

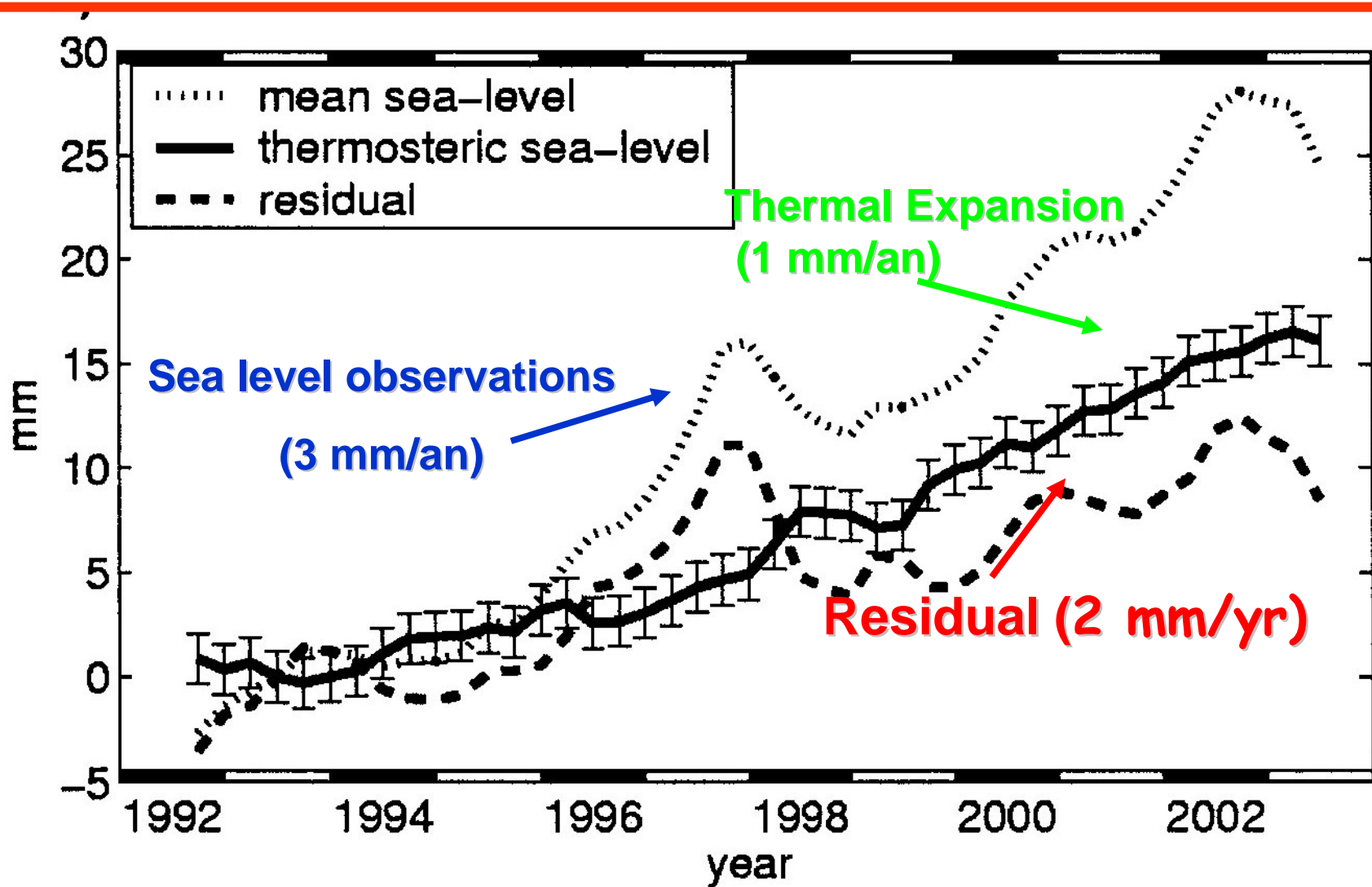


Group on
Earth Observations

GEO

To Understand Trends, Forecast Changes, Support Informed Decisions

José Achache
Director
GEO Secretariat





Solar Radiation

CLIMATE VARIABILITY AND CHANGE

ATMOSPHERIC COMPOSITION

H₂O, CO₂, CH₄, N₂O, O₃, etc. Aerosols

The Earth is a complex system of systems...

Clouds

Volcanoes

WATER CYCLE

Terrestrial Radiation

ECOSYSTEMS

CARBON CYCLE

HUMAN CONTRIBUTIONS AND RESPONSES

Industries

Cities

Transportation

Glaciers

Ice Sheet

Vegetation

Vegetation-Soil interaction

Agriculture

Oceans

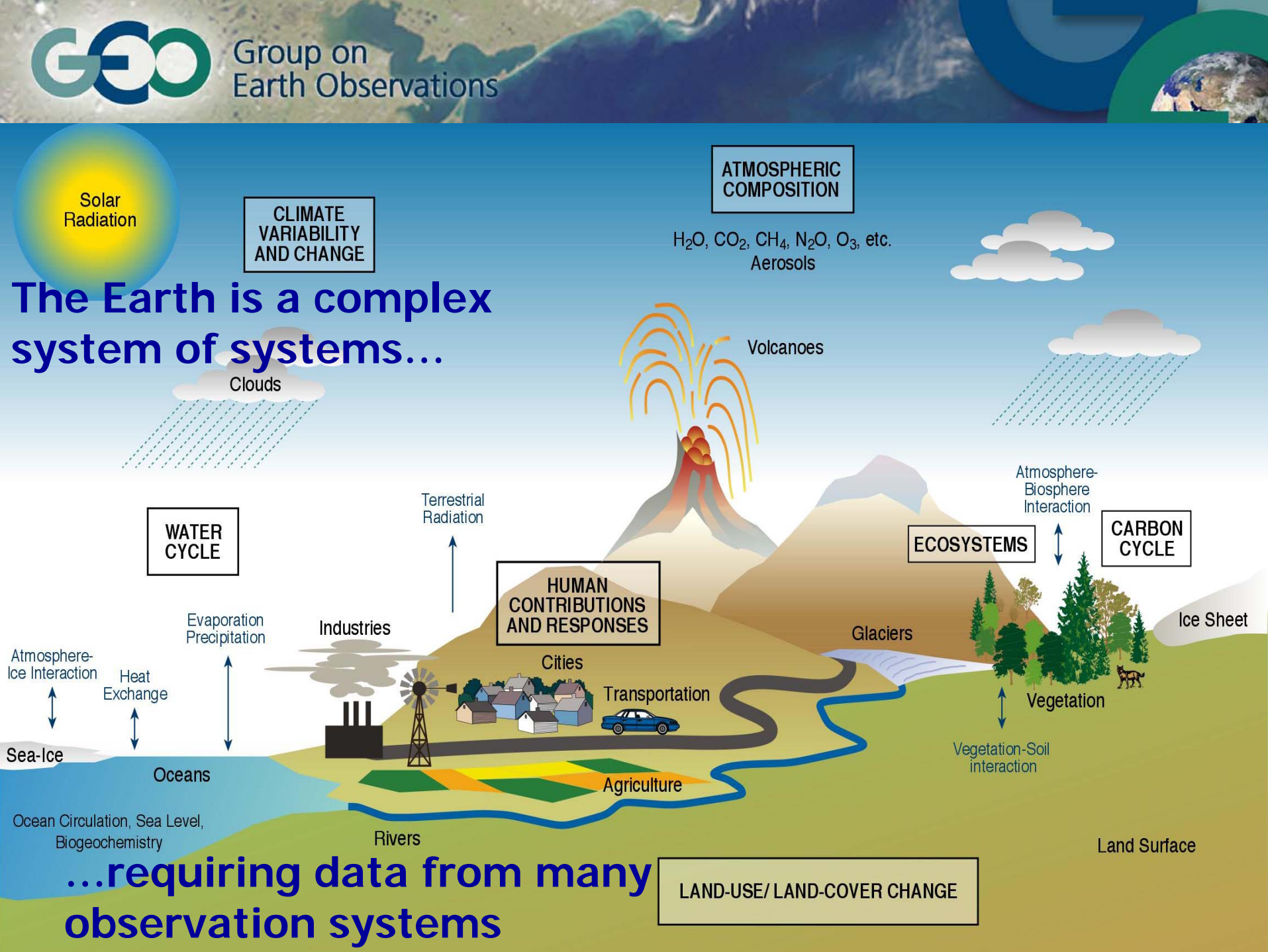
Rivers

Land Surface

Ocean Circulation, Sea Level, Biogeochemistry

...requiring data from many observation systems

LAND-USE/ LAND-COVER CHANGE





Group on
Earth Observations



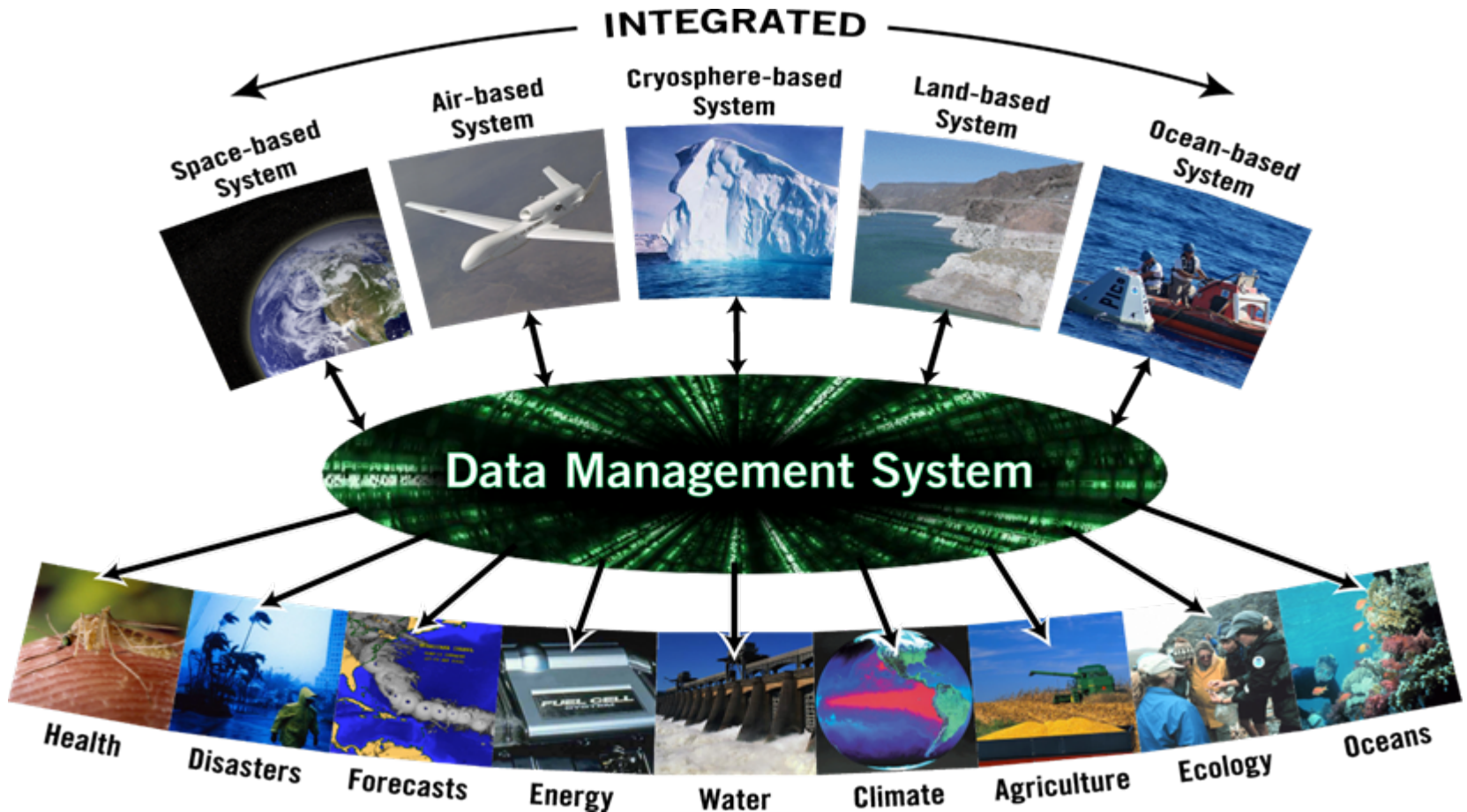
Recognizing the Need to Share Observations



Washington
Tokyo
Brussels



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





**Any Single Problem Requires Many
Data Sets**

**A Single Data Set Will Serve Many
Communities**



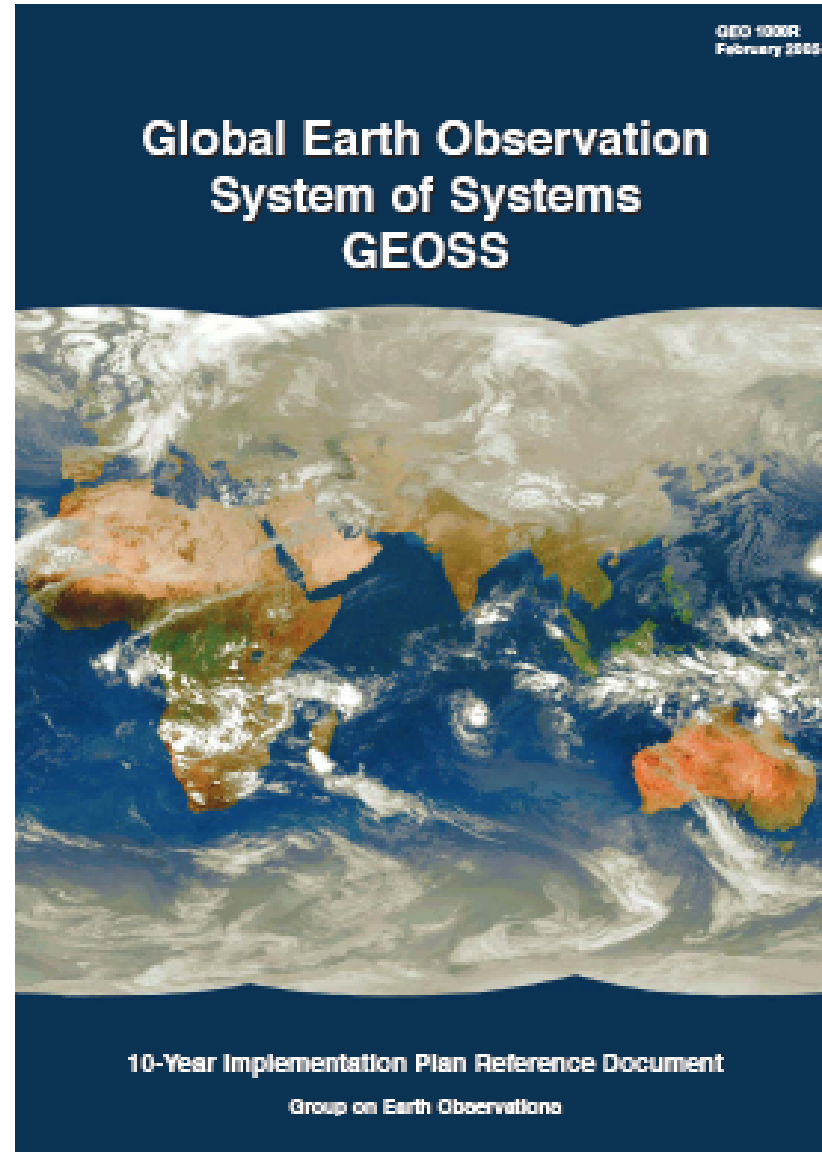
Group on
Earth Observations

GEO : The Group on Earth Observations is an Intergovernmental Organization of 66 Member Countries, the European Commission and 43 Participating Organizations





- **GEOSS 10-Year Implementation Plan Endorsed**
- **GEO Secretariat established in Geneva**



GEO: A User-driven Process

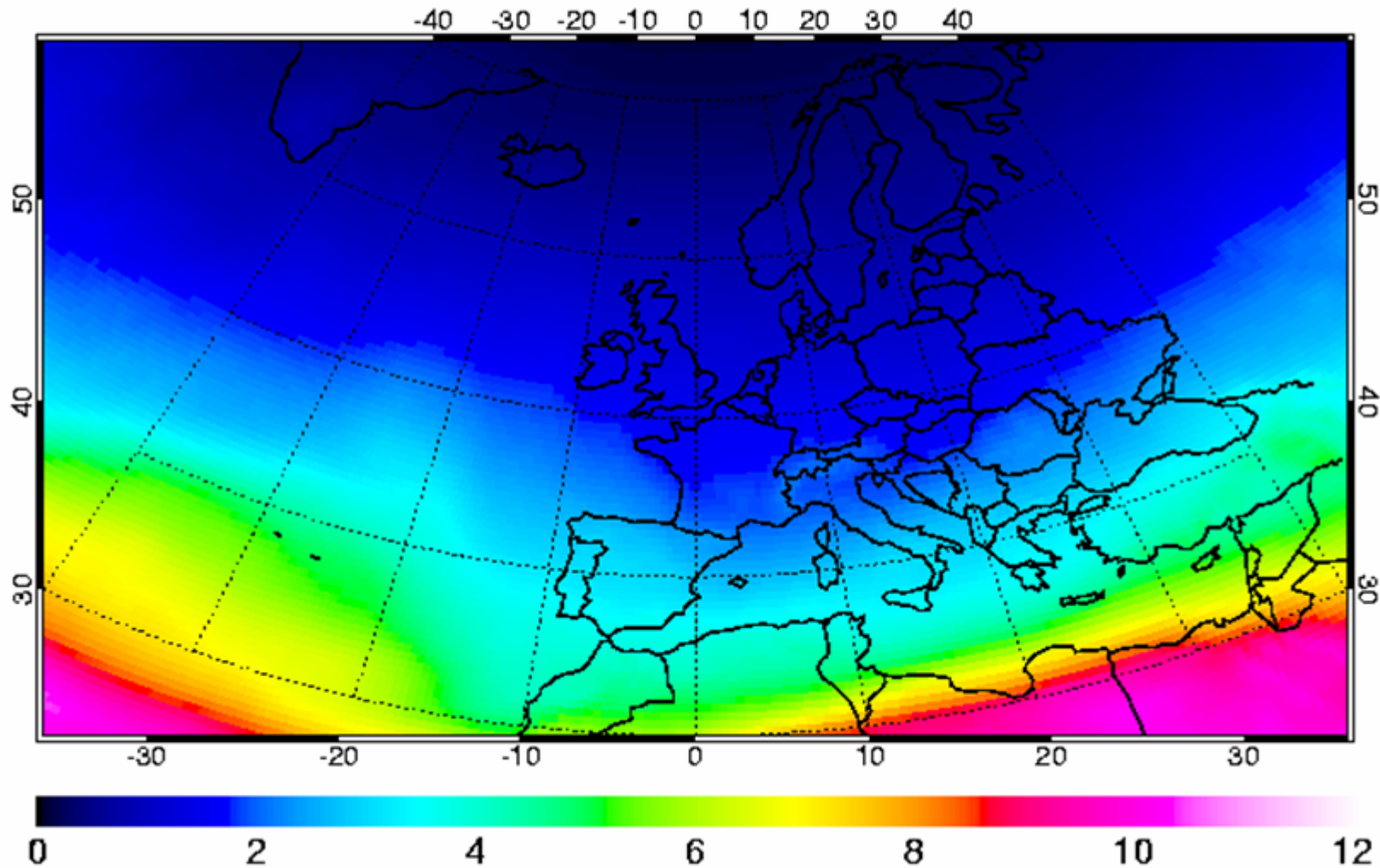
- **Improve and Coordinate Observation Systems**
- **Provide Easier & More Open Data Access**
- **Foster Use through Science and Applications**

**... to answer Society's need
for informed decision making**



Erythemal UV index
SCIAMACHY - KNMI/ESA

local solar noon
29 February 2004

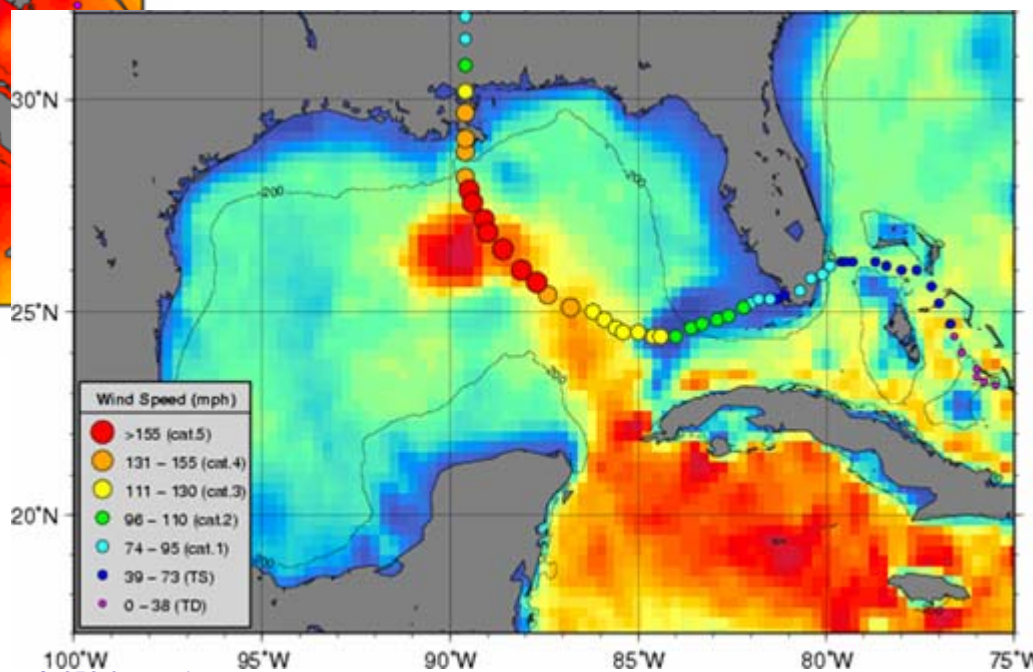
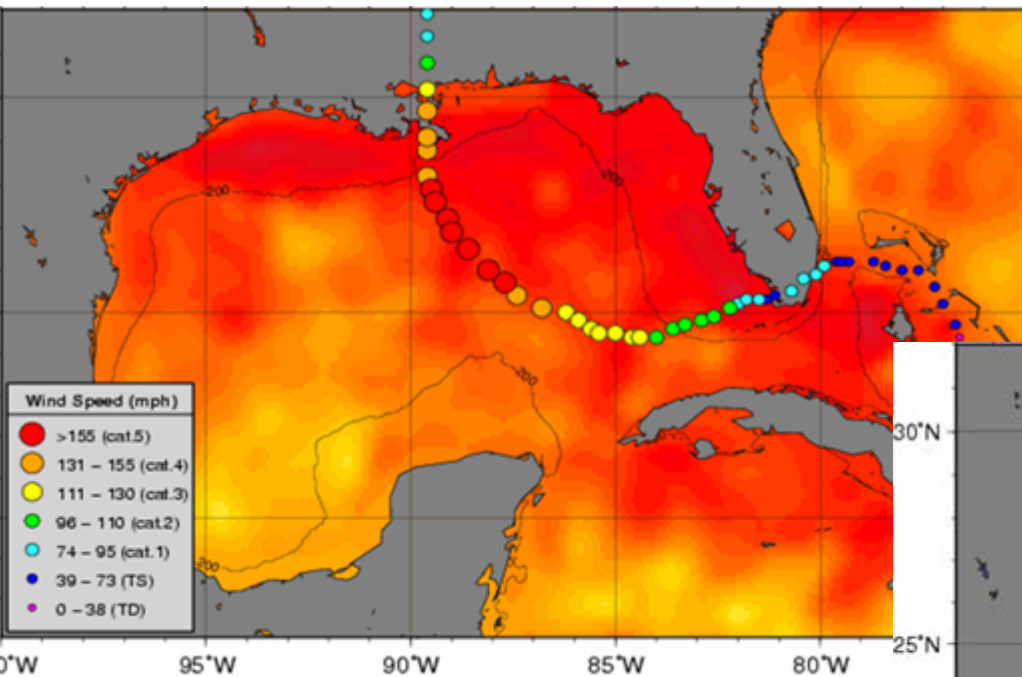


Manage_Energy

- Developing applications for monitoring renewable energy sources
- Improving forecasting of fluctuations and intermittency
- Monitoring Environmental Impact
- Planning Energy Policies

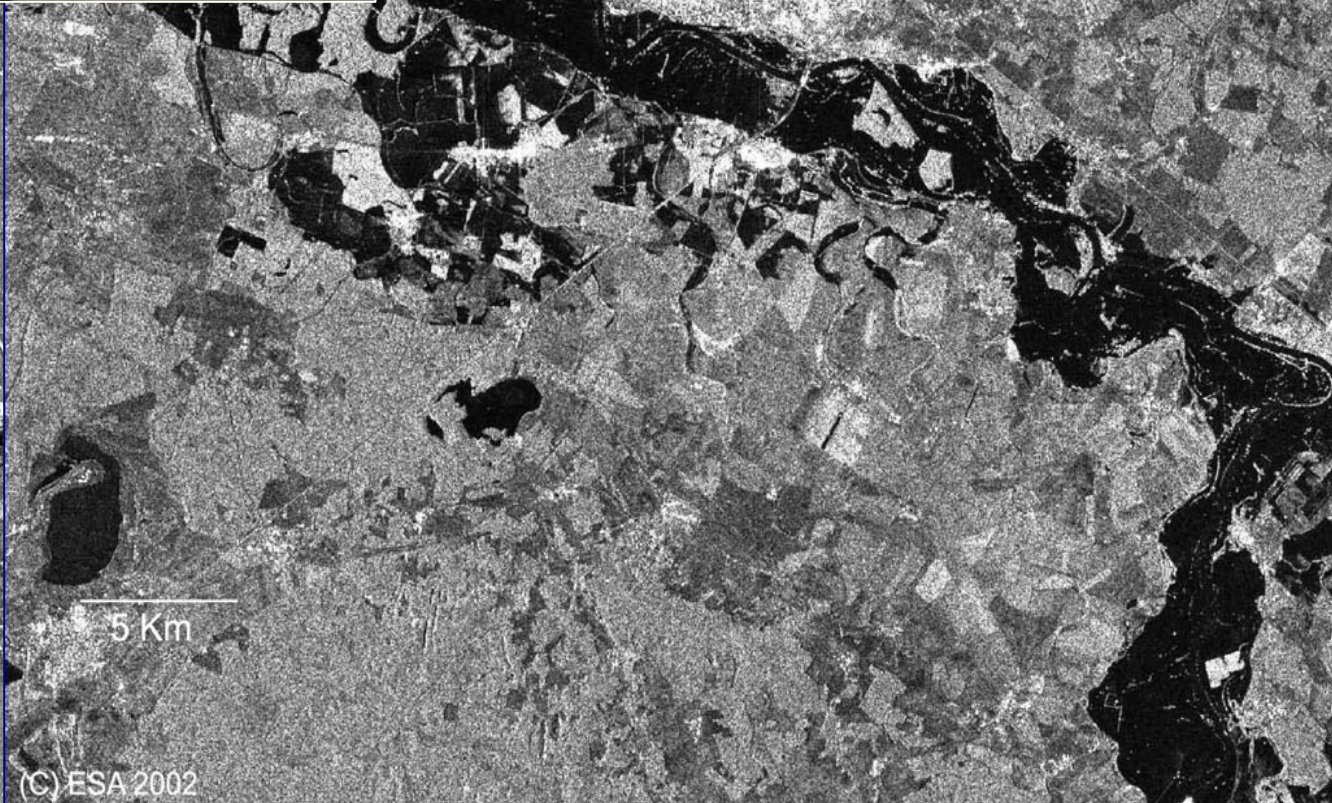
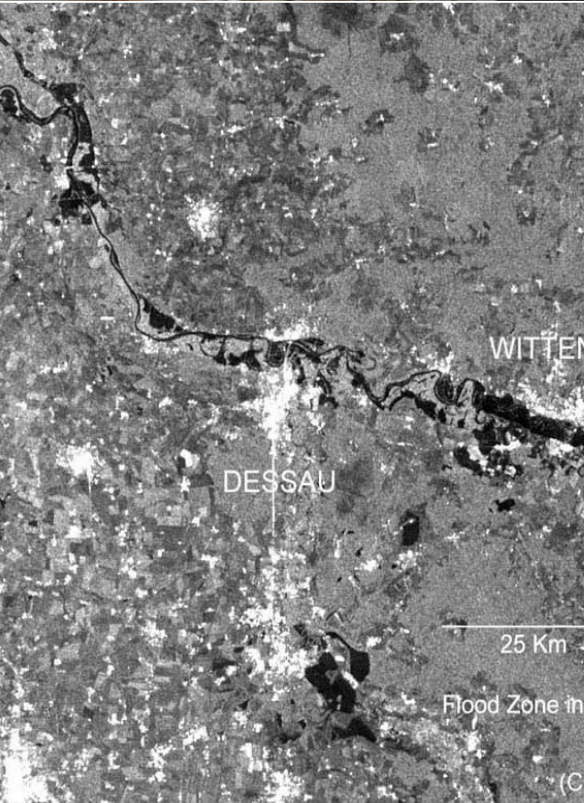


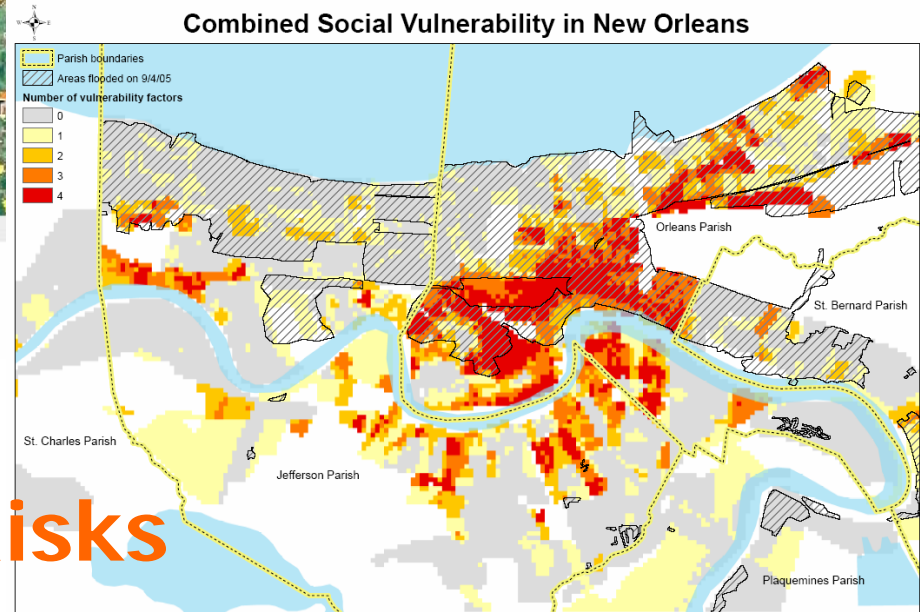
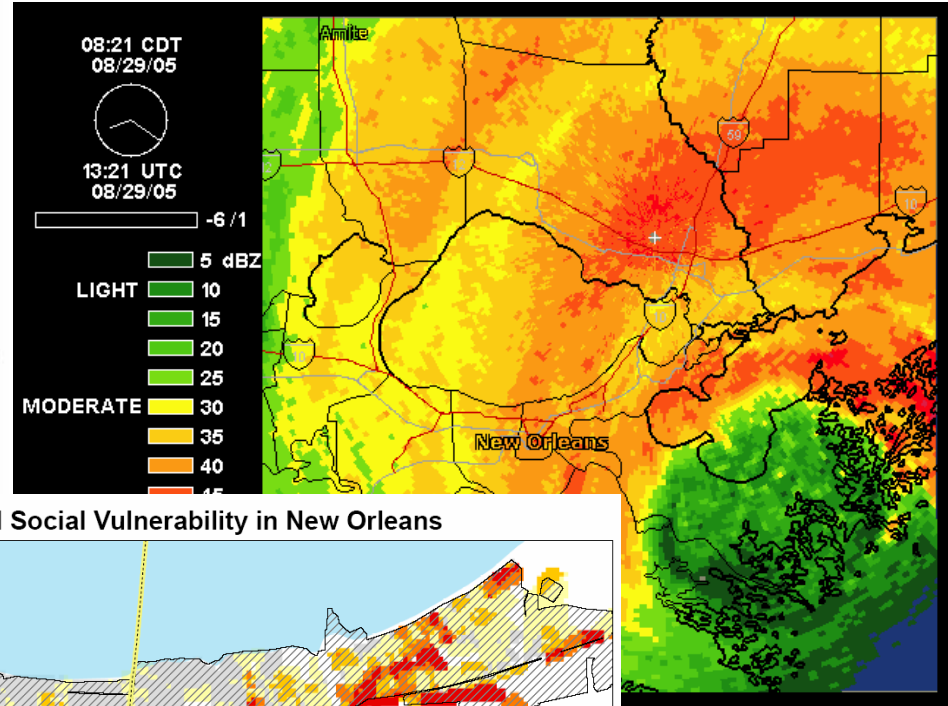
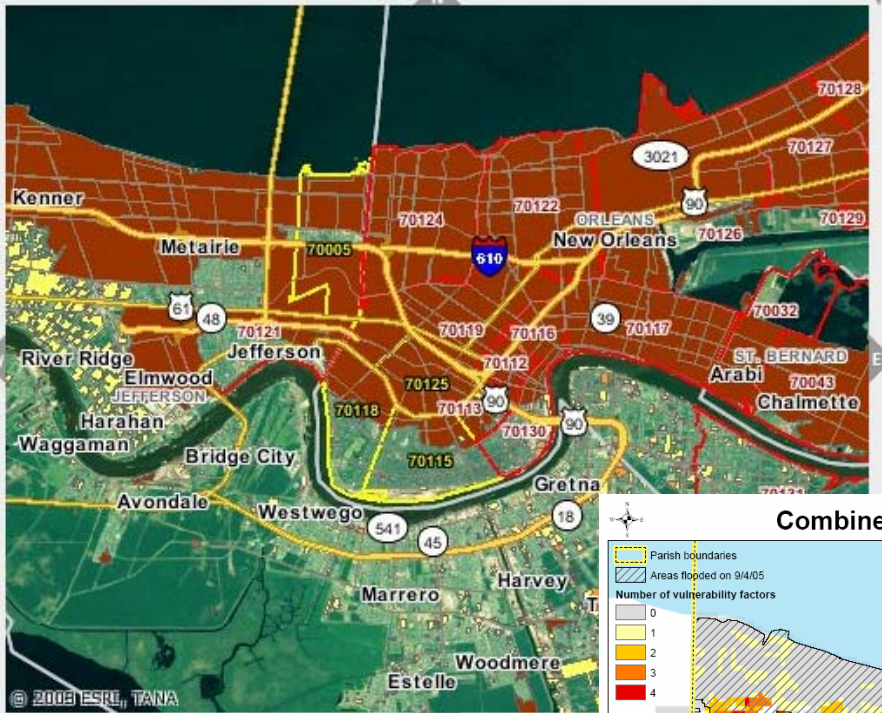
Forecast_Disasters





Forecast_Disasters





A grid cell is considered vulnerable if it falls in the top 3 deciles for one or more of the following measures:
 % of residents living below the poverty line
 % of residents who are African American
 % of households without a vehicle
 % of housing units occupied by renters

Hazard

Exposure

Evaluate Risks

Vulnerability

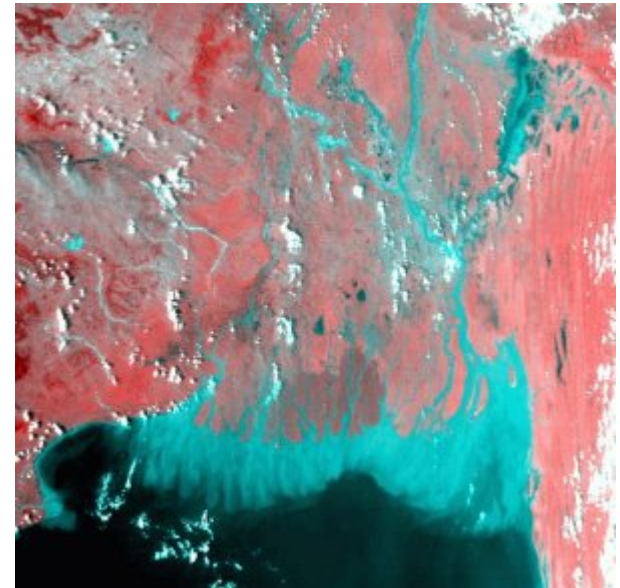


Forecast Epidemic Outbreaks

**VIBRIO CHOLERAE HAS A
MARINE ZOOONOTIC CYCLE
ASSOCIATED WITH ALGAL
BLOOMS**

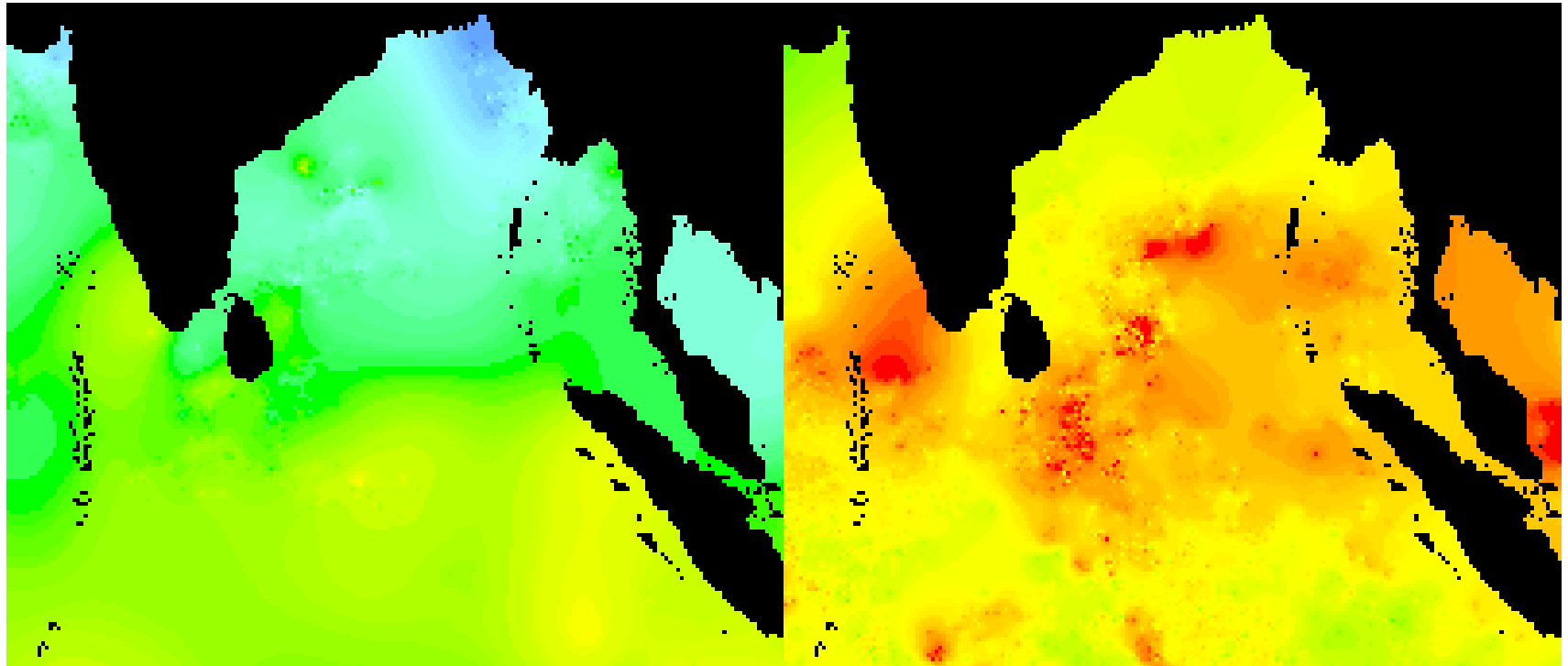


COPEPOD



BAY OF BENGAL

**AVRHH SEPT 1992
FALSE COLOR INFRARED**

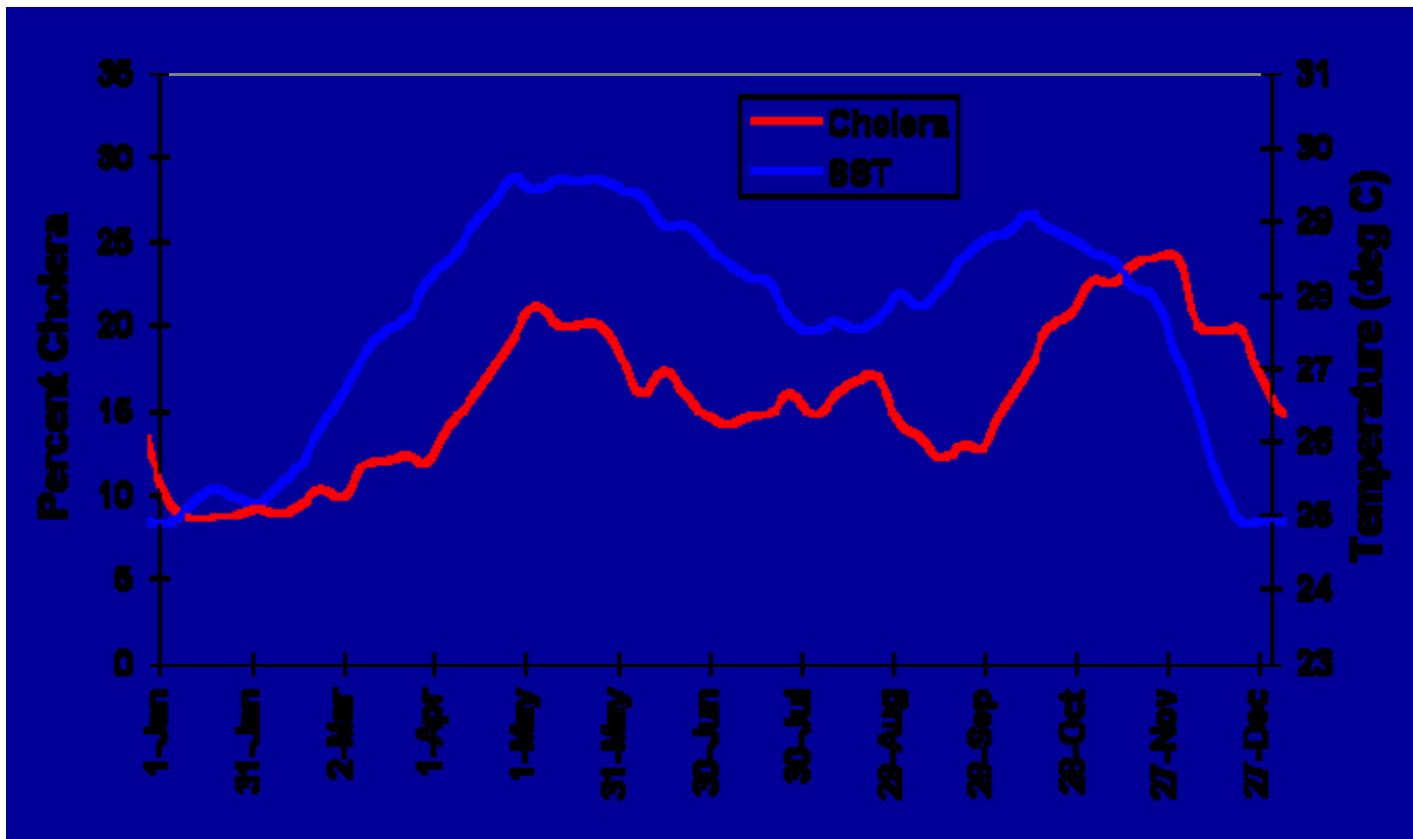


JANUARY

MAY

AVHRR Global Composite SST images from 1992

SEA SURFACE TEMPERATURE PREDICTS CHOLERA CASES



BAY OF BENGAL

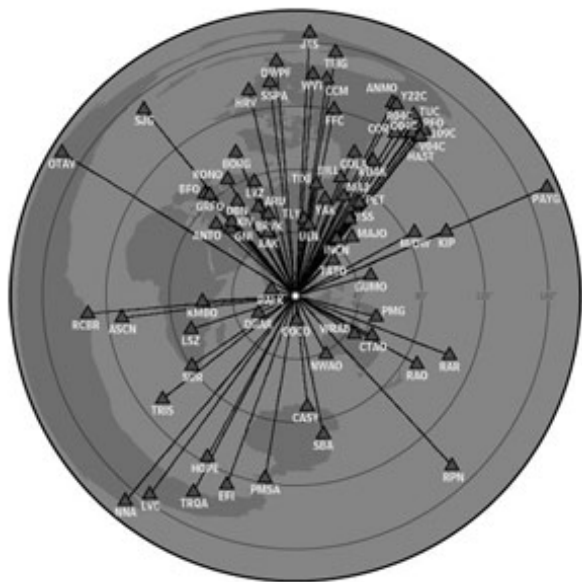
GEOSS Architecture will Provide Systems Interoperability and Easier and More Open Data Access



Space Systems



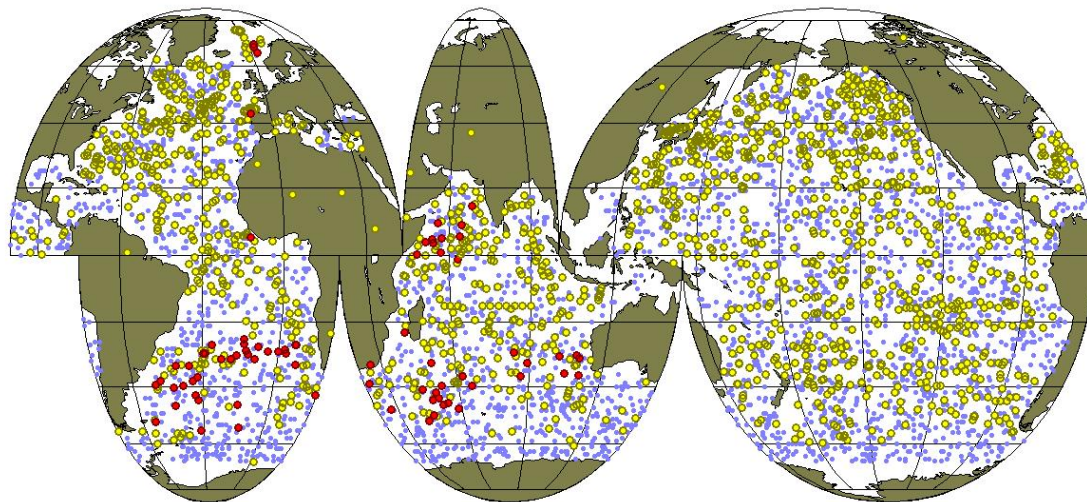
Global In-situ Networks



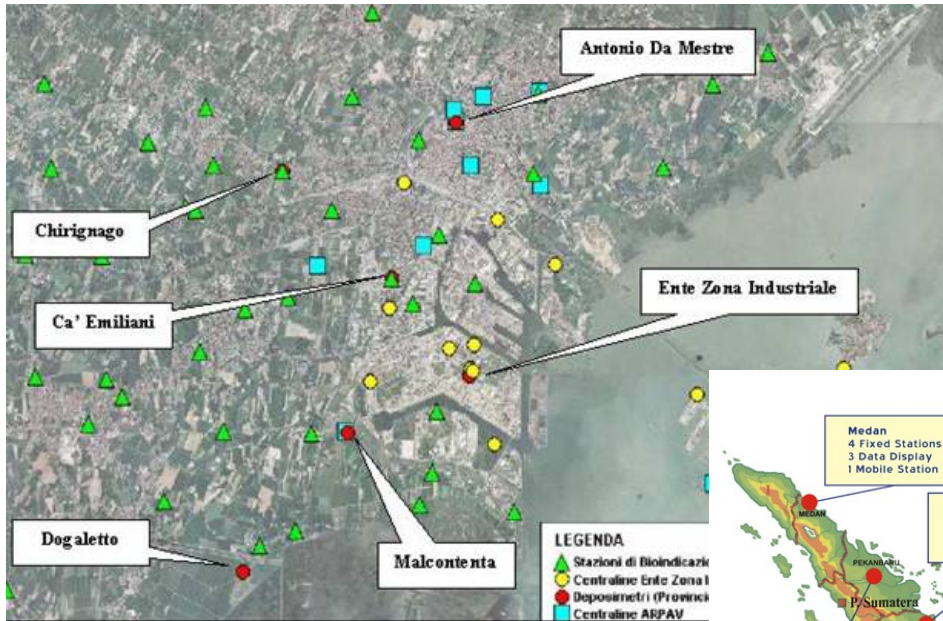
Seismic Networks

Argo Float Array

Global Argo Float Array (red – Argo UK; yellow – all Argo; blue – proposed array)

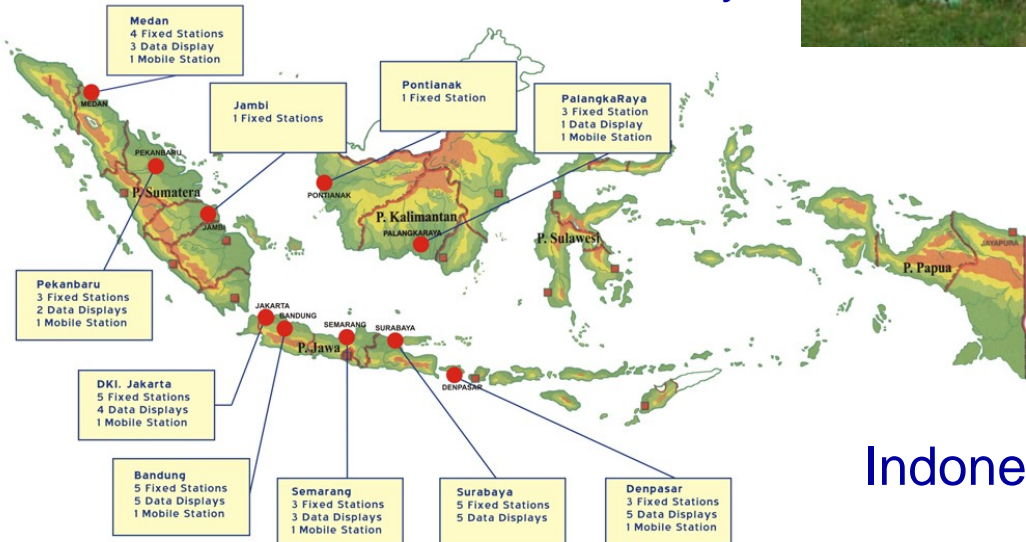


Regional and Local In-situ Networks



Venice, Italy

Air pollution measurement station Emden, Germany



Indonesia

EXAMPLE:
Air Pollution
Observation

Regional and Local In-situ Networks



TEAM

Tropical Ecology Assessment & Monitoring Initiative

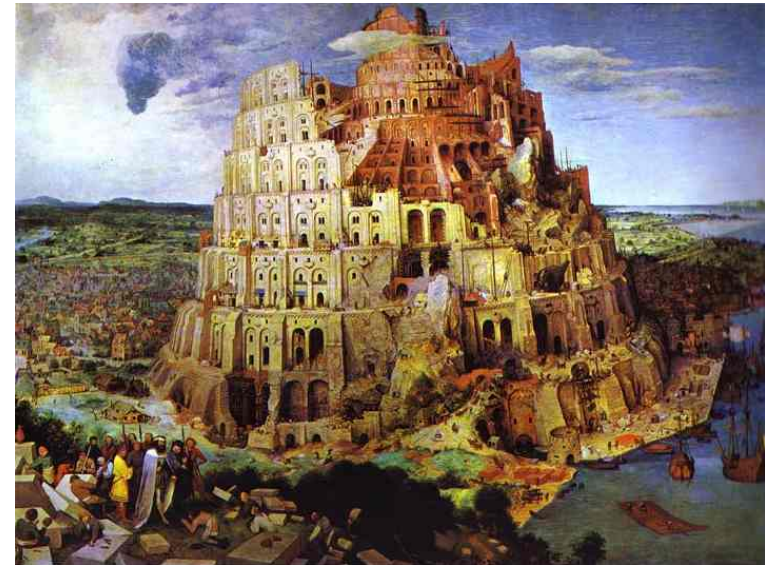
The Tower of Babel

**There is a Need to Share
all Earth Observation
Data in Standard
Interoperable Formats**



Interoperability Arrangements

- **Technical Specifications for Collecting, Processing, Storing, and Disseminating Data and Products**
- **Based on Non-proprietary Standards**
- **Defining only how System Components Should Interface to be Contributed to GEOSS**

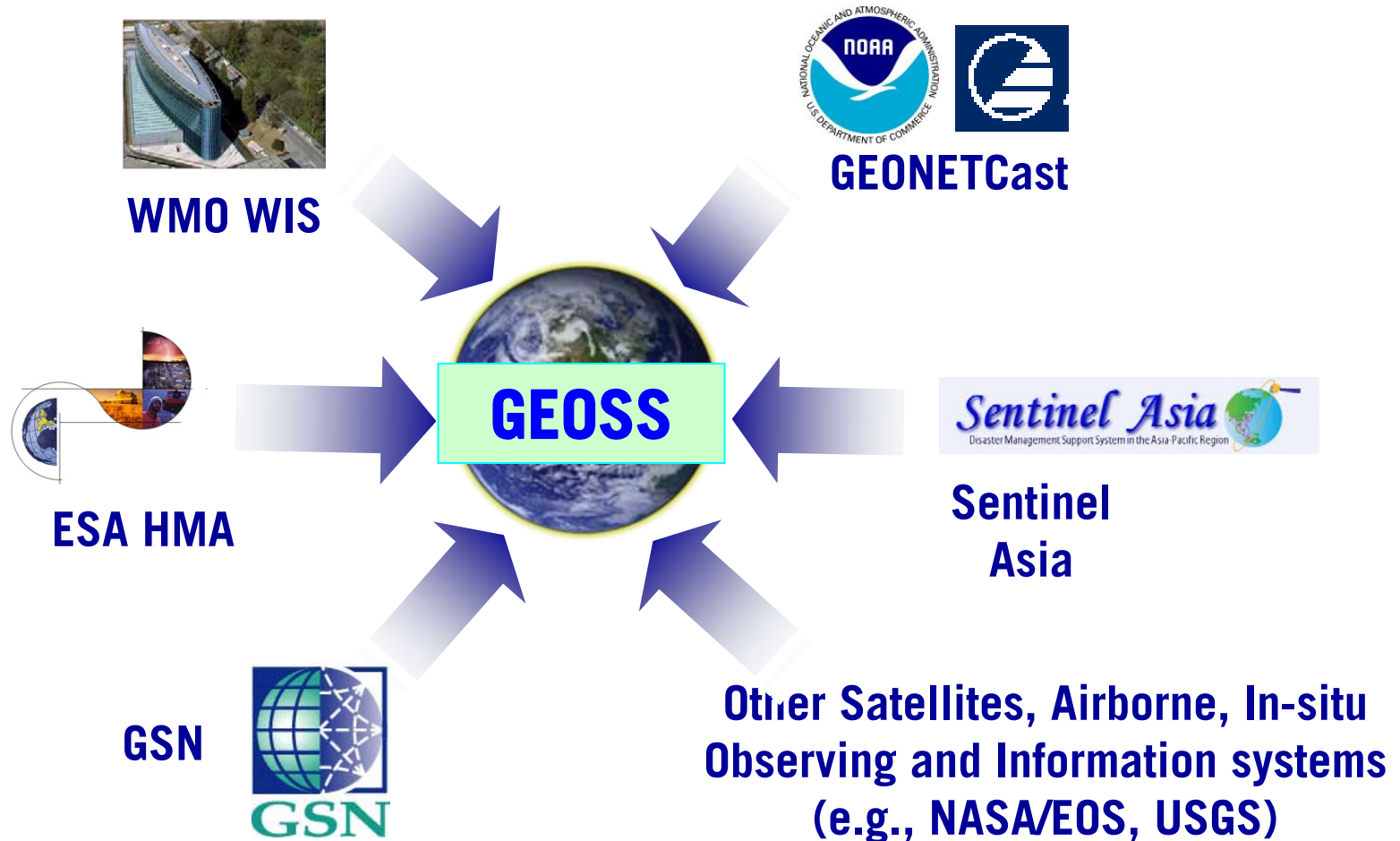


Interoperability Arrangements

*“What few things
must be the same
so that everything
else can be different”*



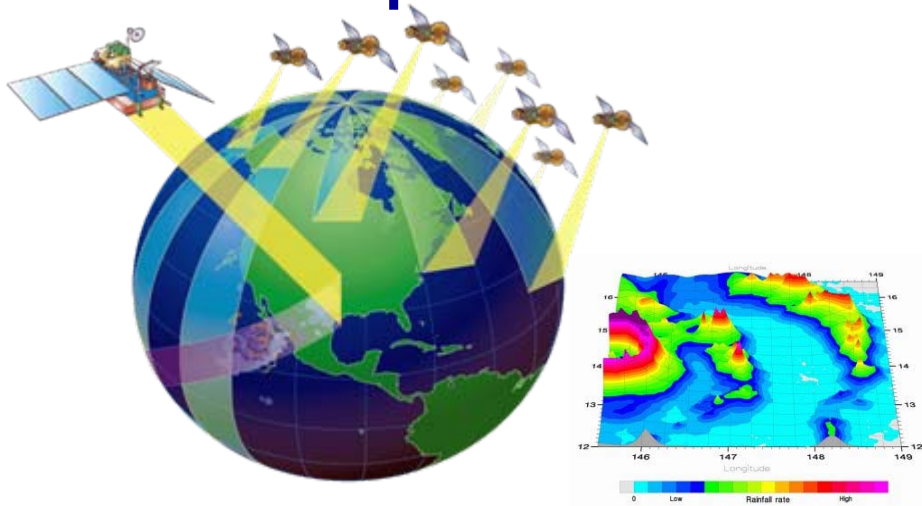
GEOSS Components Commitments



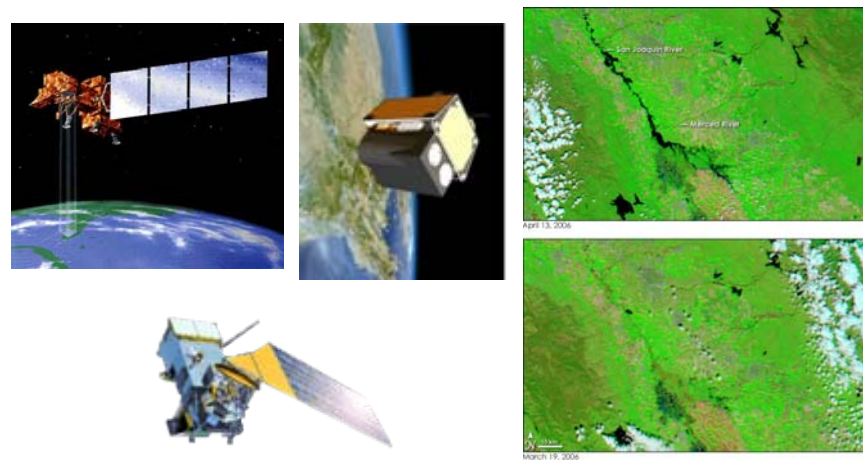
Initial Candidates of Component Contributors

Virtual Constellations

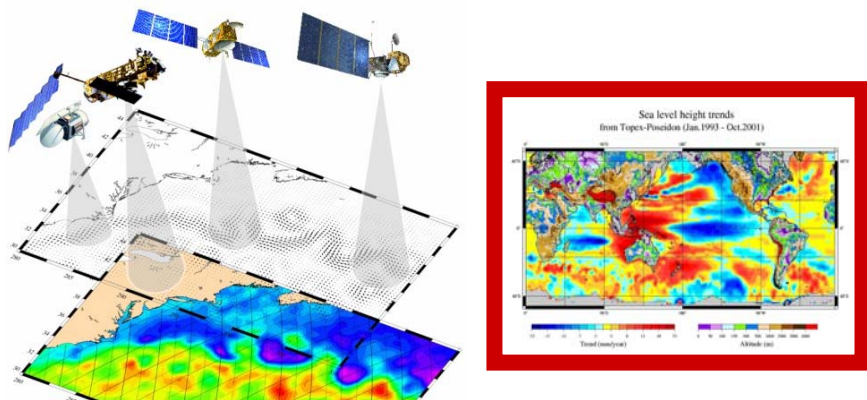
Precipitation



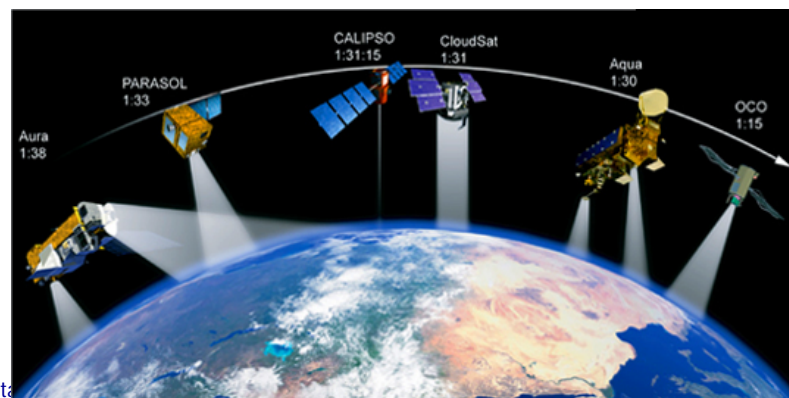
Land-Surface Imaging



Ocean Surface Topography



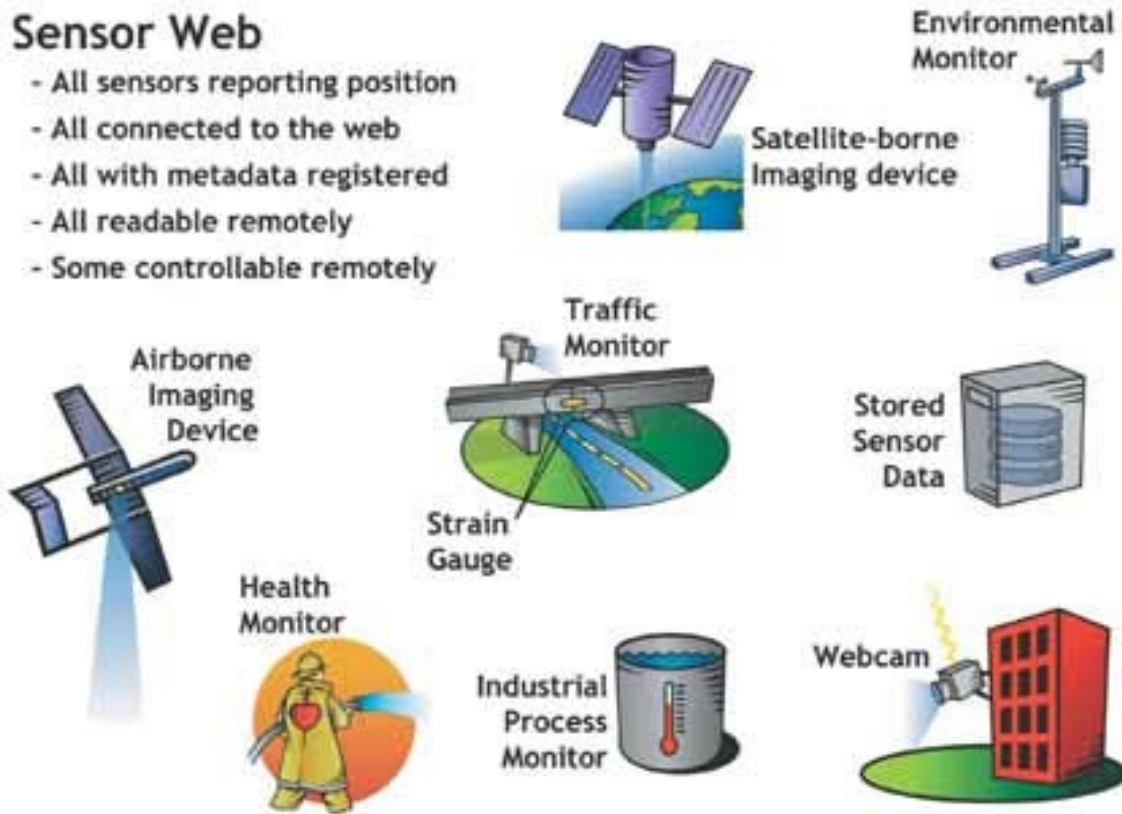
Atmospheric Chemistry



Sensor Web For In situ Networks

Sensor Web

- All sensors reporting position
- All connected to the web
- All with metadata registered
- All readable remotely
- Some controllable remotely



- Less development of ground based sensing network
- Develop use cases to demonstrate the value of the technology
- Target SBAs (Disaster, Health, Biodiversity, Ecosystem, Water)

FIGURE 1 The Sensor Web will comprise diverse, location-aware environmental sensing devices that report data about their surroundings in real time.

Image courtesy of OGC

GEO should Provide Easier and More Open Data Access



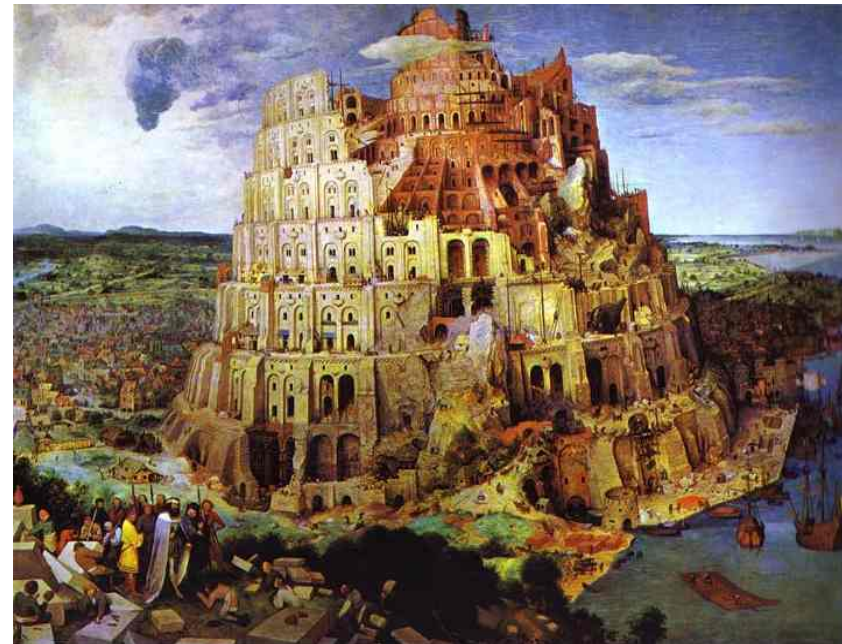
GEO Web Portal and Clearinghouse

- **Defining Standards for Quality Assurance of Derived Products**
- **Providing Online Calibration and Validation**
- **Providing Tools**

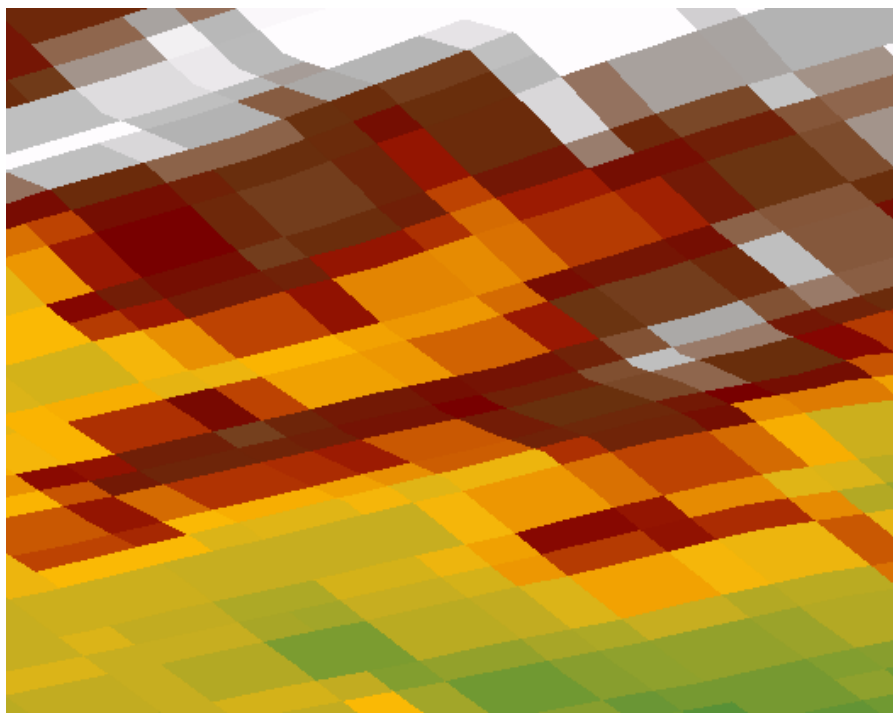


GEO Data Sharing Principles

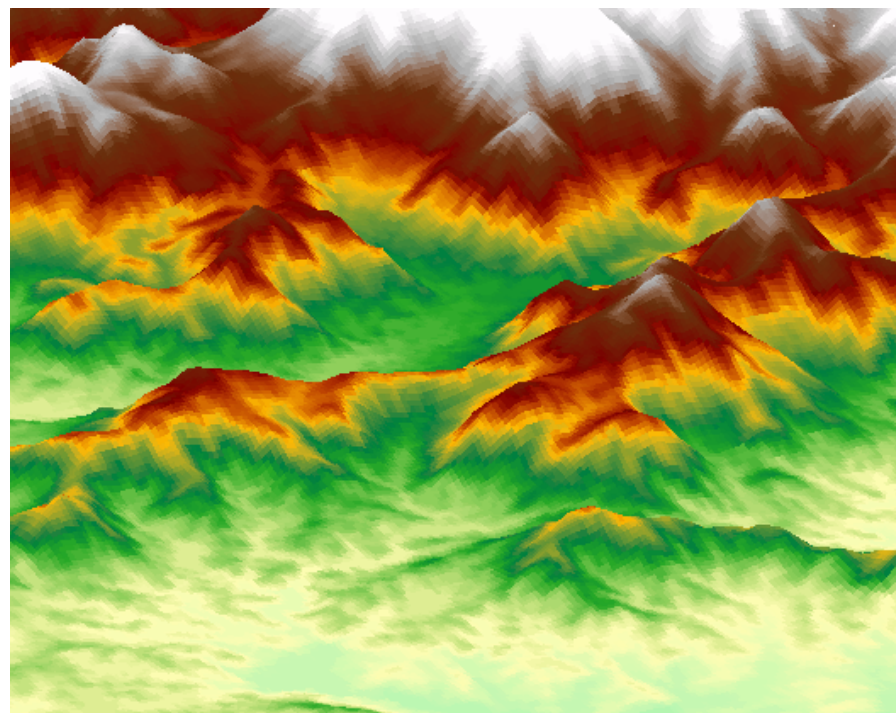
- **Full and Open Exchange of Data...Recognizing Relevant International Instruments and National Policies and Legislation**
- **Data and Products at Minimum Time delay and Minimum Cost**
- **Free of Charge or Cost of Reproduction for Research and Education**



Challenge: National Security



90 m



30 m



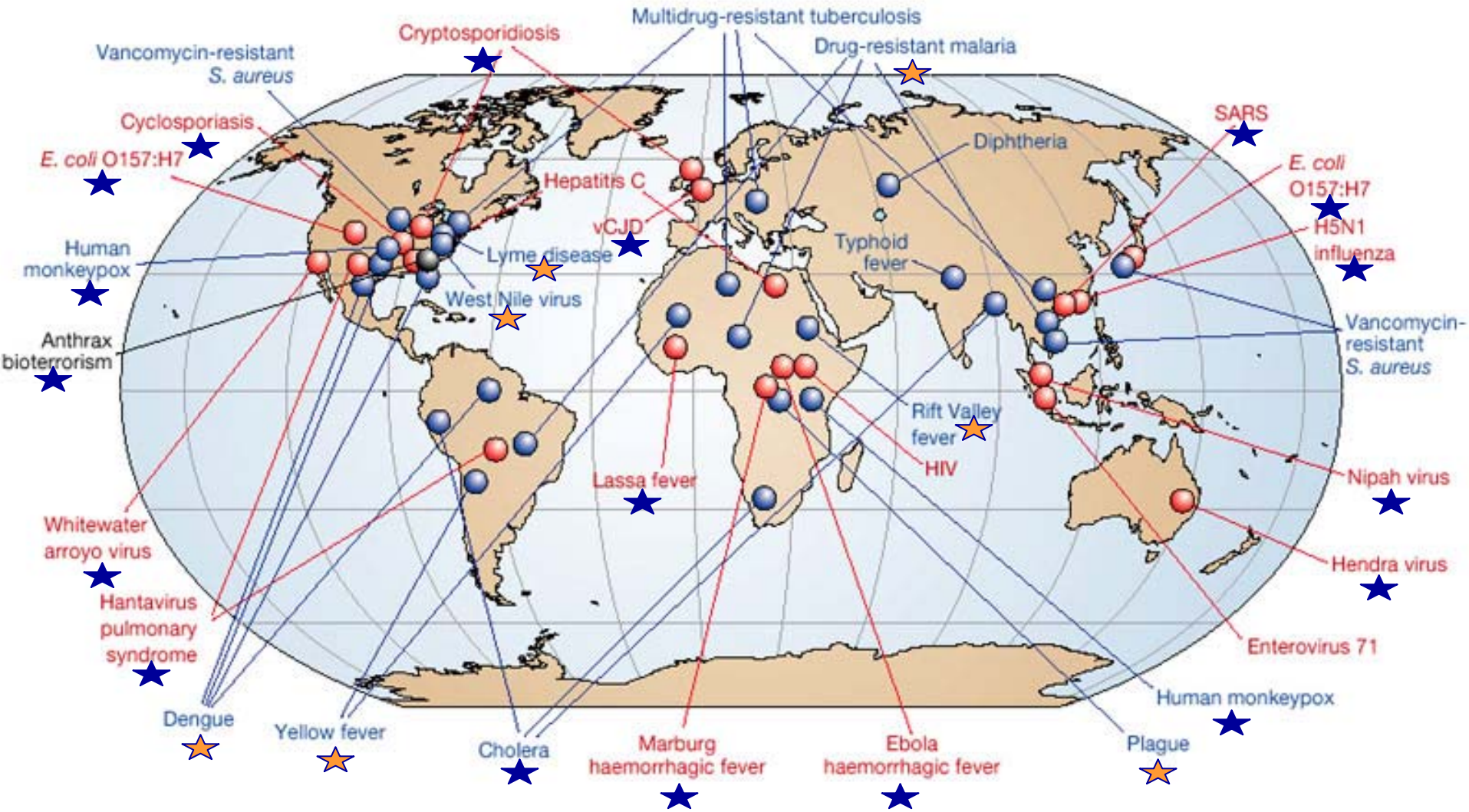
Group on
Earth Observations

Challenge: Commercial Providers



GEO will Foster Interdisciplinary Developments Addressing Cross-cutting Issues, Linking Local to Global





EMERGING
RE-EMERGING

★ ZOO NOTIC
★ VECTOR-BORNE

* Modified from Morens et al. 2004 *Nature* 430:242



Disasters

Reducing loss of life and property from natural and human induced disasters.

Energy

Improving management of energy resources.

Health

Understanding environmental factors affecting human health and well being.

Weather

Improving weather information, forecasting and warning.

Biodiversity

Understanding, monitoring and conserving biodiversity.

Climate

Understanding, predicting, mitigating and adapting to climate variability and change.

Water

Improving water resource management through better understanding of the water cycle.

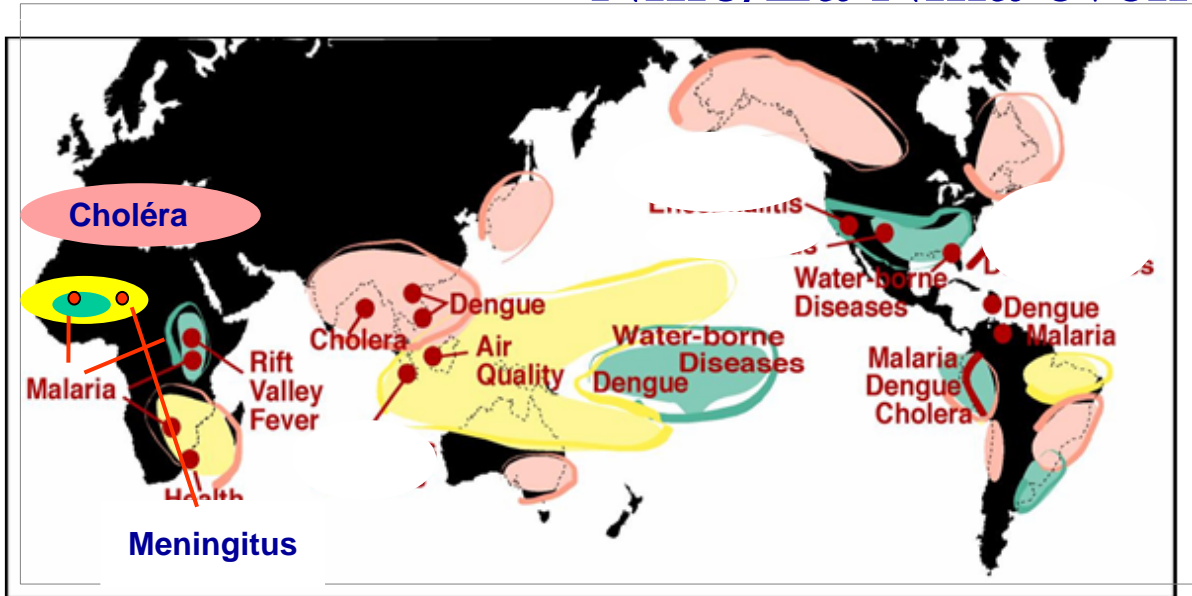
Ecosystems

Improving the management and protection of terrestrial, coastal and marine ecosystems.

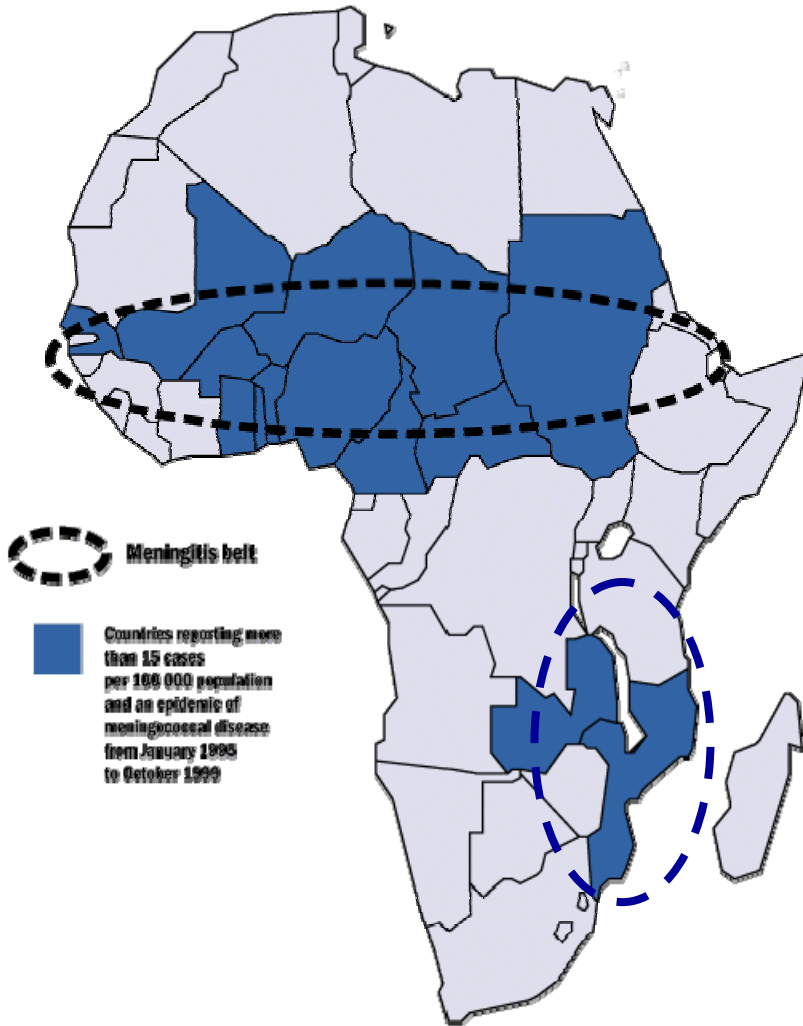
Agriculture

Supporting sustainable agriculture and combating desertification.

Emerging Diseases Show Correlations with El Niño/La Niña events



- World Population at risk: 2 to 3 billions
- Human Mortality per yr: 3.5 to 4.5 millions with ½ under 5 yrs (~ 5 millions due to AIDS)
- Animal Mortality per yr: 10 to 15 millions



Relative Positions of « Meningitis Belt » and Intertropical Convergence Zone (July and January)



Disasters

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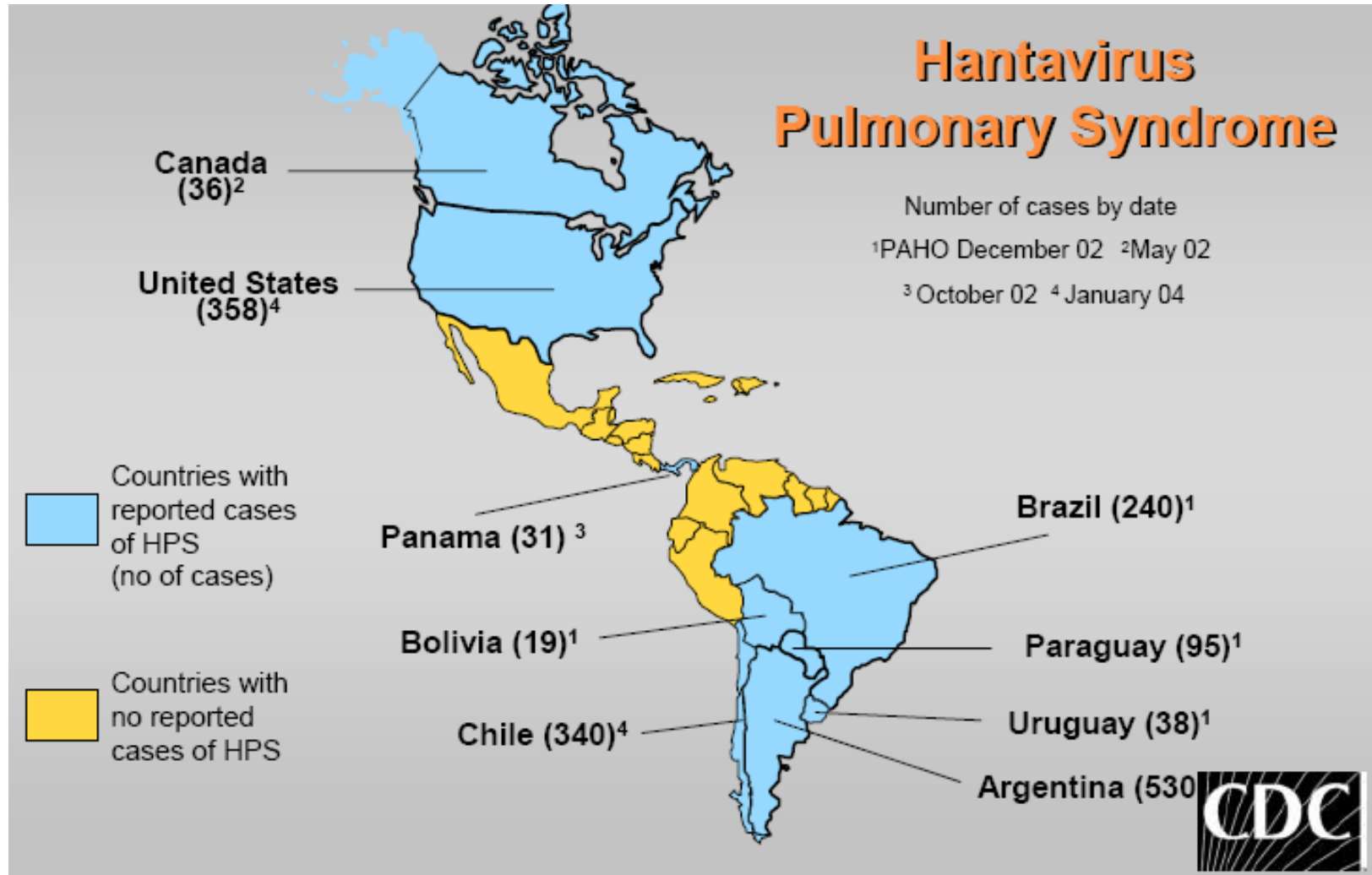
Agriculture

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Hantaviruses in Western Hemisphere

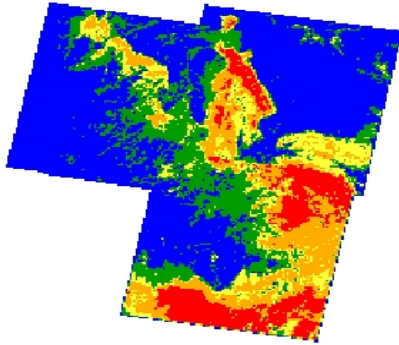




HANTAVIRUS RISK PREDICTION FROM LANDSAT IMAGERY

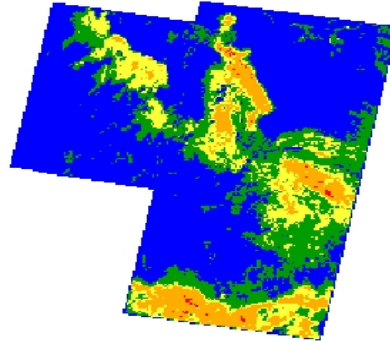
1993

Hantavirus Pulmonary Syndrome
Southwestern, USA - 1992



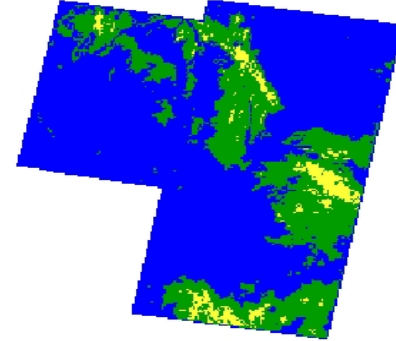
1994

Hantavirus Pulmonary Syndrome
Southwestern, USA - 1993



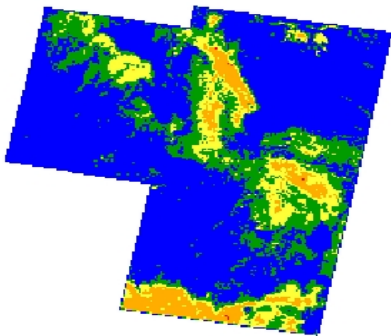
1995

Hantavirus Pulmonary Syndrome
Southwestern, USA - 1995



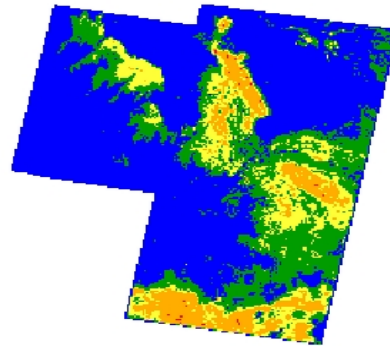
1997

Southwestern, USA - 1997



1998

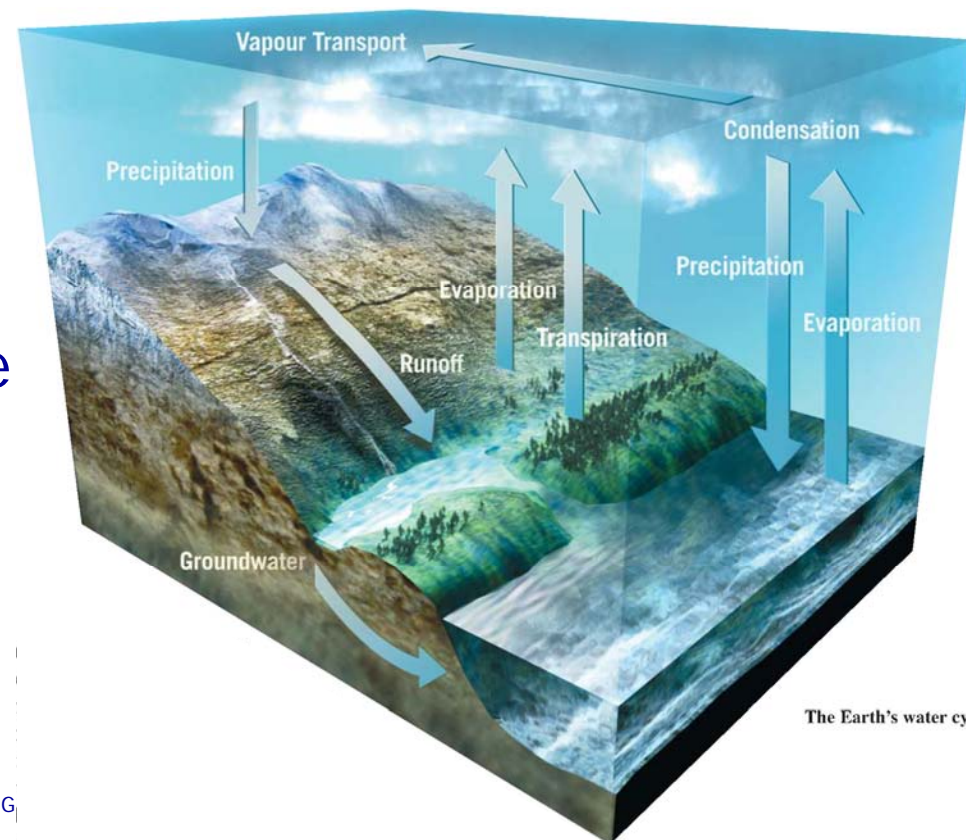
Southwestern, USA - 1998



Global Continental Water-Level Observations

Strengthening satellite and in situ monitoring networks of estuaries, rivers, lakes, reservoirs, and groundwater levels:

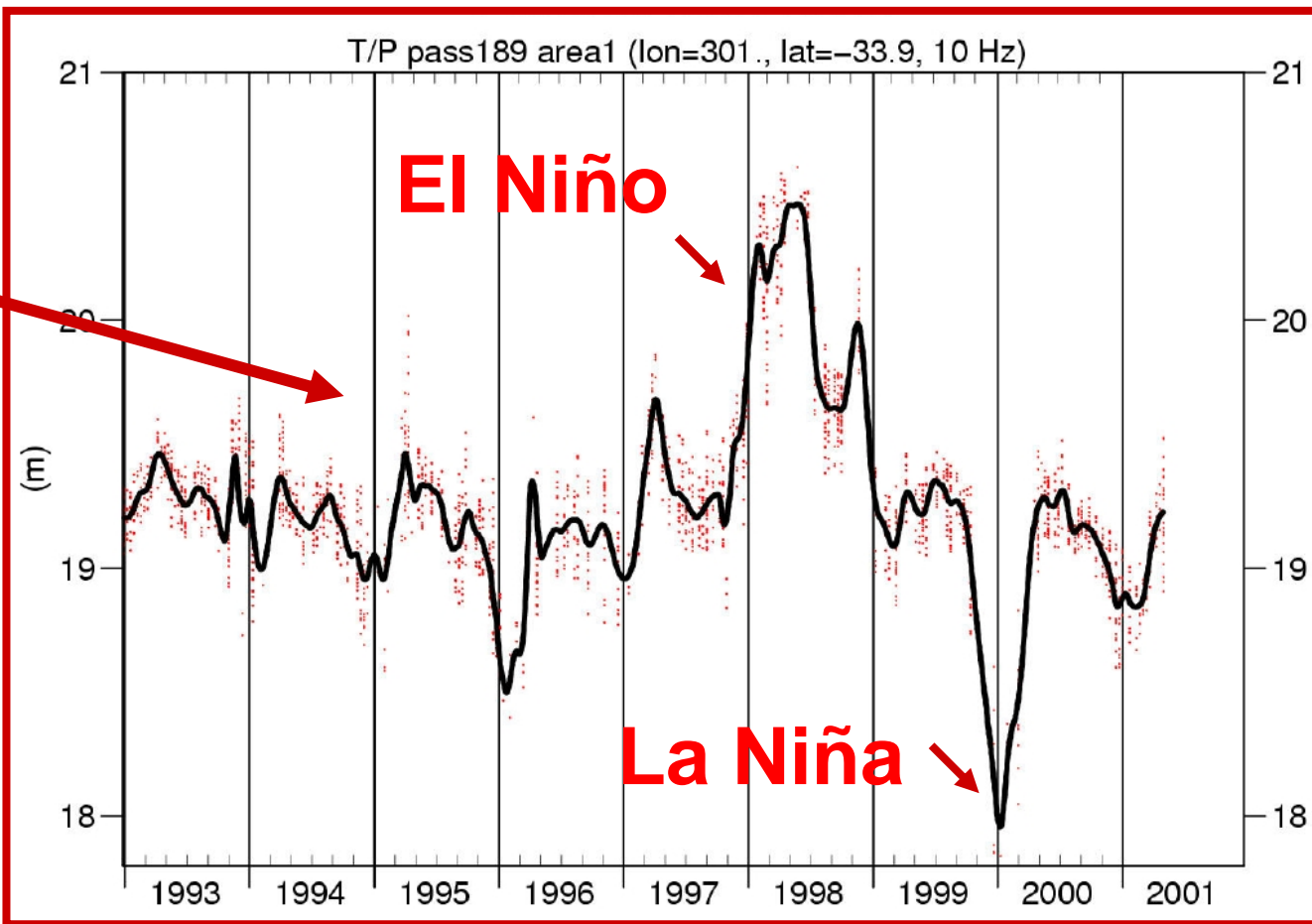
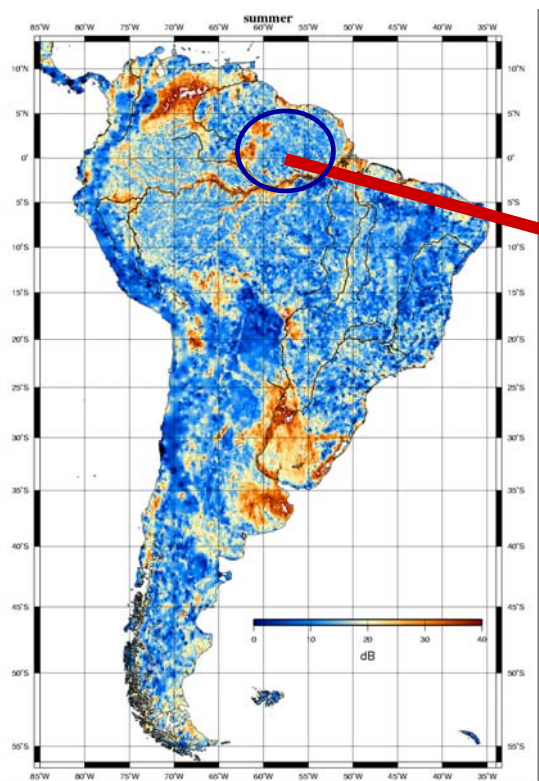
- For flood risk management
- For improving water resource management
- For understanding sea-level rise





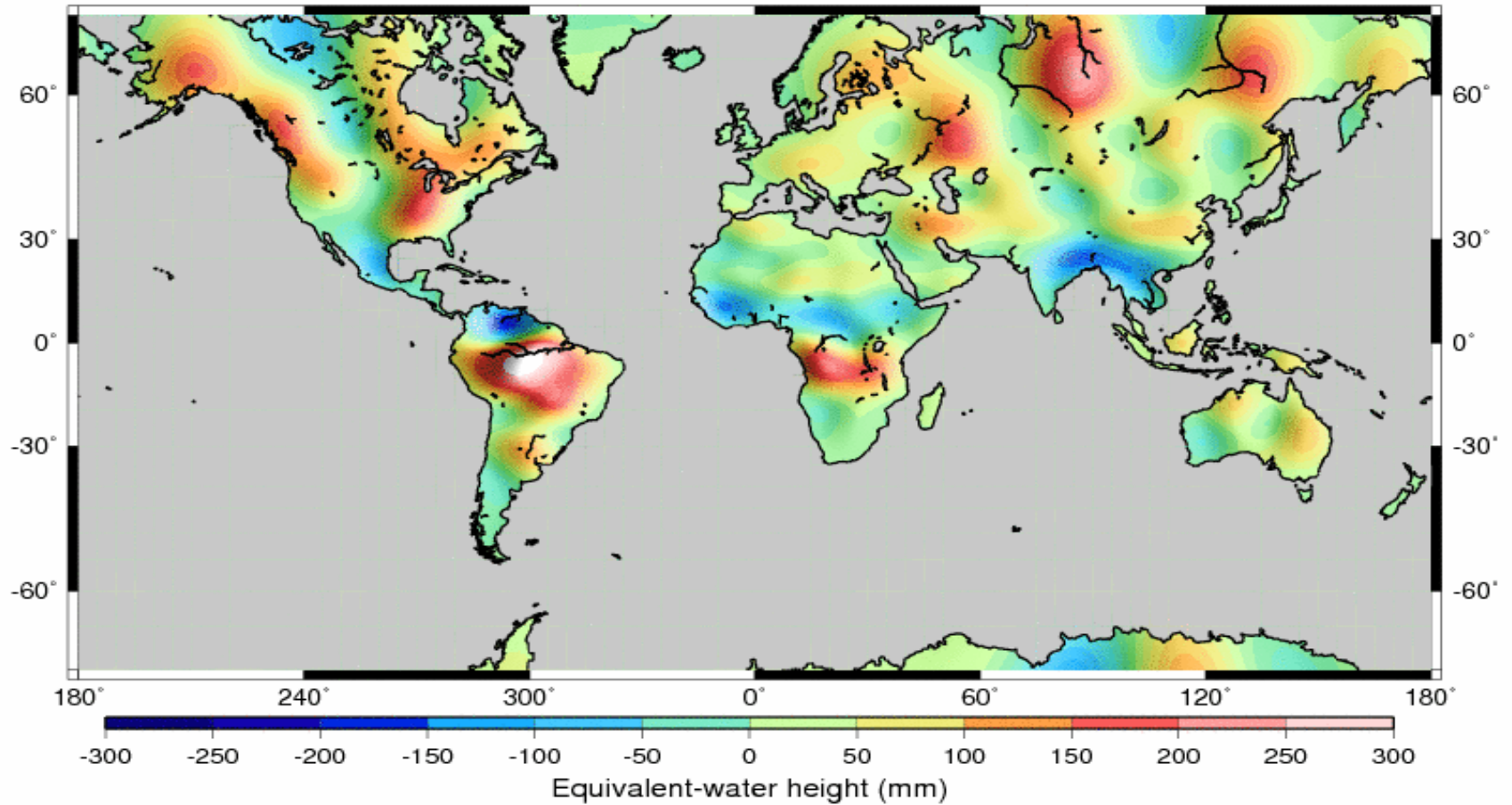
Integrate Space and In-situ Observations

PARANA

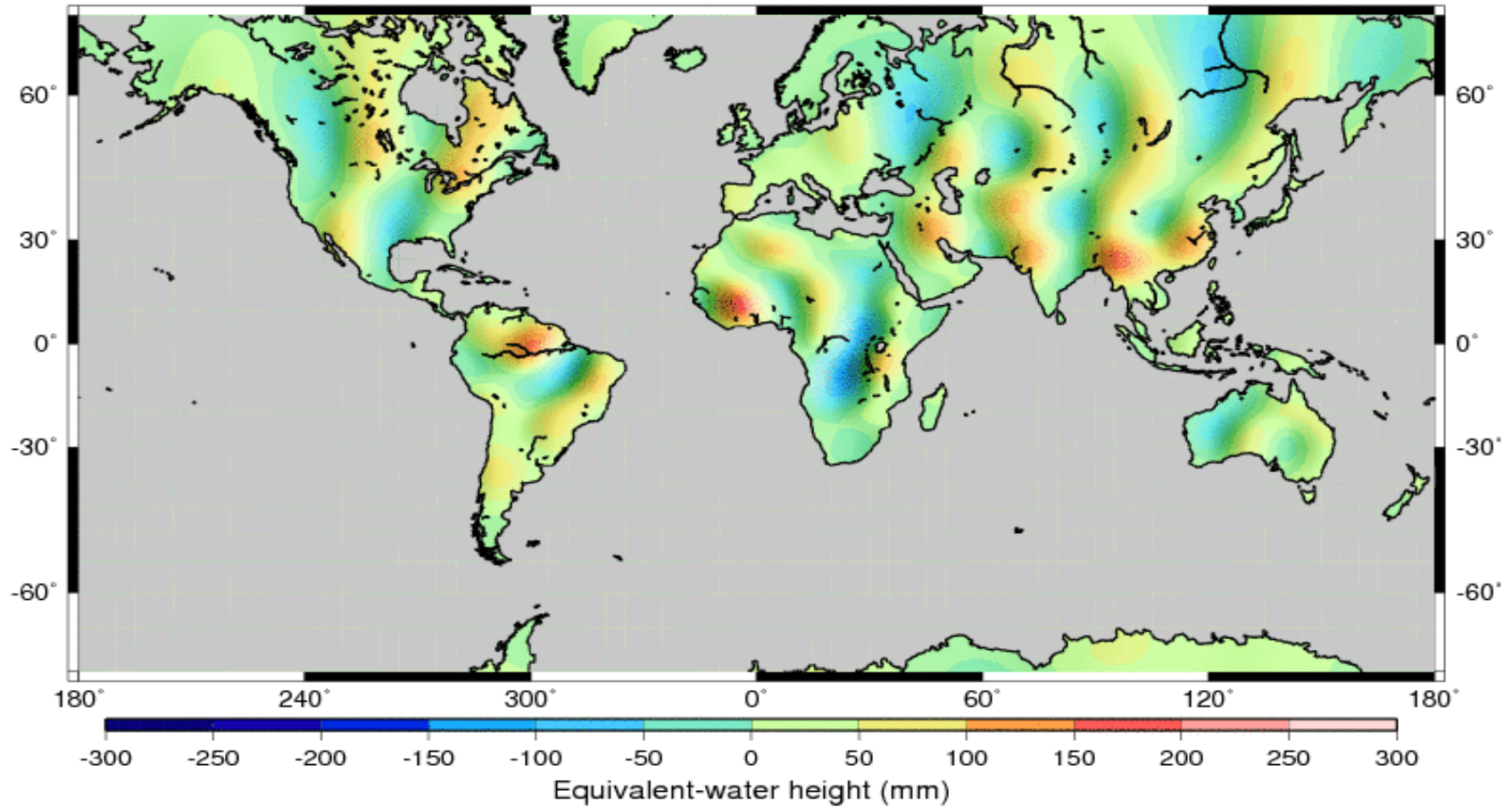




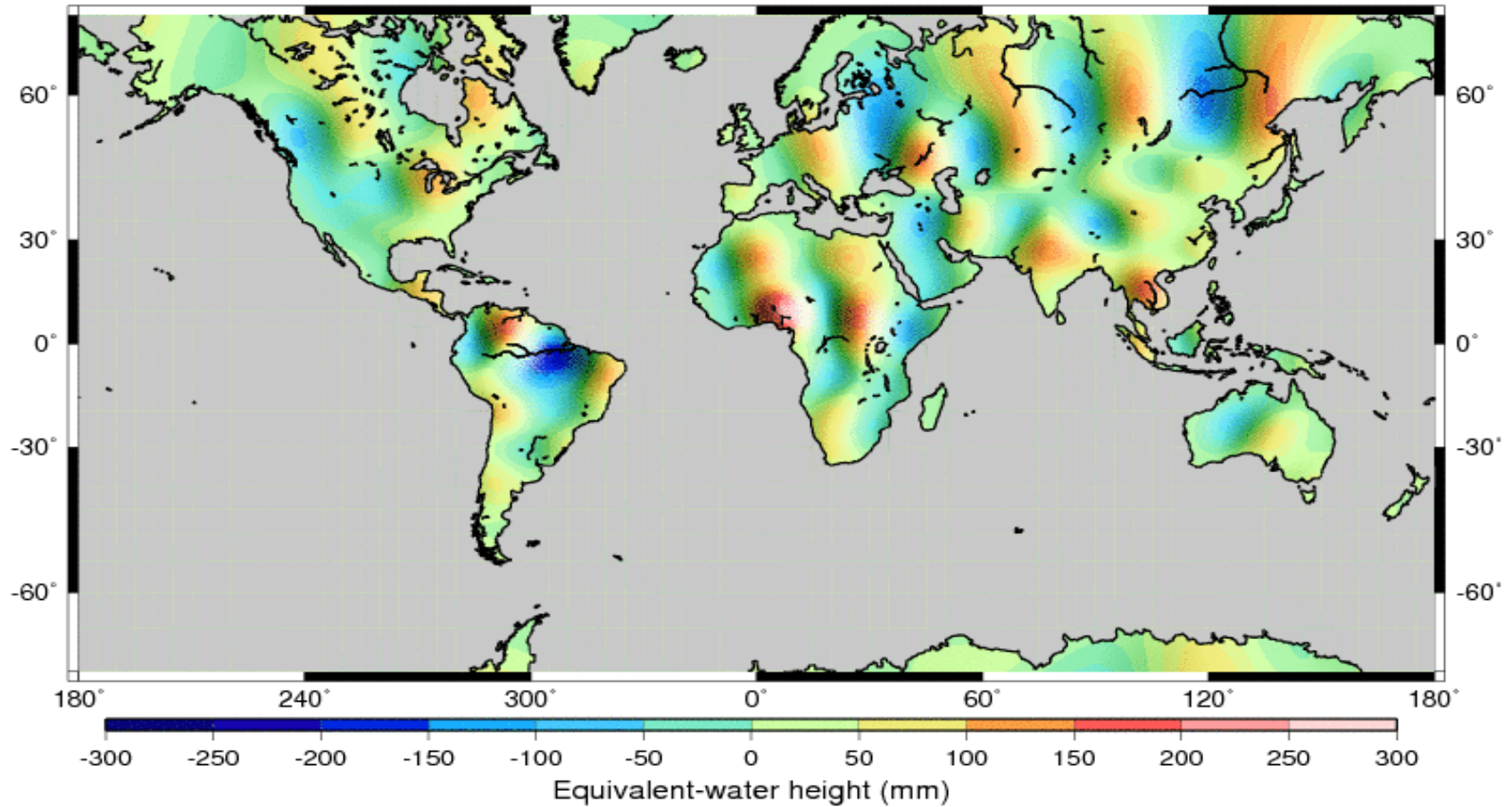
GRACE LW SOLUTION --- APR MAY 2002 --- DEG=25-30 --- 5 ITERATIONS



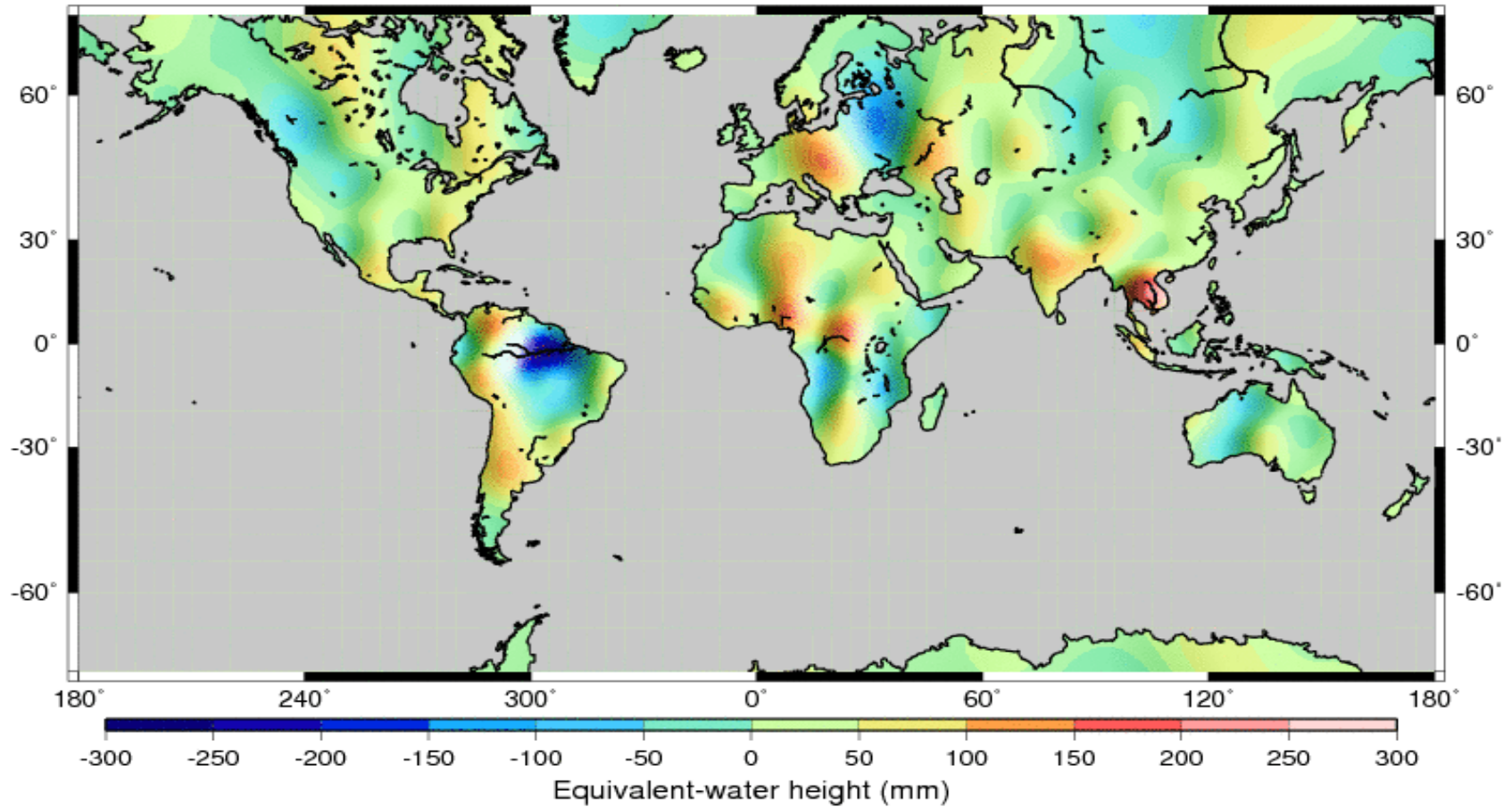
GRACE LW SOLUTION --- AUG 2002 --- DEG=25-30 --- 5 ITERATIONS



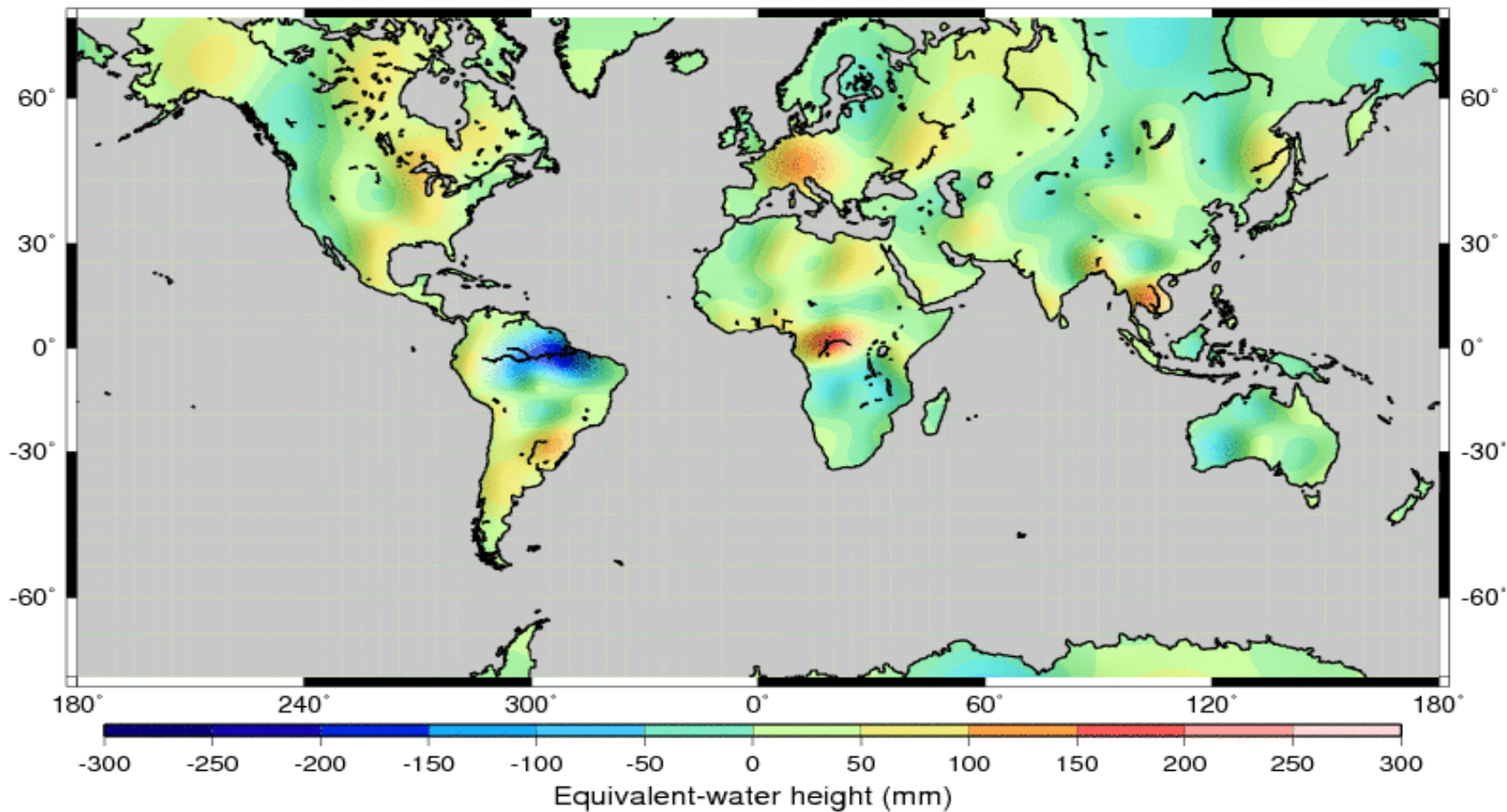
GRACE LW SOLUTION --- SEP 2002 --- DEG=25-30 --- 5 ITERATIONS



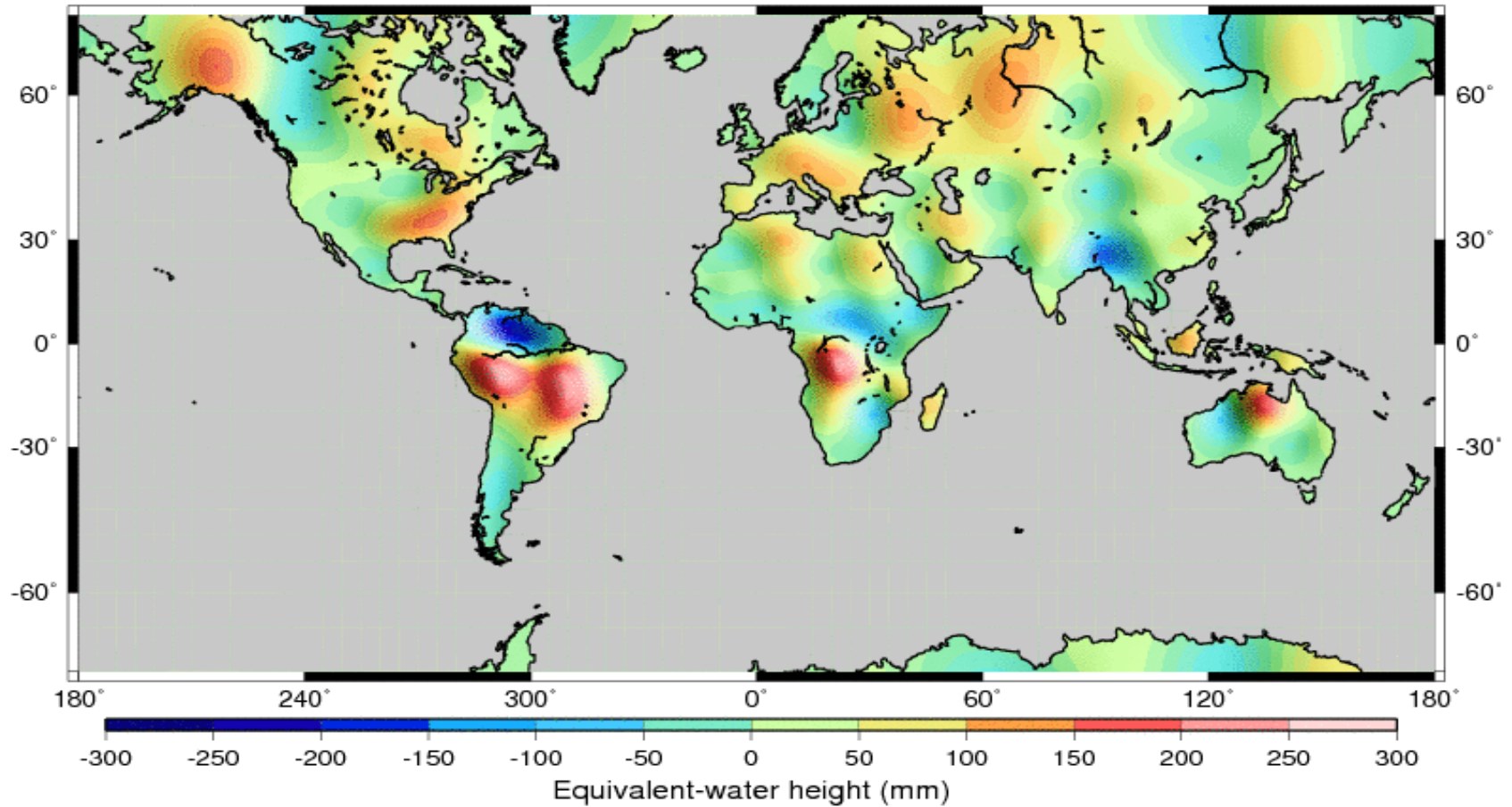
GRACE LW SOLUTION --- OCT 2002 --- DEG=25-30 --- 5 ITERATIONS



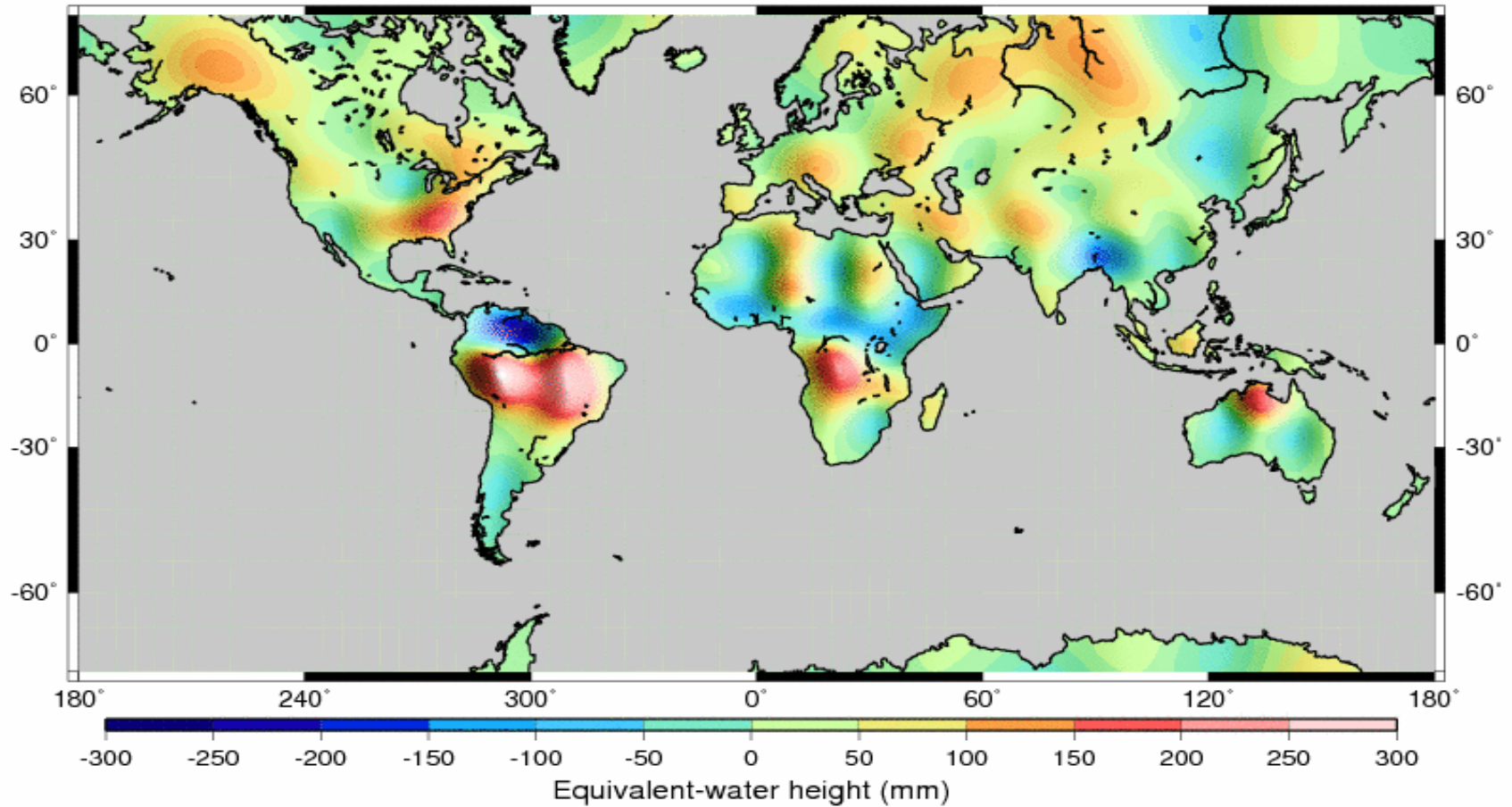
GRACE LW SOLUTION --- NOV 2002 --- DEG=25-30 --- 5 ITERATIONS



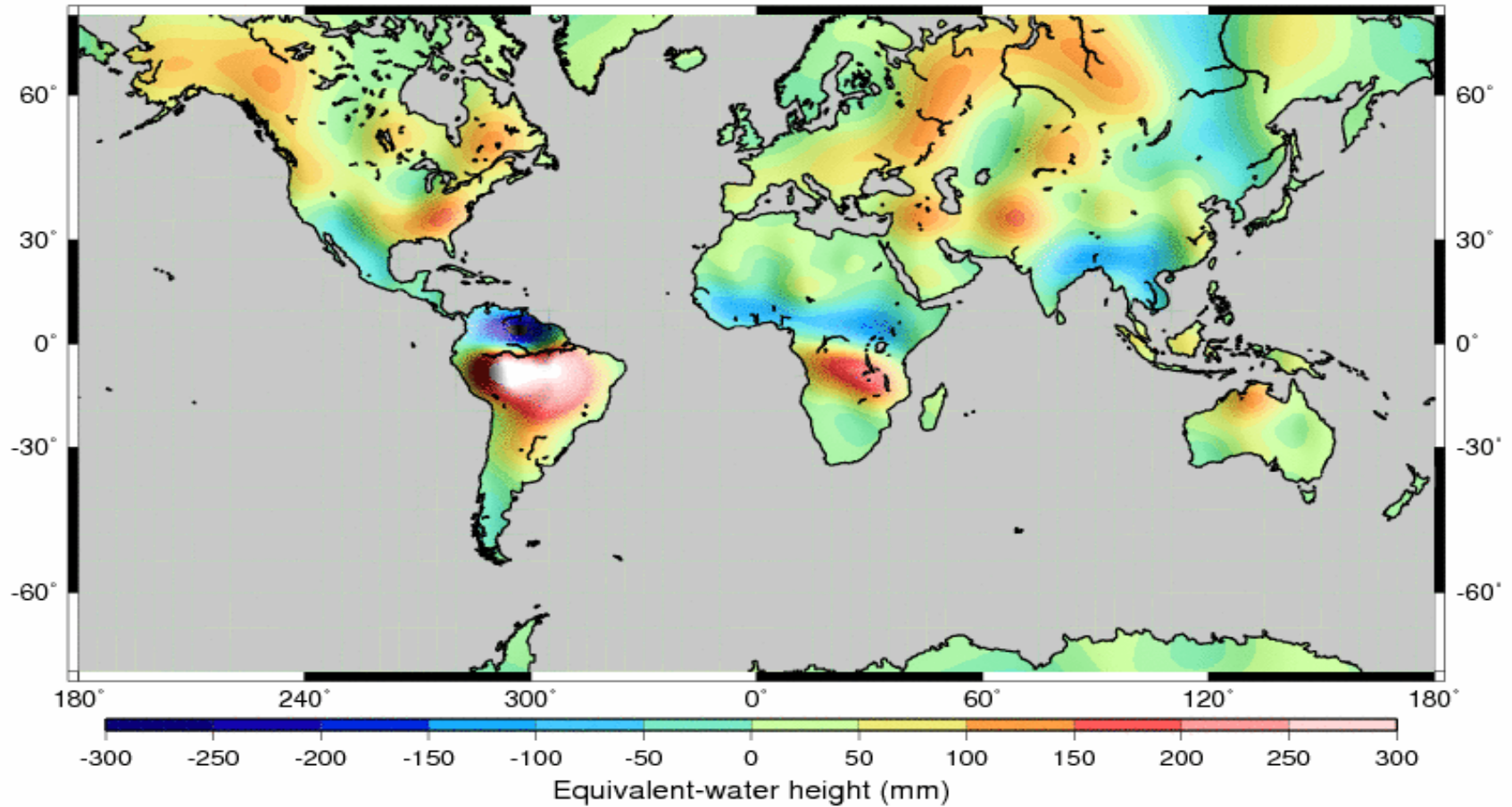
GRACE LW SOLUTION --- FEB 2003 --- DEG=25-30 --- 5 ITERATIONS



GRACE LW SOLUTION --- MAR 2003 --- DEG=25-30 --- 5 ITERATIONS

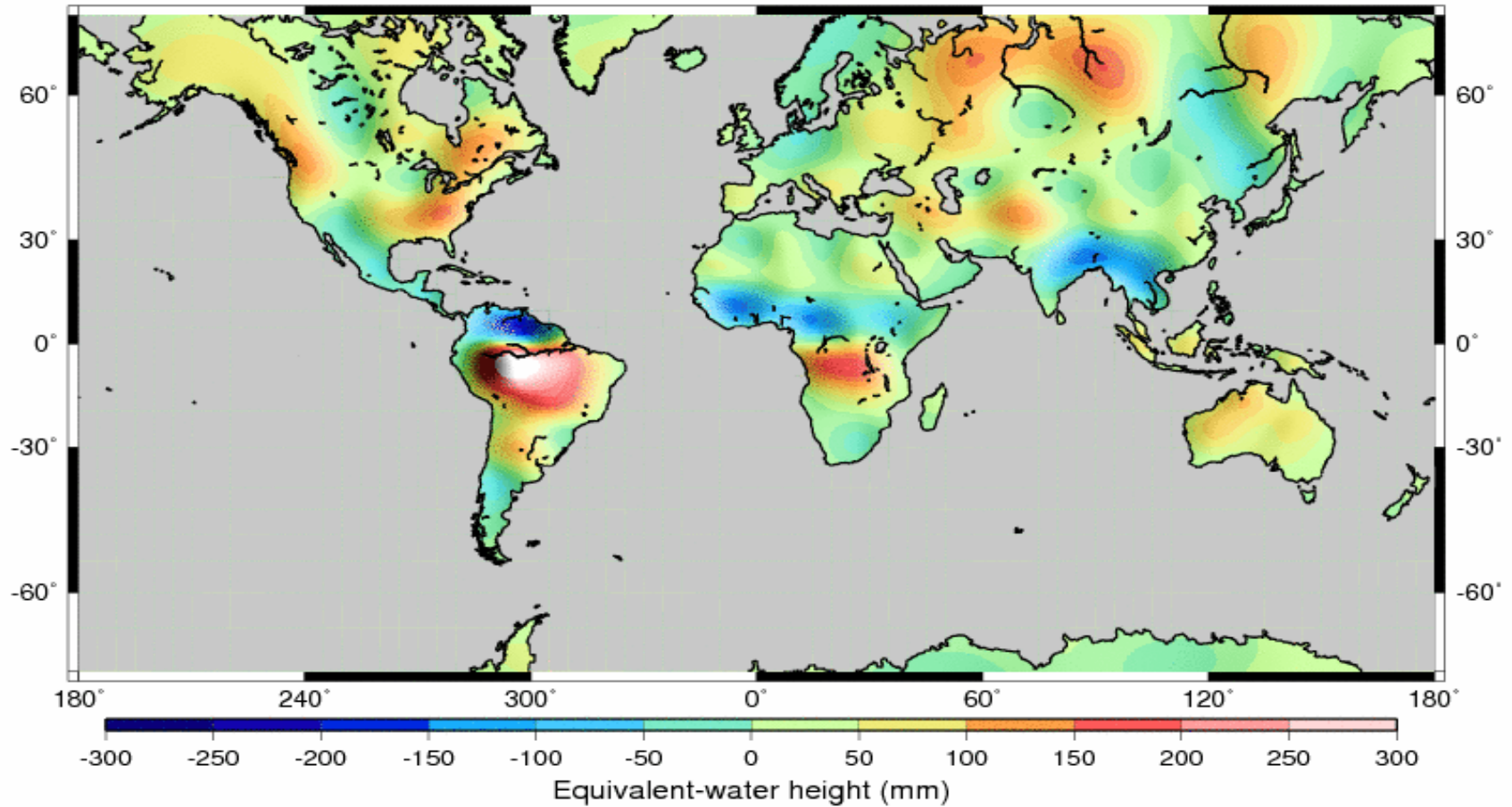


GRACE LW SOLUTION --- APR 2003 --- DEG=25-30 --- 5 ITERATIONS

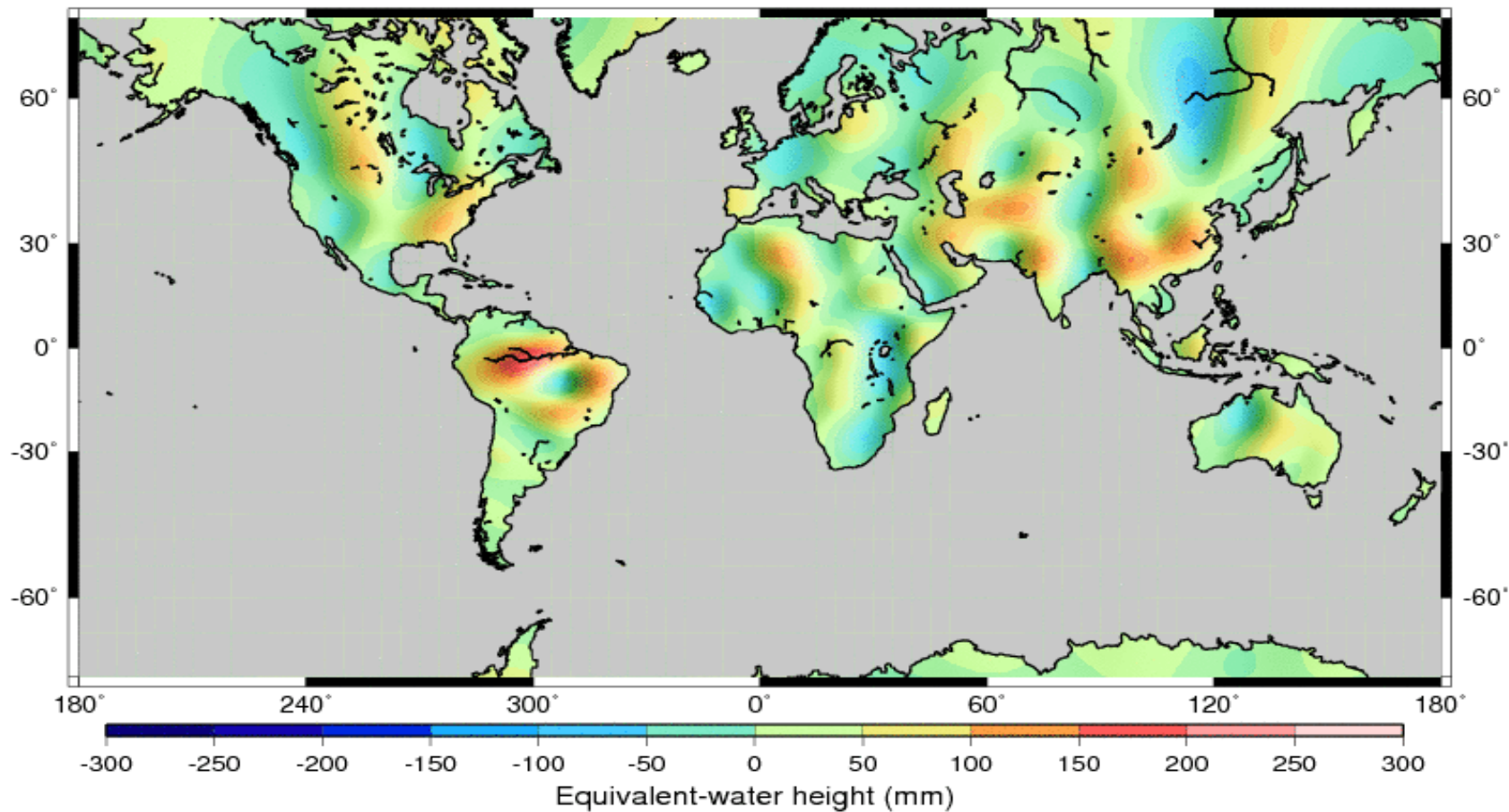




GRACE LW SOLUTION --- APR MAY 2003 --- DEG=25-30 --- 5 ITERATIONS

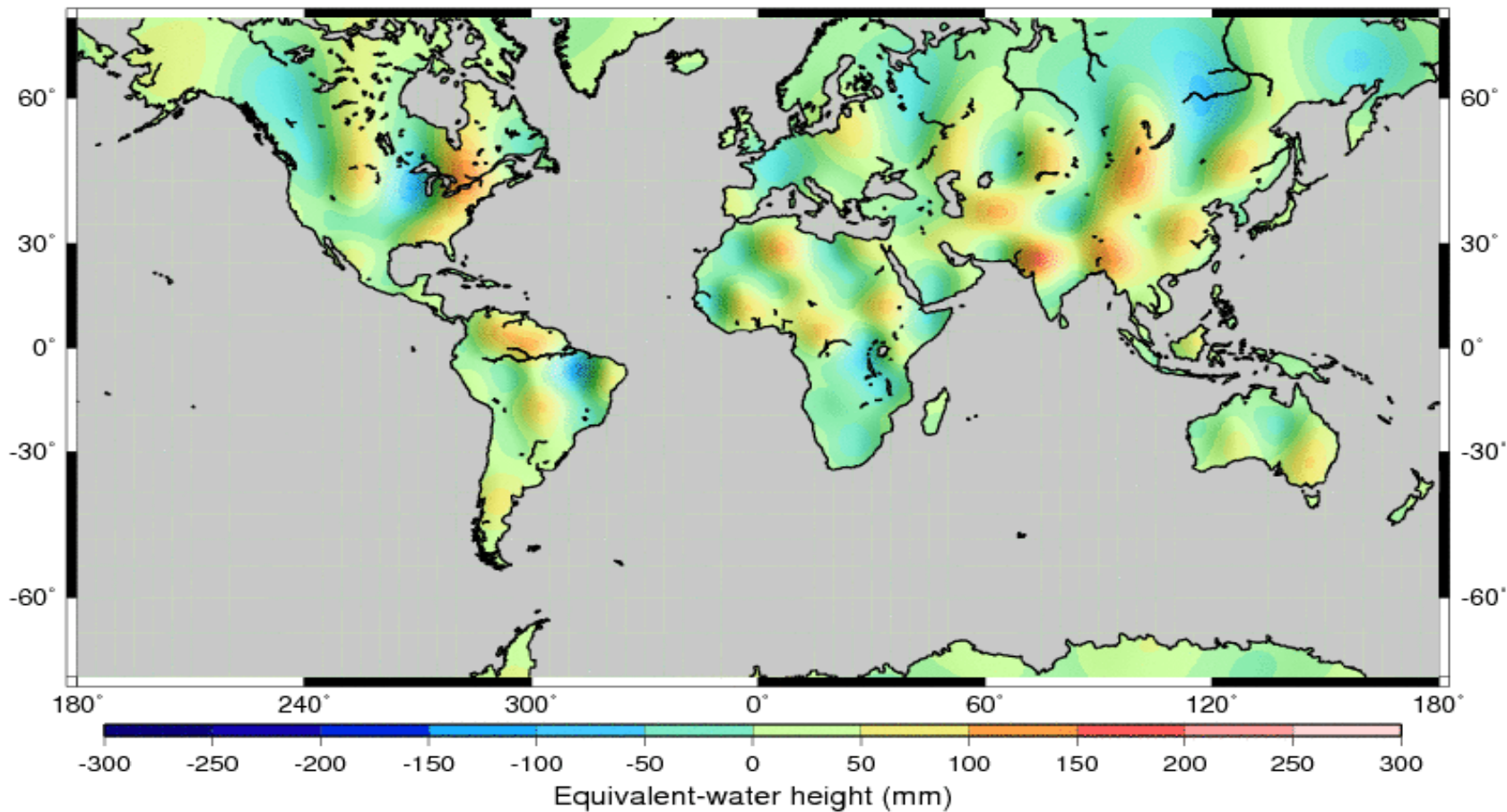


GRACE LW SOLUTION --- JUL 2003 --- DEG=25-30 --- 5 ITERATIONS

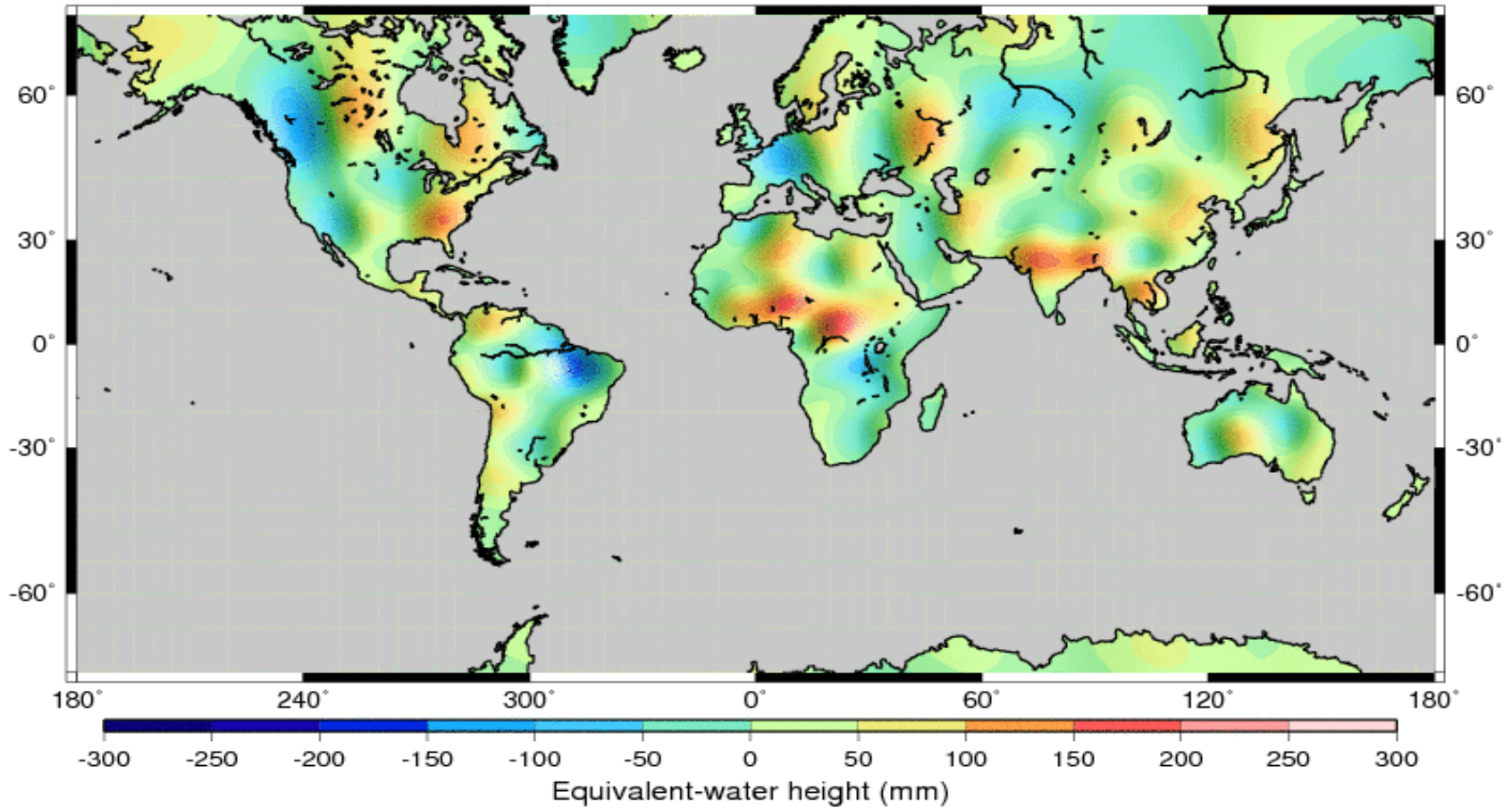




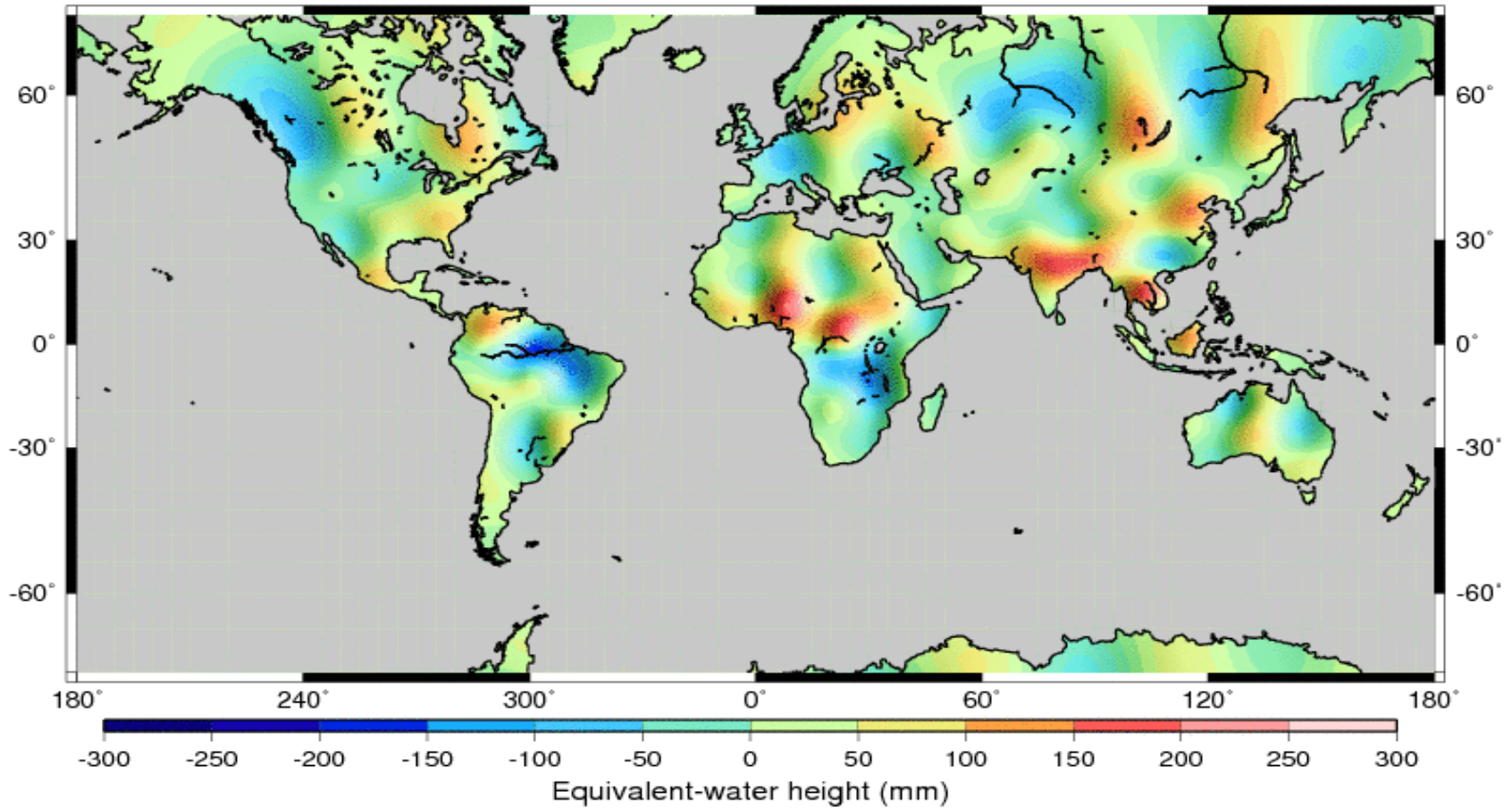
GRACE LW SOLUTION --- AUG 2003 --- DEG=25-30 --- 5 ITERATIONS



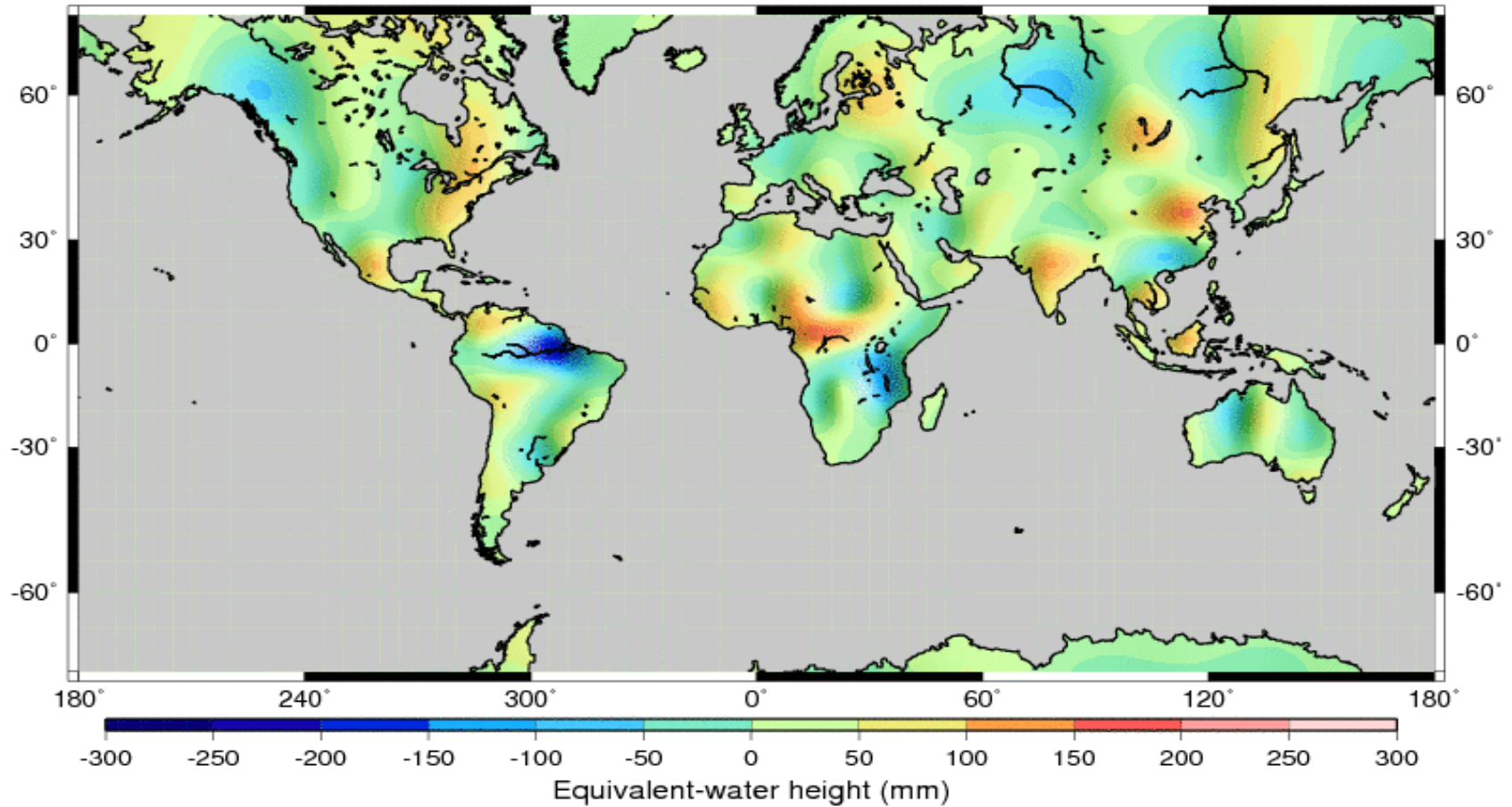
GRACE LW SOLUTION --- SEP 2003 --- DEG=25-30 --- 5 ITERATIONS



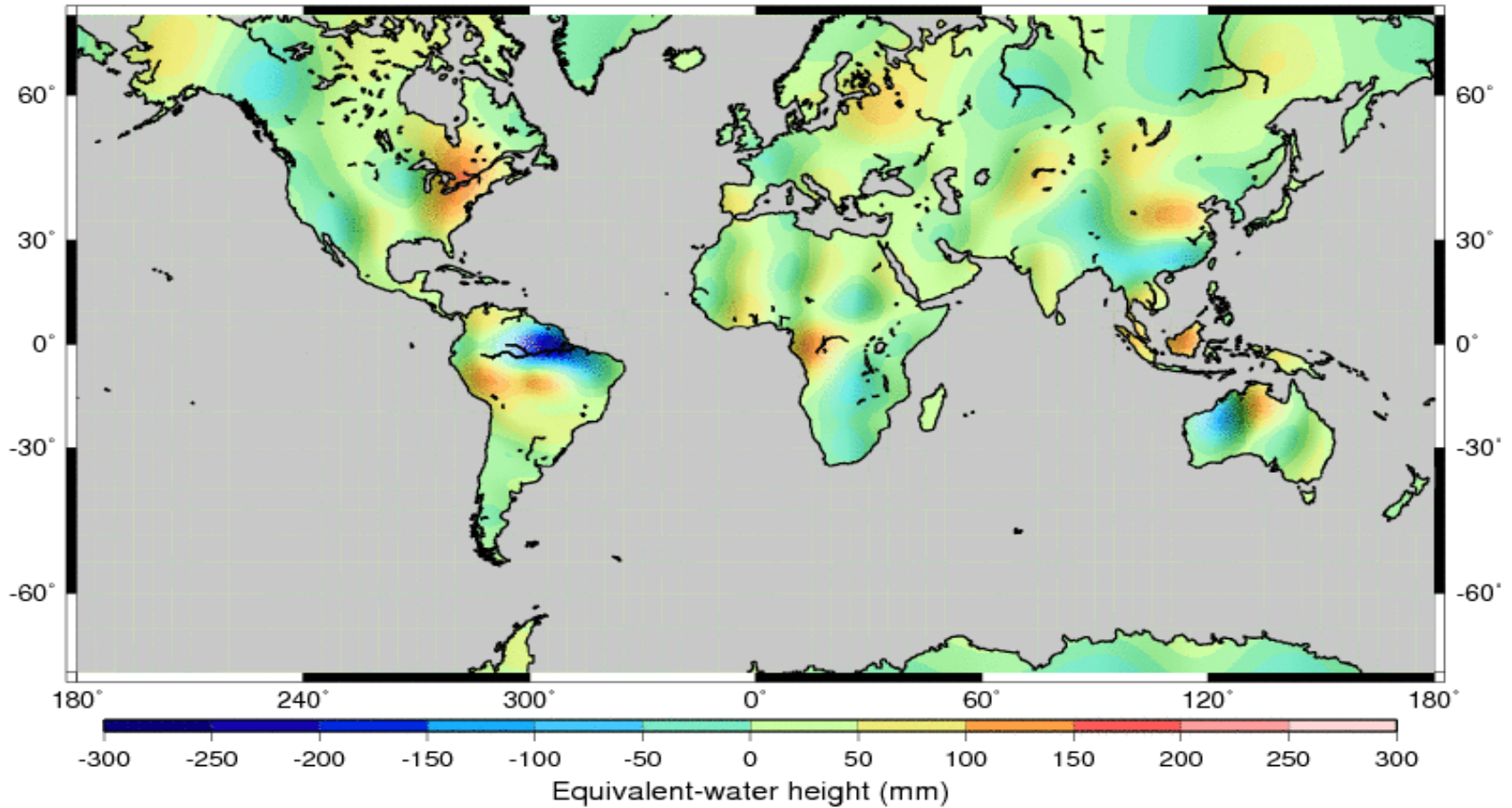
GRACE LW SOLUTION --- OCT 2003 --- DEG=25-30 --- 5 ITERATIONS



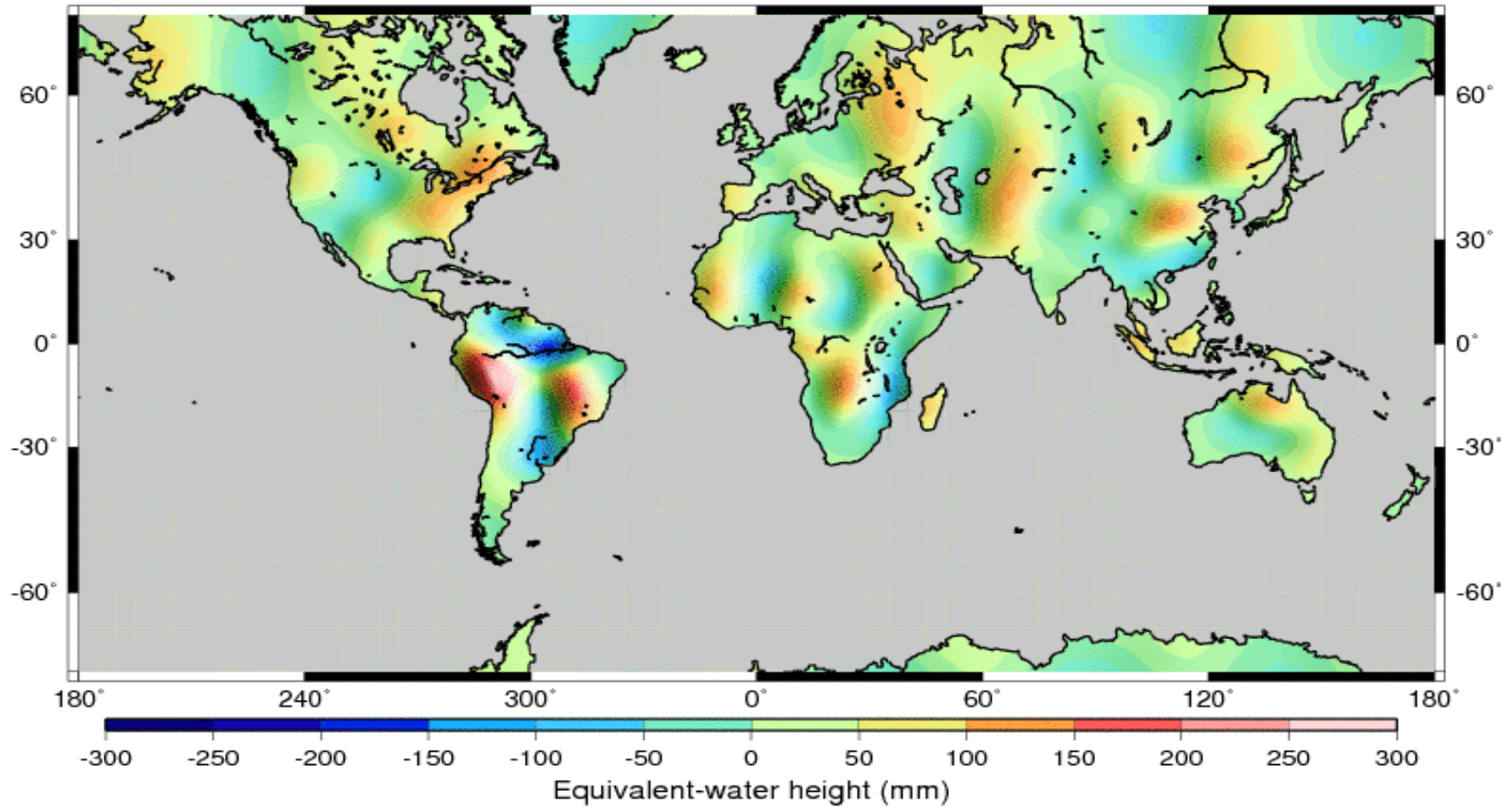
GRACE LW SOLUTION --- NOV 2003 --- DEG=25-30 --- 5 ITERATIONS



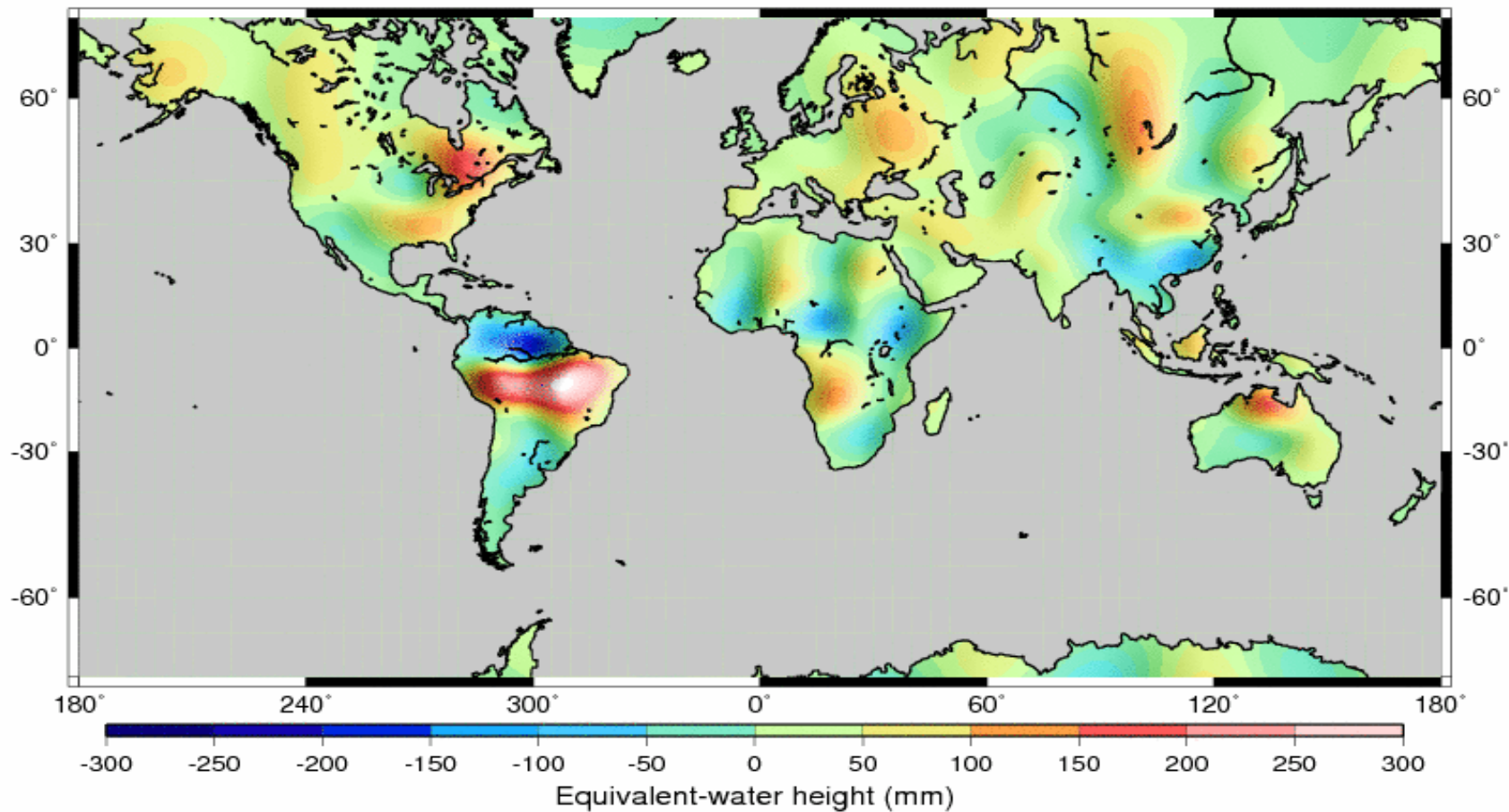
GRACE LW SOLUTION --- DEC 2003 --- DEG=25-30 --- 5 ITERATIONS



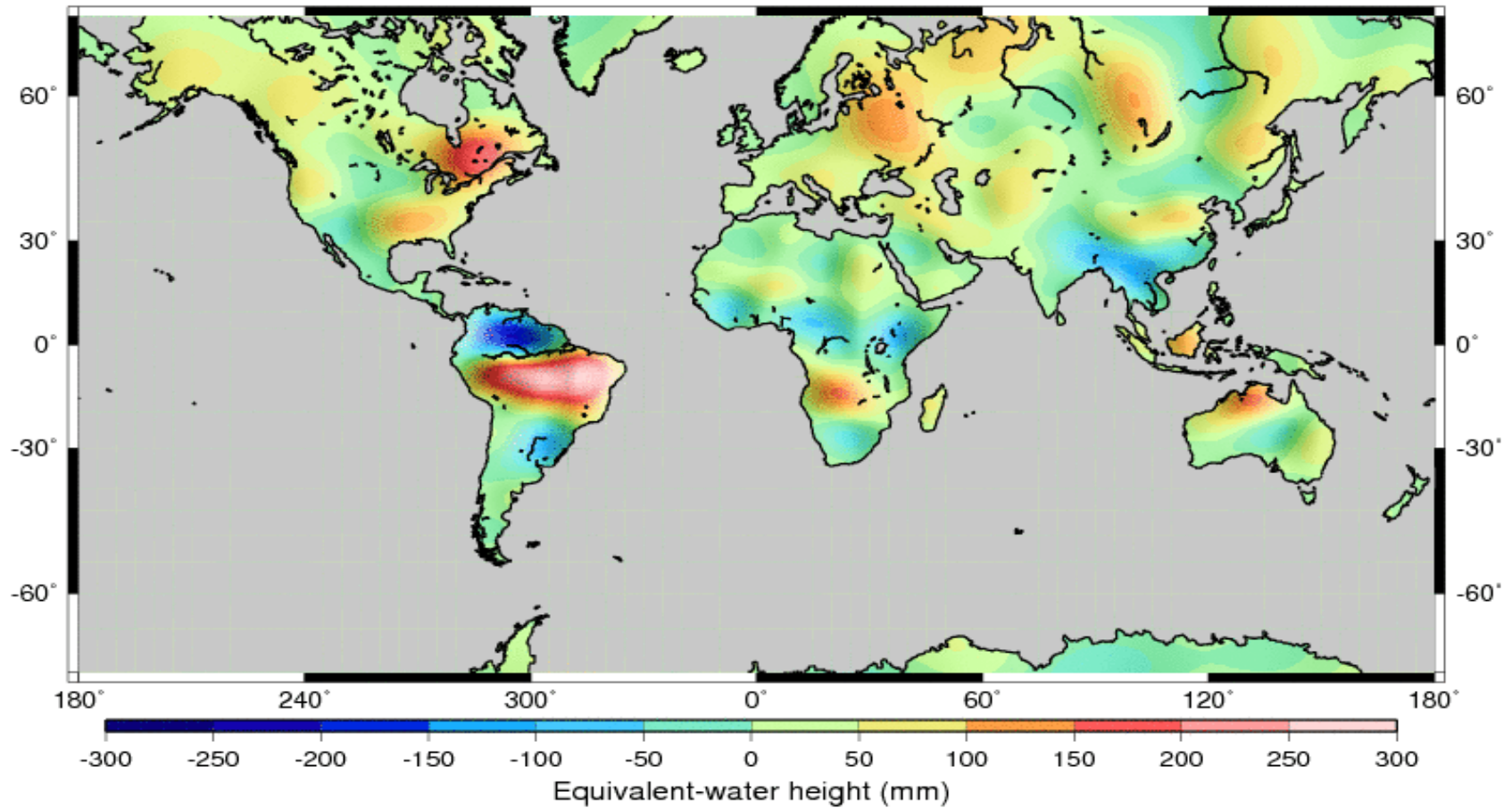
GRACE LW SOLUTION --- JAN 2004 --- DEG=25-30 --- 5 ITERATIONS



GRACE LW SOLUTION --- FEB 2004 --- DEG=25-30 --- 5 ITERATIONS



GRACE LW SOLUTION --- MAR 2004 --- DEG=25-30 --- 5 ITERATIONS



Energy

- Developing applications for monitoring renewable energy sources
- Improving forecasting of fluctuations and intermittency

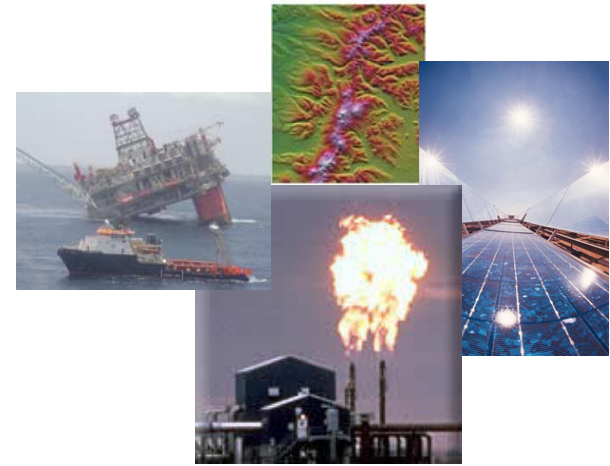




G8 Plan of Action on Global Energy Security

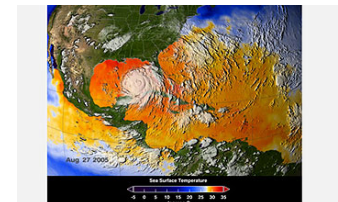


- Diversify energy mix
- Ensure physical security of critical infrastructure
- Reduce energy poverty
- Address climate change & sustainable development

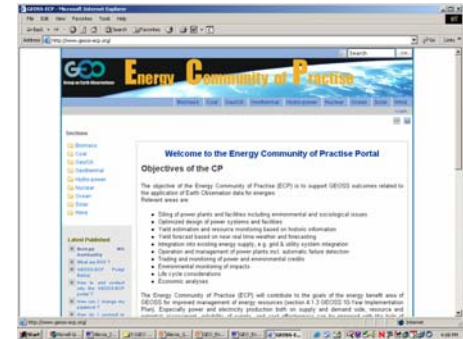


Collaboration among:

Canada, China, Denmark, EC, France, Germany, Greece, Italy, Japan, Norway, Portugal, South Africa, Thailand, USA; IEA, CEOS, FAO, ECMWF, ESA, GOOS, IEEE & WMO



2006 Milestones

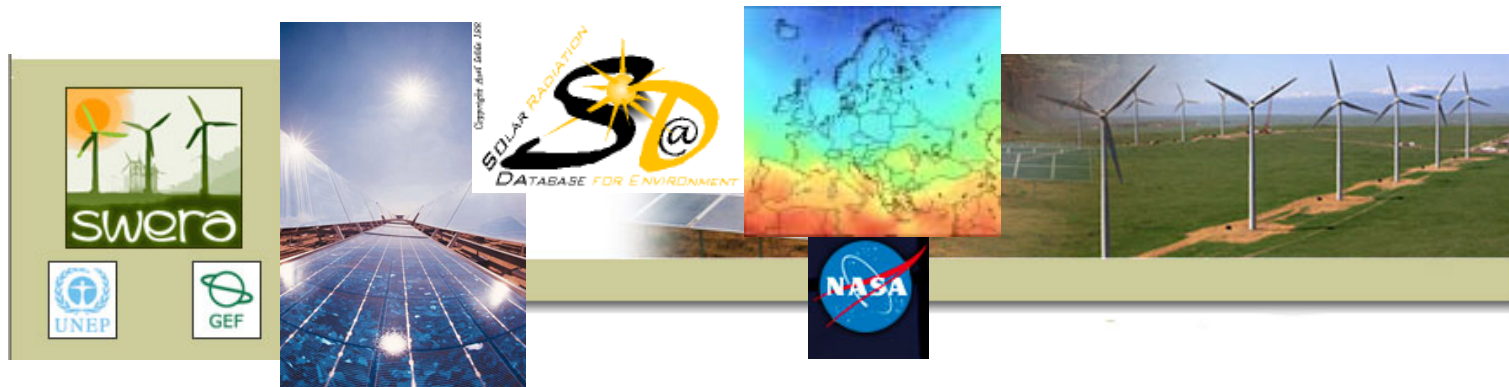


- Identification of a GEO Energy “**expert group**” to support GEOSS Energy activities
- Development of a **web-portal** for the GEO Energy Community of Practice (<http://www.geoss-ecp.org>)
- Plan to issue a report on wind & solar energy **user requirements** by GEO Ministerial Mtg (Nov 07)
- Plan to issue a draft GEO **strategic 5-10yr plan** by GEO Ministerial Mtg

2006 Milestones

Toward Near-term Achievements

- Identification of pilot-project enhancing **solar data access** for developing countries (www.soda-is.com).
- Proposal to develop a **major GEO Energy project** based on the “federation” of existing projects.



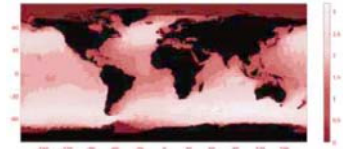
2007-2009 Work Plan



1: Management of Energy Sources

Initial Support from: EC, Norway, CEOS, ICSU, IEA

Support the development of Earth observations for improving the resource assessment, monitoring and forecast of fluctuating energy sources (e.g. hydro, solar, wind, ocean).



2: Environmental Impact Monitoring

Initial Support from: EC, South Africa, CEOS, IEEE

Promote the development of Earth observation systems for the monitoring and prediction of environmental impact from energy resource exploration, extraction, transportation and/or exploitation.



3: Energy Policy Planning

Initial Support from: EC, CEOS

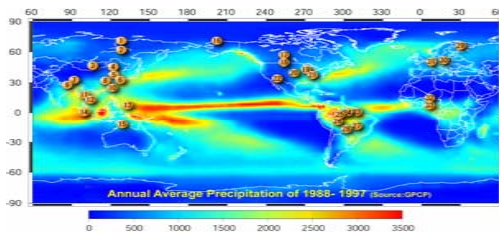
Encourage the use of Earth observation for informed energy-policy planning in developed and developing countries.



Climate: 3 Main Streams

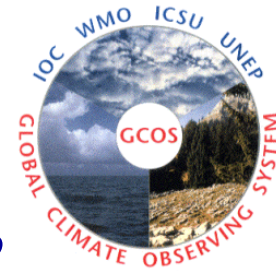


1. Key climate observations in response to GCOS IP
2. Reprocessing and reanalysis of the climate record
3. Seamless weather & climate prediction system





**Collaboration among: Argentina,
Australia, France, Finland, Germany,
Italy, Japan, Korea, Netherlands, Portugal,
Spain, Thailand, Usa; CEOS, ECMWF, EEA,
EUMETNET, GCOS, GOOS, GSDI, GTOS,
IAG, IGBP, POGO, WCRP, WMO
(THORPEX)**

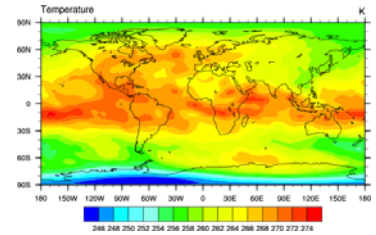


2006 Milestones



- **Identification** by GCOS of "Observation Requirements for Satellite-based Products".
Preparation of CEOS **response** for COP-12 UNFCCC
- Identification of ocean lead entities towards **integration of regional** observing capabilities into **global system** of ocean observations.
3rd Forum of GOOS Regional Alliances
(14-17 November 2006, Cape Town, South Africa)

2006 Milestones



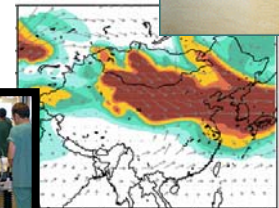
- Plans for new generation of reanalysis in Europe, Japan and US
- ECWMF/GEO Workshop on Reanalysis (June 06 in Reading, UK)
- Preparation of 3rd International Conference on Reanalysis (Jan 08 in Tokyo, Japan)



2007-2009 Work Plan



Multi-disciplinary (physics-biology-chemistry) collaboration on a high-resolution weather/ climate global prediction system, including atmosphere-ocean data-assimilation.





2007-2009 Work Plan

"Legacy of IPY"

Organization: GEO, WMO, CLIC, SCAR, - to be extended -

Date and Venue: Spring 2007 at WMO, Geneva (following a planning meeting in late 2007)

Organizing Committee: Members of IPY Joint Committee, the IGOS Cryo-Team, IPY Data-, Observations- and Space Group, WMO and GEO, SCAR, -to be extended-

Prime Objective: Review and **prioritize Projects** selected through IPY that are "**vital**" to be continued and identify potential sponsors/support per priority activity



Capacity Building

- **Coordinated Survey of Activities and Plans (Workshop in Brazil)**
- **GEO Capacity Building Strategy in Earth Observation including Education, Training and Infrastructure Improvement.**
- **Major Symposium in Early 2007, hosted by Spain, to Advocate Multinational Projects**

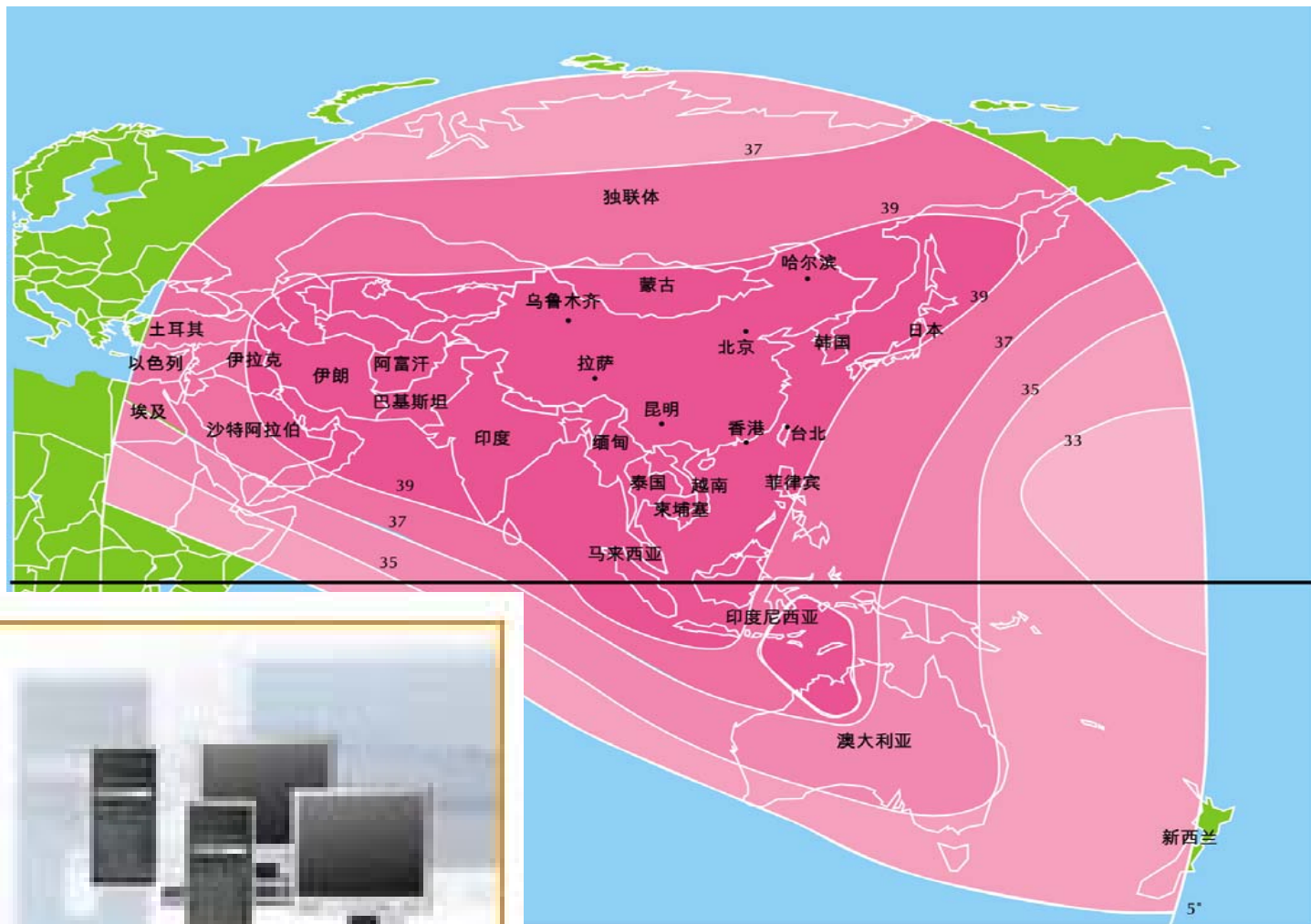
GEONETCast



Figure 1 - GEONETCast/ARMACast coverage area



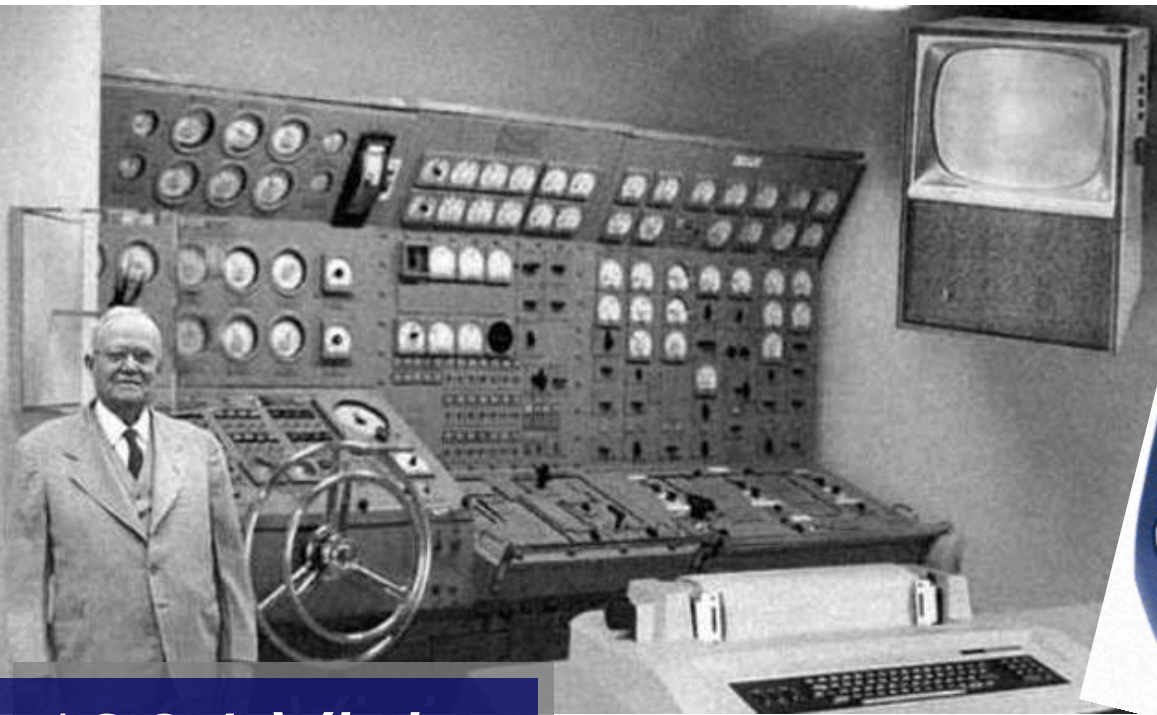
GEONETCast





Group on
Earth Observations

The Future of Earth Observation?



1964 Vision



2004 Reality



Information Providers and Web Services

Google Earth

File Edit View Add Tools Help

Fly To Local Search Directions

e.g. 37 d 25' 19.07"N, 122 d 05' 06.34 "W

Search

Places

- Fussen
- Trip 2 US
 - Universal Studios
 - Orlando Disney
 - Iaiagara
- Sightseeing
 - default
Google Earth default view
- Temporary Places

Layers

- Keyhole Community BBS
- User-Supplied Collections
- Dining
- Lodging
- Banks/ATMs
- Bars/Clubs
- Coffee Houses
- Malls/Shopping Centers
- Major Retail
- Movie Rentals
- Grocery Stores

Pointer 34°49'05.01" N 142°32'58.60" E Streaming 100% Eye alt 8115.40 mi

© 2005 Google

The value-adding Private Sector

EO Global turnover today:

Infrastructures: 2-3 B€

Services: 1 B€

(should be compared with Broadcast:

Infrastructures: 5-10 B€

Services: 100 B€)





**To Provide the Right Information, in the Right
Place, at the Right Time, to the Right People
to Make the Right Decisions.**

