GROUP ON EARTH OBSERVATIONS

The Seven Year Itch

A story by Jose Achache

Starring CEOS

Now Playing at
The 27th CEOS SIT
La Jolla, California

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GEOSS has been building-up on 3 Pillars

1. Coordinated Data Access
2. Open Data Policy
3. Political Visibility

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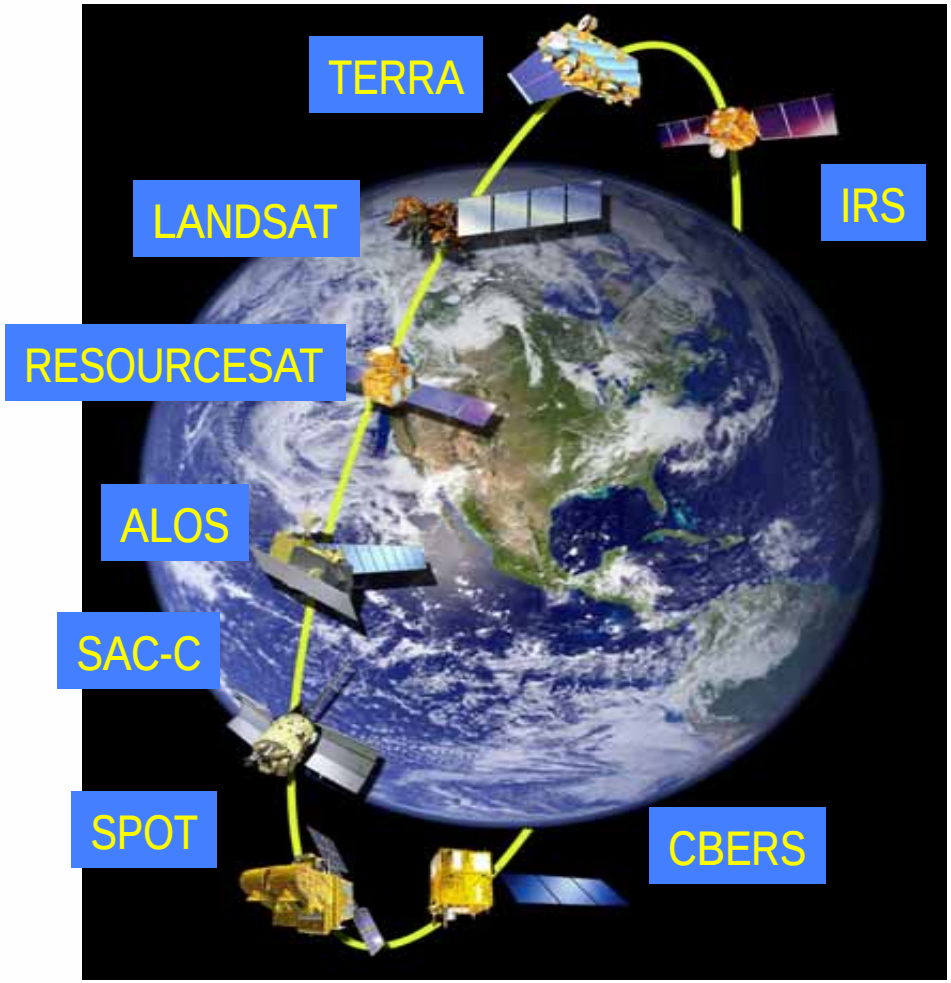
CEOS has Coordinated Access to Space Data



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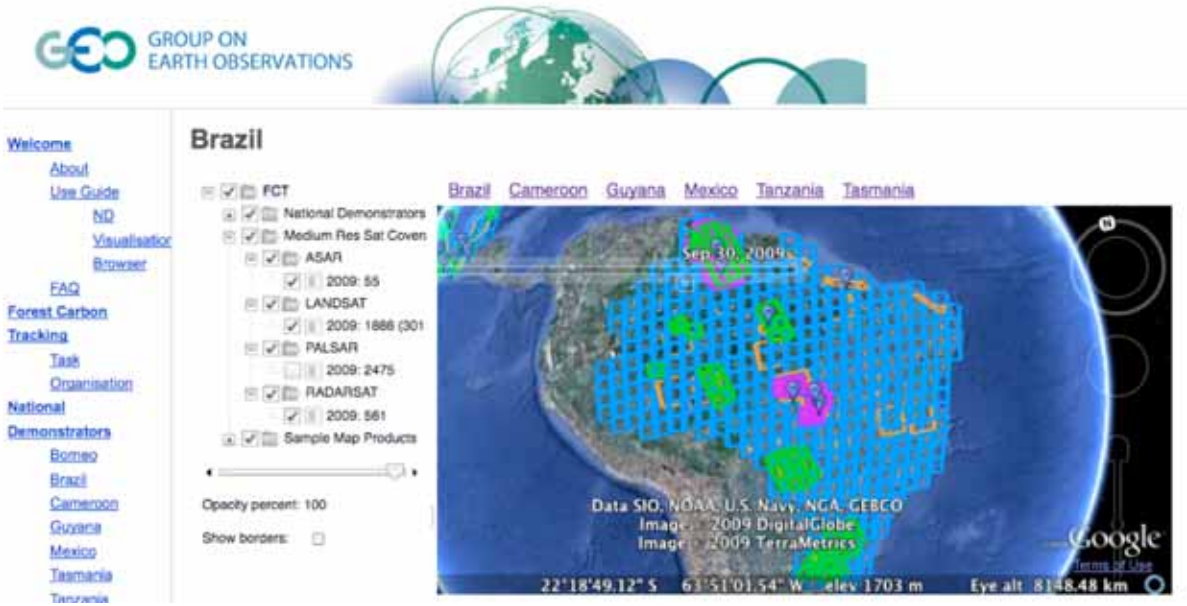
GFOI for National Reporting of Reduced Deforestation

Provide observations of suitable consistency, accuracy and continuity, and methodologies to support forest carbon Monitoring, Reporting and Verification (MRV)



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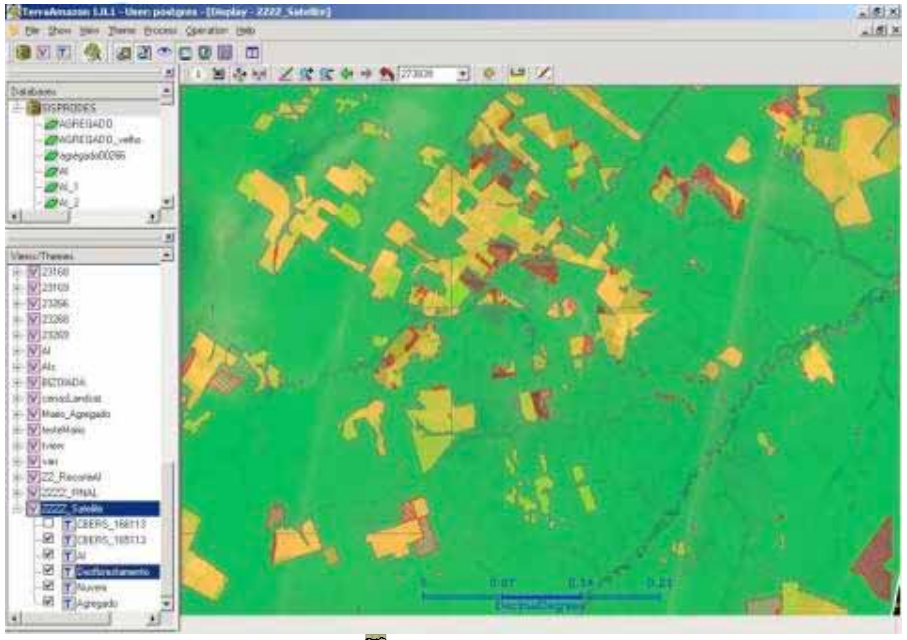
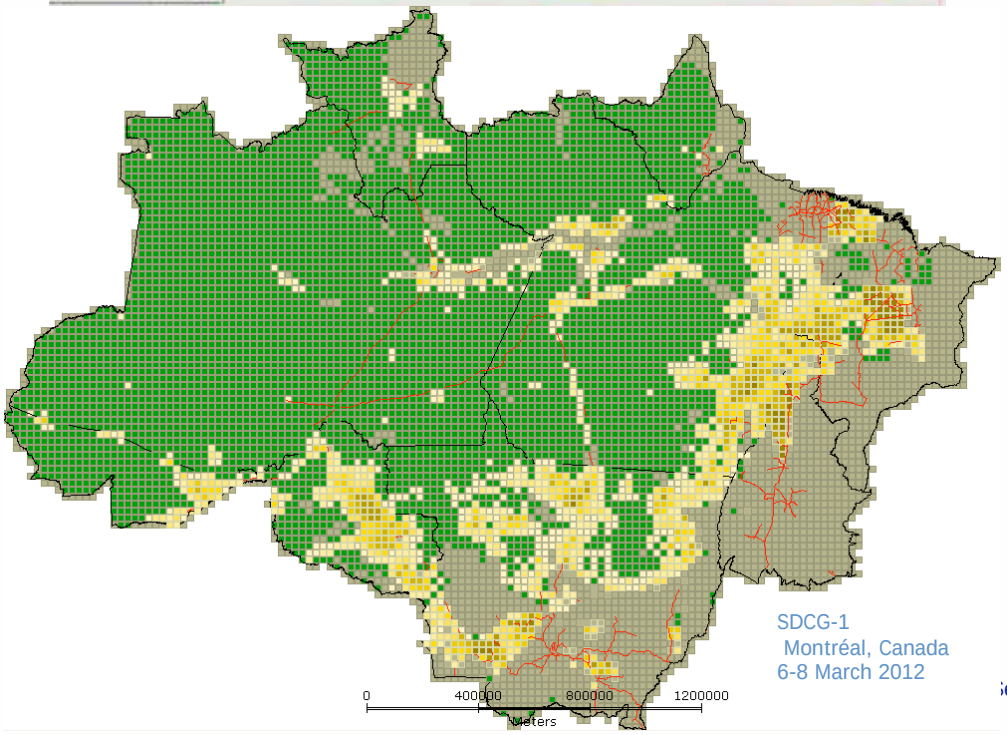
Outcomes of the 3rd FCT Science and Data Summit

- This 3rd SDS meeting was was held on 6-10 February 2012 in Arusha, hosted by the Tanzanian MNRT, with support of the NSC and was attended by almost 90 participants, representing institutions from about 25 countries, out of which 15 developing countries, 8 in Africa).
- Several prototype “products”, including forest and forest change mapping and initial carbon assessments, were produced with the support of dedicated Product Development Teams (one per country) that the GEO FCT task has established.
- The preliminary results show quite a different level of progress in the different ND countries, both for what concerns overall readiness for REDD+ implementation and for advancement of FCT activities. The end-to-end process (from observations to carbon assessment) is covered in few countries, while for others intermediate products have been produced.





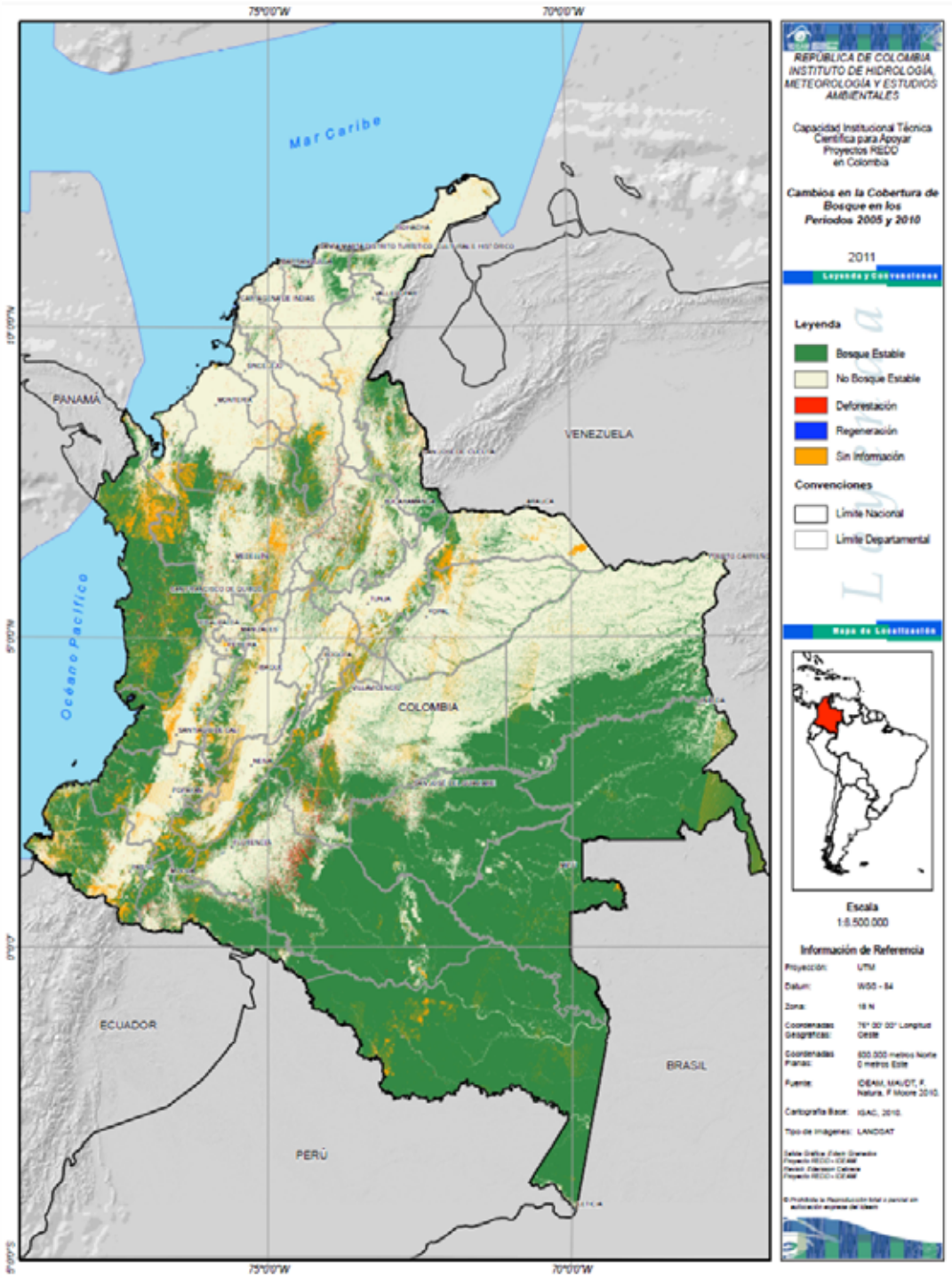
Brazil

Horizon 1a & 1b

Forest cover & forest cover change

PRODES – Brazilian Amazon (w2w) annual forest change. Operational system since 1988.
Minimum mapping unit 6.25 ha.

A range of different optical sensors have been used (Landsat 5, 7, CBERS, DMC, IRS)



Colombia

Horizon 1a & 1b

Forest cover & forest cover change

National-scale (w2w)Horizon 1a and 1b product - (combined) forest cover and change - derived from Landsat data.

at

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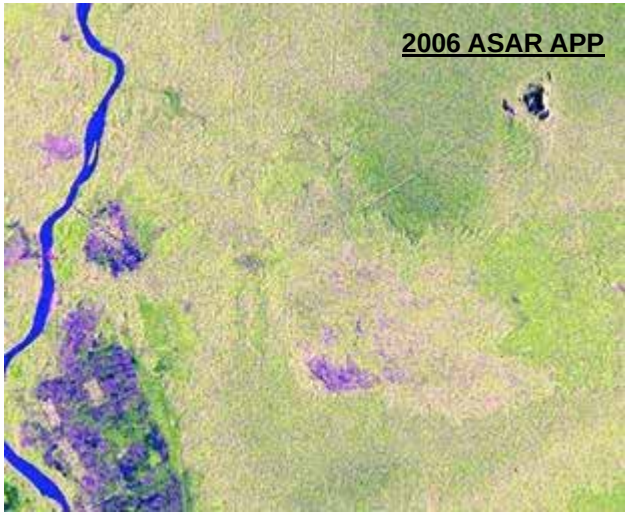
Indonesia Horizon 1b & Horizon 2

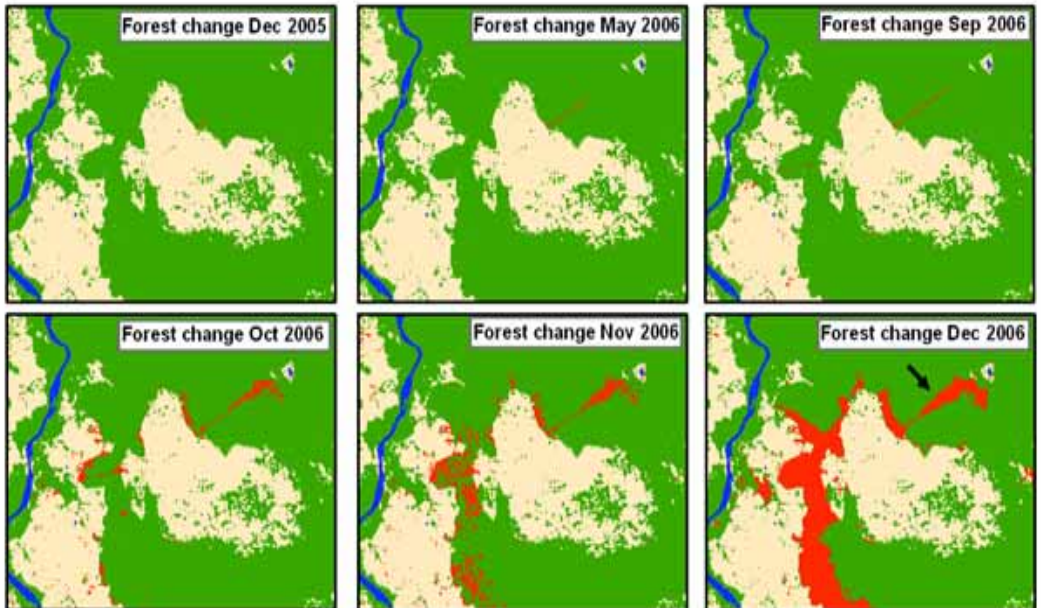
Forest cover change & Deforestation detection



ellite data courtesy ESA, processed by SarVision

ENVISAT ASAR APP has been demonstrated in Borneo as a fast and reliable tool for operational deforestation monitoring

Feasible to use optical (or L-band SAR) to generate forest/non-forest mask and monthly/bi-monthly time-series of C-band SAR to monitor tropical deforestation



Optimising information extraction from C-band SAR

WETLANDS INTERNATIONAL

WAGENINGEN UNIVERSITY ENVIRONMENTAL SCIENCES

SarVision

GROUP ON

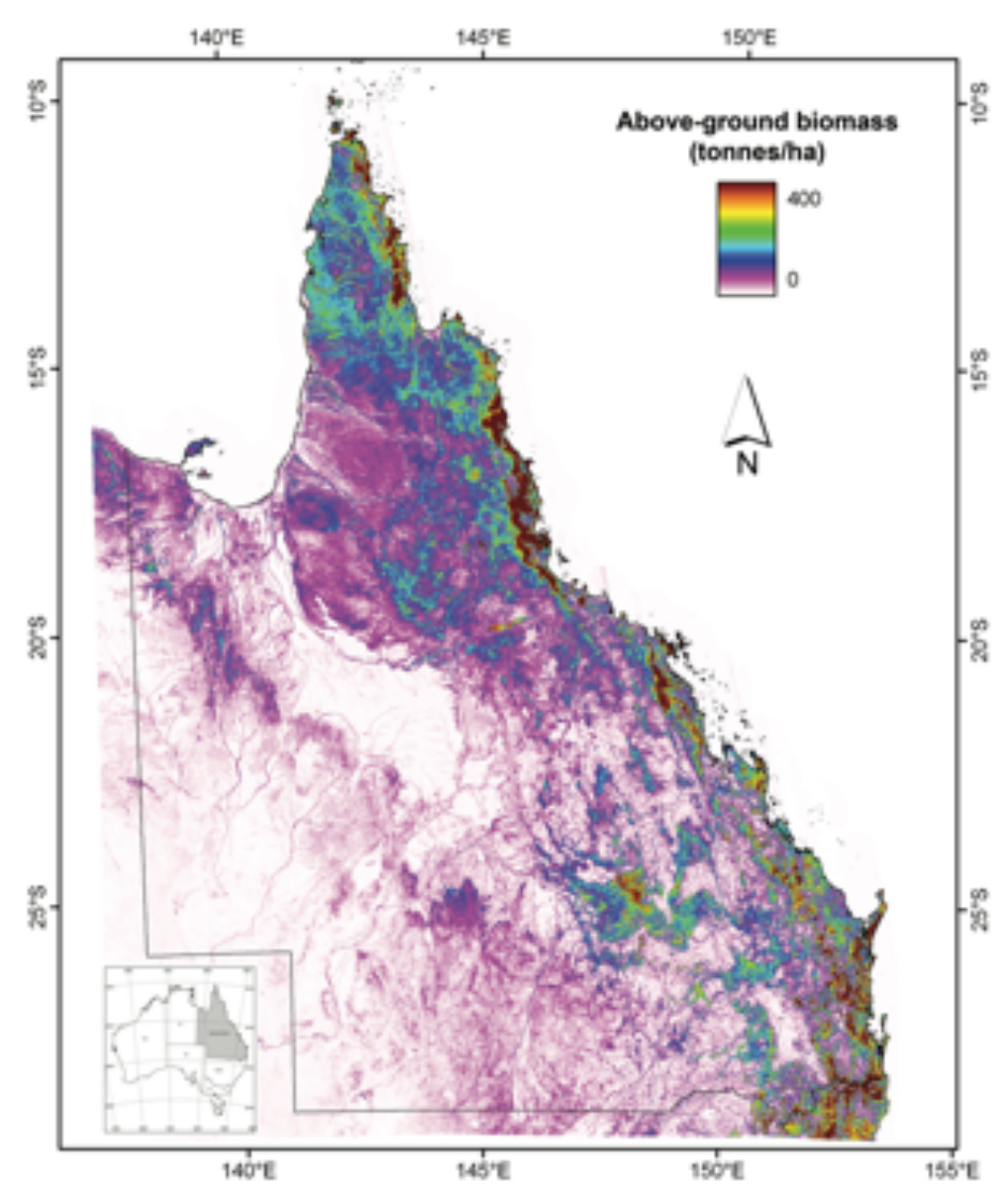
Borneo

Horizon 1c

Land cover

Subnational-scale (w2w)Horizon 1c product derived from dual-season ALOS (L-band) data.

Multi-seasonal (2 obs/yr wet/dry) image pairs improve distinction between certain classes compared to only one acquisition per year.



Australia (QL)

Horizon 2

Above-ground biomass

Subnational-scale (w2w)ABG map derived from a combination of Landsat and ALOS (L-band) data.

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Questions discussed at SDS

1. Sensor Interoperability

"Obtaining the same thematic results from different sensors"

2. Sensor Complementarity

"Obtaining additional thematic information through the (synergetic) use of two or more different sensors"

3. Optimising information extraction from C-band SAR

4. Applications and optimal use of X-band SAR

5. Others (e.g. biomass estimations, woodlands, etc)

Questions discussed at SDS

- **Degradation**

– Due to logging, fire, pests/insects. Degradation also early indicator of forthcoming large-scale deforestation

– A big challenge for GFOI.

  - High or Very High spatial resolution required to detect subtle changes in the forest canopy
  - High temporal revisit required

Sensors of use:

– VHR optical systems

– SAR

  - Dense time series (monthly/bi-monthly)

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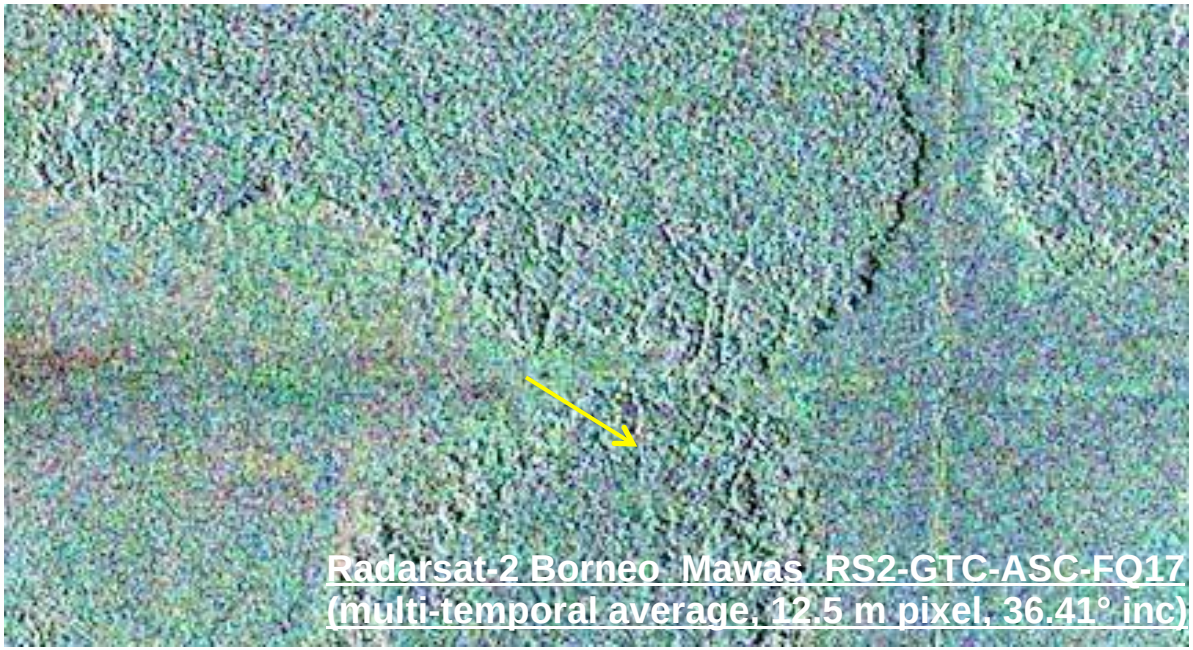
Indonesia Horizon 2a

Degradation (detection of logging roads)



Radarsat-2 Borneo Mawas RS2-GTC-ASC-FQ17 (multi-temporal average, 12.5 m pixel, 36.41° inc)

Dense time series (monthly/bi-monthly) of Radarsat-2 (C-band)

Multi-temporal filtering improves radiometric quality (speckle reduction) while maintaining spatial resolution

Logging roads remain visible longer in Radarsat-2 than in RapidEye

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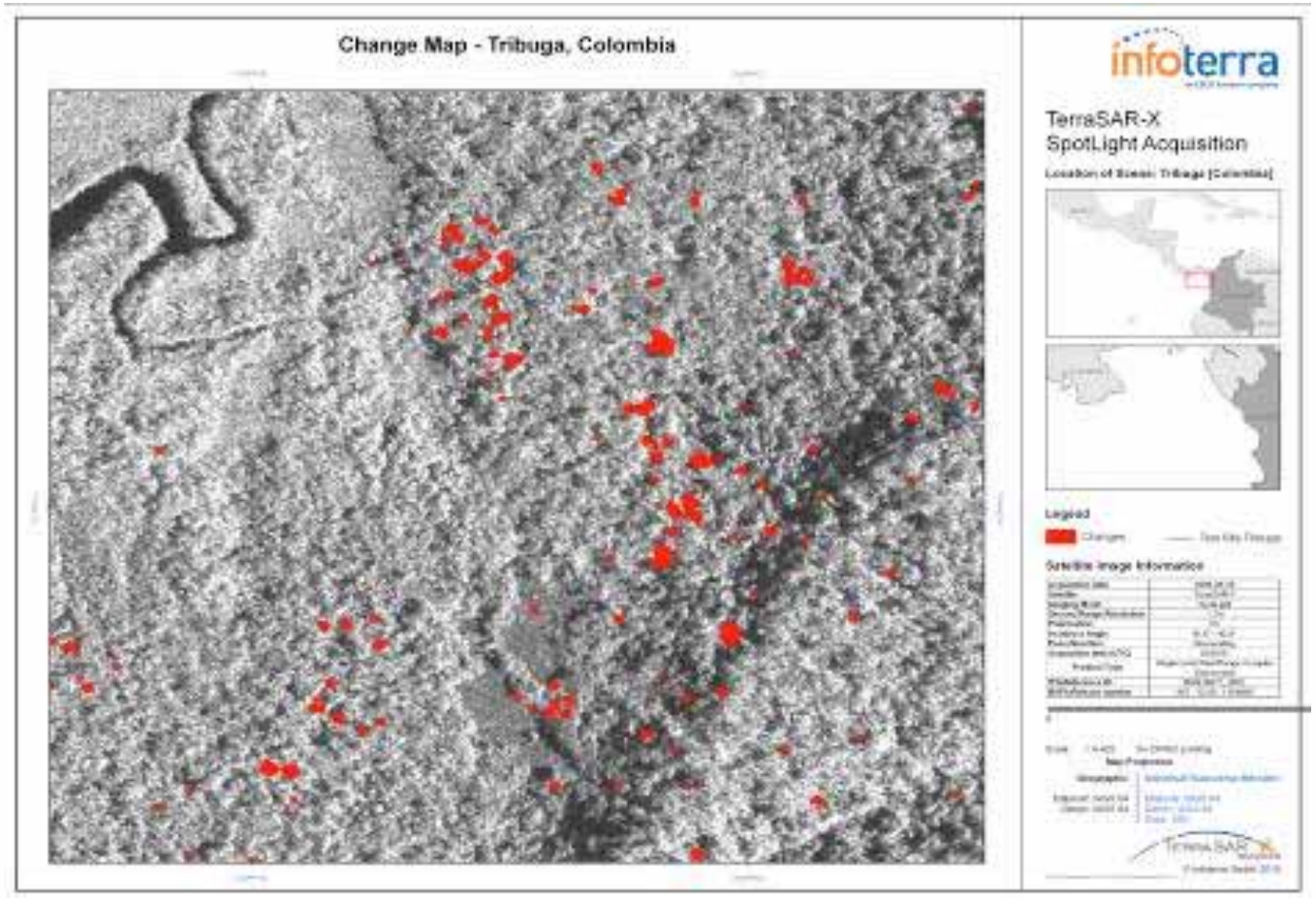
Colombia Horizon 2a
Degradation (selective logging)



Local scale
Detection of the removal of individual trees detected in TerraSAR-X (spotlight mode)

Questions discussed at SDS

- **Forest type classification**

– Correlation with both forest spectral signature and with forest structural parameters and above ground biomass

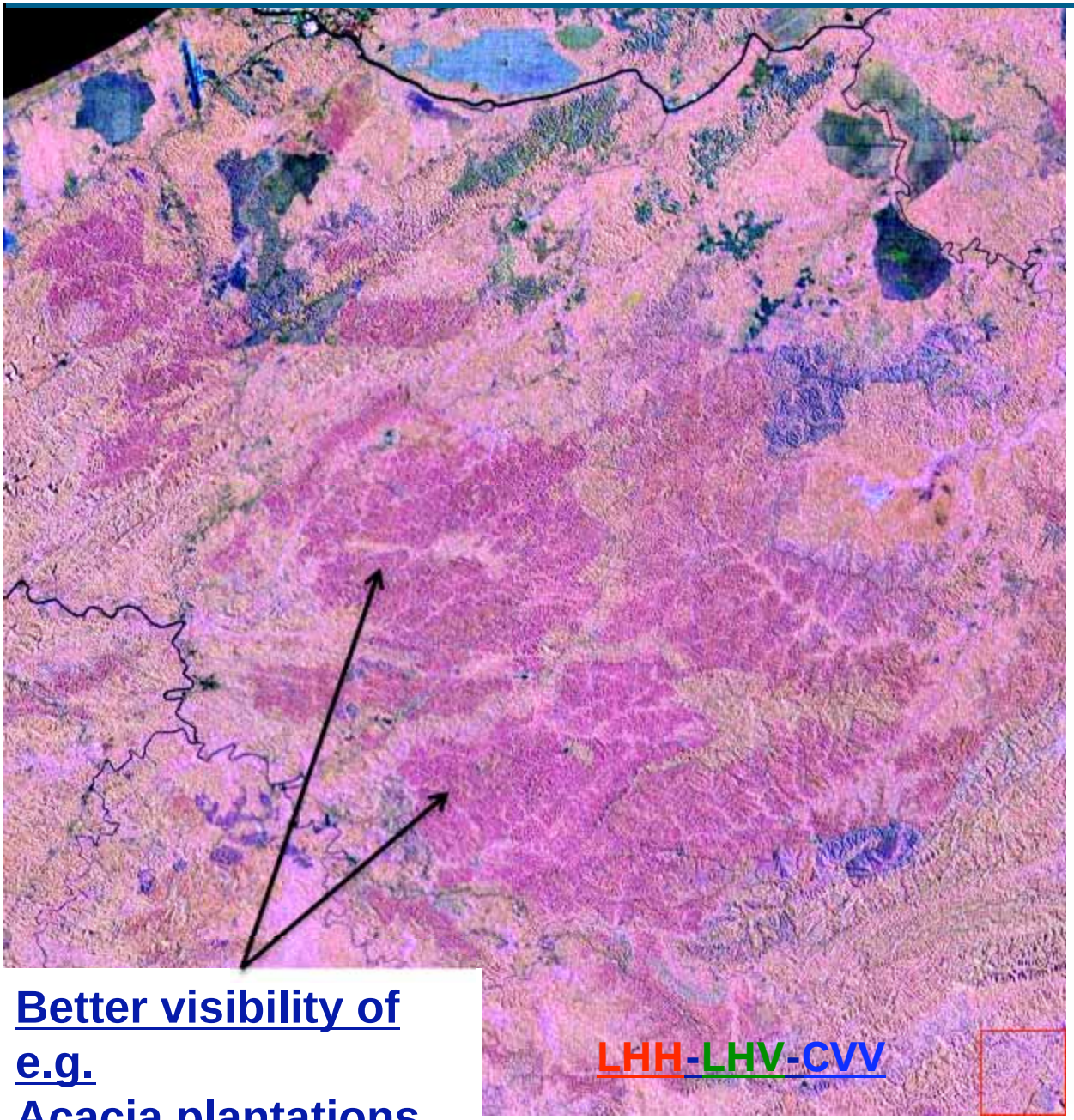
Sensors of use:

– Optical systems (SWIR bands particularly useful)

– SAR

  - Multi-season observations improve class distinction
  - Consistent observations over several years provide “retroactive improvement” of classification results
  - Combined use of different sensors (“complementarity”) can improve class distinction

Improved distinction of Forest types



Better visibility of e.g. Acacia plantations

LHH-LHV-CVV

L-band/C-band complementarity

Radarsat-2 WB C-band
PALSAR FB L-band
LHH-LHV-CVV

Sarawak, Malaysia

L-band/C-band combination improves contrast between forest and Acacia plantations and between (medium biomass level) forest types and within forest (biomass) variation

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SDS Conclusions

- National and sub-national scale Horizon 1 products could be generated
- All sensor types have some unique characteristics that render them useful for some specific applications
- Combined use of different sensor types can render new information that is not evident in any one data on its own
- The GEO-FCT “ad-hoc” coordinated acquisitions since 2009 have resulted in a range of new applications having been discovered
- The importance of a consistent archive cannot be under-estimated.

SDS conclusions

Optical sensors

- The optical core missions (Landsat, Sentinel-2, CBERS-3) are the anticipated work-horses for GFOI. At least one cloud-free coverage desired per year
- Cloud coverage is the most serious limitation. What can be done to improve utlilisation?
  - investigate interoperability between the core missions – as well as other relevant optical missions (SPOT, DMC, RapidEye, etc…) Investigate to what extent these sensors can be used to replace each other.
  - Enhanced pixel mining/cloud-free compositing – making use of all data acquired.

SDS conclusions

C-band SAR

- Sentinel-1 and RCM the anticipated SAR work-horses. Several approaches to enhance information extraction from C-band SAR were demonstrated. Possible acquisition scenario:
  - National-scale w2w coverage 2 times/year (dual-season) (or every 2 years) for baseline mapping in combination with other sensors
  - Dense time series mapping over deforestation hotspot regions (stratified w2w) under forest mask
    - Monthly – no less than bi-monthly – acquisitions required in order not to lose the signal

SDS conclusions

L-band SAR

- Demonstrated utility for forest applications with an established science and user community
- ALOS PALSAR is presently PPP and not one of the core missions, but nevertheless one of the most utilised sensors – on par with Landsat – within GEO-FCT.
- The global acquisition strategy for PALSAR – global w2w coverage two times/year – adequate for GFOI.
- L/C-band complementarity demonstrated
- The evolution of CONAE's SAOCOM-1 L-band SAR of great interest for GFOI

SDS conclusions

X-band SAR

– Several approaches to enhance information extraction from X-band SAR were demonstrated. X-band is the key sensor to address the degradation requirement
  - VHR resolution acquisitions very demanding on system resources
  - No “default” acquisition strategy can be anticipated. Has to be tailored individually for each country that requests it (data provision through bilateral agreements foreseen for TS-X/TD-X)

GFOI priorities for 2012

- Establish the GFOI Project office
- Strengthen/establish relationships with international organizations (“User Organizations”/Capacity building/ Donors):
- Continue working with the NDs countries:
- Develop a Research and Development Plan
- Continue working on Data with CEOS, commercial data providers, and data processing providers
- Produce the first issue of the Guidance Document(s) and ND Brochure
- Prepare a revised GFOI Implementation Plan for submission to the GEO-IX Plenary.

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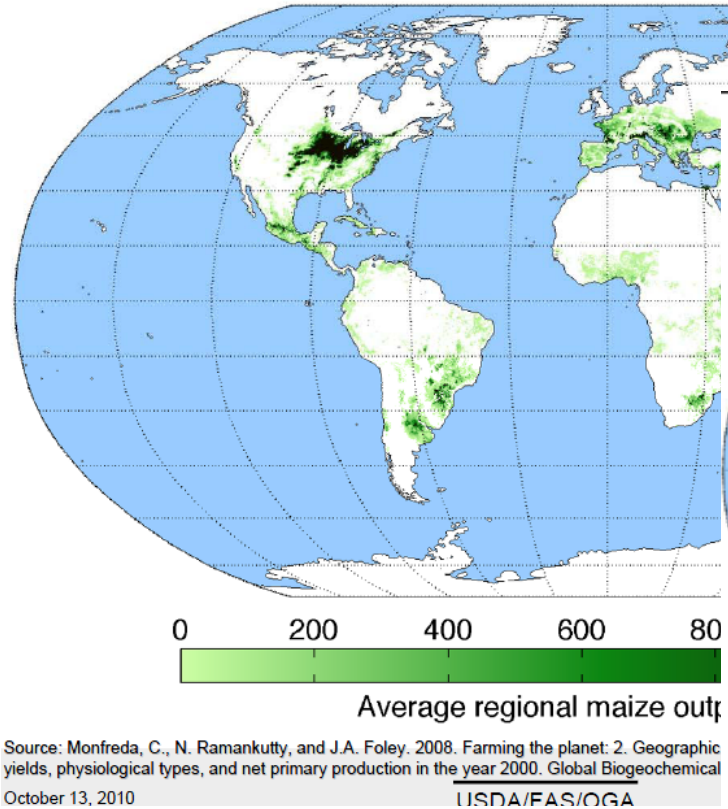
Food Security

Global Corn Yields

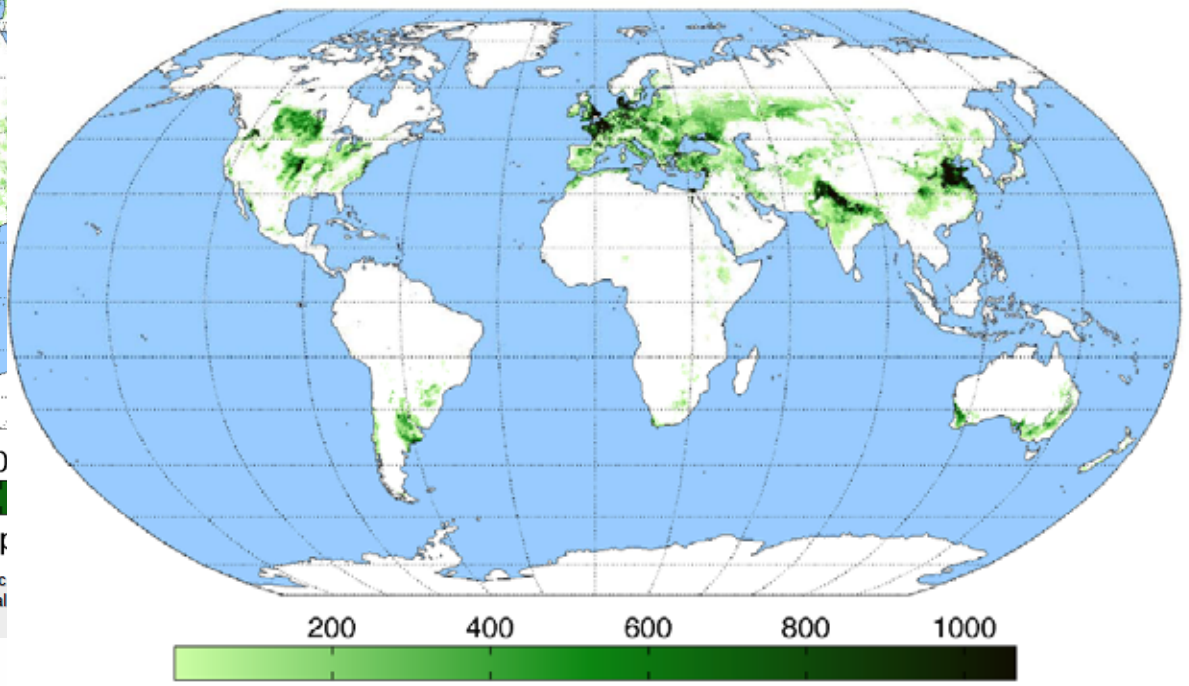


Source: Monfreda, C., N. Ramankutty, and J.A. Foley. 2008. Farming the planet: 2. Geographic yields, physiological types, and net primary production in the year 2000. Global Biogeochemical

October 13, 2010

USDA/FAS/OGA

Global Wheat Yields



Source: Monfreda, C., N. Ramankutty, and J.A. Foley. 2008. Farming the planet: 2. Geographic distribution of crop areas, yields, physiological types, and net primary production in the year 2000. Global Biogeochemical Cycles 22: GB1022

October 13, 2010

USDA/FAS/OGA

Linking U.S. Agriculture FAS to the World

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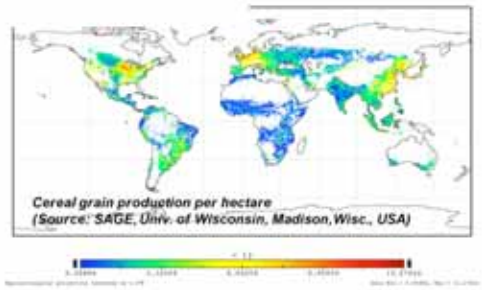
G20 FRANCE 2011 NEW WORLD NEW IDEAS

GEO-GLAM

The GEO led Initiative for GLOBAL AGRICULTURAL MONITORING



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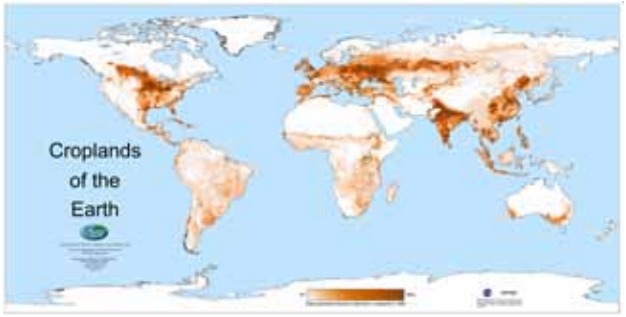
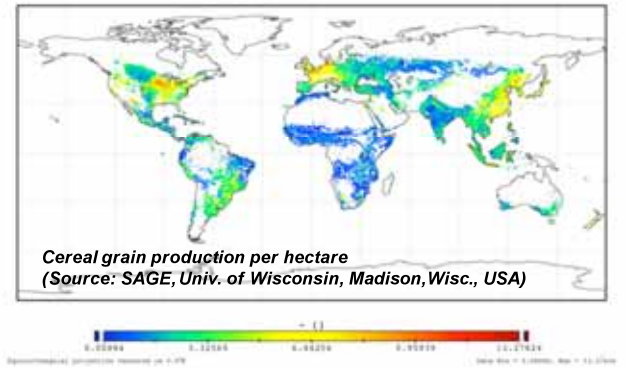
The GEO-GLAM Initiative : Objectives

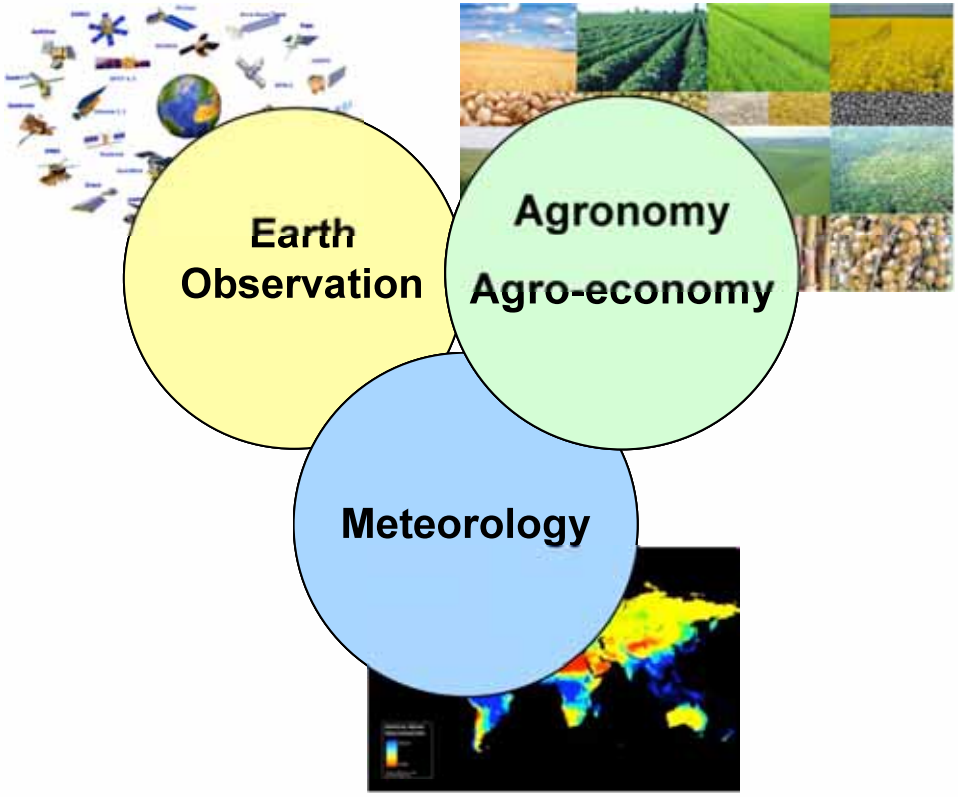
To reinforce the international community's capacity to produce and disseminate relevant, timely and accurate forecasts of agricultural production at national, regional and global scales.



Cultivated area / crop type area



Crop yield forecast



2. The GEO-GLAM Initiative : Deliverables

Deliverable 1 : Access to Earth Observation data for agriculture monitoring

Deliverable 2 : Access to Meteorological data and forecasts

Deliverable 3 : Cultivated areas, crop-type distribution, crop yield forecasts

Deliverable 4 : Improved monitoring methods

Deliverable 5 : Strengthened national agricultural monitoring capacities

Deliverable 6 : Dissemination of data to stakeholders;

Deliverable 7 : A sustained Earth observation system of systems for agricultural monitoring,

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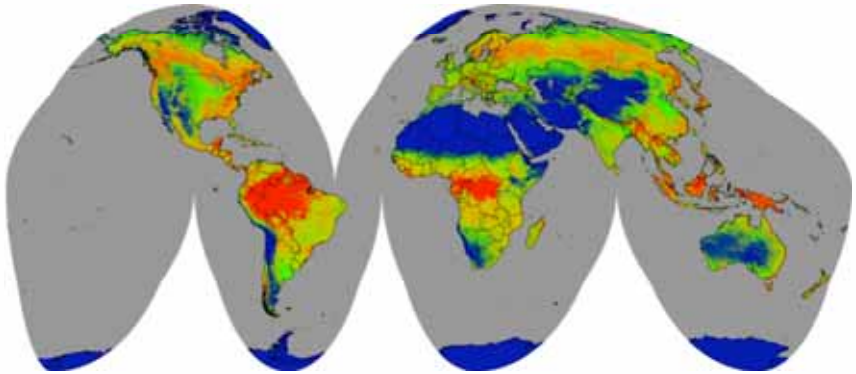
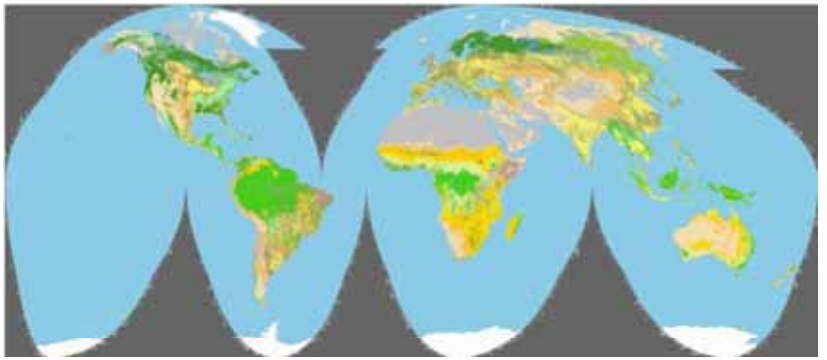
GEO Global 30m Land Cover Products



Annual land cover continuous variables

- Quantitative annual continuous measures of per pixel percent tree, shrub, herbaceous, water, snow/ice, and barren cover.
- Change products



Mid-decadal year land cover types

- Land cover categories (TBD) consistent with FAO Land Cover Classification System (LCCS)
- Maps and statistical estimates of major land cover types
- Complementary with other global land cover products (e.g., MODIS land cover, Globecover)

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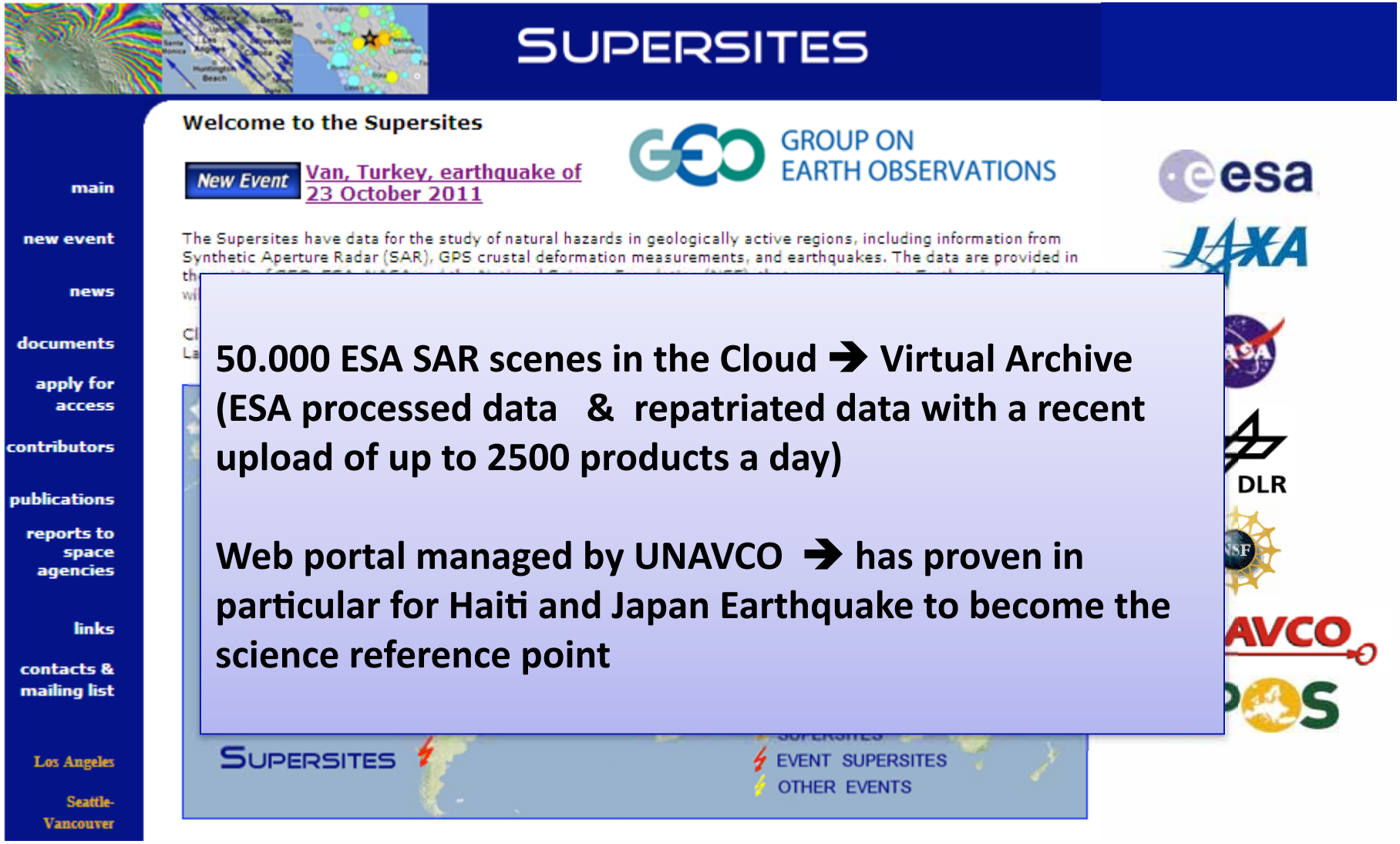

50.000 ESA SAR scenes in the Cloud ➔ Virtual Archive (ESA processed data & repatriated data with a recent upload of up to 2500 products a day)

Web portal managed by UNAVCO ➔ has proven in particular for Haiti and Japan Earthquake to become the science reference point

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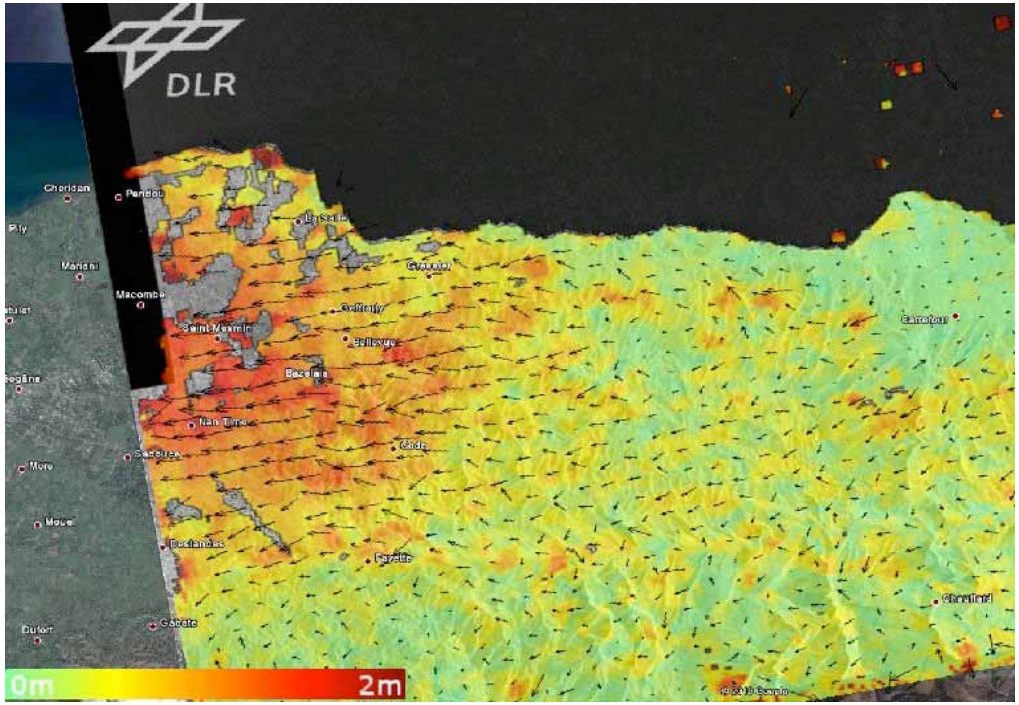
1. Coordinate Data Collection and Access



The Geohazard Supersites provide a **portal** for optimizing the data acquisition strategy and sharing of preliminary information amongst scientists.

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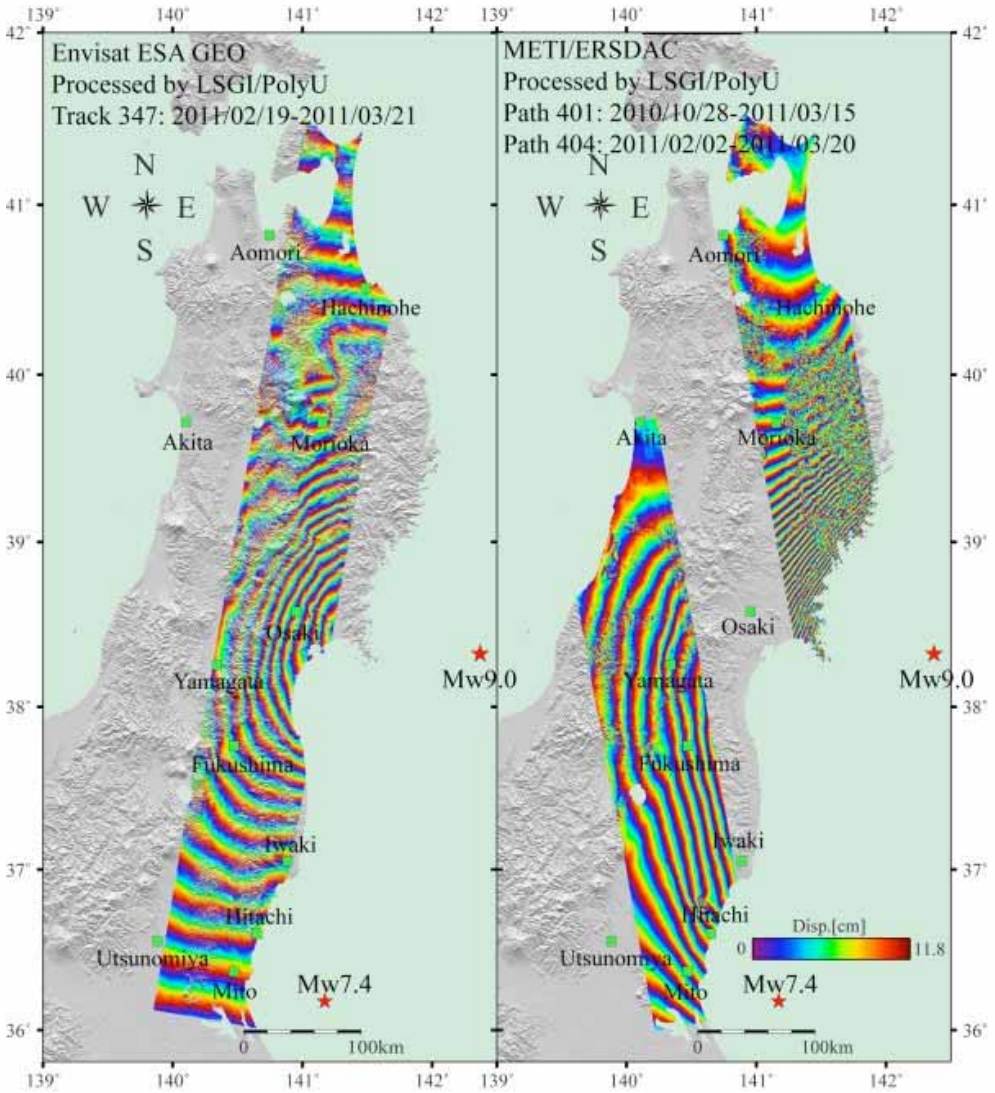
2. Develop and Share Products



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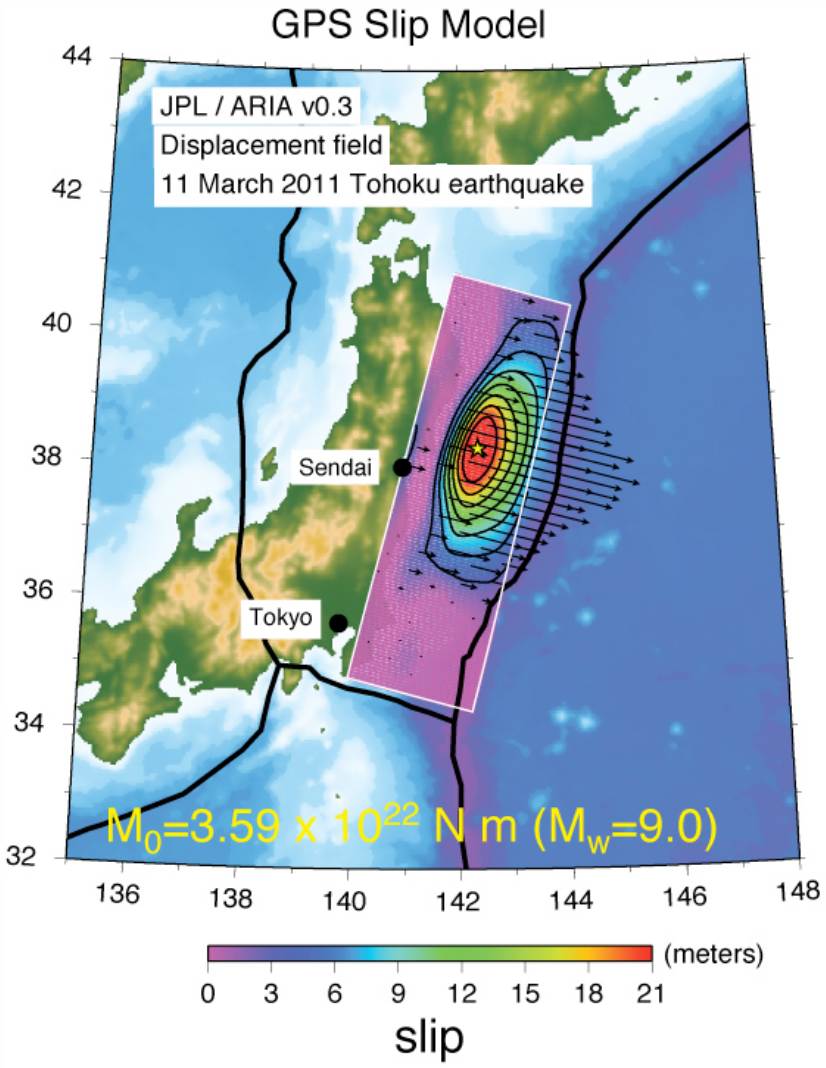
The Tohoku-Oki Supersite



JAXA esa DLR NASA UNAVCO NSF

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Supersites and National Laboratories (SNL)

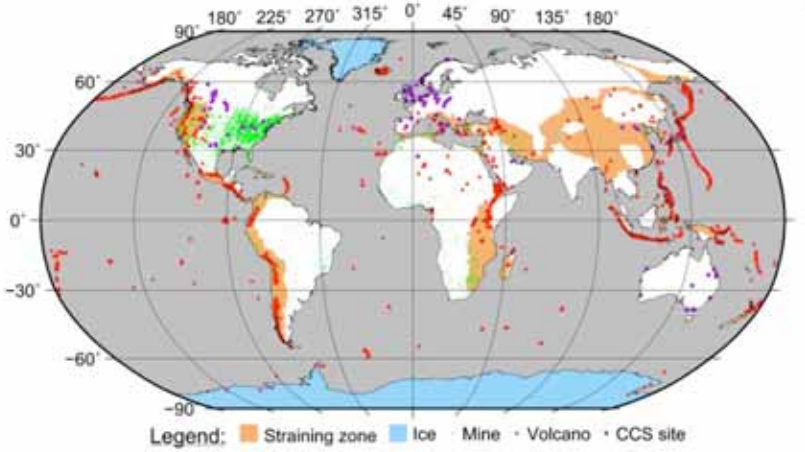
Pooling Satellite imagery and terrestrial in-situ data for earthquake and volcano studies.

There are 3 different level of sites:

- **Supersite** ➔ **all data**
- **Event Supersite** ➔ **all data in case of large scale event**
- **Natural Laboratories** ➔ **Global Network of Natural Laboratories.**

Providing online access to historic multi-sensor SAR data sets (digital heritage of Earth Observation for geohazards).

1 Million ERS/Envisat frames, under investigation.



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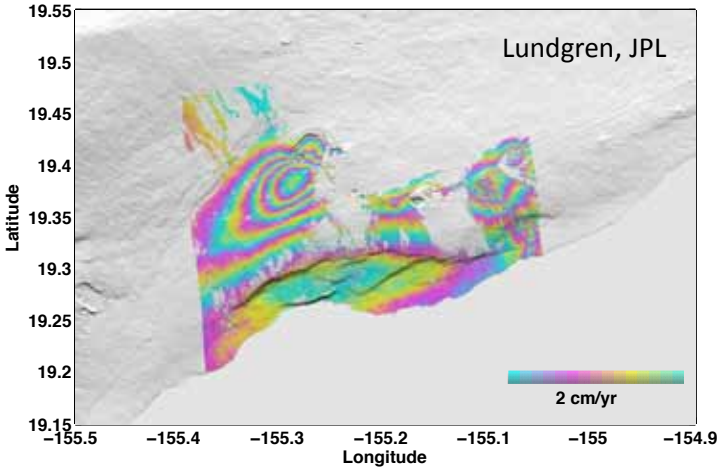
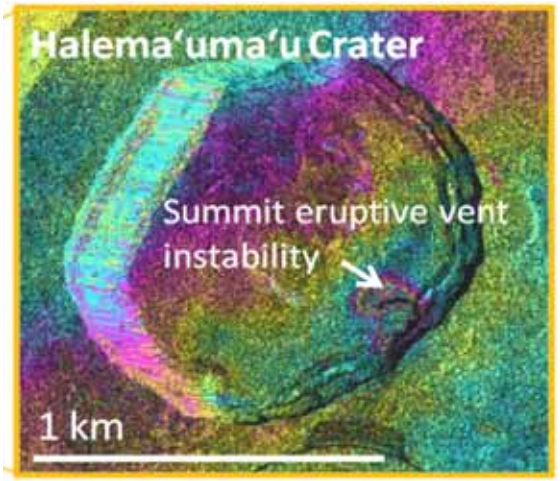
Example: Kilauea (Hawaii)

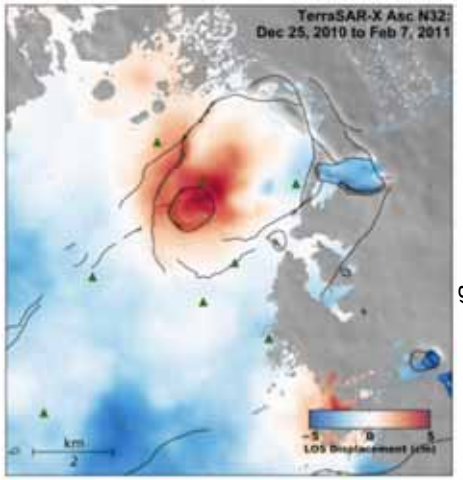


TerraSAR-X interferometry

JAXA recently contributed with PALSAR data

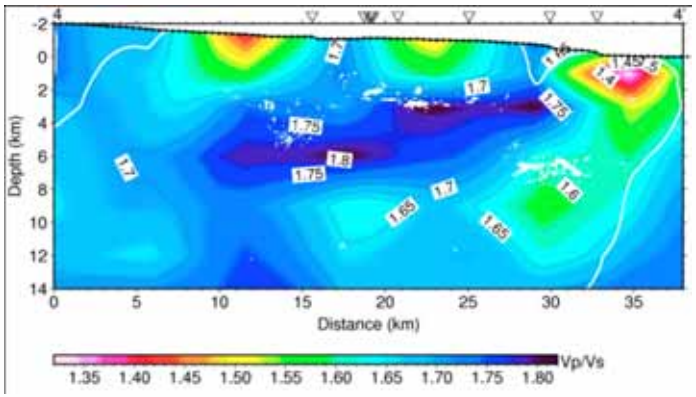
Richter and Poland, Hawaii Volcano Obs.





Baker and Amelung, U of Miami

Seismic tomography



Lin and Okubo, U of Miami and HVO

Multiple groups using same data → better science!

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SNL- Potential Contributions of CEOS Members

ALOS-2:	2 images/46 days
TerraSAR-X:	2 images/11 days
RSAT-2:	2 images/24 days
Cosmo-Skymed:	2 images/4 days
Envisat:	2 images/30 days
Sentinel:	2 images/12 days
Kompsat-5,	RISAT-1 (RISAT-3)

Daily to sub-daily observations possible!

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Ten Years After (Johannesburg)

…to create a world where decisions and actions are informed by coordinated, comprehensive and sustained Earth observations.

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Pillar #1: Coordinated Data Access
More Challenges for CEOS

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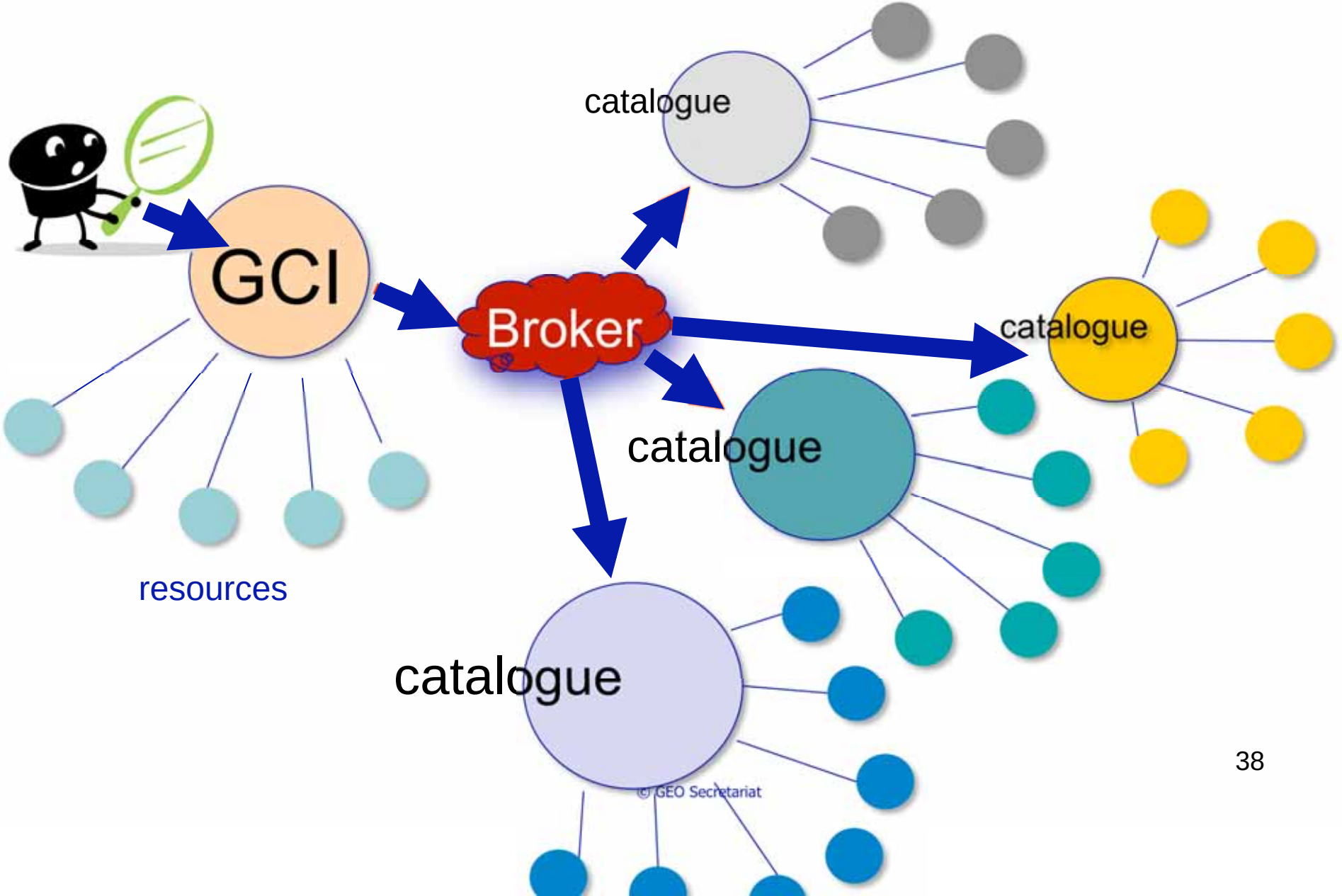
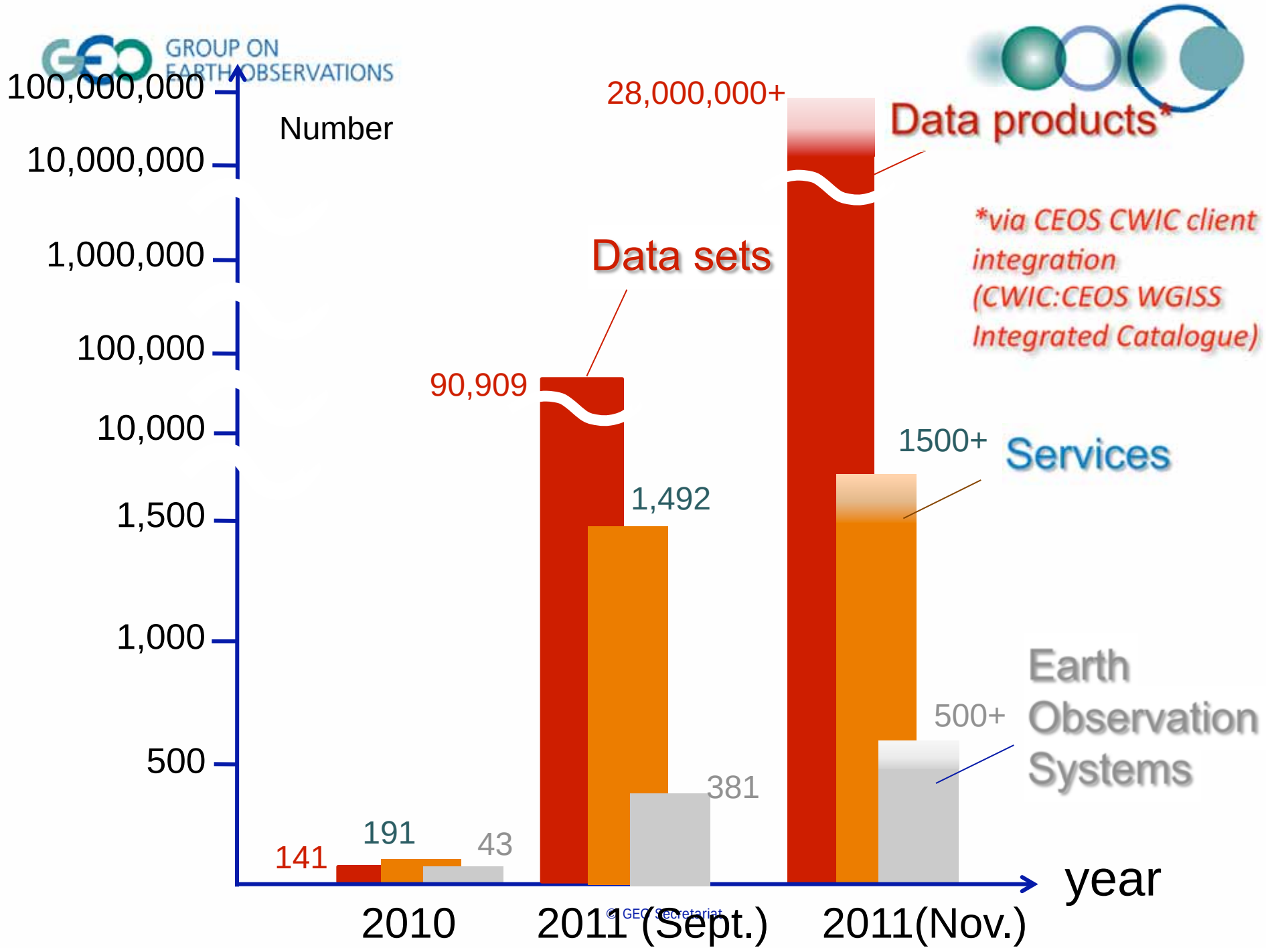
GEOSS Provides Coordinated Access to Information from All Sources


catalogue
GCI
Broker
catalogue
catalogue
resources
catalogue
© GEO Secretariat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Number
100,000,000
10,000,000
1,000,000
100,000
10,000
1,500
1,000
500
28,000,000+
Data products*
*via CEOS CWIC client integration (CWIC:CEOS WGISS Integrated Catalogue)
Data sets
90,909
1,492
381
1500+
Services
500+
Earth Observation Systems
141
191
43
year
2010
2011 (Sept.)
2011(Nov.)
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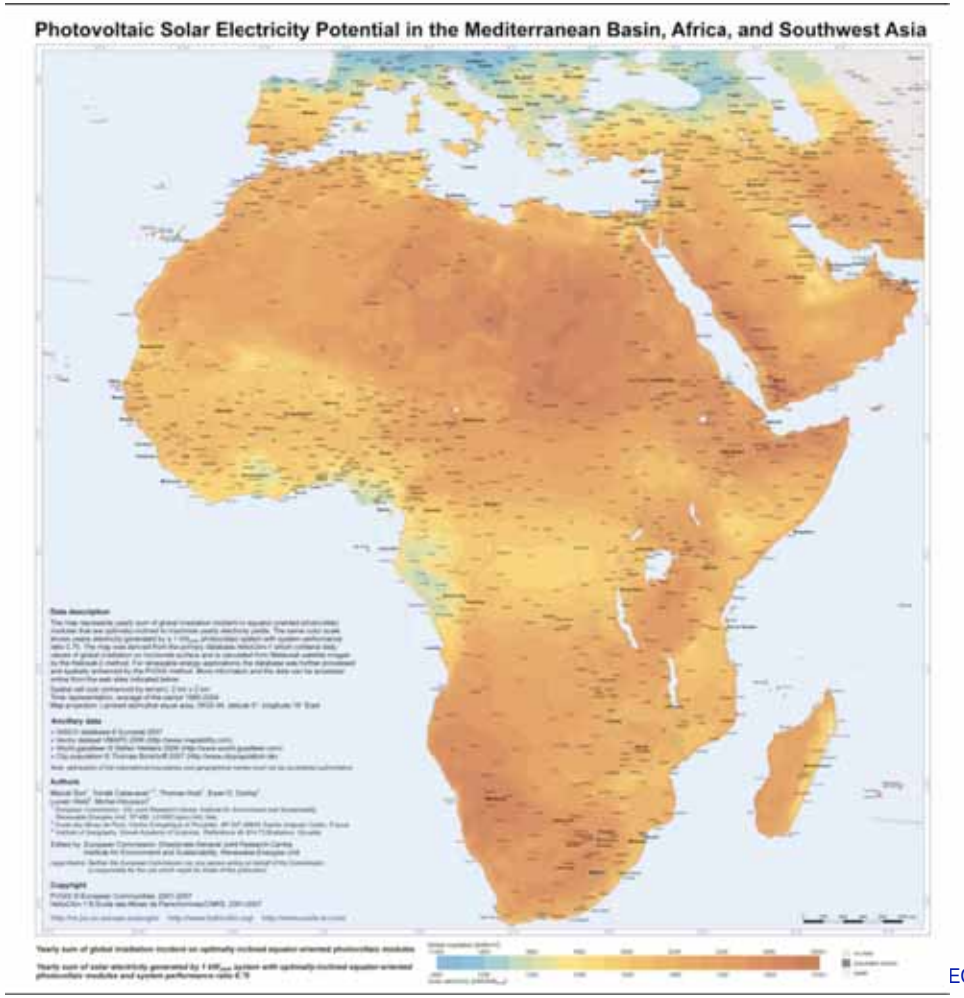
AfriGEOSS: GEOSS in and for AFRICA



GEONETCast, CBERS, SERVIR, Sand and Dust Storm Warning System, AEGOS, Wildland Fire Early Warning System, Puma, AMESD and GMES Africa, BIOTA, TIGER, SoDa, MERIT, African Protected Areas, ClimDev Africa, ChlorOGIN, GeoAFRICA

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AfriGEOSS: Priority Actions

- **Engage with regional agencies and training centres**
- **Coordinate satellite infrastructure pilot projects**
  - Coordinate data acquisition strategy for Africa.
  - African Resources and Environmental Management Constellation (ARMC)
  - AfricaGeoSat-1 Project
  - African Monitoring of the Environment for Sustainable Development (AMESD) and Monitoring of Environment and Security in Africa (MESA)
- **Coordinate application pilot projects**
  - Bio-Energy Atlas for Africa.
  - GEO Forest Carbon Tracking (FCT) and Global Forest Observations Initiatives (GFOI)
  - The Meningitis Risk and Information Technology project (MERIT)
  - GEO-GLAM
- **Promote data democracy and data sharing**

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SEAS-Gabon

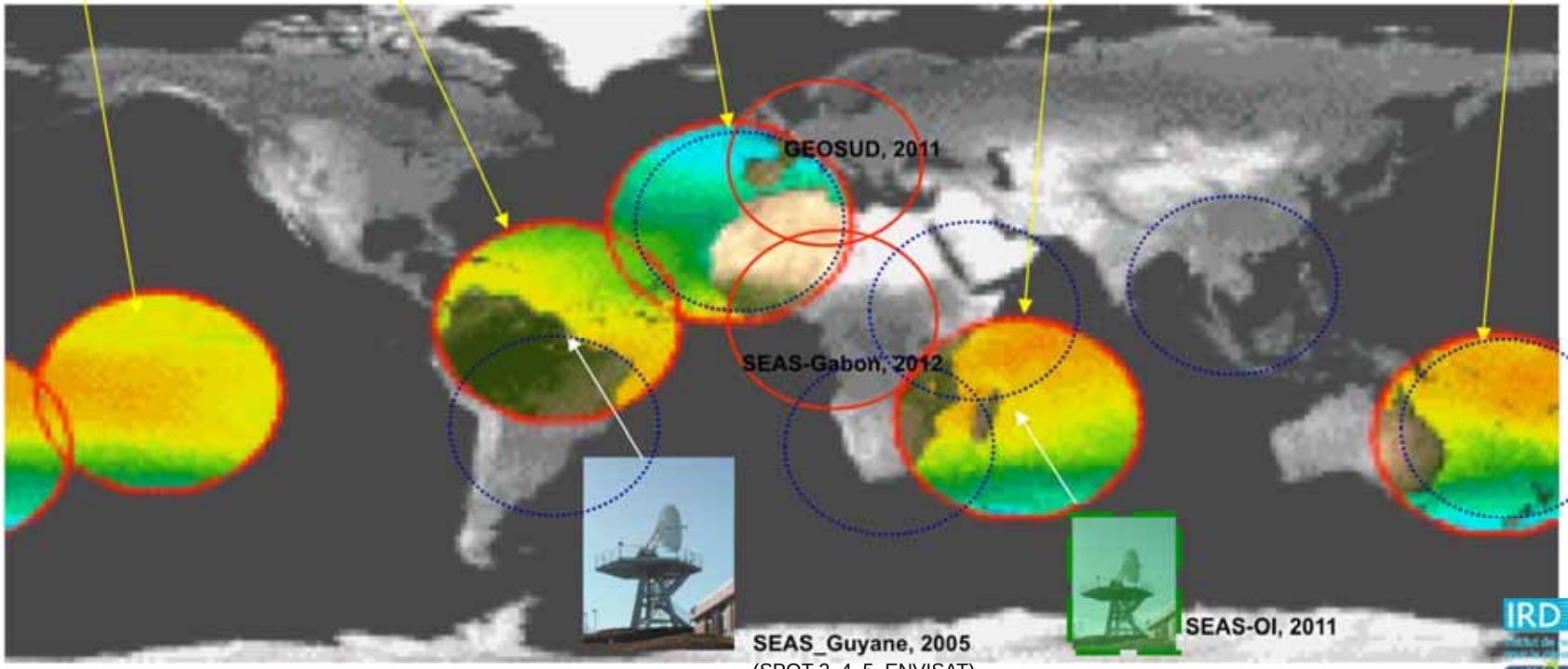
Polynésie, 2004

Guyane,1998

Canaries,1996

Réunion,1991

Nlle Calédonie,1997



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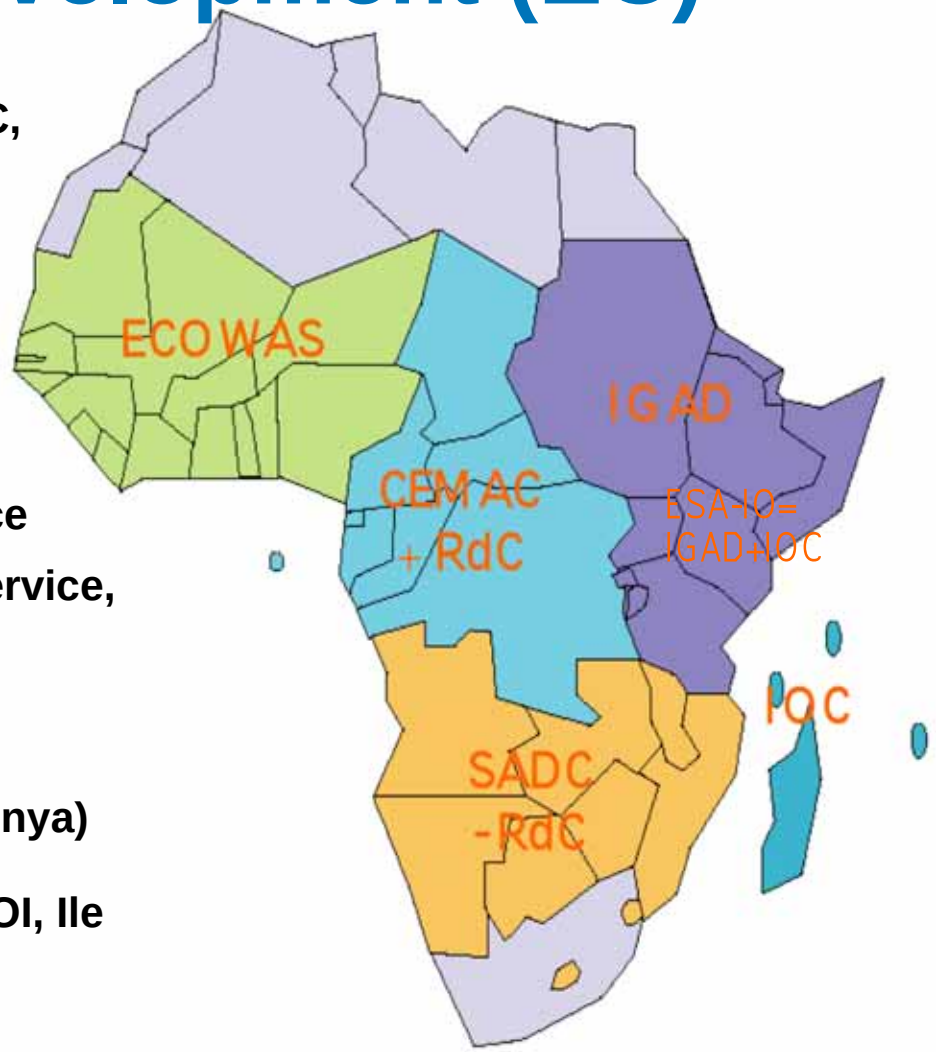
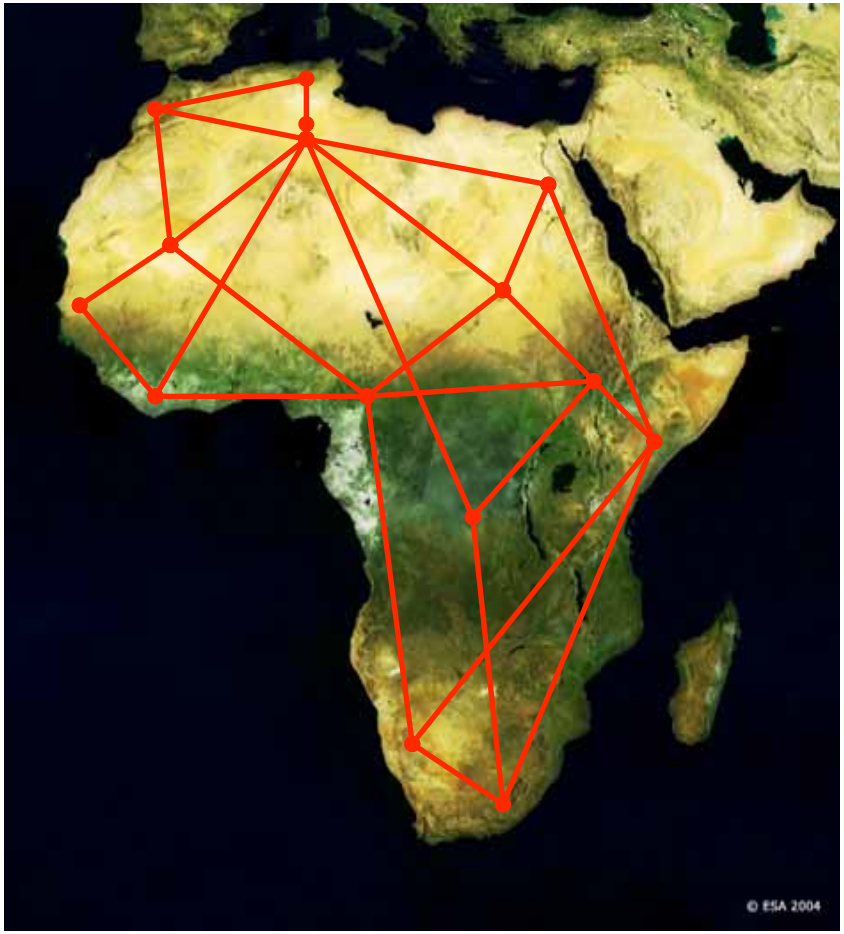
African Monitoring for Environment and Sustainable Development (EC)

- **Water Resource Management, (CEMAC, CICOS, RDC)**
- **Water Management for Cropland and Rangeland Management (ECOWAS, AGRHYMET, Niger)**
- **Agricultural & Environmental Ressource Management (SADC, Meteorological Service, Botswana),**
- **Land Degradation, Mitigation & Natural Habitat Conservation (IGAD, ICPAC, Kenya)**
- **Marine & Coastal Management (IOC, MOI, Ile Maurice)**



TIGER: Water Information & Knowledge Network



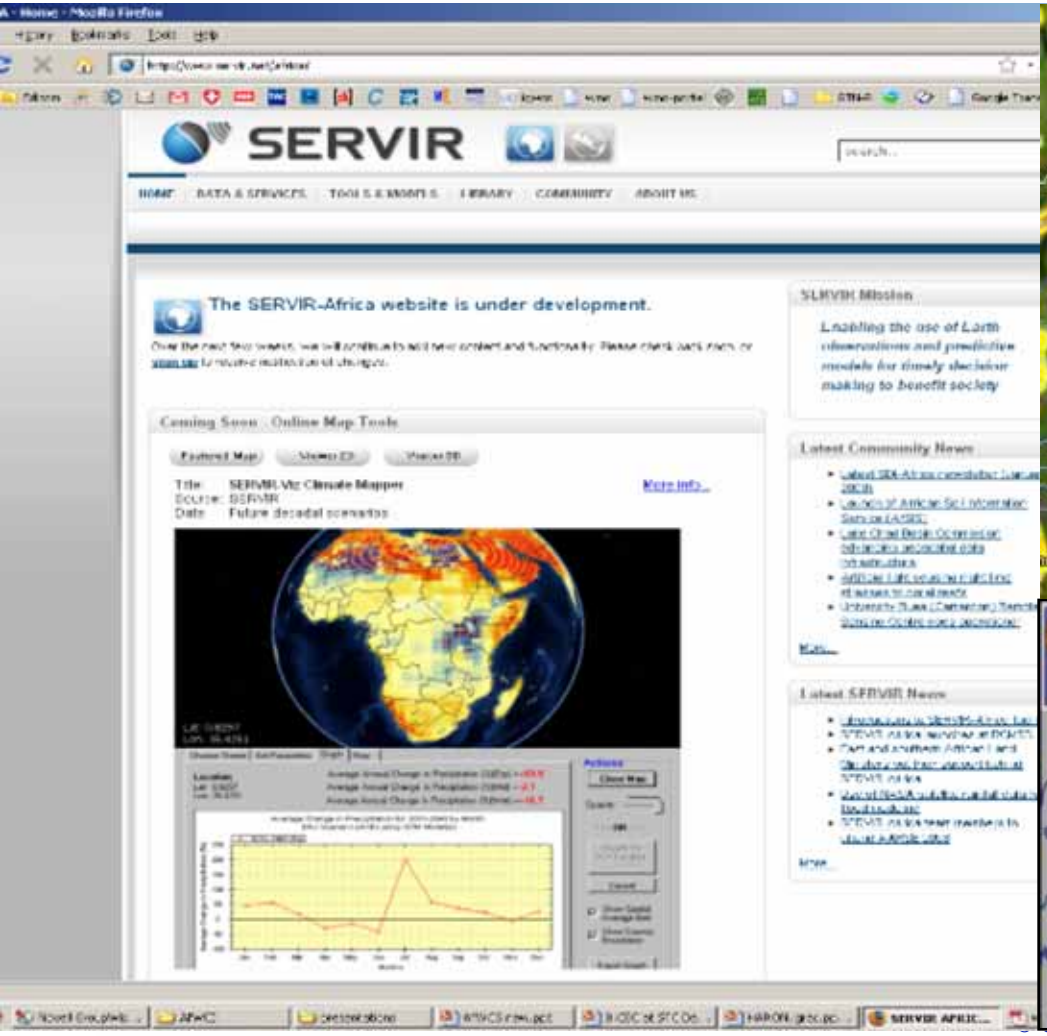
TIGER involves more than 200 African experts (universities, technical centers, water authorities

Actions dedicated to:

- Facilitate sharing of water knowledge, information and data;
- Support the development of common water research programs;
- Identify and promote best practices;

GROUP ON EARTH OBSERVATIONS

SERVIR-Africa and SERVIR-Himalaya



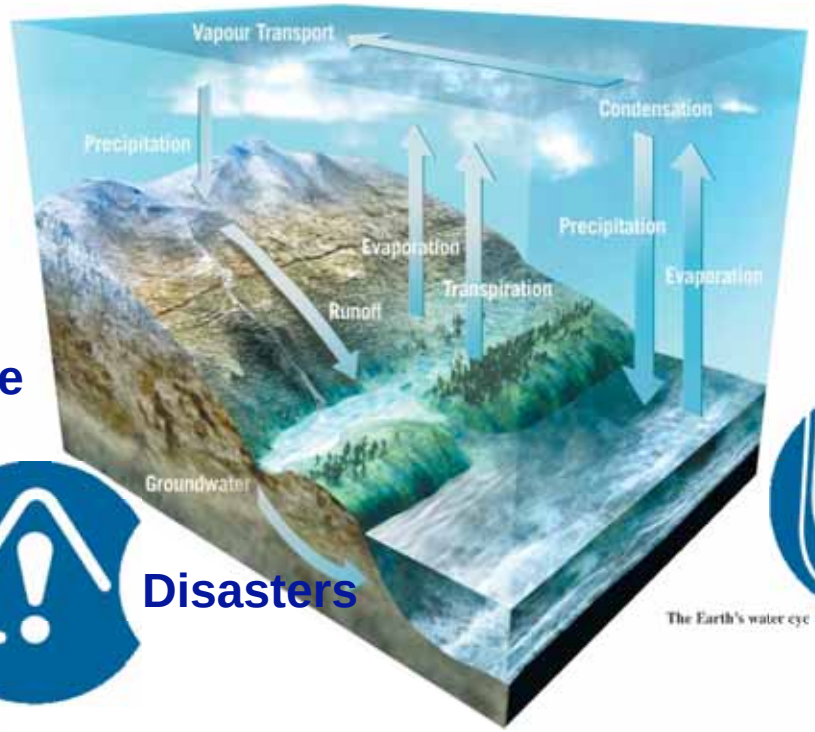
GROUP ON EARTH OBSERVATIONS

Water Cycle Management: A complex problem requiring Coordinated Access to Heterogeneous Data Streams

Energy

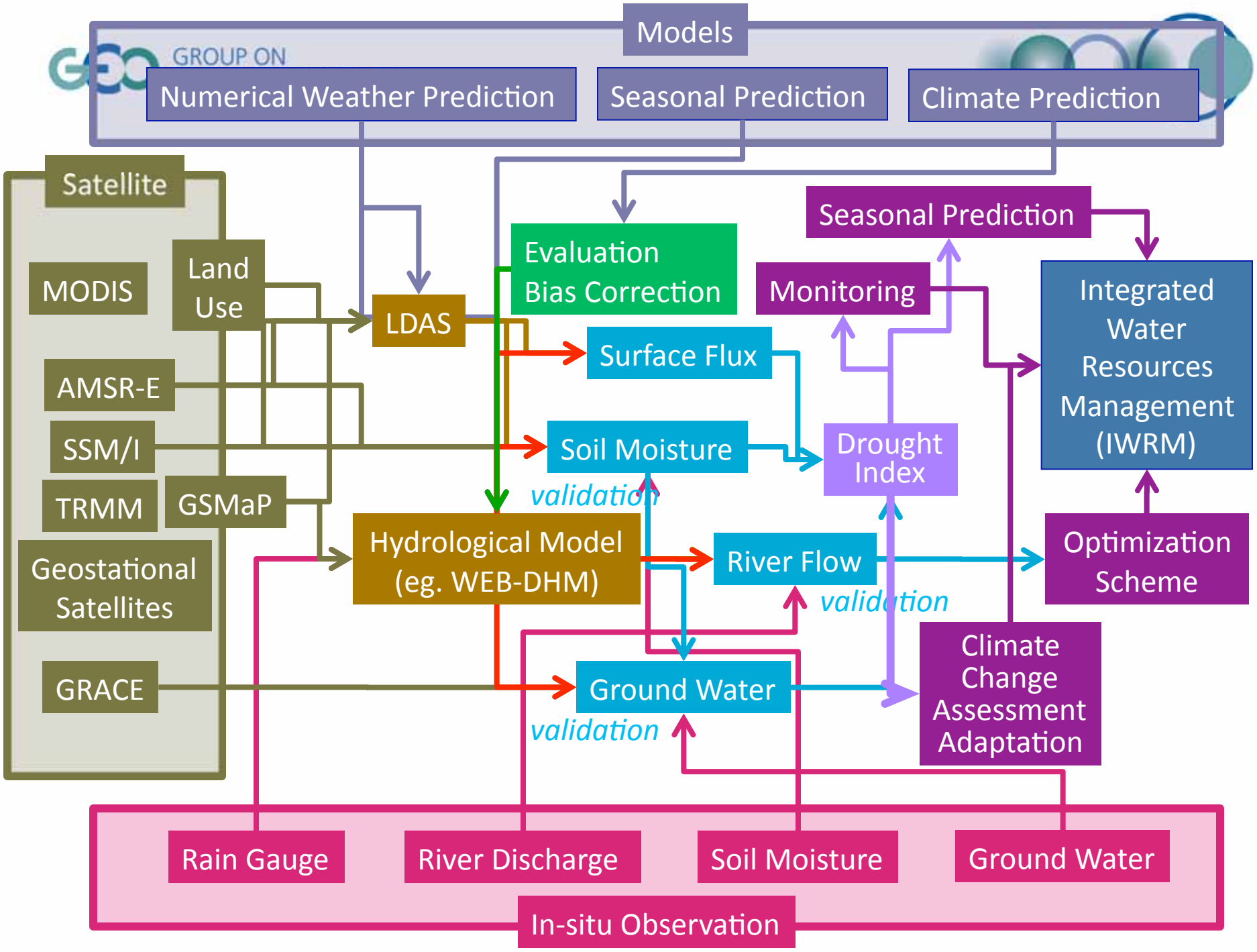
Climate

Disasters



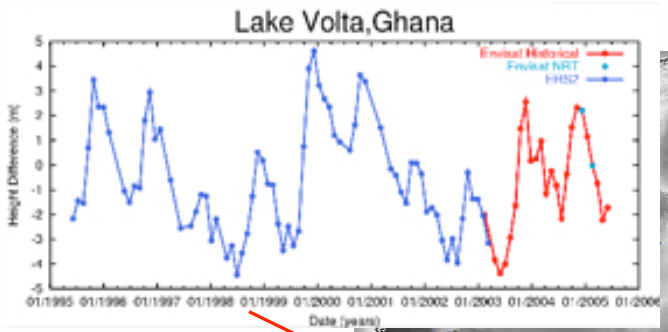
Health

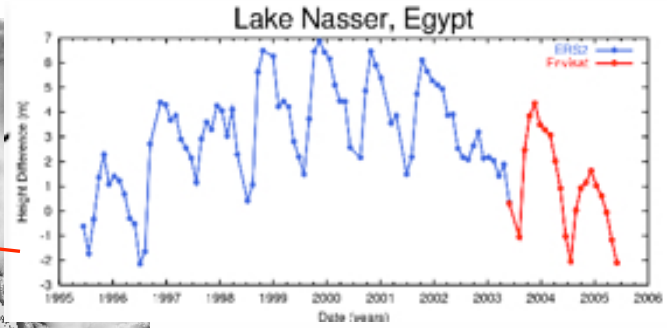
Agriculture

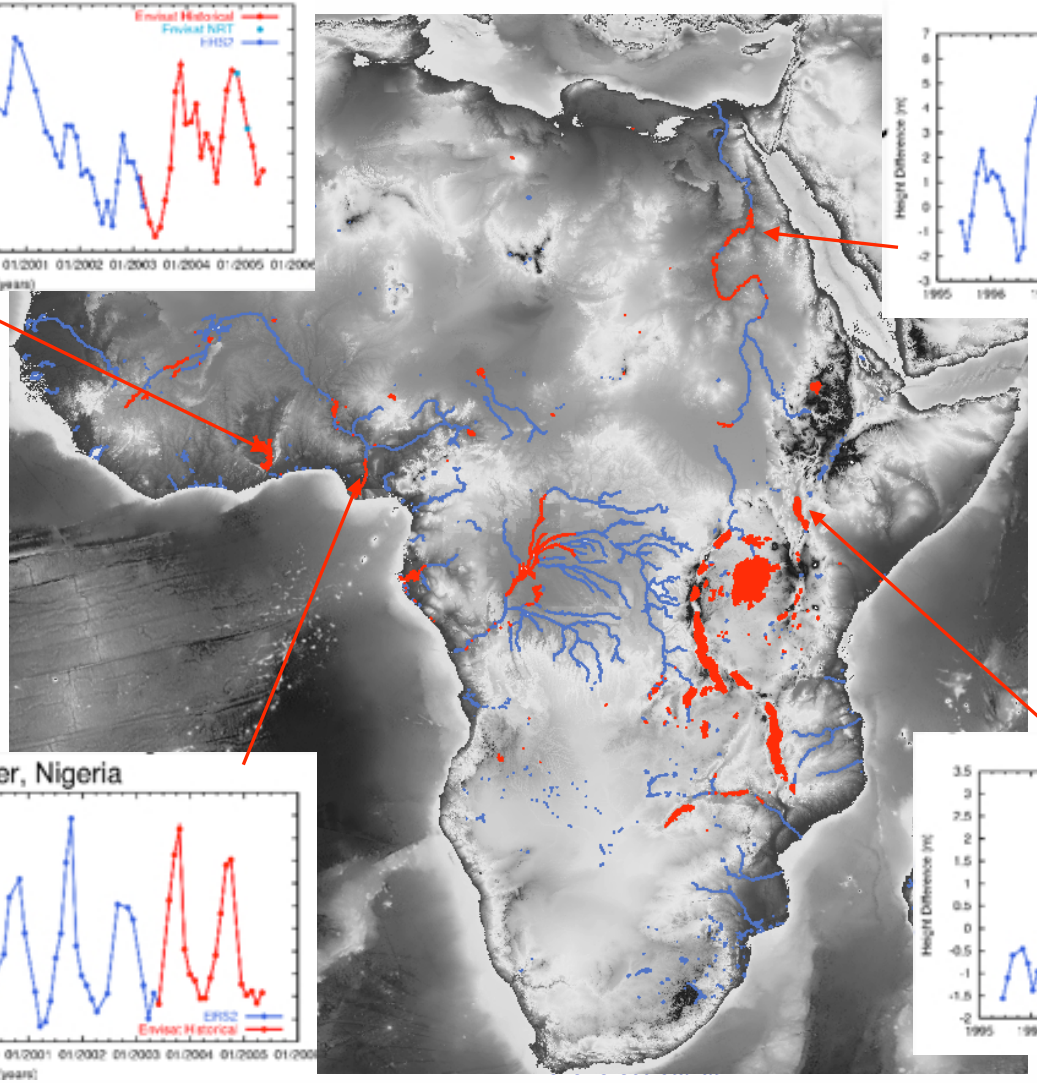

GROUP ON
Models
Numerical Weather Prediction
Seasonal Prediction
Climate Prediction
Satellite
MODIS
Land Use
AMSR-E
SSM/I
TRMM
GSMaP
Geostational Satellites
GRACE
LDAS
Evaluation Bias Correction
Surface Flux
Soil Moisture
validation
Hydrological Model (eg. WEB-DHM)
River Flow
validation
Ground Water
validation
Seasonal Prediction
Monitoring
Drought Index
Integrated Water Resources Management (IWRM)
Optimization Scheme
Climate Change Assessment Adaptation
Rain Gauge
River Discharge
Soil Moisture
Ground Water
In-situ Observation

GROUP ON EARTH OBSERVATIONS

To combine space observations...

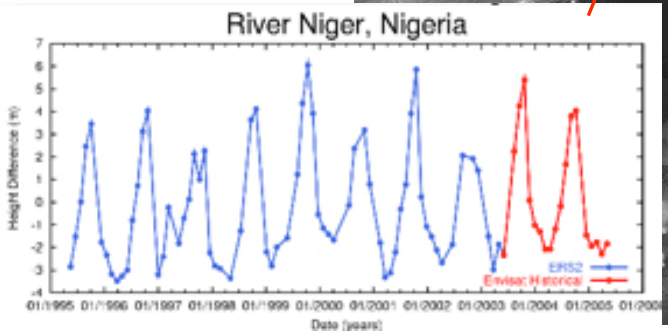


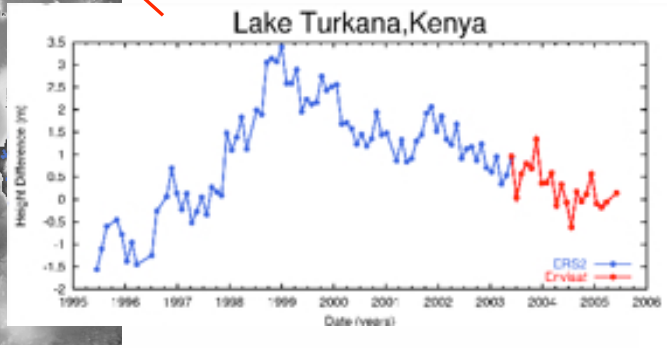




Red indicates area where NRT products are currently generated

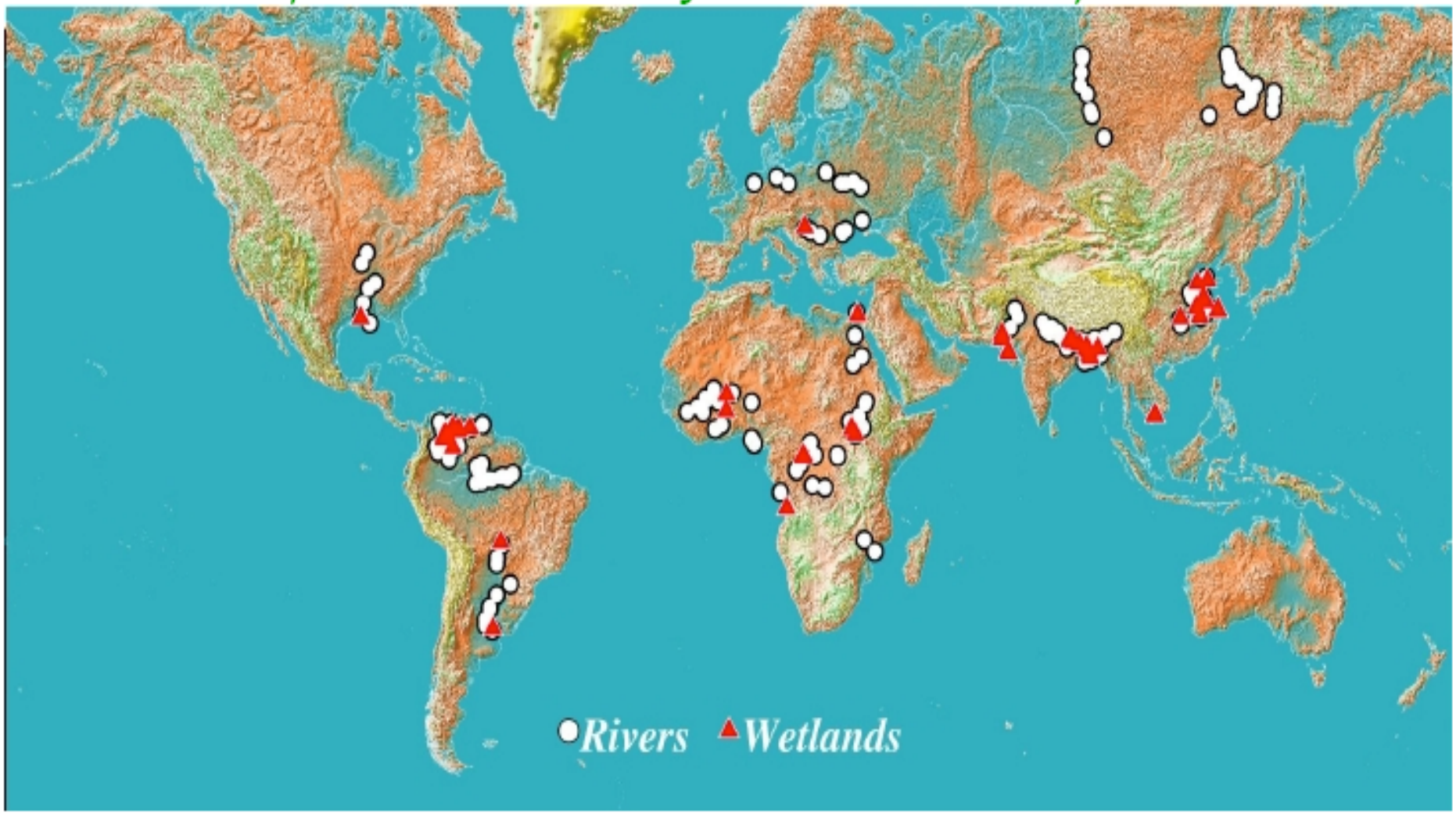
Blue indicates area where products may be generated in the future.





GROUP ON EARTH OBSERVATIONS

Map of virtual stations over large rivers and wetlands in «Hydroweb»



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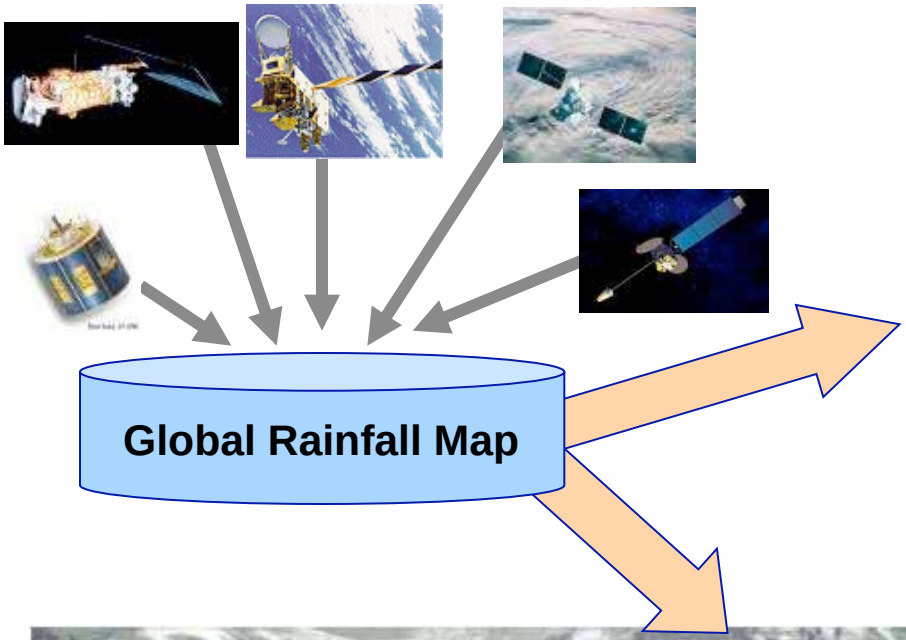
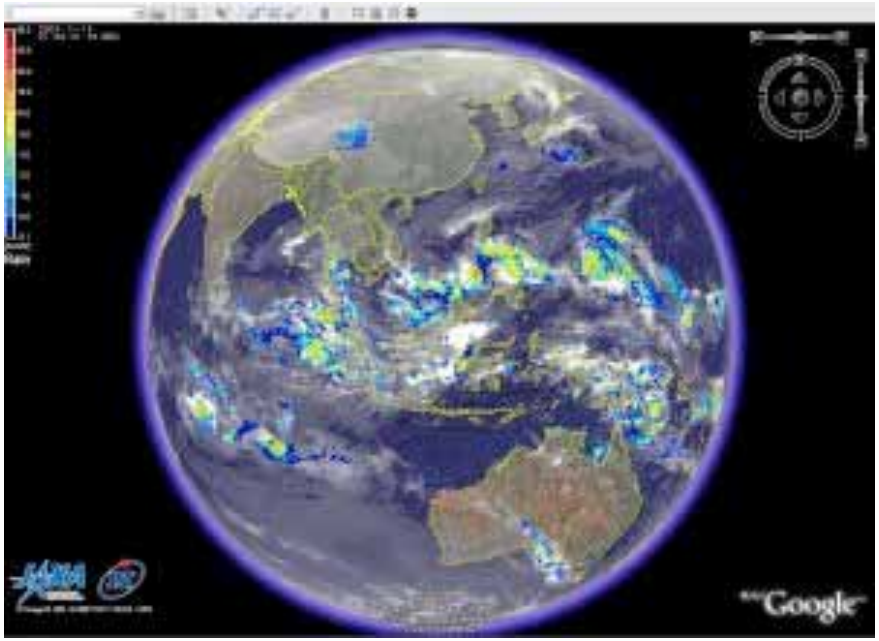
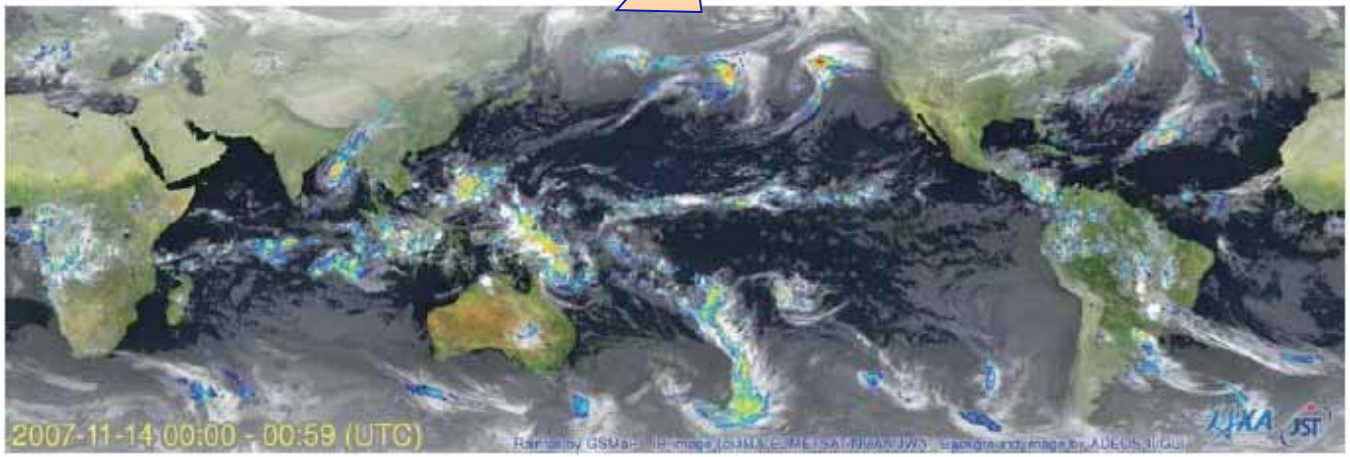
Global Rainfall Maps from Satellites







produced 4 hours after observation and updated every hour and accessible on internet as google files

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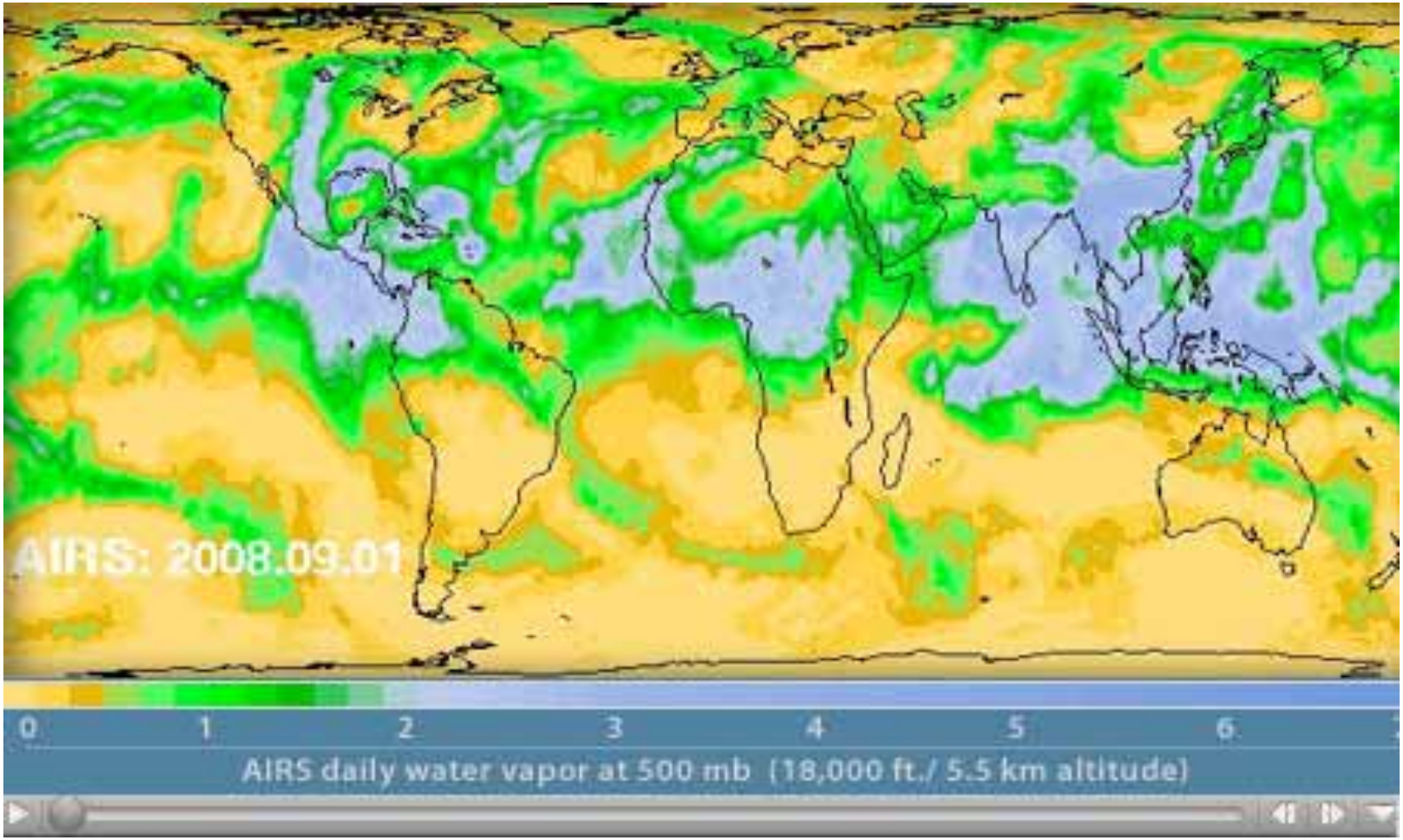
Atmospheric Water Vapor



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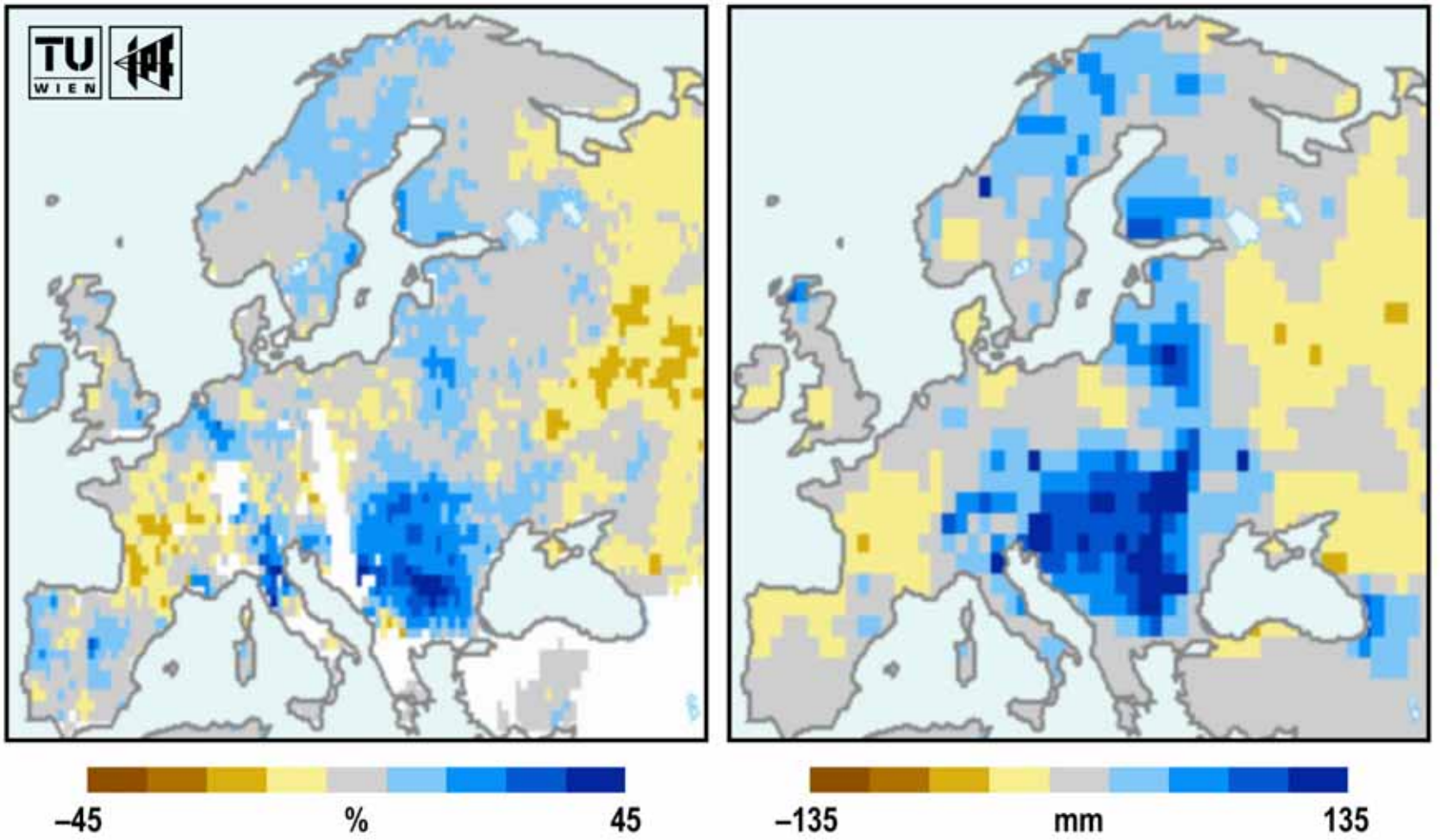
Soil moisture

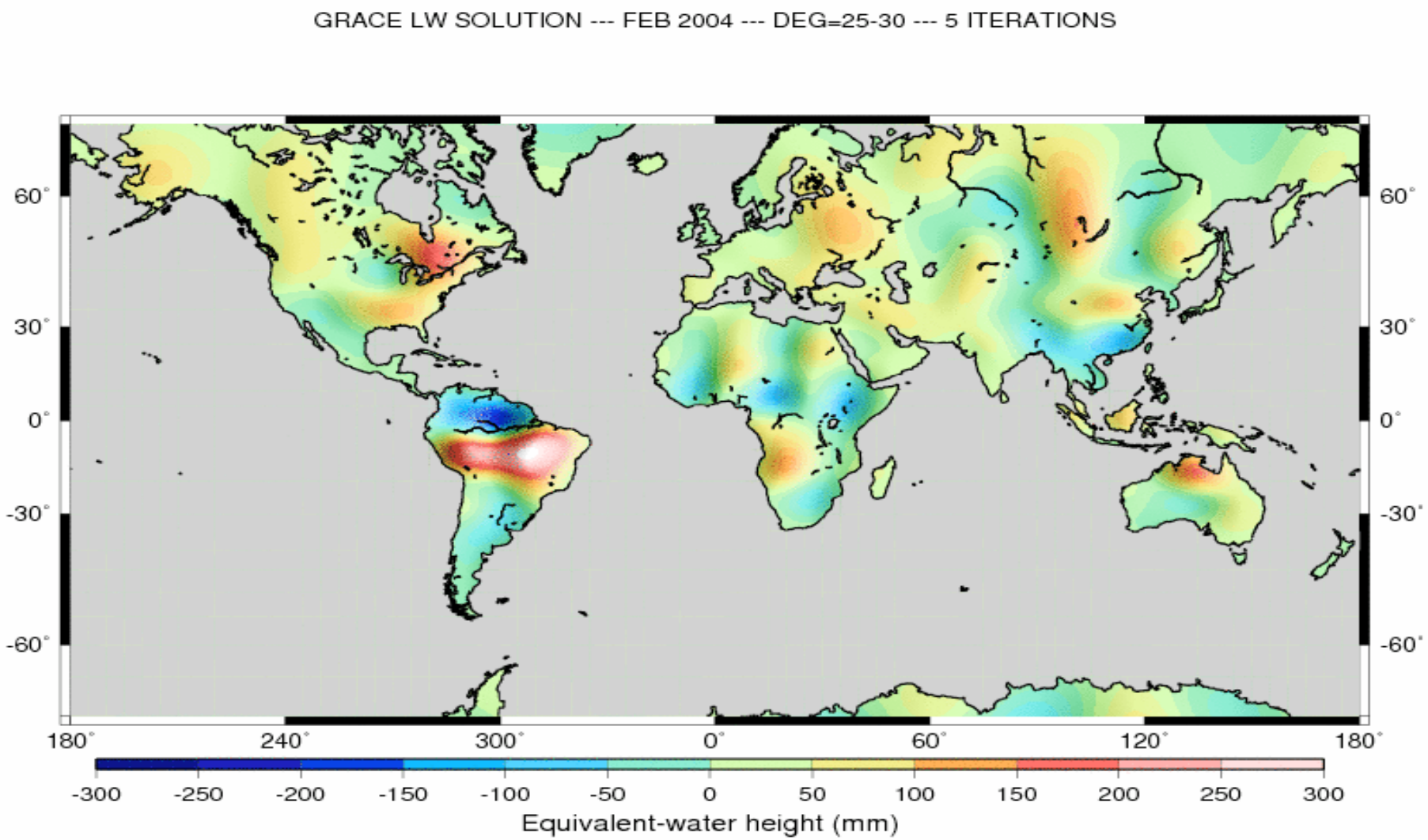


Soil moisture from ERS scatterometer

Soil moisture from SMOS

GROUP ON EARTH OBSERVATIONS

GRACE subsurface water estimates

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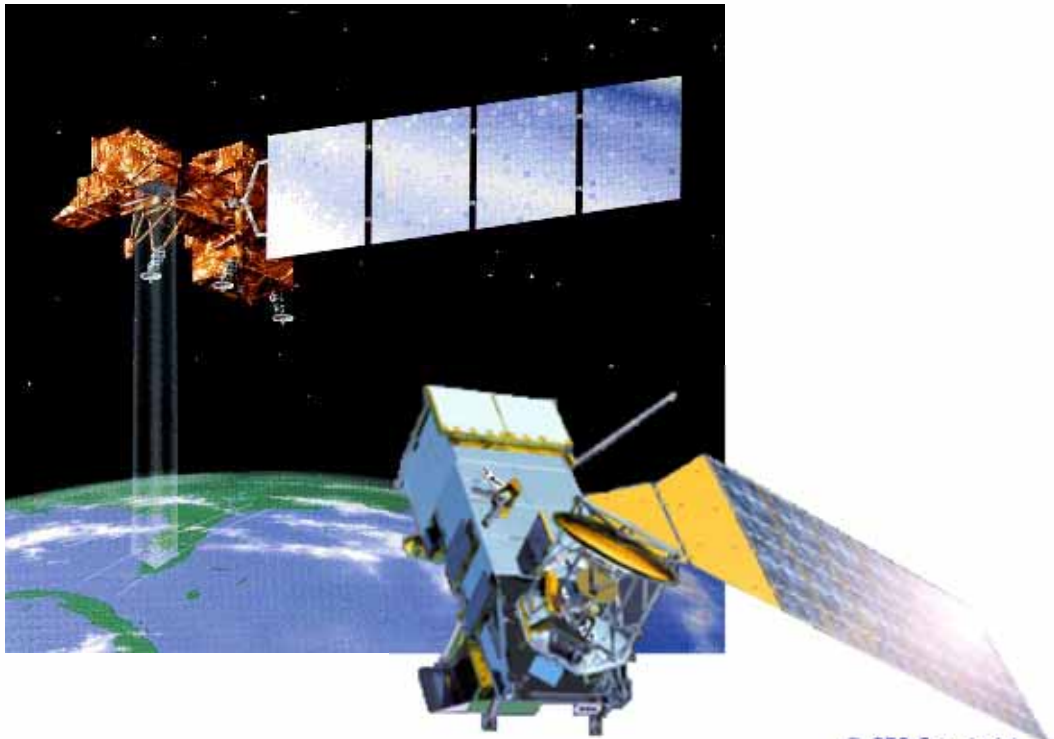
Pillar #2: Open Data Access

- Full and Open Exchange of Data, recognizing Relevant International Instruments and National Policies
- Data and Products at Minimum Time delay and Minimum Cost
- Free of Charge or minimal Cost for Research and Education

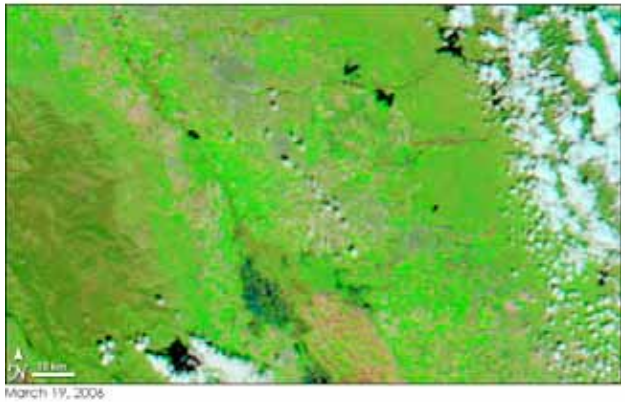
GROUP ON EARTH OBSERVATIONS

Free and Open Access to Satellite Observations



© GEO Secretariat

April 13, 2006



March 19, 2006

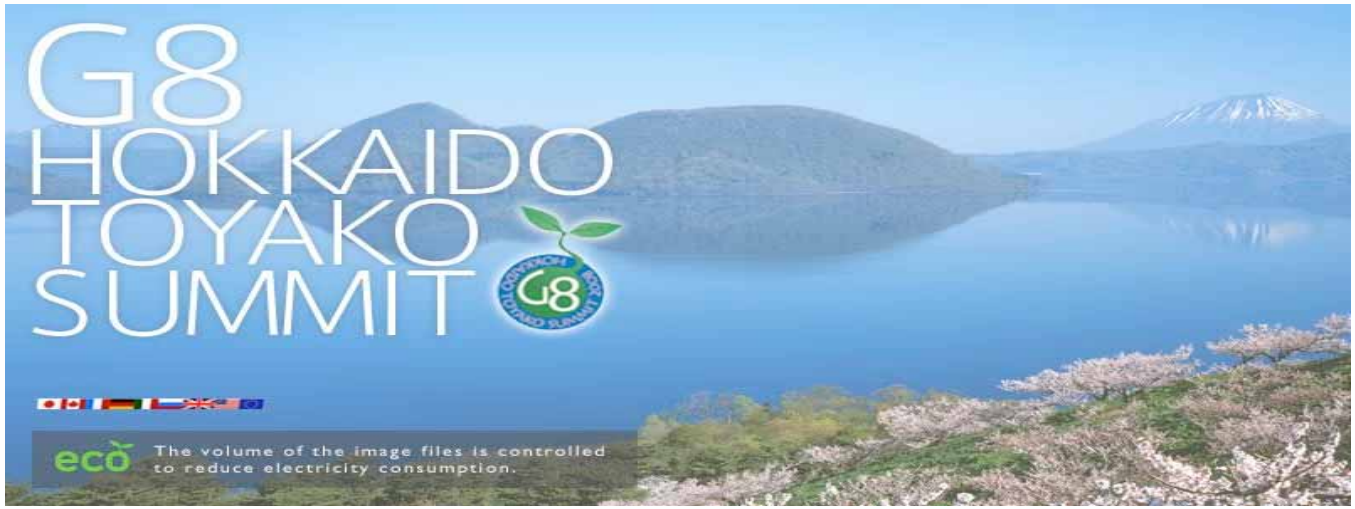
Pillar #3: Political Visibility

▲第２回地球観測サミット参加者集合写真

2nd Earth Observation Summit in Tokyo, Japan, 2004

GROUP ON EARTH OBSERVATIONS

G8-2008



"…we will accelerate efforts within the Global Earth Observation System of Systems (GEOSS), ... in priority areas, inter alia, climate change and water resources management, by strengthening observation, prediction and data sharing. ... capacity building for developing countries … interoperability and linkage …"

G20 Final Declaration

44. We commit to improve market information and transparency in order to make international markets for agricultural commodities more effective. To that end, we launched:

- The "Agricultural Market Information System" (AMIS) in Rome on September 15, 2011, to improve information on markets ...;

- The **"Global Agricultural Geo-monitoring Initiative" (GEO-GLAM)** in Geneva on September 22-23, 2011. This initiative will coordinate satellite monitoring observation systems in different regions of the world in order to enhance crop production projections and weather forecasting data.

GROUP ON
EARTH OBSERVATIONS

Featuring at RIO?!