

The Global Earth Observation System of Systems (GEOSS): Building the Link from Global to Local

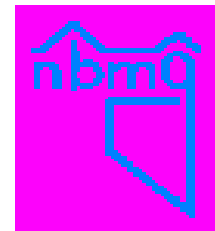
Hans-Peter Plag, Geoff Blewitt,
Bill Hammond, Corné Kreemer

Nevada Bureau of Mines and Geology and
Nevada Seismological Laboratory,
University of Nevada, Reno

with Input from Douglas Cripe, GEO Secretariat



University of Nevada, Reno
Statewide • Worldwide



The Global Earth Observation System of Systems (GEOSS): Building the Link from Global to Local

What is GEO?

What is GEOSS?

How does GEO and GEOSS Work?

The Link from Global to Local: Examples of Pilot Projects

A New Pilot Project for Low-Latency Surface Displacements

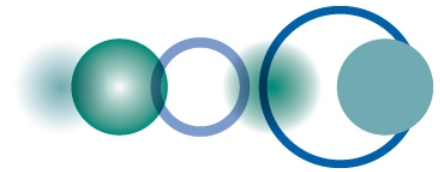
The European Example: TerraFirma



GEO, the Group on Earth Observations

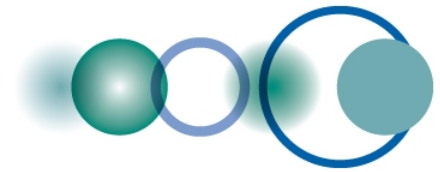
An Intergovernmental group with 82 Members and 58 Participating Organizations





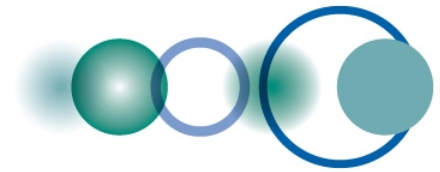
What is GEO?

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



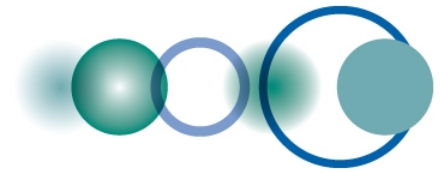
What is GEOS?

- the Global Earth Observation System of Systems
- an **integrating public infrastructure**, interconnecting a diverse, growing array of Earth observing instruments and information systems for monitoring and forecasting changes in the global environment
- supports policymakers, resource managers, science researchers and other experts to **support informed decision making for society**
- 10-year implementation plan
- 2015: Global, Coordinated, Comprehensive and Sustained System of Observing Systems



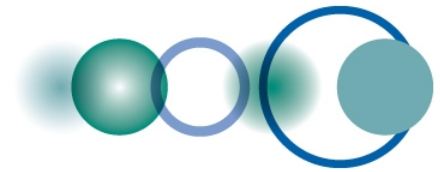
“The Global Earth Observation System of Systems (GEOSS) is a **coordinating and integrating network of Earth observing and information systems**, contributed on a voluntary basis by Members and Participating Organizations of the intergovernmental Group on Earth Observations (GEO).”

- *To support informed decision making for society, including the implementation of international environmental treaty obligations.*



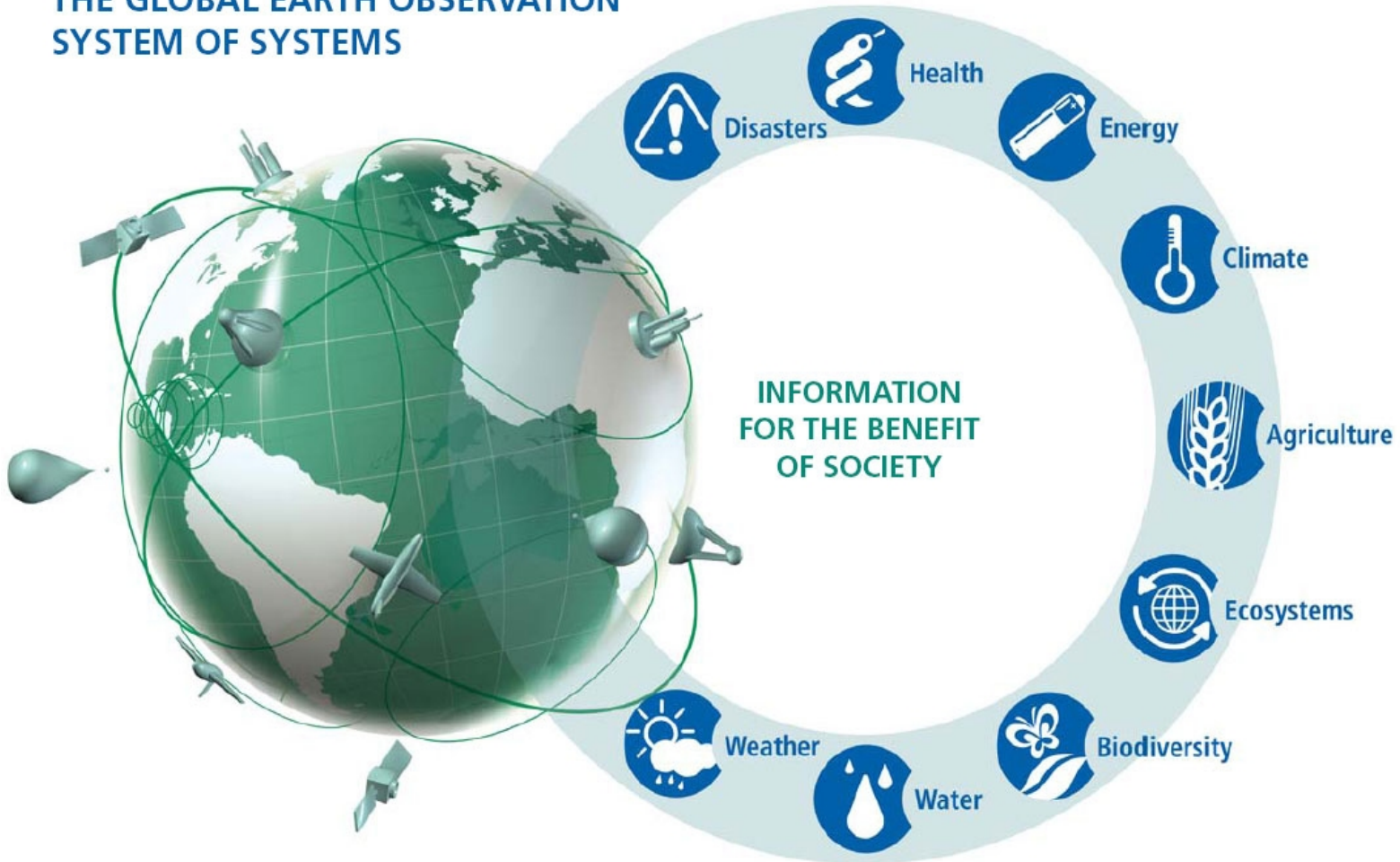
In 2004, the 2nd Ministerial Summit on Earth Observations (EOS-2) identified Nine Societal Benefit Areas (SBAs) of Earth Observations:

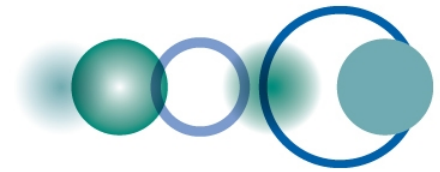
- *Disasters: Reducing loss of life and property from natural and human-induced disasters;*
- *Health: Understanding environmental factors affecting human health and well-being;*
- *Energy: Improving management of energy resources;*
- *Climate: Understanding, assessing, predicting, mitigating, and adapting to climate variability and change;*
- *Water: Improving water resource management through better understanding of the water cycle;*
- *Weather: Improving weather information, forecasting, and warning;*
- *Ecosystems: Improving the management and protection of terrestrial, coastal, and marine ecosystems;*
- *Agriculture: Supporting sustainable agriculture and combating desertification;*
- *Biodiversity: Understanding, monitoring, and conserving biodiversity.*



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

THE GLOBAL EARTH OBSERVATION
SYSTEM OF SYSTEMS



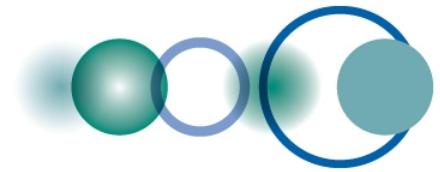


GEOSS: main objectives

- Improve and Coordinate Observation Systems (avoid duplications)
- Provide Easier & More Open Data Access
- Foster Use (Science, Applications)
- Building Capacity
- Identify gaps in observations (based on user requirements)

...Earth Observation Systems should be coordinated and shared internationally

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



How do GEO and GEOSS Work?

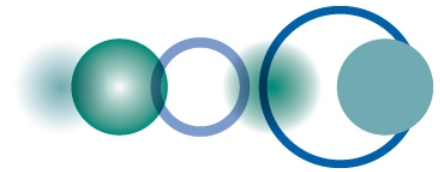
- 10-Year Implementation Plan 2005-2015, prepared by ad hoc GEO and endorsed by 3rd Ministerial Summit on Earth Observations
- Strategic Targets for each of the SBAs
- GEO Work Plan with several Tasks in each SBA, and Tasks in User Engagement, Architecture, Science&Technology, Capacity Building, Data Management; implemented by Task Teams based on voluntary contributions
- Four GEO Committees: User Interface (UIC), Architecture and Data (ADC), Science&Technology (STC), Capacity Building (CB)
- Executive Committee
- GEO Plenary meets annually, decides on Work Plan, provides guidance
- Ministerial Summit every three years assesses progress & achievements and decides on support
- **Links to users and supporters in Communities of Practice**



Community of Practice

“A group of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.” *Etienne Wenger*

- **Domain**
- **Community**
- **Practice**



*Our mission:
Empowering integrated coastal zone management
through Earth observations ...*

[Disclaimer](#)
[Citation](#)

Coastal zones are areas of particular ecological, social, and economic value where many conflicting interests need to be resolved in order to ensure a sustainable development of this highly complex environment. Humanity has always shown a special interest in the coastal zone and a large fraction of the human population traditionally settles in or close to the coastal zone. Recent increases in coastal urban population and changes in land-use practices have led to rapid and large changes in sediment supplies and increases in nutrient, pollutant and pathogen loadings to coastal waters. Climate-induced changes in sea level are likely to increase the risk of inundation in many parts of the coastal zone. The on-going and anticipated changes pose serious risks to human health and the capacity of ecosystems to support



The IGOS-P Coastal Zone Theme Report: The Theme Report provides the basis for the work of the GEO Coastal Zone Community of Practice.

If you are new to the CZCP and are considering to join, start by reading the Theme Report ...

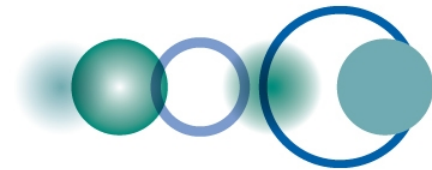
More about the CZCP, who we are, what we do, and why we do it, is available [here](#).

If you have questions, want to express your interest, become a member/contributor, or have relevant information, please go to "[You & the CZCP](#)" or contact the [Co-Chairs](#).

Coastal Zone Community of Practice (CZCP)
Our mission: empowering integrated coastal zone management through Earth Observations...

in the frequency of extreme weather.

members will meet on June 9, 2010 to work out details of a work plan for the next two to three years. This one-day meeting will take place in the broader U.S. East Coast area, with the exact location still to be determined. More information will be made available on the



The GeoHazards Community of Practice (GHCP)

About these pages ...

- Introduction
- About GHCP
- GHCP and GEO
- News
- Projects
- Products
- Library
- Meetings
- Workshops
- Internal

[Geohazards CoP at BRGM](#)

Increasing resilience:
- Disaster roundtable of NAS

Eyjafjallajökull Eruption:
- Wiki on Ash Cloud

Northern Mexico (Baja) earthquake 2010:
- NYT: In California, Louder Calls to Prepare for Quakes
- USGS Page
- Baja SuperSite



Geohazards: A challenge to Society

In many regions, geohazards are a major threat to society, costing lives, disrupting infrastructure and destroying livelihoods. Understanding the associated processes

The Geohazards Community of Practice for GEO

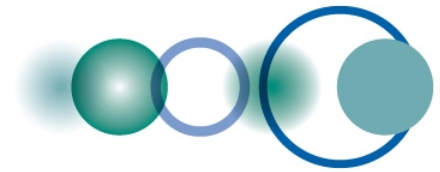
Over the past few years, initial steps have been taken by members of the former IGOS Geohazards Theme Team to make progress towards a Geohazards Community of Practice (GHCP) for GEO. This has been seen in successful initiatives like Super Sites and through a number of GEO Tasks, in the Disasters SBA, in other SBAs and in cross-cutting tasks like the Global Datasets Task. In order to support and build on this progress, a comprehensive review of the

The Draft [Roadmap](#) of the GHCP ...

Our Strategic Target

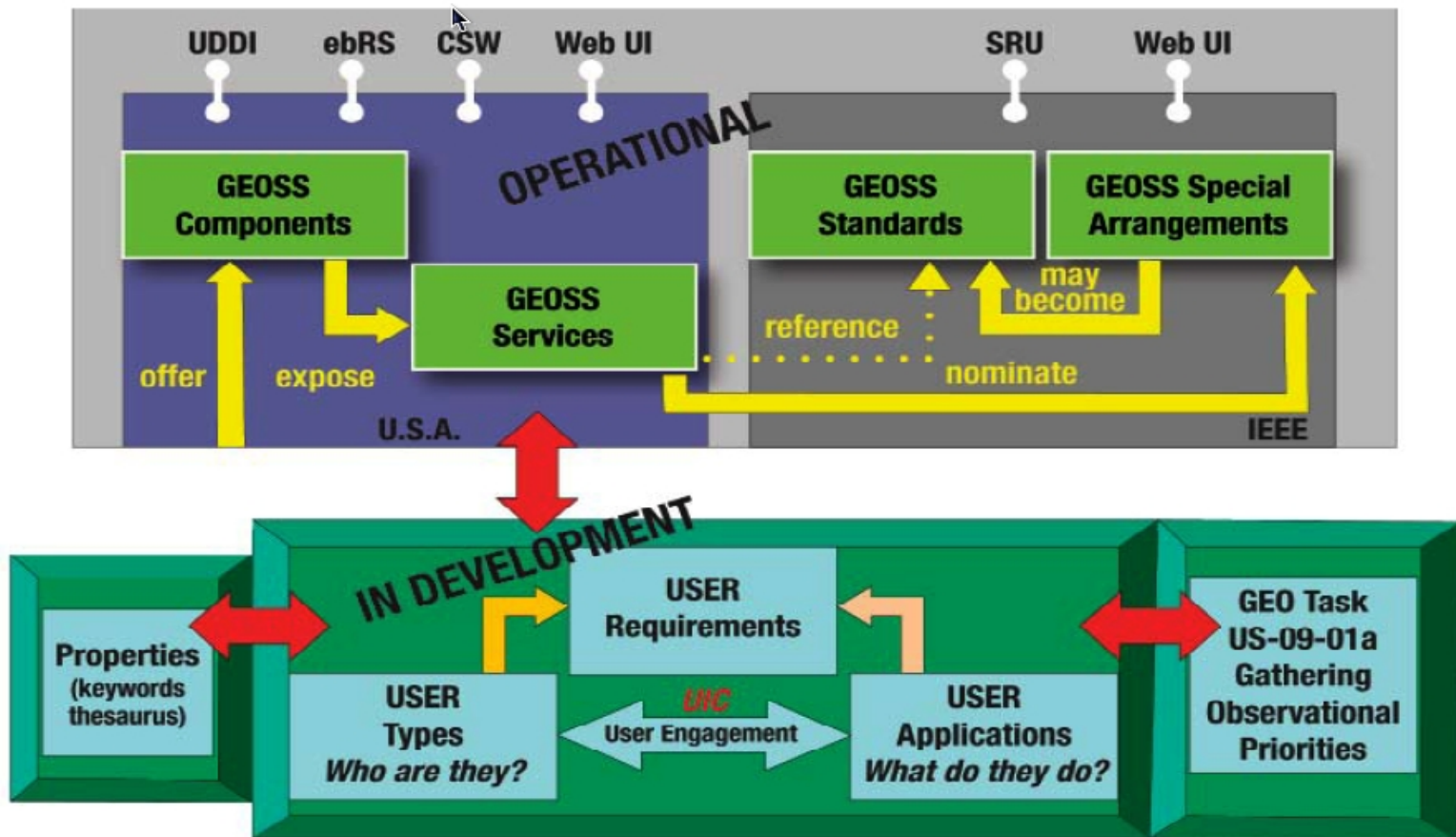
By 2020 put in place all building blocks for comprehensive monitoring of geohazards and the provision of timely information on spatio-temporal characteristics, risks, and occurrence of geohazards, in support of all phases of the risk management cycle (mitigation and preparedness, early warning, response, and recovery), and as a basis for increased resilience and disaster reduction.

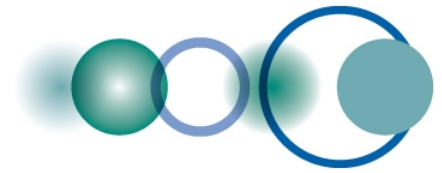
**Geohazards Community of Practice (GHCP)
Supporting all phases of the risk management cycle
through Earth Observations...**



Implementation of GEOSS

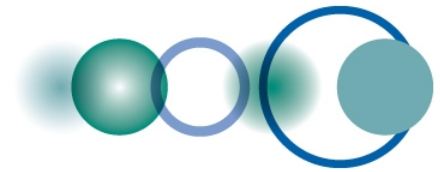
- Build a GEOSS Common Infrastructure: Registries and Portals for access to data and services





Implementation of GEOSS

- Build a GEOSS Common Infrastructure: Registries and Portals for access to data and services
- GEOSS is user-driven: Effort to establish a User Requirement Registry
- GEO Portal give access to data and services



GEO Portal

- **Provides web-based interface for searching and accessing the data, information, imagery, services and applications available through GEOSS.**
- **Connects users to data bases, services and portals that provide reliable, up-to-date, integrated and user-friendly information – vital for the work of decision-makers, managers and other users of Earth observations.**



GEO Portal



- HOME
- ABOUT GEOPORTAL
- SEARCH GEOSS
- MAP VIEWER
- CONTACTS

GEO Portals Usability Survey

BROWSE RESOURCES BY SOCIETAL BENEFIT AREAS

- DISASTERS
- HEALTH
- ENERGY
- CLIMATE
- WATER
- WEATHER
- ECOSYSTEMS
- AGRICULTURE
- BIODIVERSITY

CAPACITY BUILDING



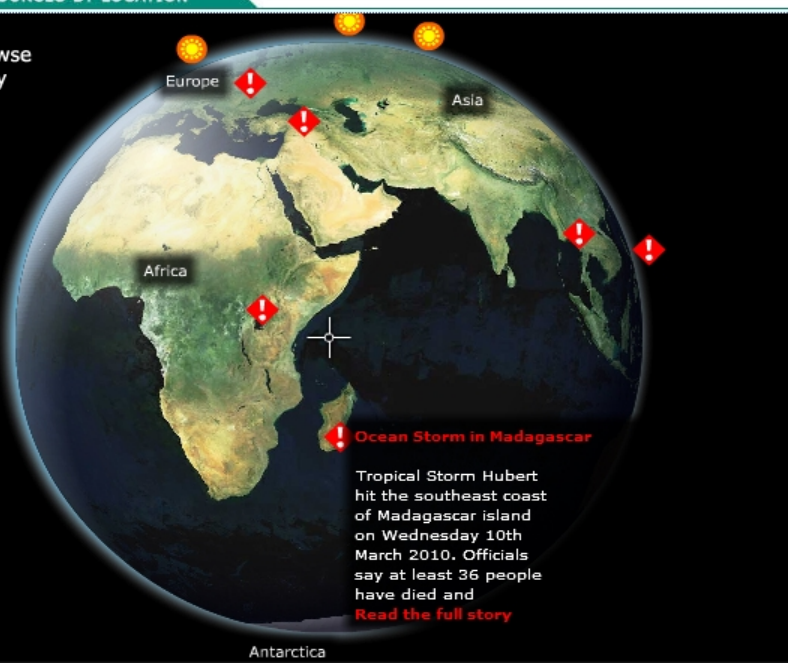
GEOSS Resources for Haiti Earthquake

WELCOME TO GEOPORTAL

The GEOportal provides an entry point to access remote sensing, geospatial static and in-situ data, information and services. [More ...](#)

BROWSE RESOURCES BY LOCATION

Click to browse resources by location



Ocean Storm in Madagascar
Tropical Storm Hubert hit the southeast coast of Madagascar island on Wednesday 10th March 2010. Officials say at least 36 people have died and [Read the full story](#)

zoom -

GEONETCAST

GEOSS Common Infrastructure (GCI)

About GCI

REGISTER YOUR RESOURCES

Standards and Interoperability Registry

[More about Registry System](#)

Best practices wiki

GEO SECRETARIAT

News

GEOSS AUGMENTATION

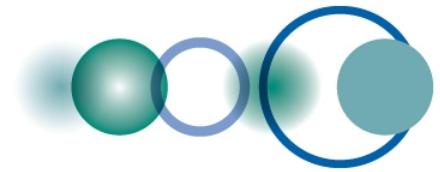
Develop and Test your Services and Processing Components

AIP-3

GEOSS Clearinghouses Test Area

BREAKING NEWS

EO NEWS



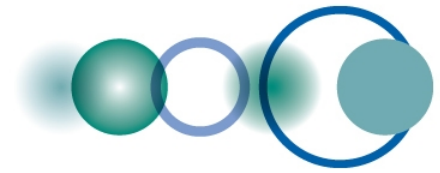
Implementation of GEOSS

- Build a GEOSS Common Infrastructure: Registries and Portals for access to data and services
- GEOSS is user-driven: Effort to establish a User Requirement Registry
- GEO Portal give access to data and services
- Much of the Implementation of services happens through Pilots
- GEO Task AR-09-01b “Architecture Implementation Pilot” (AIP):
Develop and pilot new process and infrastructure components for the GEOSS Common Infrastructure (GCI) and the broader GEOSS architecture



Examples of SBA-Related Work Plan Tasks

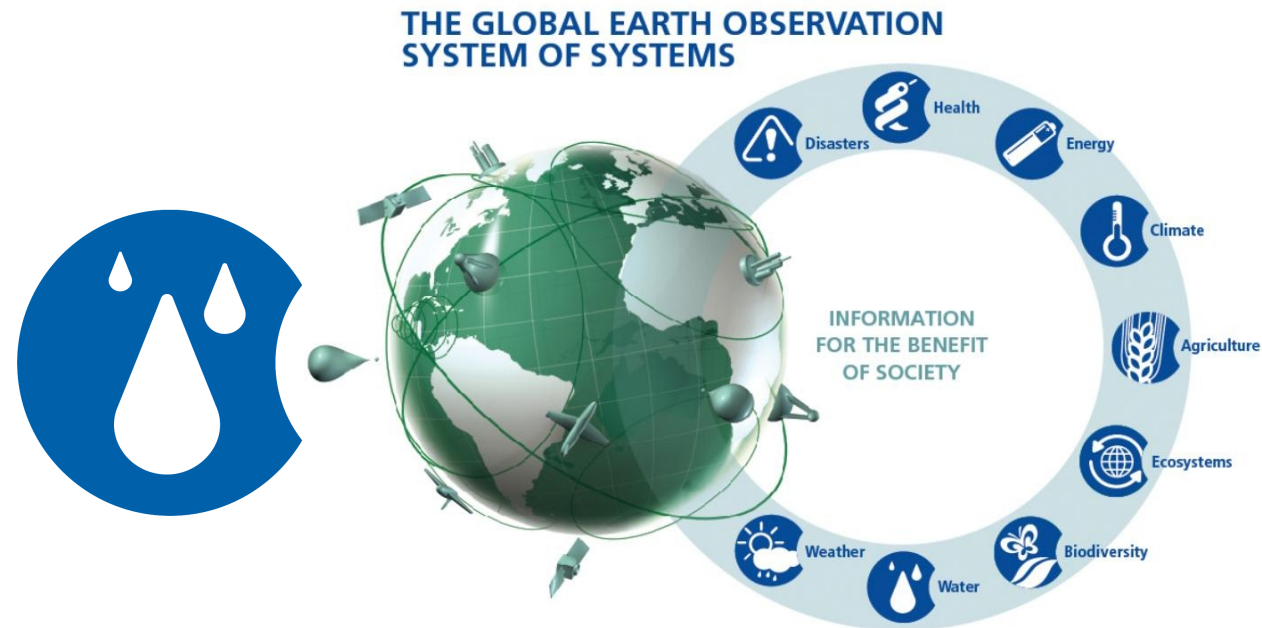
- Water
- Disasters

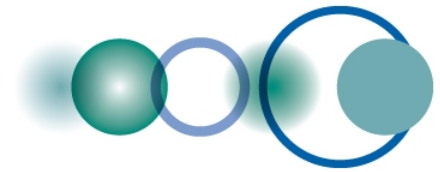


Strategic Target Water

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.





GEO Water Tasks

- **Droughts, Floods and Water Resource Management**
 - Address decision-making challenges related to the management of hydro-meteorological extremes and the sustainable use of water.
- **Capacity Building for Water Resource Management**
 - Initiate capacity building programs in support of water management, to show the value of, and develop tools for, Earth observation data.
- **Integrated Products for Water Resource Management and Research**
 - Improvements and expansion of in-situ networks, combined with new satellite missions and emerging assimilation and prediction capabilities for integrated tools in global water-cycle management.

Main Menu

- Home
- EU Floods Directive
- Ongoing floods
- National flood information
- EFAS Flood forecasts
 - EFAS real-time forecasts
- Current news on floods
- Climate change impact assessment
- Flood risk
- Land use modeling and

Select layers

Select the date
2010-02-28 12

Background layers

- Country Borders
- Urban Areas
- Major Rivers

General layers

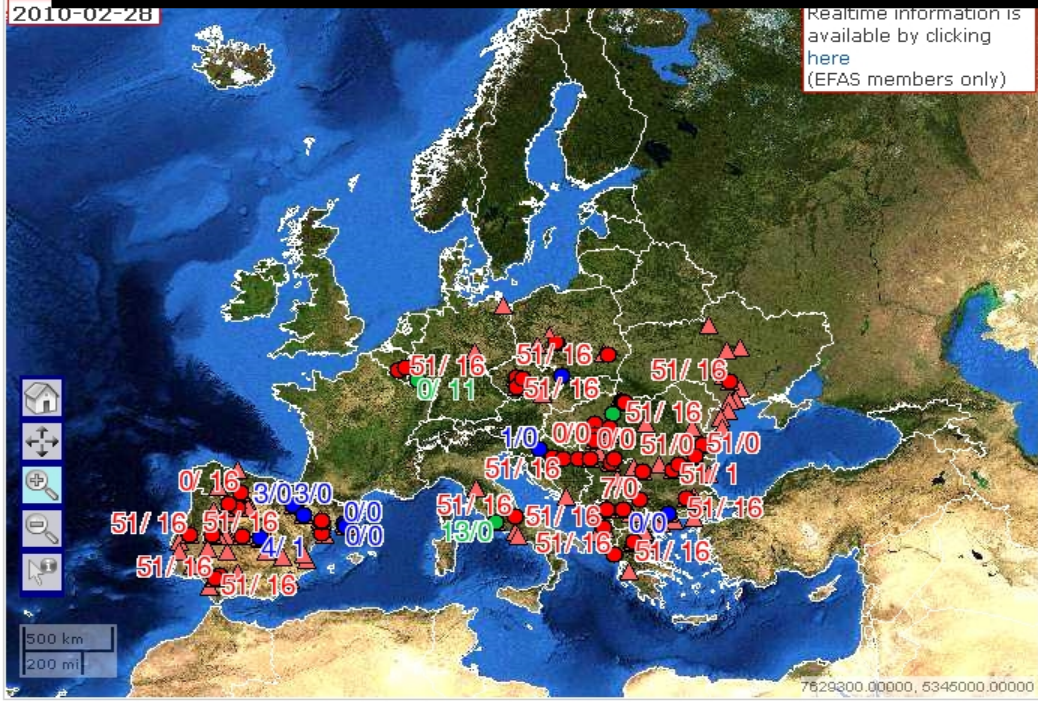
- Reporting Points (triangles)
- Reporting Points (circles)
- Flood Probability > 48h
- Flood Probability < 48h
- EUE probRgt50

Expert layers

EFAS Flood forecasts

European Flood Alert System (EFAS) provides

- up to 10-day flood forecasts (input from ECMWF)



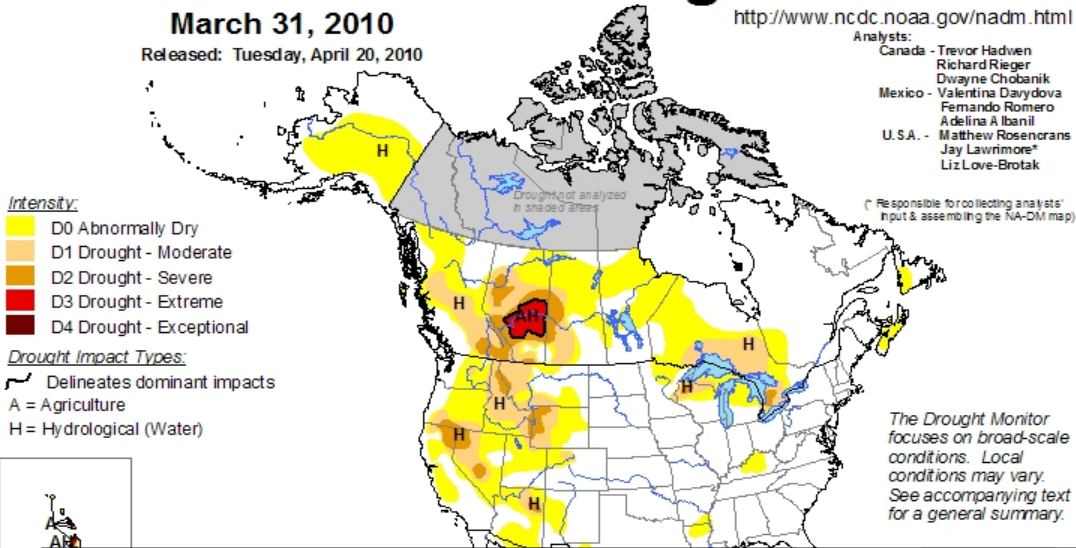
Contact person: Jutta Thielen

North American Drought Monitor

March 31, 2010

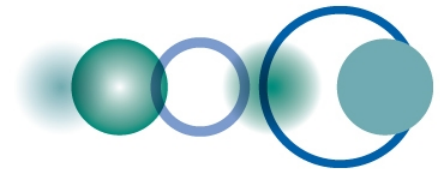
Released: Tuesday, April 20, 2010

<http://www.ncdc.noaa.gov/nadm.html>



North American Drought Monitor (NADM)

- international cooperation between Canada, US, Mexico in the framework of GEO for on-going continental drought monitoring.
- could serve as model for Global drought early warning system (GDEWS), based on Standardized Precipitation Index (SPI) as recommended by WMO.

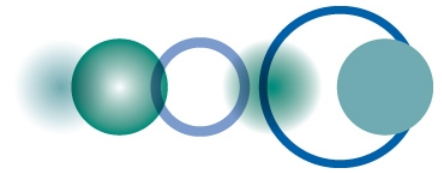


Strategic Target Disasters

Before 2015, GEO aims to:

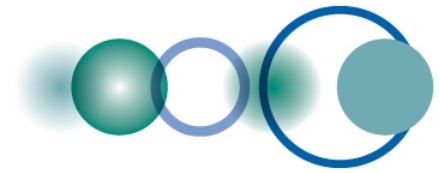
Enable the global coordination of observing and information systems to support all phases of the risk management cycle associated with hazards (mitigation and preparedness, early warning, response, and recovery).





Pieces of the Puzzle

- **Earth observation of hazards and disasters**
- **Modeling of processes that lead to hazards**
- **Development of tools that support the risk management cycle, based on geo-information and Earth observations**



GEO Disaster Tasks

DI-06-09 Use of Satellites for Risk Management

- Define and facilitate implementation of satellite constellations for risk management from a multi-hazard perspective

DI-09-01 Systematic Monitoring for Geohazards Risk Assessment

- Define and implement a unified and integrated approach to geohazards risk assessment.

DI-09-02 Multi-Risk Management and Regional Applications

- Define and implement an integrated approach to all phases of disaster management.

DI-09-03 Warning Systems for Disasters

- Support the development, improvement and coordination of early warning systems for natural disasters.

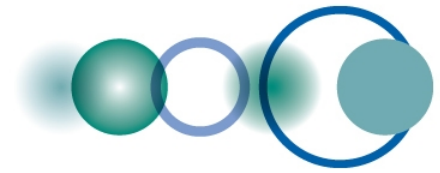


A Global Early Warning System for Wildland Fire

Disasters Task 101-09-3b

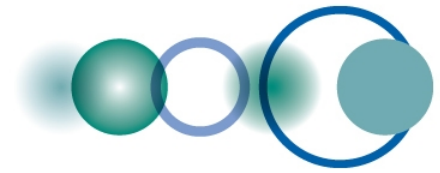


Bill de Groot, *Canadian Forest Service*
Johann Goldammer, *Global Fire Monitoring Centre, University of Freiburg*
Tim Lynham, *Canadian Forest Service*
Ivan Csizsar, *National Oceanic and Atmospheric Administration*
Chris Justice, *University of Maryland*
Jesus San-Miguel Ayanz, *Joint Research Center*



Objectives of DI-09-02B “Regional End-to-End Demonstrations” Pilots

- To **demonstrate the effectiveness** of satellite imagery to strengthen regional, national and community level capacity for mitigation, management and coordinated response to natural hazards
- To **identify specific satellite-based products** that can be used for disaster mitigation and response on a regional level
- To **identify capacity building activities** that will increase the ability of the region to integrate satellite-based information into disaster management initiatives



List of Pilots in DI-09-02B:

- **Project 1: Sensor Web Satellite-based Flood Prediction and Warning** – Caribbean-wide

Project leads: NASA and CIMH

- **Project 2: Coastal Erosion Monitoring and Coastal Decision Support Tool**

Project leads: Grenada and CSA

- **Project 3: Urban Flood Mitigation** (focus on high resolution issues in urban context)

Project leads: BVI and Italy (TBC)

- **Project 4: Flood Vulnerability Mapping** (with risk assessment focus)

Project leads: Jamaica and ESA

- **Project 5: Ecosystem Monitoring** for Flooding and Landslides (focus on **sensitive areas** and landslide prediction)

Project leads: Barbados and NASA/CATHALAC

- **Project 6: Integration of Satellite Data into Local Operational Flood Warning and Response Systems**

Project leads: CDEMA and NASA



SUPERSITES



main

documents

apply for access

collaborators

links

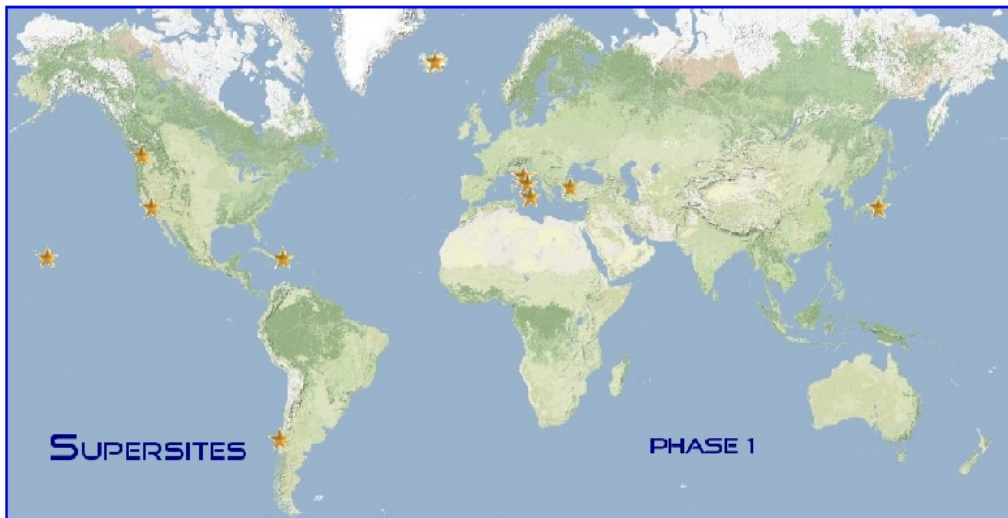
contact

Welcome to the Supersite Website

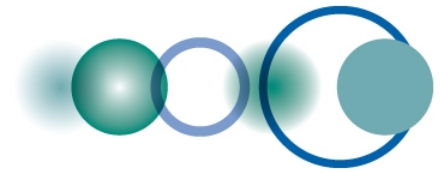
The Supersites have data for the study of natural hazards in geologically active regions, including information from Synthetic Aperture Radar (SAR), GPS crustal deformation measurements, and earthquakes. The data are provided in the spirit of GEO, ESA, NASA and the National Science Foundation (NSF), that easy access to Earth science data will promote their use and advance scientific research, ultimately leading to reduced loss of life from natural hazards.

Click on a site in the map below, or see the regions listed below in Phase 1 and Phase 2 Supersites.

This website is a prototype created by [UNAVCO](#) and [WinSAR](#) on behalf of the Group on Earth Observations ([GEO](#)) and the European Space Agency ([ESA](#)). The web site will attain an official design and move to a permanent home once a host is selected.



- Hawaii
- Los Angeles
- Seattle-Vancouver
- Vesuvius
- Etna
- Istanbul
- Tokyo
- Chile



Applications Places System hpplag@challe... GEO's Chile Ev... [https://10.10... Thu Mar 25, 12:41 AM

GEO's Chile Event Supersite Website - SeaMonkey

File Edit View Go Bookmarks Tools Window Help

Back Forward Reload Stop http://supersites.unavco.org/chile.php Search Print

Home Bookmarks



SUPERSITES

CHILE

Welcome to GEO's Chile Event Supersite Website



Sections

[SAR](#), [Topography](#), [Visible](#), [GPS](#), [Surface Deformation](#), [Earthquakes](#), [Links](#)

New on Tuesday Mar 23: [High Rate GPS time series](#)
 New on Friday Mar 19: [Envisat interferogram](#) [more ALOS data](#) [GPS coseismic model](#) [NEST-DORIS PALSAR interferograms](#) [GMTSAR PALSAR interferograms](#)

New on Tuesday Mar 16: [rupture properties](#)
 New on Friday Mar 12: [Updated aftershocks](#) [M 6.9 aftershock link](#) [AIST damage map](#)
[tsunami link](#) [IPGP Tsunami study](#)

New on Thursday Mar 11: [ALOS data](#)
 New on Wednesday Mar 10: [Tsunami report](#)
 New on Tuesday Mar 09: [GPS coseismic displacement](#)
 New on Monday Mar 08: [New Envisat data](#) [UCSD Palsar interferogram](#)
 New on Saturday Mar 06: [damage map](#)
 New on Friday Mar 05: [GSI PALSAR interferogram](#) [GFZ rupture movie](#)
 New on Thursday Mar 04: [ALOS PALSAR requests](#) [Stress Transfer](#)
 New on Wednesday Mar 03: [IPGP seismic context](#) [Envisat archive data](#)
[Surface displacement](#)

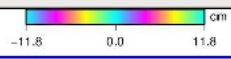
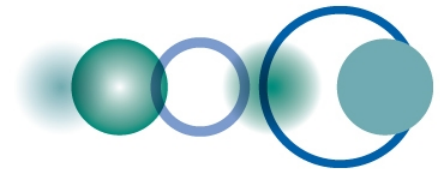
New on Monday Mar 01: [USGS source map](#)
 New on Sunday Feb 28: [shake map](#) [coherence map](#) [aftershocks](#)



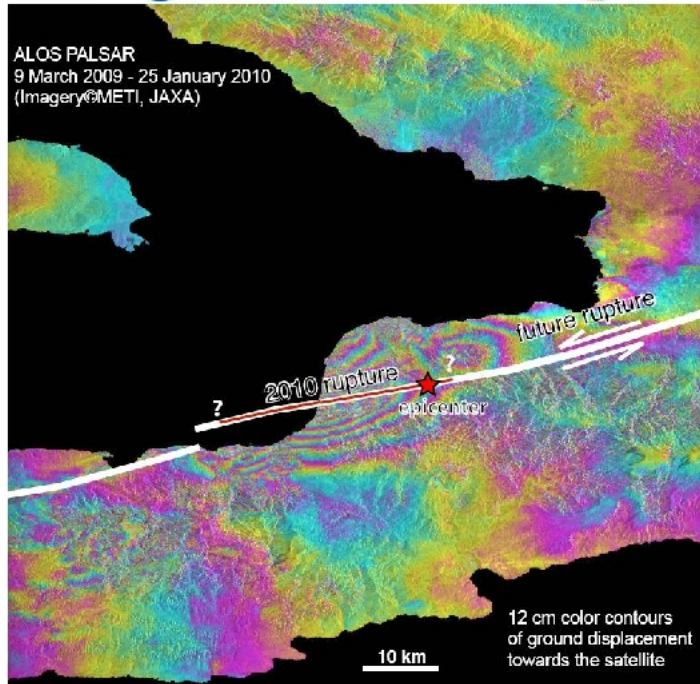
Earthquake, 27 February 2010 06:35 UTC. Latitude 35.846°S. Longitude 72.719°W. 8.0. Depth 35 km (USGS).

Waiting for supersites.unavco.org...

- main
- documents
- apply for access
- collaborators
- links
- contact
- Hawaii
- Los Angeles
- Seattle-Vancouver
- Vesuvius
- Etna
- Istanbul

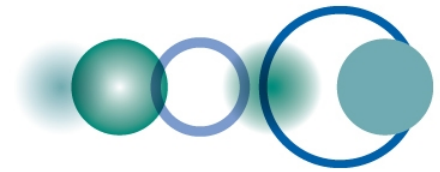


Falk Amelung's group at the University of Miami has made a new PALSAR interferogram:



Sang-Hoon Hong, Falk Amelung, Tim Dixon, Shimon Wdowinski, Guoqing Lin, Fernando Greene
Rosenstiel School of Marine & Atmospheric Science, University of Miami

The rupture length shown above has been inferred by preliminary modelling. We expect to obtain better constraints on the rupture length from the ascending interferogram expected for February 14.



A new pilot around a service for low-latency surface displacements

What could we do if we had surface displacements available with low latency?

- assess geohazards potential
- monitor geohazards
- “early warnings”
- support groundwater management
- geothermal energy potential and management
- stability of infrastructure
- identify anomalous events/trends
- ...



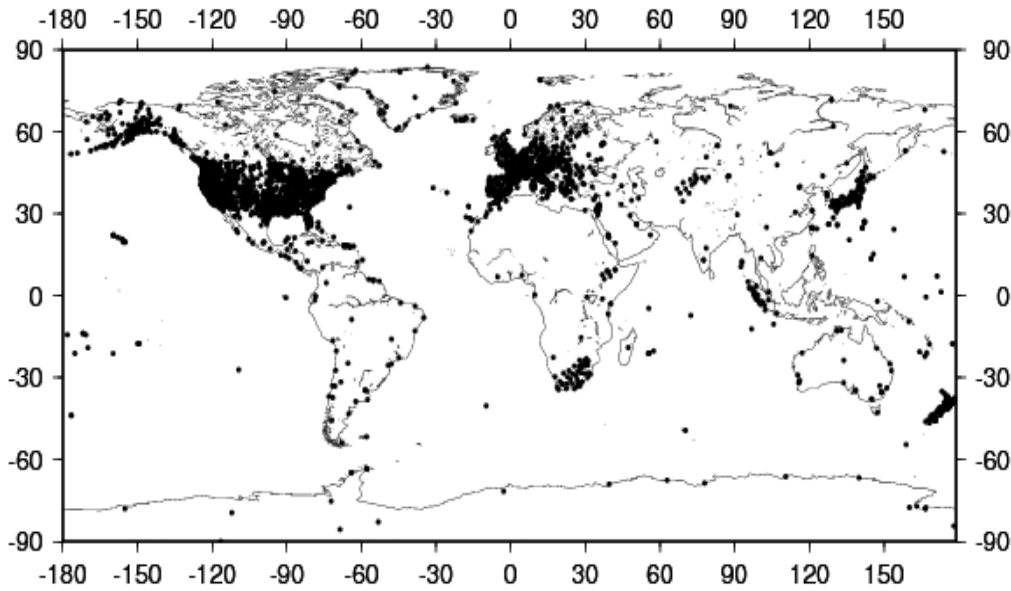
A new pilot around a service for low-latency surface displacements

- Service would provide continuous information on surface displacements with low latency
- What are the requirements?
 - latency: 1 hour, days, months ...?
 - spatial sampling: points, spatial grid?
 - spatial resolution: m, km, ...?
 - temporal resolution: hours, days, weeks, ...?
- Integration with other data in GIS?



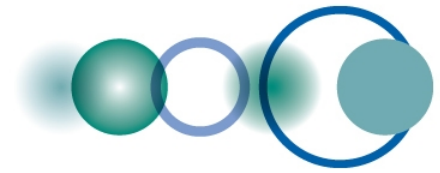
A new pilot around a service for low-latency surface displacements

~4,000 publicly available GPS stations



Current status:

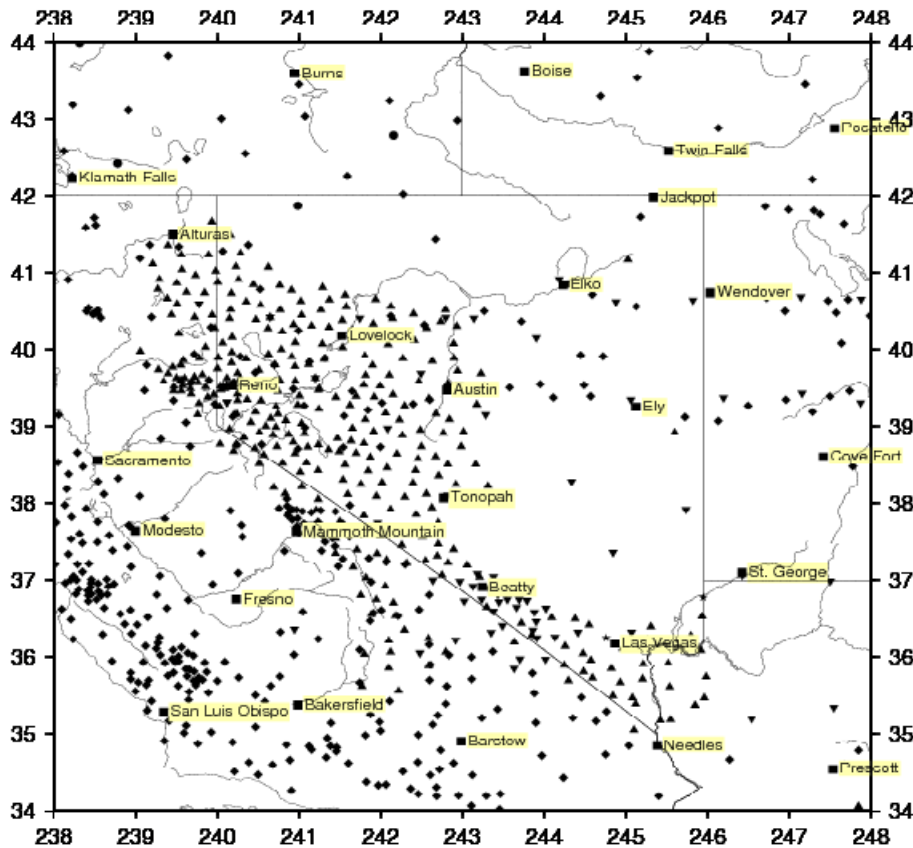
- networks of GPS stations, partly real-time, partly continuous;

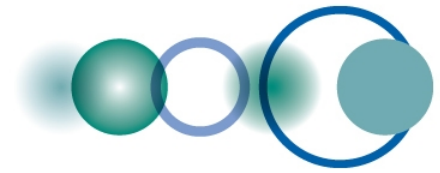


A new pilot around a service for low-latency surface displacements

Current status:

- networks of GPS stations, partly real-time, partly continuous;






A new pilot around a service for low-latency surface displacements

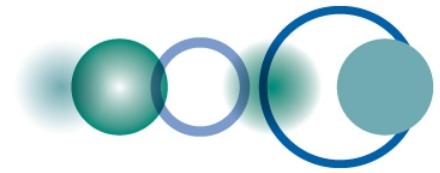
Current status:

- networks of GPS stations, partly real-time, partly continuous;
- InSAR with variable latency



Mission is ENVI; data source is UNAVCO GeoEarthscope holdings; 504 scenes match search
Map shows archive scenes on ascending paths centered in search area

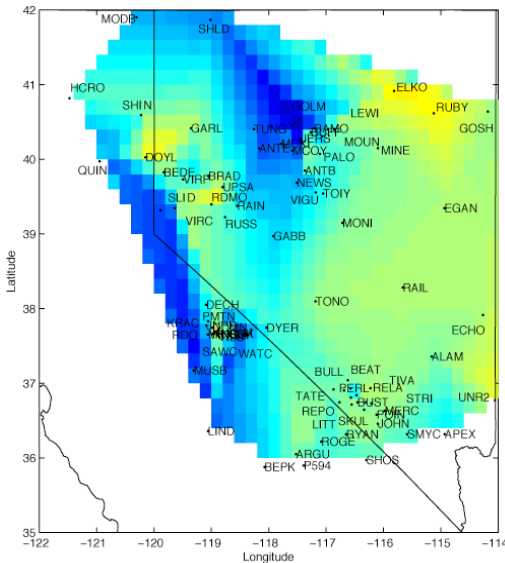
Frame markers:  = SAR data available from UNAVCO



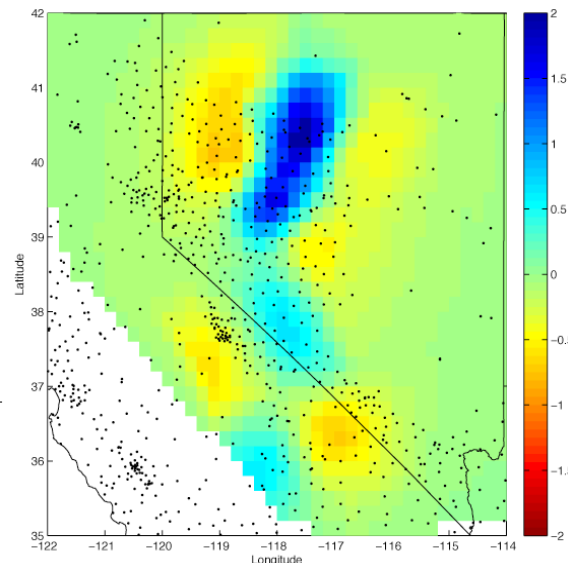
A new pilot around a service for low-latency surface displacements

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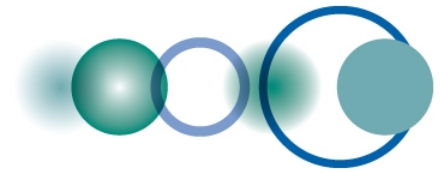
- networks of GPS stations, partly real-time, partly continuous;
- InSAR with variable latency
- Can determine secular trends, strain rates, transients caused by magma intrusion, earthquakes, groundwater extraction...



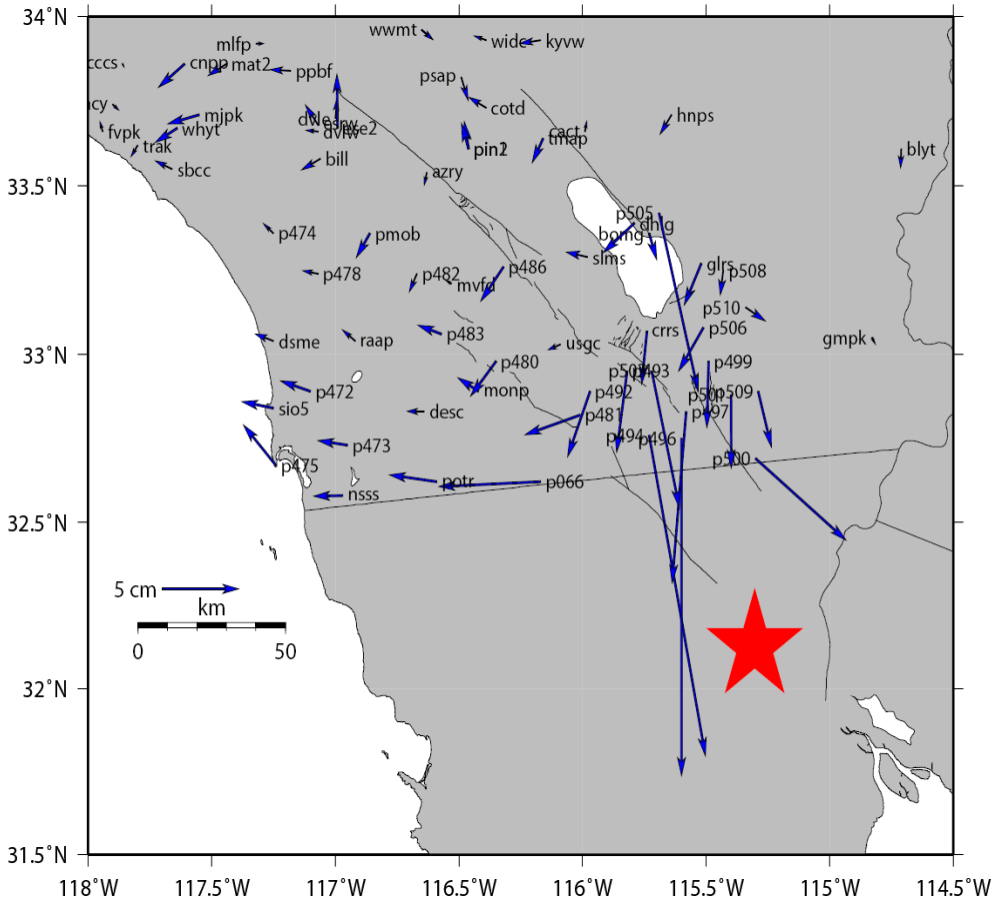
Observed vertical rates



Predicted post-seismic rates



A new pilot around a service for low-latency surface displacements

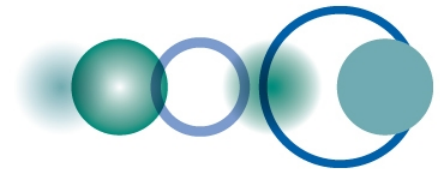


SOPAC's rapid coseismic displacement map

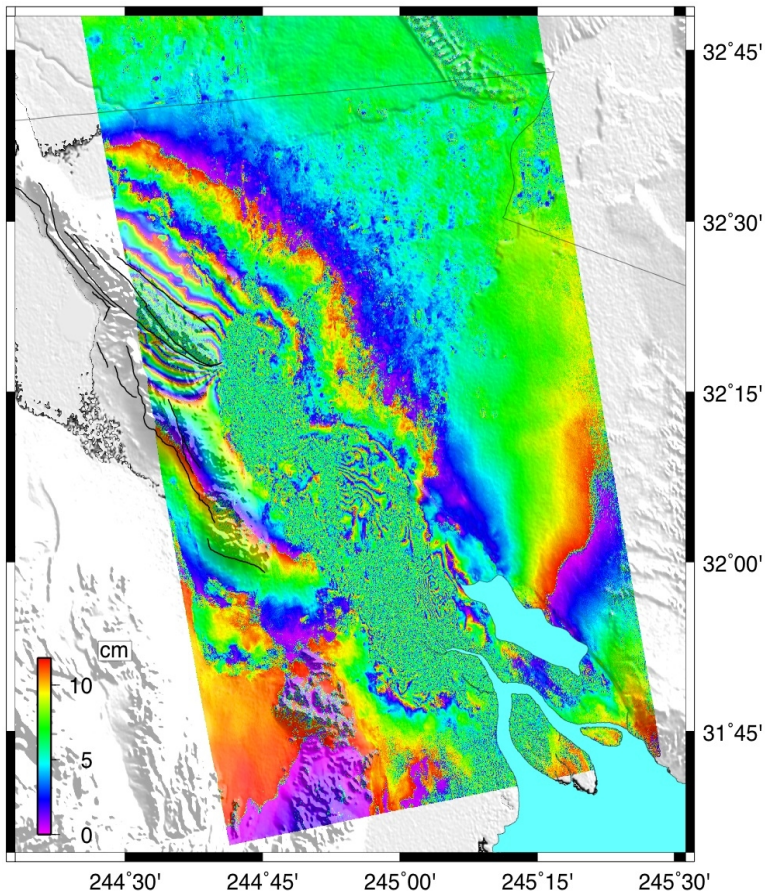
From <http://supersites.unavco.org>

Current status:

- networks of GPS stations, partly real-time, partly continuous;
- InSAR with variable latency
- Can determine secular trends, strain rates, transients caused by magma intrusion, earthquakes, groundwater extraction...
- Can determine coseismic offsets, ...



A new pilot around a service for low-latency surface displacements



Current status:

- networks of GPS stations, partly real-time, partly continuous;
- InSAR with variable latency
- Can determine secular trends, strain rates, transients caused by magma intrusion, earthquakes, groundwater extraction...
- Can determine co-seismic offsets, ...

Eric Fielding, JPL, unwrapped interferogram, ALOS path 533
From <http://supersites.unavco.org>



A new pilot around a service for low-latency surface displacements

- Advantages of integrating pilot into the GEO/GEOSS framework:
 - access to satellite data
 - access to other services (e.g., SERVIR)



SERVIR: *Regional Visualization & Monitoring System*

Provides common platform for:

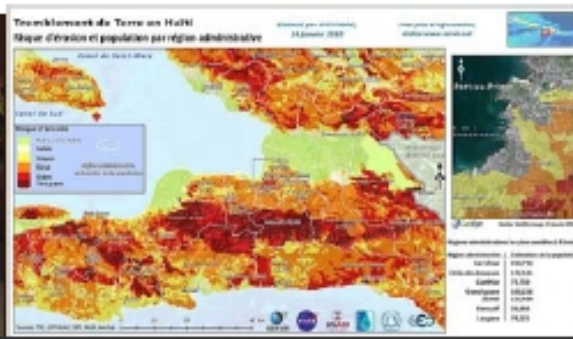


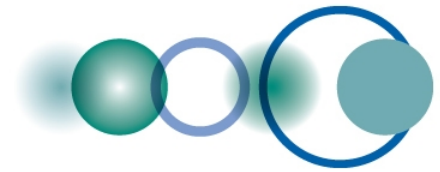
Providing data, models, geospatial analyses, & web services

Building EO & mapping capacity



Facilitating partnerships & collaboration





A new pilot around a service for low-latency surface displacements

- Advantages of integrating pilot into the GEO/GEOSS framework:
 - access to satellite data
 - access to other services (e.g., SERVIR)
 - links to relevant communities of practice (Geohazards, Water, ...)
 - transition to sustained operation after pilot project
 - transfer to other regions (including developing countries)
 - visibility