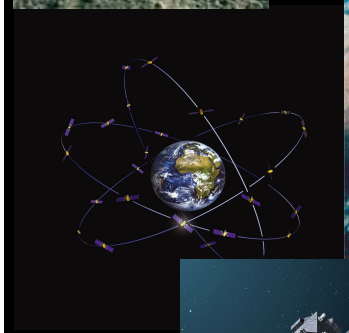


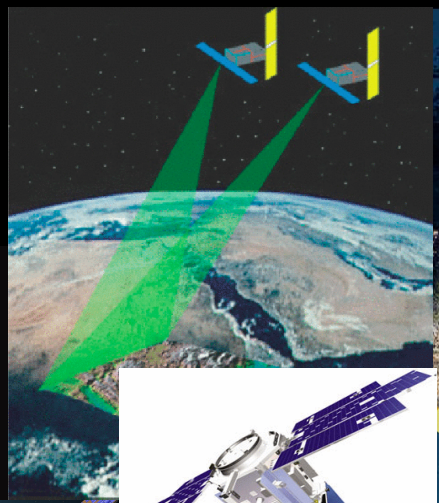


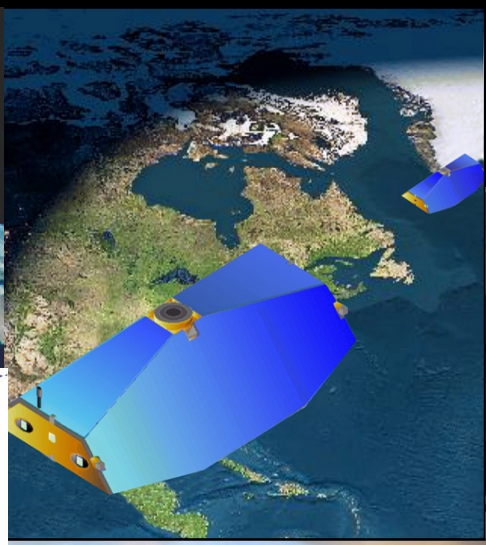


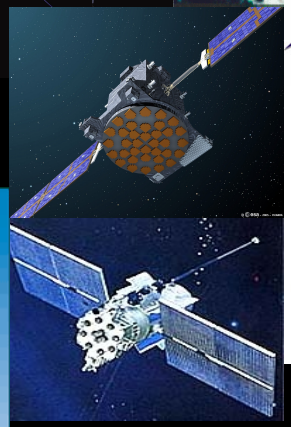
GGOS
http://www.ggos.org

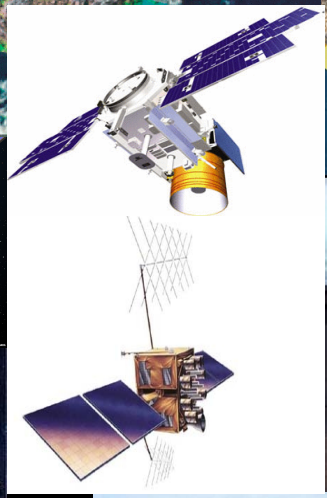


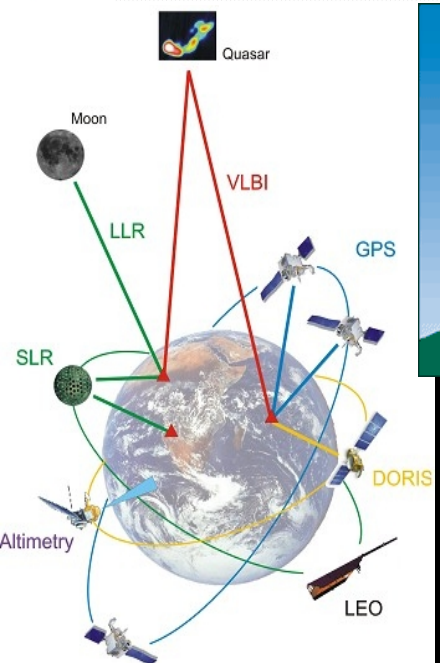


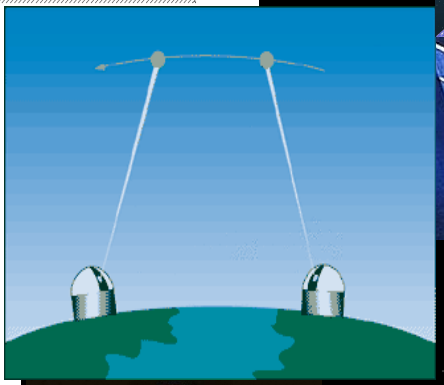


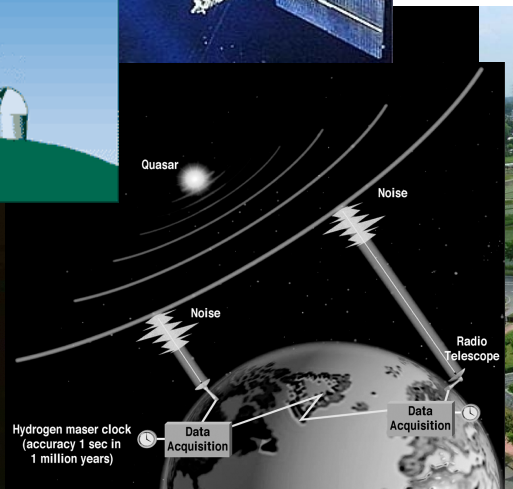




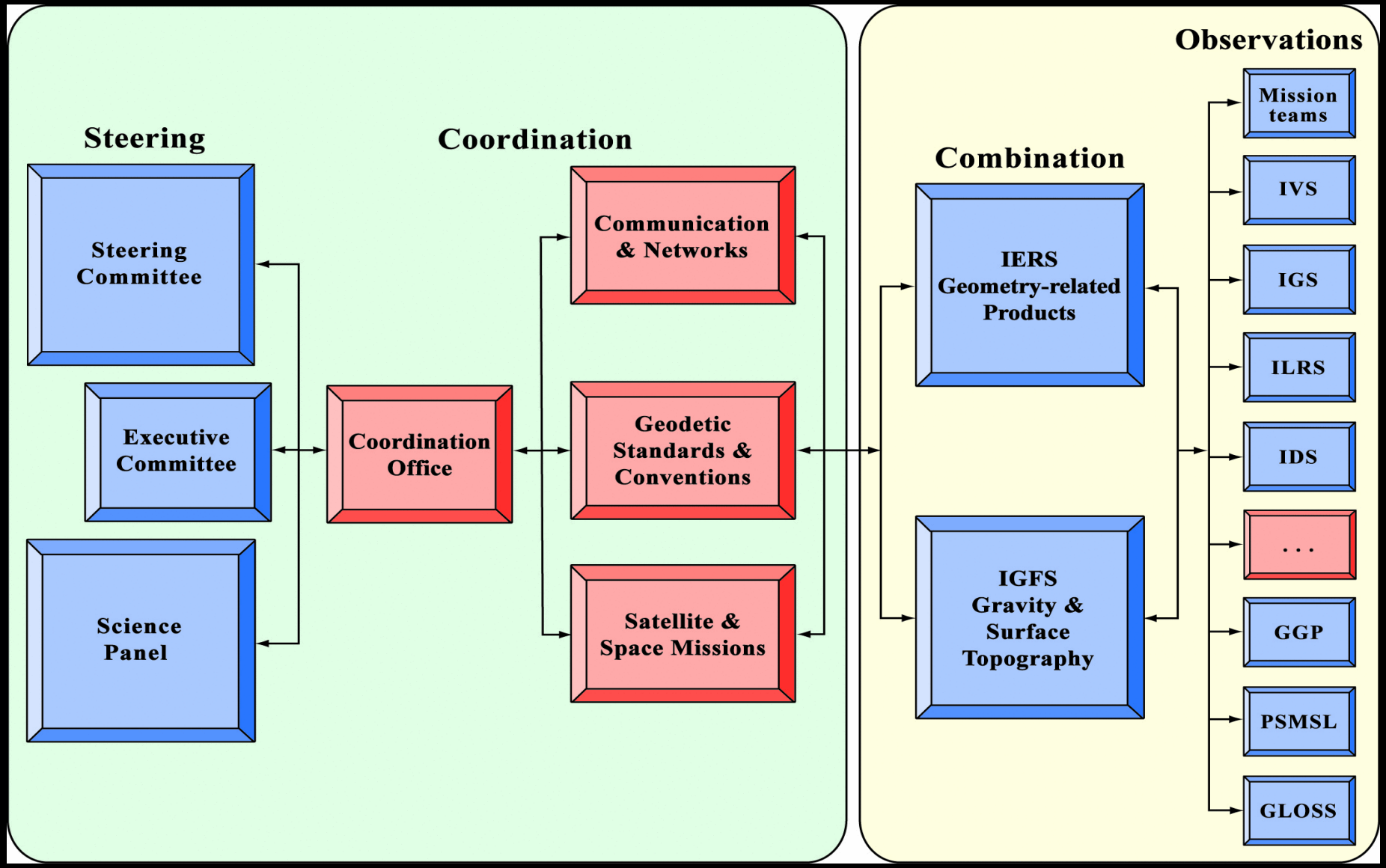






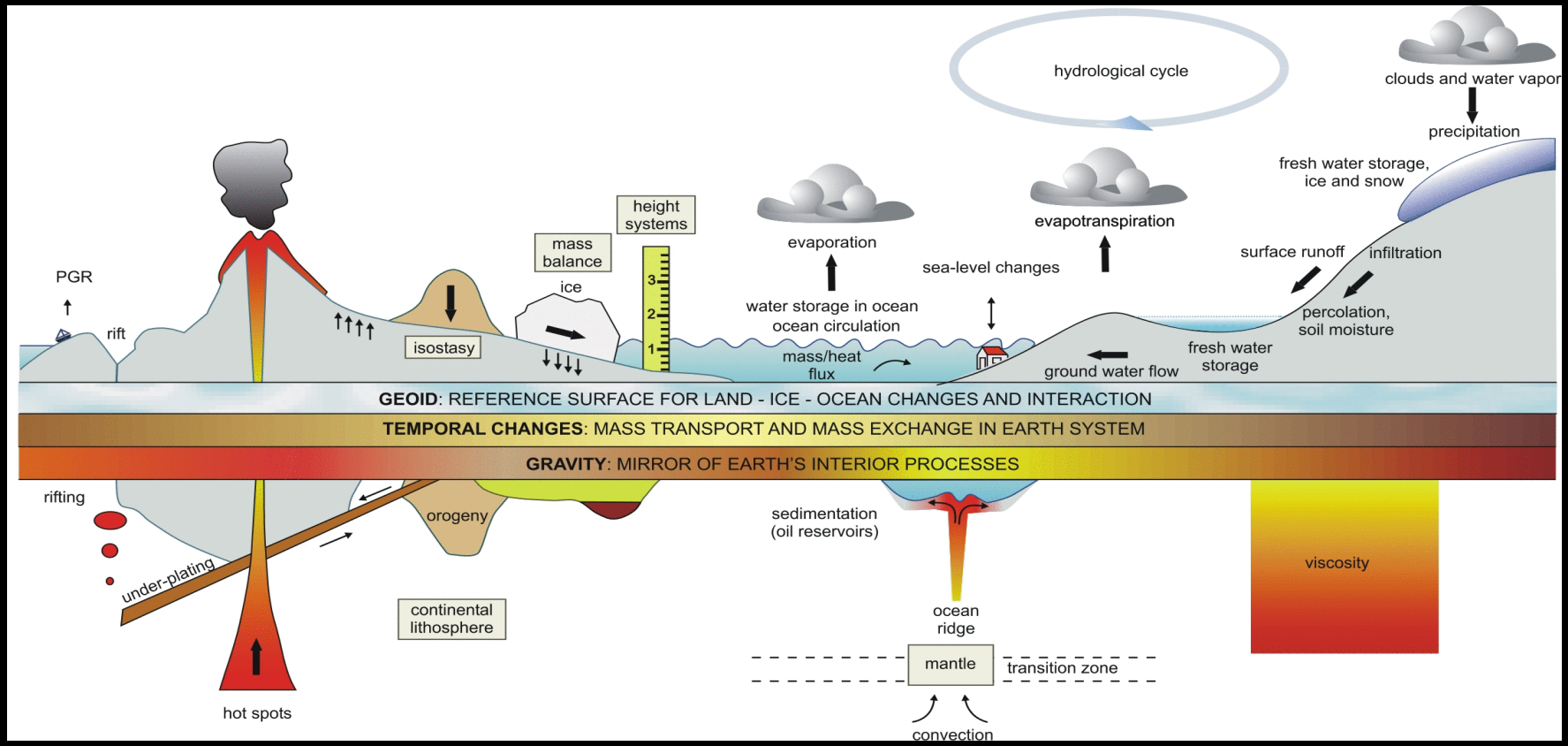


The Global Geodetic Observing System



The Global Geodetic Observing System

GGOS and the global water cycle



Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

IGCP 565 Objectives

Explore and develop components of GGOS most relevant for monitoring the water cycle

Make observations available for assimilation in predictive models of the global water cycle.

Develop products and algorithms that will allow regional water management to fully utilize the potential of the geodetic techniques for monitoring the regional terrestrial hydrosphere.

Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

IGCP 565 Activities

Research projects:

- on-going projects related to combined analysis of geodetic observations
- proposed projects for assimilation in hydrological models
- planned projects for regional water management

Coordination with:

- GEO Tasks
- GEWEX
- IGWCO

Specific Activities:

- Series of five annual workshops
- Funding for participants from developing countries
- Maintain a web page (http://geodesy.unr.edu/igcp565/)

Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

IGCP 565 Science Issues

- The development of an integrated dynamic model for the prediction of geodetic signals due to daily to interannual surface mass changes.
- Inversion algorithms for combined geodetic observations for surface mass changes.
- Integration/assimilation of the observations in integrated predictive models of the hydrological cycle.
- Development of products relevant for regional water management.

- How will projected climate change affect the hydrological cycle and the availability of water to society in the various regions?

Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

IGCP 565 Research Projects

Current Projects:

Synthesis of NASA Data on Earth's Changing Geometrical and Gravitational Shapes to Assess Changes in Terrestrial Water Storage and its Effect on Sea Level, Lithospheric Loading, and Earth Rotation, to Image Mantle Rheology, NASA, Plag

The Global Geodetic Observing System: Meeting the Requirements of a Global Society on a Changing Planet in 2020. JPL/NASA, Plag

- Surface Mass Loads from GRACE, GPS, and Earth Rotation Measurements. NASA, Plag
- Development and Evaluation of a California Water and Energy Model, CEC, Miller
- Environmental Geodesy: Variations of Sea Level and Water Storage in the Australian Region, Australia, Rizos.
- TIVAGAM – Time-Variable Gravity and Surface Mass Processes: Validation, Processing and First Application of Satellite Gravity Data. Rothacher.

Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

IGCP 565 Workshop 1

December 11, 2008, San Francisco (prior to GRACE Science Team meeting): Science of geodetic monitoring of the hydrological cycle

Workshop will:

- Review the state of the art in understanding the quantitative fluxes in the global water cycle;
- Consider the relation between geodetic observations and mass changes in the main reservoirs of the water cycle;
- Clarify the open science questions that the geodetic observations can help to reconcile;
- Report to the GRACE Science Team meeting.

Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

IGCP 565 Workshop 2

June/July 2009, Europe: Geodetic gravity satellite missions

Workshop will:

- address mission requirements, options for the design of the missions, options for the deployments and mission operation, and participation in the science and operational mission teams.
- Particular emphasis will be on the participation of emerging space agencies in Africa and Asia.
- Interact with the GEO Task WA-07-02 (Satellite Water Quantity Measurements and Integration with In-situ Data) and CEOS with the goal to discuss a virtual constellation for water cycle monitoring.
- A delivery will be a Workshop summary report with specific recommendations and agreements for the implementation of GRACE follow-on missions.

Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

IGCP 565 Workshop 3

2010: Determination of mass transports in the hydrological cycle from geodetic observations

- Workshop will:focus on the inversion of geodetic observations for surface mass changes and the relation of these changes to parameters of the global water cycle.
- Key issues will be comparison of models and algorithms, cross-technique and cross-model validation, including meteorological and climatological models of the water cycle at regional and global scales.

Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

IGCP 565 Workshop 4

2011: Integration of geodetic observations and products in models of the hydrological cycle

- Workshop will focus on algorithms for assimilation of geodetic observations and products into models of components (terrestrial, atmosphere, ocean) the global water cycle.
- Assess the improvements in terms of accuracy, spatial and temporal resolution, and predictive capabilities of the models.

Developing the Global Geodetic Observing System into a Monitoring System for the Global Water Cycle

IGCP 565 Workshop 5

2012: Improving regional water management in Africa and Asia on the basis of geodetic water cycle monitoring

- Workshop will bring together representatives of regional water management authorities and representatives of the research and observation communities involved in the project activities.
- Assess the requirements of regional water management, in particular in developing countries, in terms of products derived from space-geodetic observations and the associated models.
- The goal is to define a set of products in terms of parameter, spatial and temporal resolution, accuracy, and latency, which can be made available in support of regional water management.