IGCP 565, GEO and GGOS: Objectives and Relevant Science Questions

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IUGS UNESCO IGCP

GEO GROUP ON EARTH OBSERVATIONS

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

- What is GEO and GEOSS?
- The GEO Water Societal Benefit Area
- Global Geodetic Observation Infrastructure
- Objectives and Activities of IGCP 565
- Science Questions

GROUP ON EARTH OBSERVATIONS

GEO, the Group on Earth Observations

An Intergovernmental group with >80 Member Countries and 57 Participating Organizations

U.S. Department of State, Washington DC
July 31, 2003

GROUP ON EARTH OBSERVATIONS

What is GEO?

- launched in response to calls for action by the 2002 World Summit on Sustainable Development and by the G8 (Group of Eight) leading industrialized countries
- voluntary partnership of governments and international organizations
  - 79 member governments + EC
  - 57 Participating Organizations (PO)
- provides a framework within which these partners can develop new projects and coordinate their strategies and investments
- charged with developing GEOSS

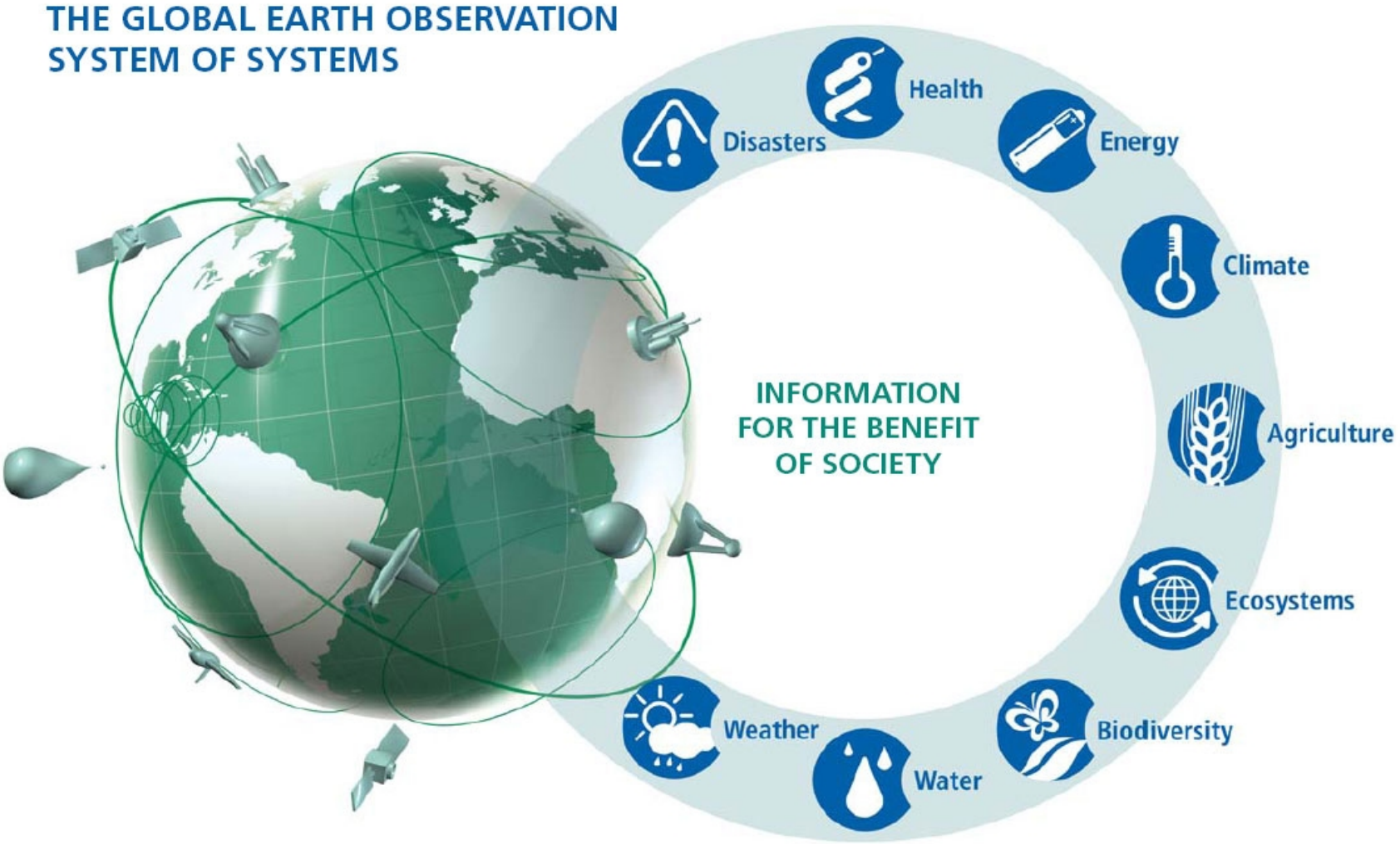
GROUP ON EARTH OBSERVATIONS

What is GEOSS?

- the Global Earth Observation System of Systems
- an integrating infrastructure for Earth observing and information systems to support informed decision making for society
- 10-year implementation plan
- 2015: Global, Coordinated, Comprehensive and Sustained System of Observing Systems

GROUP ON EARTH OBSERVATIONS

GEOSS: A Global, Coordinated, Comprehensive and Sustained System of Observing Systems



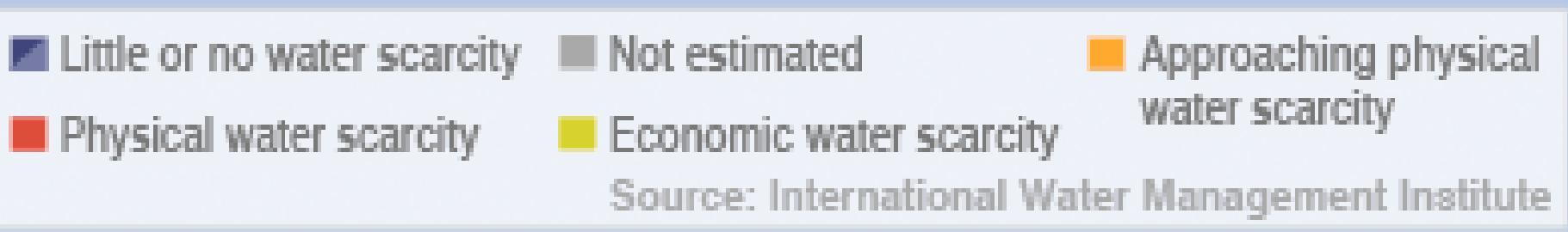
GEO Strategic Target in the Water Societal Benefit Area

Before 2015, GEO aims to:

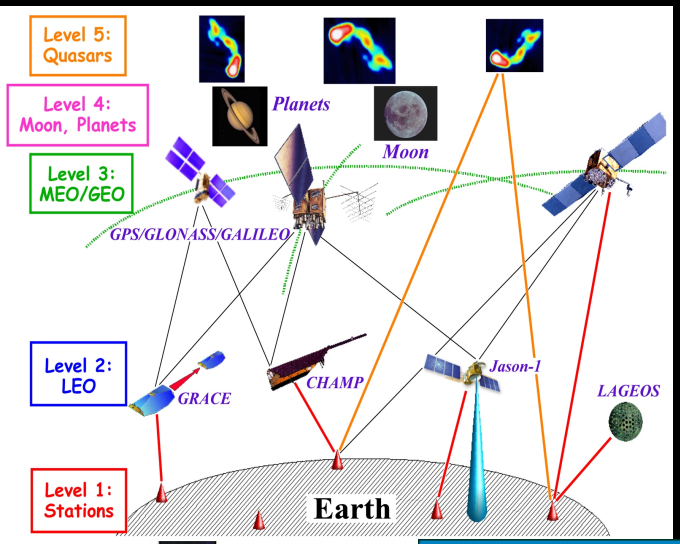
13. Produce comprehensive sets of data and information products to support decision-making for efficient management of the world's water resources, based on coordinated, sustained observations of the water cycle on multiple scales.

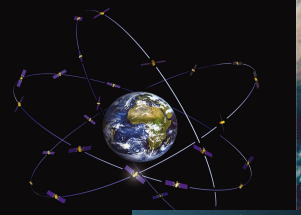
Motivation:

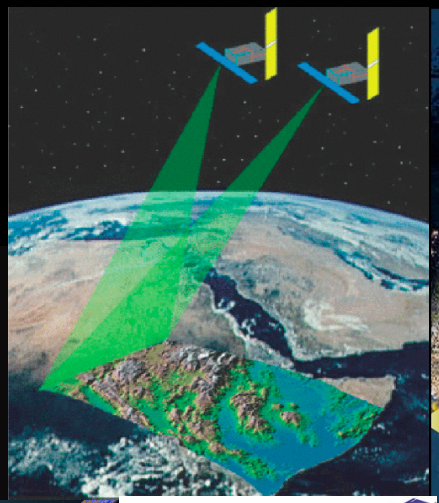
- ***one billion people*** *are currently without sufficient access to clean* ***drinking water****;*
- *according to the 2nd UN Water Assessment Report, this deficit is a result of* ***governance problems*** *and poorly informed decision-making;*
- ***demand for water resources is rising*** *due to increased water usage for potable consumption, energy production, irrigation for agriculture purposes, industrial and urban uses, while climate change is locally to regionally impacting water resources through increased frequencies and magnitudes of droughts and floods;*
- *a* ***better understanding of the water cycle*** *on regional to global scales is* ***critical for managing water resources*** *in a sustainable manner;*

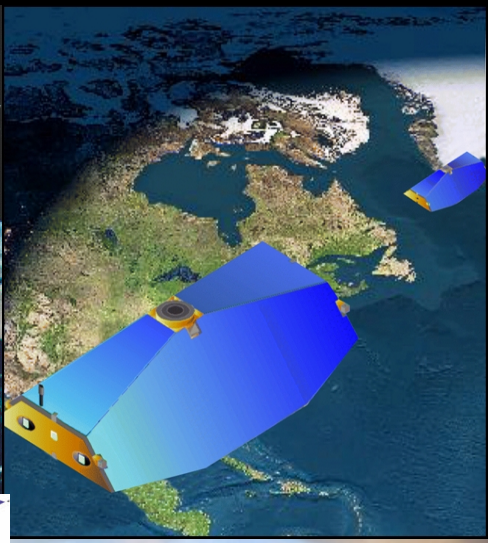


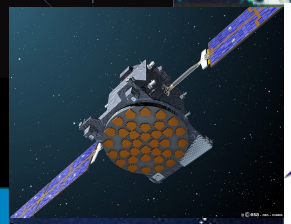
The Global Geodetic Observation Infrastructure

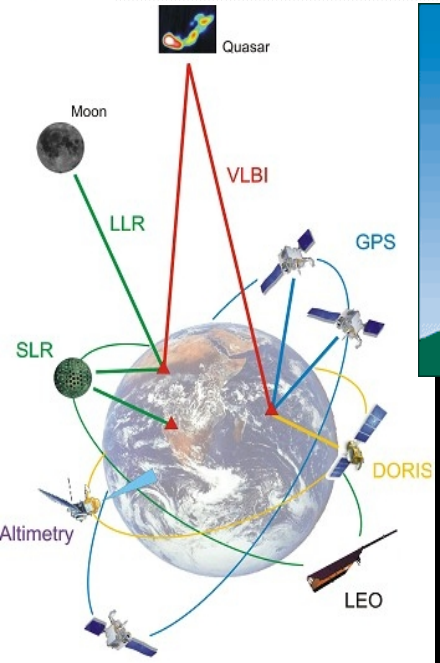


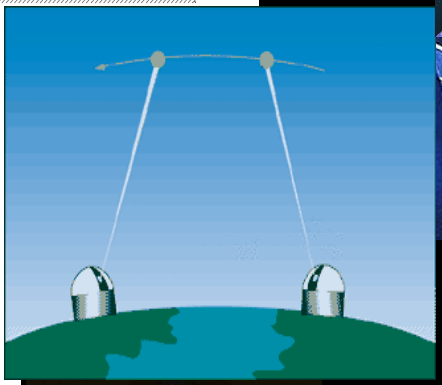


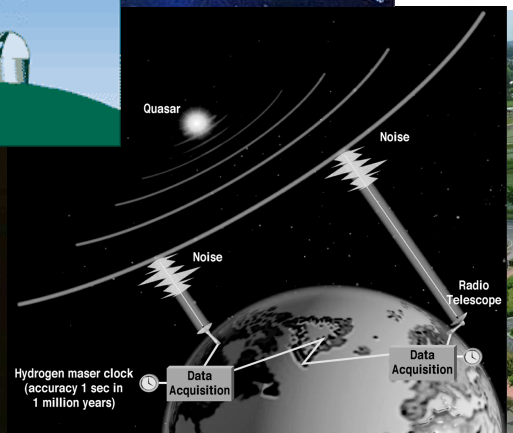




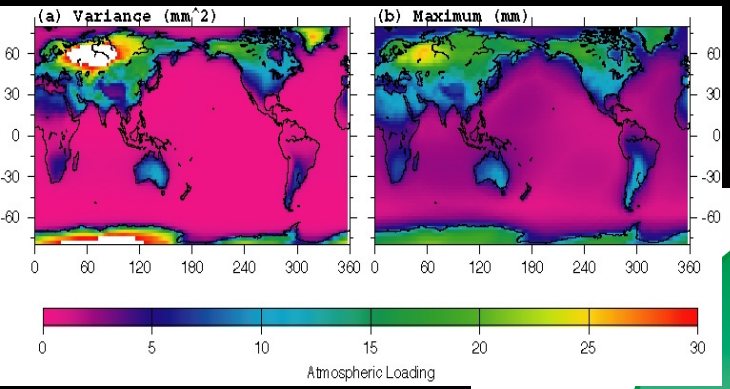








Geodesy and Water Cycle

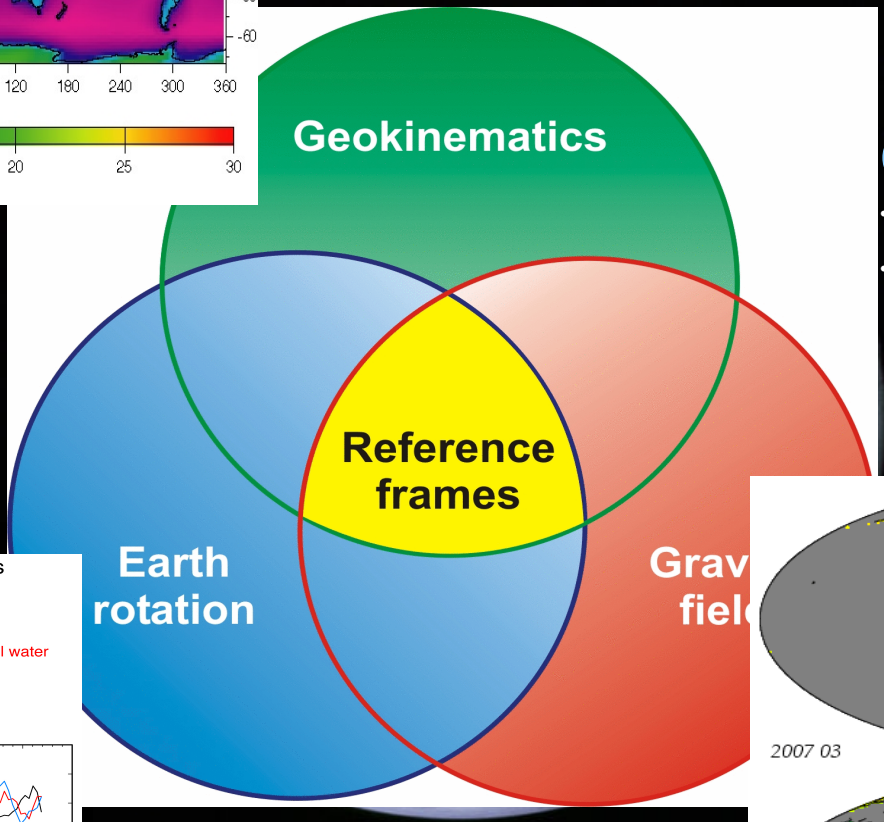


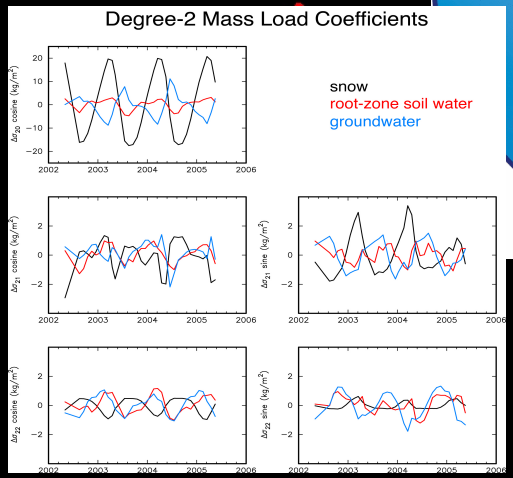
The 'three pillars of geodesy':

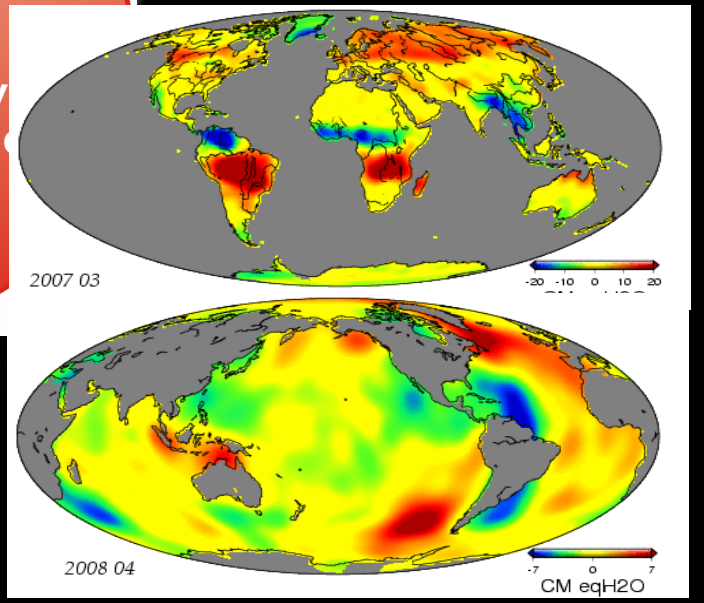
- Earth's Shape
- Earth's Gravity Field
  Earth Rotation

Output:

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







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

IGCP 565 Objectives

Origin and Intent:

- Initiated as an outreach from geodesy to hydrology;
- Intended as a framework for the dialogue between hydrology and geodesy.

Goals:

- Explore and develop components of the geodetic infrastructure most relevant for the monitoring of the water cycle
- Make observations and products 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 Participation

Project Leads:

Hans-Peter Plag, Nevada Bureau of Mines and Geology and Seismological Laboratory, University of Nevada, Reno, NV, USA, hpplag@unr.edu.

Norman Miller, Berkeley National Laboratory and University of California, Berkeley, CA, USA.

Richard S. Gross, Jet Propulsion Laboratory, California Inst. of Technology, Pasadena, CA, USA.

Markus Rothacher, ETH, Zurich, Switzerland

Susanna Zerbini, Department of Physics, Sector of Geophysics, University of Bologna, Italy.

Chris Rizos, School of Surveying & Spatial Information Systems, University of New South Wales, Sydney, Australia.

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 (in particular, Water Tasks)
- IGWCO (Integrated Global Water Cycle Observations)
- GEWEX
- ...

Specific Activities:

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

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

IGCP 565 Workshops

Workshop 1: December 11, 2008, San Francisco: Science of geodetic monitoring of the hydrological cycle

Workshop 2: September 30-October 2, 2009, Graz, Austria: Toward a Roadmap for Future Satellite Gravity Missions

Workshop 2b: December 12-13, San Francisco, USA: From Satellite Gravity Observations to Products

Workshop 3: October 11-13, 2010, Reno, USA: Separating Hydrological and Tectonic Signals in Geodetic Observations

Workshop 4: 2011, Australia/Africa(?): Integration of geodetic observations and products in models of the hydrological cycle

Workshop 5: 2012, Africa: Improving regional water management in Africa on the basis of geodetic water cycle monitoring

GEO Water Cycle Community of Practice: Request for Training course/summer school in use of GRACE and other geodetic products for water management

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

IGCP 565 Workshop 1 Summary

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

Conclusions:

- Main gaps in the hydrological budget: deep groundwater but also evapotranspiration;
- Important problem in water management: seasonal prediction; this requires models with predictive capability;
- Approach to utilize geodetic observations: assimilation into hydrological models;
- Addressing the hydrological question: hybrid of local implementation and global observations and models;
- geodetic observations are valuable on all scales;

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

IGCP 565 Workshop 2 Summary

September 30-October 2, 2009, Graz, Austria: Toward a Roadmap for Future Satellite Gravity Missions

Workshop addressed 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.

Declaration "Toward a Service for the Water Cycle" recognizes the potential of geodetic techniques and requests a community effort toward a service providing products with societal relevance

Declaration, Roadmap, and several "one-page stories" as input to the GEO Plenary, November 2009, Washington, D.C.

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

IGCP 565 Workshop 2b Summary

December 12-13, 2009 San Francisco, USA: From Satellite Gravity Observations to Products

Objective:
Review of the current project status and a planning of the next steps, including the workshops in 2010 to 2012 and the coordination of research projects and proposals.

See http://www.igcp565.org/workshops for details

Decision on Topic of Third Workshop

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

IGCP 565 Workshop 3

October 11-13, 2010, Reno: Separating hydrological and tectonic signals in geodetic observations

Objective:

make progress towards improved applicability of geodetic observations for hydrological and global change studies

Anticipated output:

* Recommendations for research/infrastructure
* Workshop report on the Workshop Web page;
* Summary articles in appropriate journals (including Episodes, EOS);
* A special issue in an appropriate journal.

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.

General question: 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 Workshop 3 Questions

How can we bridge the gap in spatial scales between regional/global and point/catchment measurements?

How can we isolate long-term hydrological changes from secular effects due to tectonics, GIA, etc

How can we improve measurement accuracy and robustness to seasonal and other artifacts?

How can we improve infrastructure to build reliable services?

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

IGCP 565 Workshop Breakout Sessions

BS1: Ballroom A

BS2: Room 423

BS3: Ballroom A

BS4: Room 423

Declaration

Noticing that

***one billion people** are currently without sufficient access to clean*

***drinking water**;*

according to the 2nd UN Water Assessment Report, this deficit is a

*result of **governance problems** and poorly informed decision-making;*

***demand for water resources is rising** due to increased water usage*

for potable consumption, energy production, irrigation for agriculture purposes, industrial and urban uses, while climate change is locally to regionally impacting water resources through

increased frequencies and magnitudes of droughts and floods;

a better understanding of the water cycle on regional to global scales

Physical water scarcity Economic water scarcity

Source: International Water Management Institute

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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.

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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.

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

IGCP 565 Research Projects

Current Projects:

- Surface Mass Loads from GRACE, GPS, and Earth Rotation Measurements. NASA, (Gross, Plag, Blewitt).
- Development and Evaluation of a California Water and Energy Model, CEC (Miller et al.).
- Environmental Geodesy: Variations of Sea Level and Water Storage in the Australian Region, Australia (Tregoning, Coleman, Featherstone, Rizos, Watson, Awange, Kuhn, Titov).
- TIVAGAM – Time-Variable Gravity and Surface Mass Processes: Validation, Processing and First Application of Satellite Gravity Data (Rothacher et al.).
- Sea Level, Gravity, and the Earth's Rotation (Gross, Song)