ESA and GHCP Expectations & Interactions

Wolfgang LENGERT
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Mission Manager

Agenda

- 2008-2009 Geohazard Supersite collaboration (F. Amelung, S. Gross (UNAVCO), J. Achache, ….) & Assets
- ESA's idea for the future
- ESA's expectation allowing long-term participation and sustainability of the Geohazard system

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- Immediate action for Crisis situation ➔ Haiti
- Encouraging milestones …

Supersite contribution for GHCP since 2008 (1)

- **April 2008:** ESA has set up a "Virtual Archive" using Cloud Computing infrastructure
  - 100'ts of SAR data can be downloaded in the time frame of a few minutes.
  - Supports very high amount of simultaneous data access, which is critical for crisis situations
  - is linked to the ESA catalogue, & simple http download,
  - UNAVCO has set up a Supersite portal (http://supersites.unavco.org/main.php), which they offered to maintain on a temporary basis.

- **November 2008:** Supersite initiative announced at the USEReST meeting (Naples),
  - users and data provider (space & in-situ) committed to set up in a collaborative approach a system

- **May 2009:** Jose Achache has submitted an ESA Cat1 proposal for the Supersites referring to the Frascati declaration of 2007.
  - 0-cost to the PI and Co-PIs.
  - Falk Amelung prepared the ESA proposal and coordinates the Co-PI group, which is steadily increasing.

Supersite contribution for GHCP since 2008 (2)

- ✓ **July 2009:** GEO workplan for Task DI-09-01 has been updated
  - Supersite initiative, referring to the Frascati Declaration

- ✓ **November / December 2009:** Jose Achache send letters to Space Agencies and Geological Surveys / Volcanic Observatories who reacted so far very positively to contribute to the Supersite Initiative.

- ✓ **November 2009:** Presentation of Supersite initiative at ALOS & FRINGE workshop & CEOS Disaster SIT
  - At FRINGE breakout session discussion about:
    - White Paper
    - Science committee (ToR missing)
    - Operations committee (ToR missing and following this workshop members need to be informed)
    - Bylaws missing

Potential Geo-hazard Super Sites; Frascati

Geohazards SuperSites	Active Volcanoes	Seismic Faults	Landslide Areas	Areas subject to
				
Best Candidates	• **Mauna Loa, Kilauea , Hawaii (USA)** • **Etna (I)** • **Vesuvius / Campi Fle (I)**	**(Japan)** **bul (Turkey)** **Angeles, US** **ncouver (CA)**	Landslides prone areas in: • Ecuador • Japan • Italy • Pakistan (Quetta) • India	Cities • Ar • sites (2): and braine (France)
Other Candidates	• Nyiragong • Yellowstone • Piton de la Fourn e (Fr) • Iceland volcanoes • Sakurajima, Miyake-Jima (Japan)	• Main Japanese Islands • African Rift Valley • San Francisco (US) • Bam (Iran) • Sumatra (Indonesia) • full Italy / Greece	•....suggestions?	•....suggestions?

Initial system

Envisaged enlarged system

OBJECTIVES:
3 International Geohazard workshops; Frascati 2007

1. Encourage collaboration to improve and coordinated Observation Systems

   ➔ Data & Infrastructure

1. Provide easy & fast Access to a complete data set

   ➔ Infrastructure

1. Foster Use (Science, Applications, Capacity Bldg)

   ➔ Data

What is needed to meet objectives?

Data:

- ➔ "Supersites" containing ALL data (SAR –C,L,X band, GPS, Seismic - historical & future)
- ➔ “Natural Laboratories” containing many data, supporting data sharing but it is not complete

Infrastructure:

- **data download sites**
- Single **download tool** for all data download (e.g. “Get Data” form Univ. Miami)
- **Singe Web address;** linking all sites together and management of contributors (data download, satellite tasking plan, ensuring thT individual data policy is maintained)

➔ Users will be attracted by quantity and quality of the Supersite content, which is free of charge available, addressing applications for:

- emergency response,
- hazard assessment,
- solid earth science

ESA's assets for Geohazard Supersites

Data:

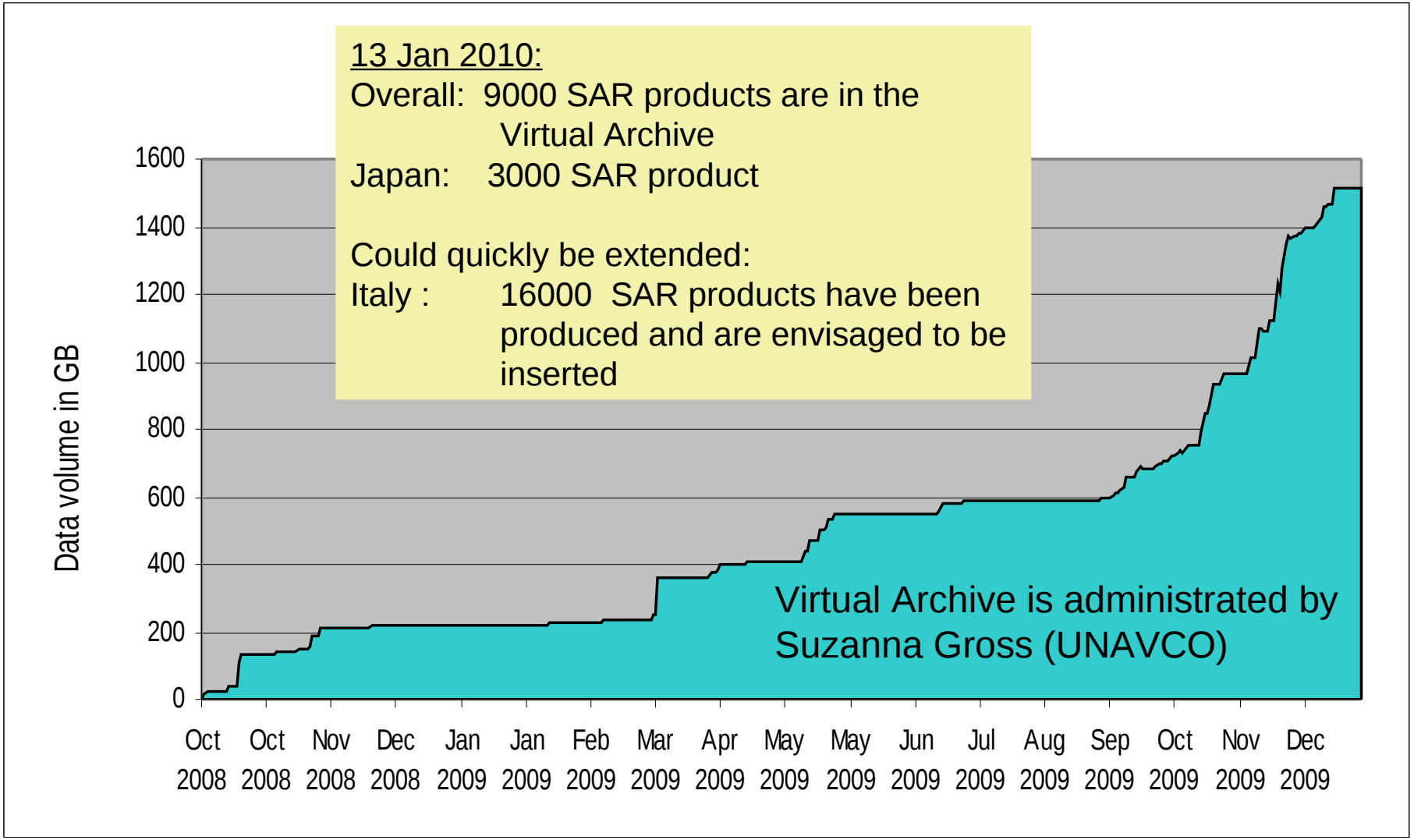
- Satellites SAR-C band 1991 – 2020 (20 years of data & experience)
- Involvement in non-ESA SAR missions through Third Party Missions Programme (e.g. JAXA/ALOS)

Infrastructure:

- Virtual Archive
- Tools (data handling, INSAR Meta data, ….)
- Supporting science for INSAR (e.g. DUE - IGOS, FRINGE (competence building))

New "Open & Free" data policy for Sentinels

Data:
Overall growth of Virtual Archive

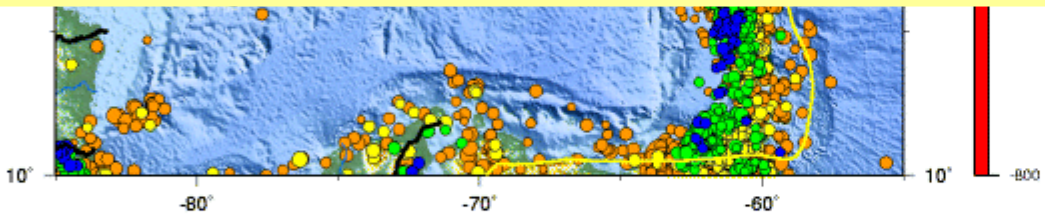


UNAVCO Geohazard Supersite
web site (temporary basis)

Missing:

- other than ESA SAR
- In-situ data (Seismic (with time delay) & GPS)
- atmospheric models
- gravity

- more ESA SAR data



Seismicity of the Caribbean, 1990 - 2006

Magnitude 7.0 - HAITI REGION

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Sentinel Data Policy Principles

FUTURE:

Full and open access to Sentinel data to all users

Aiming for maximum availability of data & corresponding access services in support of increasing demand of EO data in context of climate change initiatives and for the implementation of environmental policies, also resulting in humanitarian benefits.

This includes:

- ✓ Anybody can access acquired Sentinel data
- ✓ Licenses for the Sentinel data are free of charge
- ✓ Online access with users registration including acceptation of generic T&C

Current ERS & Envisat Data Policy needs to be adopted

➔ **GEO Geohazard Supersite Initiative could be precursor.**

SWAT Analysis of sustainable "Geohazard Supersites"

Strengh

- Centralized data access (one-stop shopping, no talking, use scientist's time for science)
- Long time-series, more data (e.g. daily or semi-daily SAR acquistions, capture dike or quake during o… …ce)
- state-of-the art technology (… …rnet, Google Earth era)
- supports novel science (an… …s: can't write paper anymore using 1 inte…
- **Long-term data preser…**
- small investment, high p…
- Comparability of results, modelling… Progress in science. Could publish solutions o… different algorithms.
- Follows decade volcano concept
- **Helps future satellite design**
- **validation, possible cal-val sites**
- facilitates collaborations

Weakness

- Lack of selection process (feeling to be left out)
- Too much competition for junior scientists (students)
- Difficult to adapt to cultural change (last 20 years were not too bad)
- Internet infrastructure required (may not work in Africa)
- resources required (for data provider)
- different data access policies for each dataset

Possible problems:
…lete data sets

With strong international collaboration

➔ Win – win for everybody

Opportunity

- Super-testsites for new analysis and measurement techniques
- **Community building**
- **Cyberinfrastucture(*) (new research environment)**
- multi-disciplinary investigations facilitated.
- New advanced techniques may be developed

Threat

- undermine authority of geological surveys/volcano observatories (misuse) (solution 6 month time-delay)
- blackout of infrastructure ("what happens when Google disappears")
- **interference with commercial interests, value-added companies maybe worried**
- **national security concerns**

ESA's future ideas on Geohazard Supersite

Data:

ESA to contribute with ALL data - historical & future

Infrastructure:

- to extend **Virtual Archive** and ensures long term sustainability
- to provide **data sharing Infrastructure on the Virtual Archive** for Crisis Situations
- to set up Single **download tool** for all data download (e.g. Get Data form Univ. Miami)
- to set up a **Singe Web address;** linking all sites together and management of contributors (satellite tasking, ensuring individual data policy is maintained), continuing the Supersite Web site of UNAVCO

➔ In combination with ESA GEOportal (http://www.geoportal.org) a cross-cutting infrastructure could be created addressing:

- emergency response,
- hazard assessment,
- solid earth science

Interaction & Coordination through ....

GEO Hazard CoP ➔ Programmatic leadership

- Defining strategy & roadmap for GEO Geohazard Supersites
- Coordination & communication of GEO activities, avoiding overlap of activities
- Elaborating tasks which are meeting contributors objectives

CEOS Disaster SBA ➔ Implementation Leadership

- Following up actions and coordinating across Agencies
- Coordinate also of in-situ data contribution (e.g. 2008 USEReST meeting, bilateral discussions at FRINGE)
- Document data systems

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ESA's expectation for long-term participation and sustainability of the Geohazard system

- GEO encouragement that all Data provider participate in with large scale data provision
  - "Supersites" contain a complete data set (Space & in-situ)
  - "Natural Laboratories" contain a substantial amount of data, but it is not a "complete" data set
- GEO should support the increase of visibility and communicate/demonstrate usefulness of system
- GEO should encourage intensive use of the system
- Geohazard Supersite initiative needs a GEO Governance strucuture

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Immediate action for Crisis situation ➔ Haiti

- ESA offers its Virtual Archive as data sharing infrastructure (if UNAVCO agrees to support the administration).
- ESA provides all historical SAR data covering the crisis area
- ESA updates its background mission for Envisat & ERS-2 ensuring long term observations and makes data available via the Virtual Archive (includes http://supersite.unavco.org)

➔ The Supersite system is ready to provide hands-on support for Haiti. Only data are missing!

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Promising Milestones

- GEO Hazard CoP (January 2010):
  - Defining roadmap
  - Encouraging large scale data contribution of collaborators for the few selected sites
- CEOS SIT workshop (April 2010):
  - Review of action and status of implementation
- ESA Living Planet Symposium (July 2010):
  - Presentation of prototype
  - encouraging user community to use the system
- GEO Ministerial (November 2010):
  - GEO Hazard Supersite to be presented as a success example

Summary

- Within a short time a “Grass Root” Geohazard Supersite system has been set up containing:
  - Large volume of data (SAR & GPS)
  - High-end and highly-reliable data dissemination infrastructure supporting data sharing of very large data sets, being of particular relevance in Crisis Situations

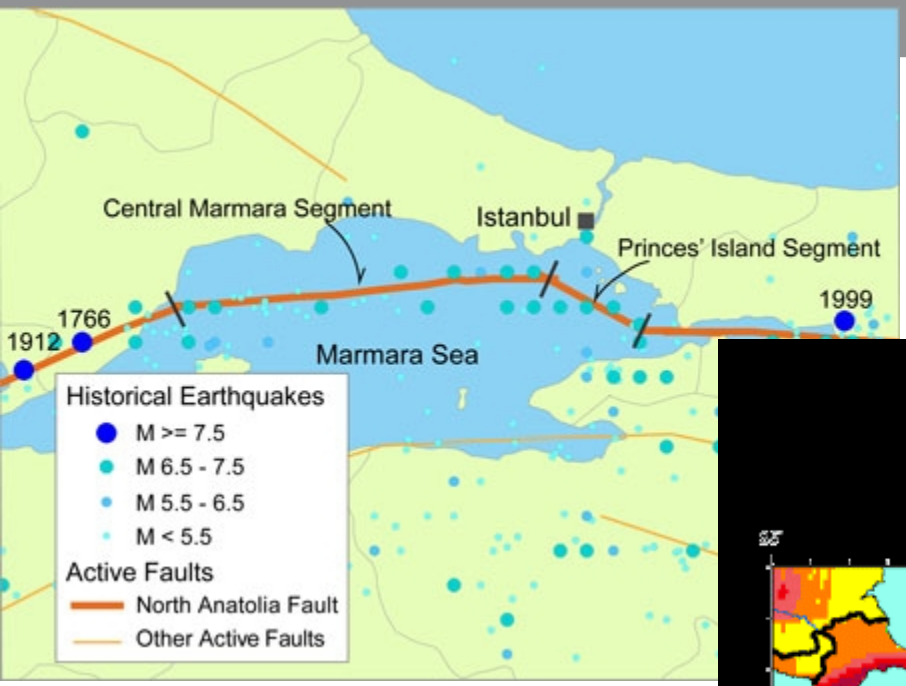
- With relatively little additional resources existing systems and services have in collaborative fashion been tune to set up a the Geohazard Supersite Intitiative containing a very large data set.

- “Grass root” system exists, however Governance and Bylaws are missing to make it an open and transparent sustainable system

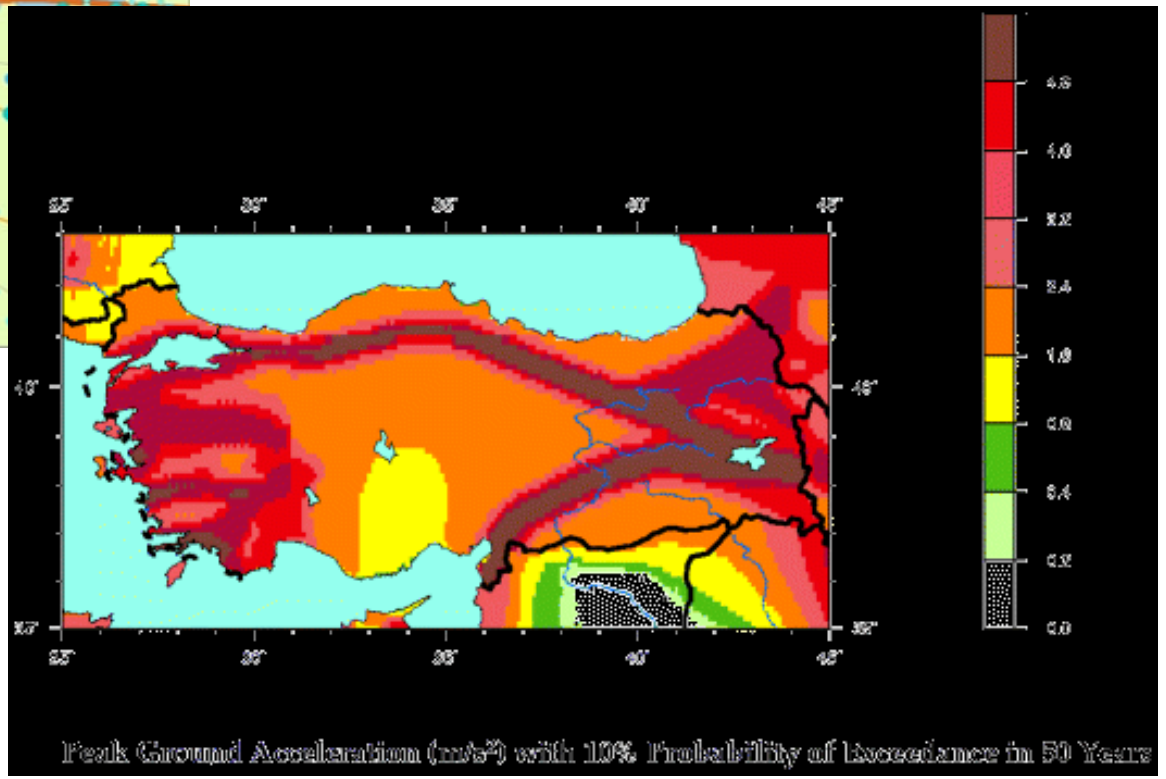
- A target to have a GEO Hazard Supersite system operational by GEO Ministerial in November would likely encourage all contributors to take actions now.

Thank You!

xample 4: Istanbul Seismic Hazard



With all data in Supersite the accumulative stress could be easier understood



Geohazard Supersite Target:

Data:

"Supersites" containing ALL data (SAR –C,L,X band, GPS, Seismic - historical & future) (ESA, DLR, ASI, USGS, BRGM, INGV, GFZ, UNAVCO)

Infrastructure:

- Using of the above mentioned contributor elements
- Single download tool for all data download (e.g. Get Data form Univ. Miami)
- Singe Web address; linking all sites together and management of contributors (satellite tasking, ensuring individual data policy is maintained

➢ All User will be attracted by quantity and quality of the Supersite content which is free of charge available addressing applications for:

- emergency response,
- hazard assessment,
- solid earth science

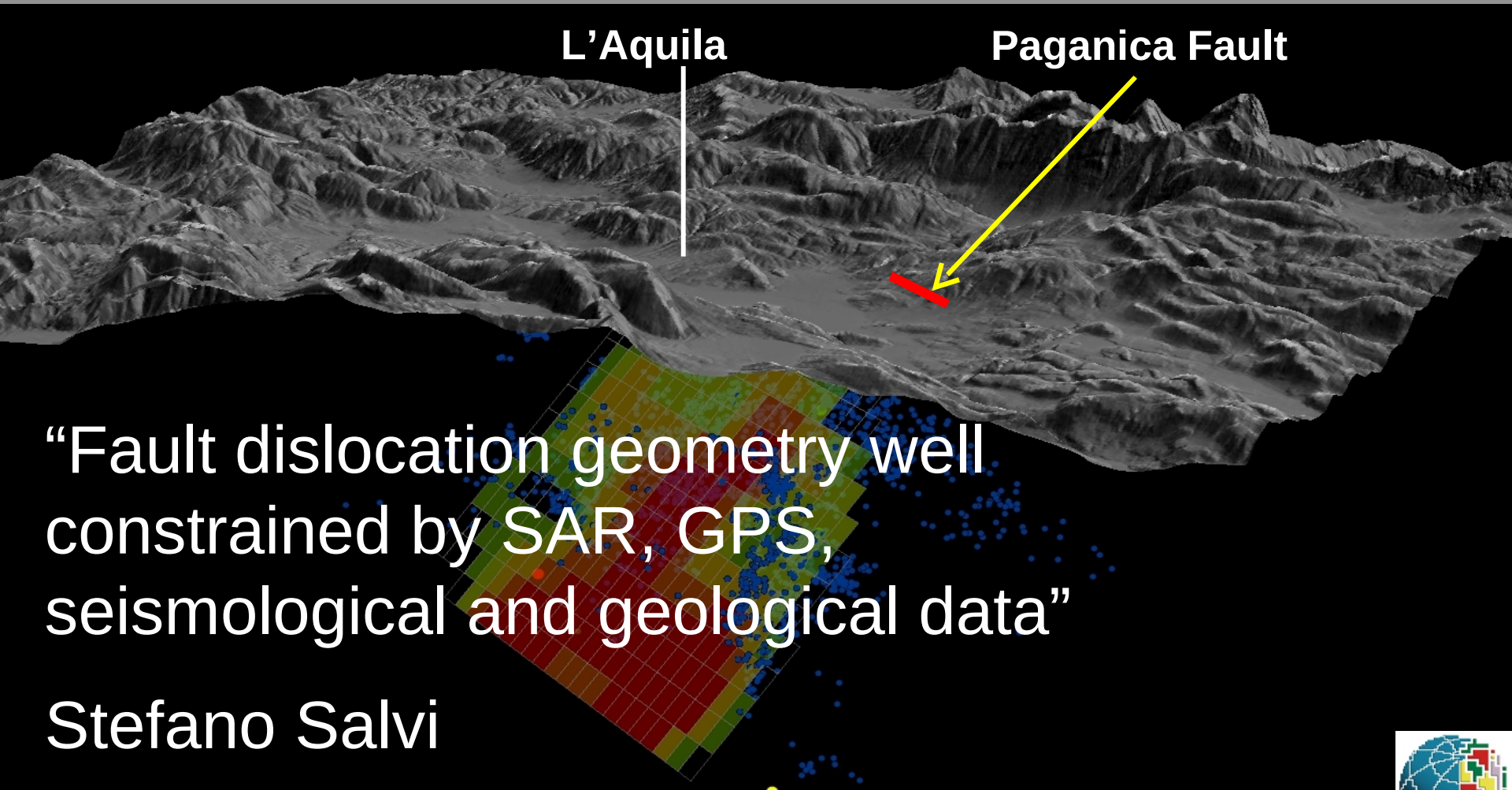
➔ Form this point on the world Earth Science user community would concentrate their work on the Supersites, because that's where they find ALL the data.

Supersite White Paper

- 2.5 hour breakout session on Thursday with 40 to 50 people
- Good discussions leading to following progress:
  - ToC has been outlined
  - Operational & Science committee has been set up
  - Milestones have been defined: ➔ kick-off in June 2010 at “Living Planet Symposia” in Bergen

➔ Bylaws essential to have a transparent system

Example 1: Final model, co-seismic + post-seismic displacements

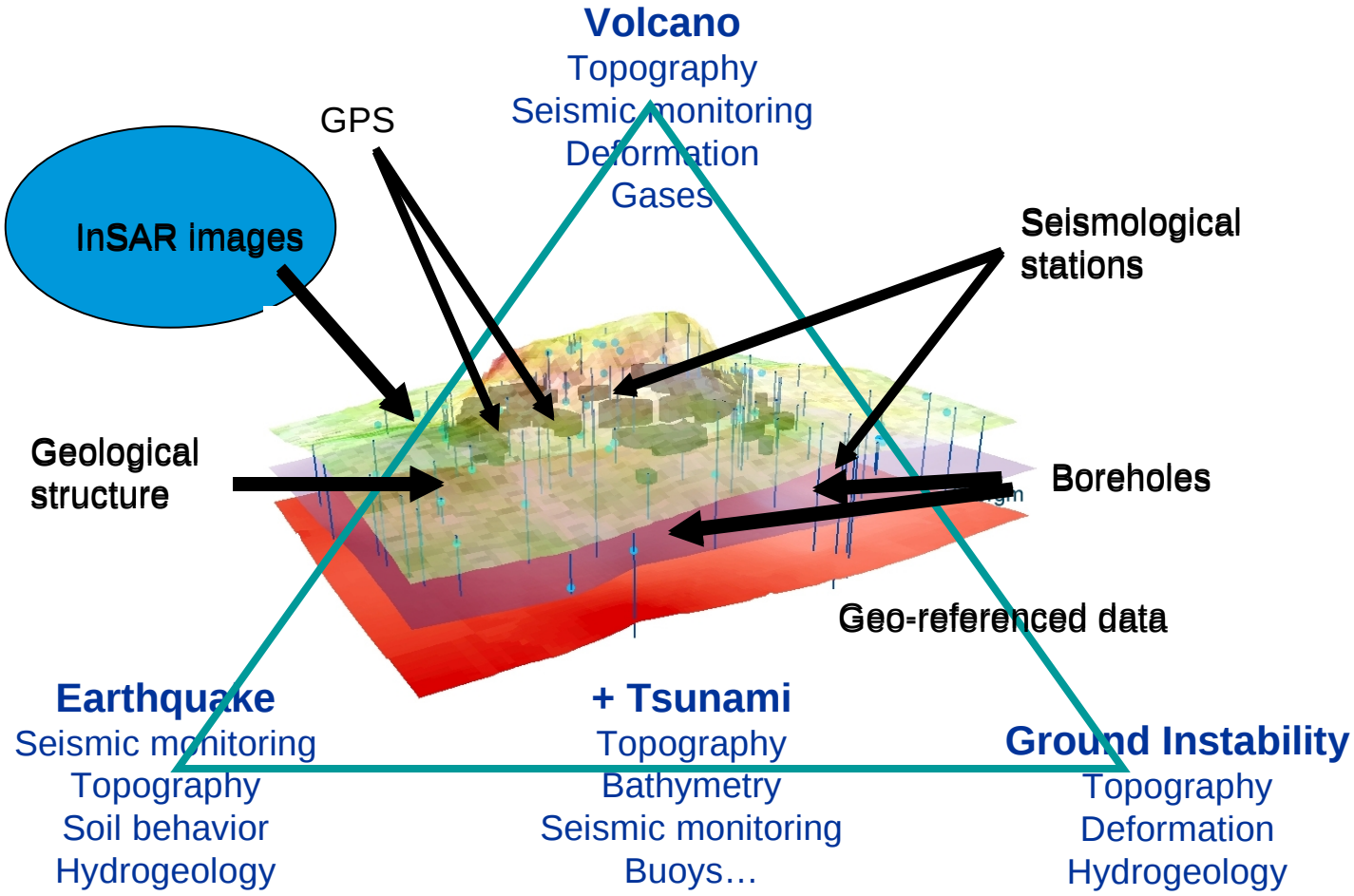


"Fault dislocation geometry well constrained by SAR, GPS, seismological and geological data"

Stefano Salvi

Research Director - Earthquake Remote Sensing Group
National Earthquake Center – INGV - Italy

Relevant “Super Site” data set

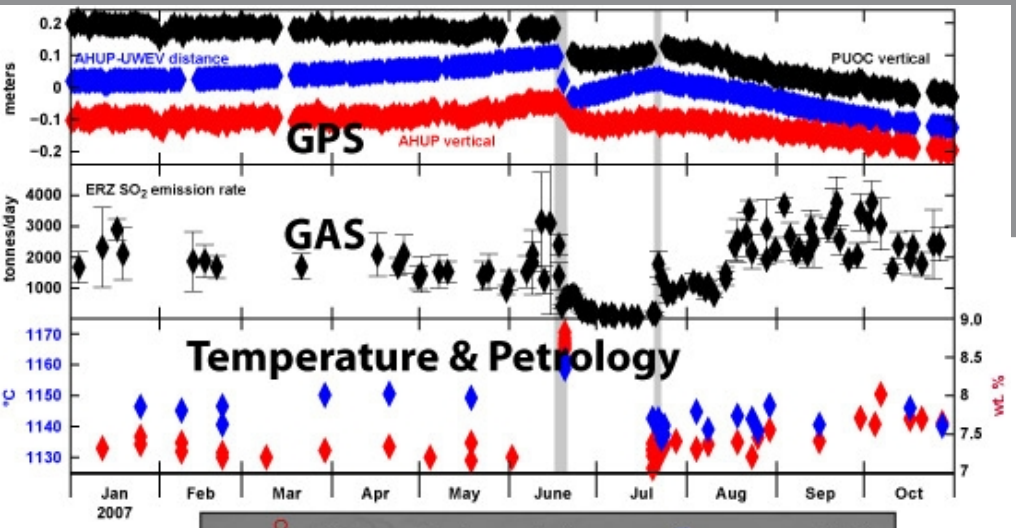


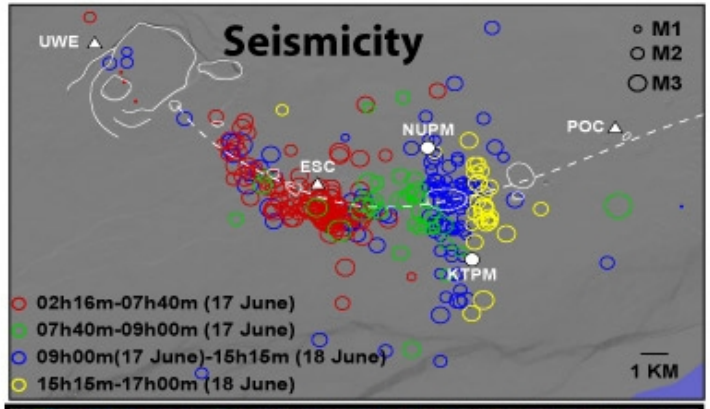
Super Site collaborator/contributor

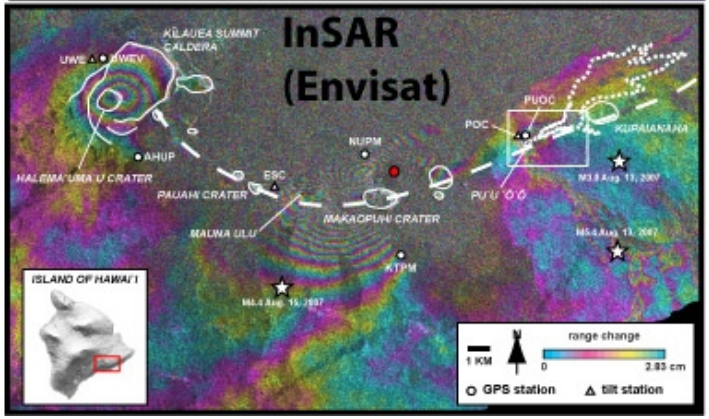
USEReST meeting Naples Nov 2008

- Lengert, ESA centralized data archive infrastructure (CDN server linked to EOLI-SA)
- Vagner, BRGM SuperSite website, ESA Cat-1 Superuser
- Dzurisin, USGS Hawaii SAR data
- Sansosti, IREA Naples Etna and Vesuvius ERS/ Envisat data
- Lengert, Laur, ESA inks to other space agencies
- Unavco/WinSAR Data repatriation and renaming services
- Unavco host SuperSite GPS data if necessary
- Amelung, U Miami (CSTARS) Galapagos SAR data
- Jonsson, U Zurich (ETH) Iceland SAR data
- Sigmundsson, U Iceland, Reyjavik Iceland SAR data
- Dixon, U Miami Iceland GPS data (raw data plus velocity field)
- Fernandez, CSIC-U Madrid SAR, GPS, gravity, crustal structure for Canary Islands
- (possibly also seismicity)
- Fernandez, CSIC-U Madrid Organize Supersite workshop in Canary islands
- Paganini, ESA ESA-funded PostDoc fellowships for SuperSite research
- Ganas, National Observatory, Athens GPS for Gulf of Corinth, Greece
- Briole, ENS Paris SAR and GPS data for Gulf of Corinth, Greece
- Martini, INGV Napoli ground-based data for Vesuvius/C.F.
- (GPS, seismicity, precise earthquake relocations, Gas)
- Sansosti and Lanari, IREA Napoli SBAS displacement time series
- Tim Wright, U Leeds Dragon Project data (~2000 scenes/year)
- Eric Fielding, JPL Atmospheric models for California
- Eric Fielding, JPL UAV SAR data for Los Angeles Supersite
- Frank Marzano, U Sapienza Roma Atmospheric Models for Etna/Vesuvius-Campi Flegreii
- Puglisi, INGV Napoli GPS data from Etna (raw data + daily solutions)
- Puglisi, INGV Napoli Organize Supersite workshop at Mt Etna.
- Borgstrom, INGV Napoli links to WoVo data for SuperSites
- Amelung, U Miami Geodetic modelling software (geodmod)
- Pritchard, U Cornell South America Subduction zone SAR data (1000 scenes (300 GB))
- Unavco/WinSAR multi-satellite SAR data for Western North America (10 TB)
- Salvi, INGV Rome Italy SAR data (about 70 % of existing ESA archive)
- NASA/NSF funding for Unavco/WinSAR
- ESA funding for Igos Geohazard

Example 2: Kilauea







Data integration for volcano monitoring:

2007 "Father's Day" Eruption at Kilauea

(GPS, Gas, petrology, Temperature, and InSAR from Envisat)

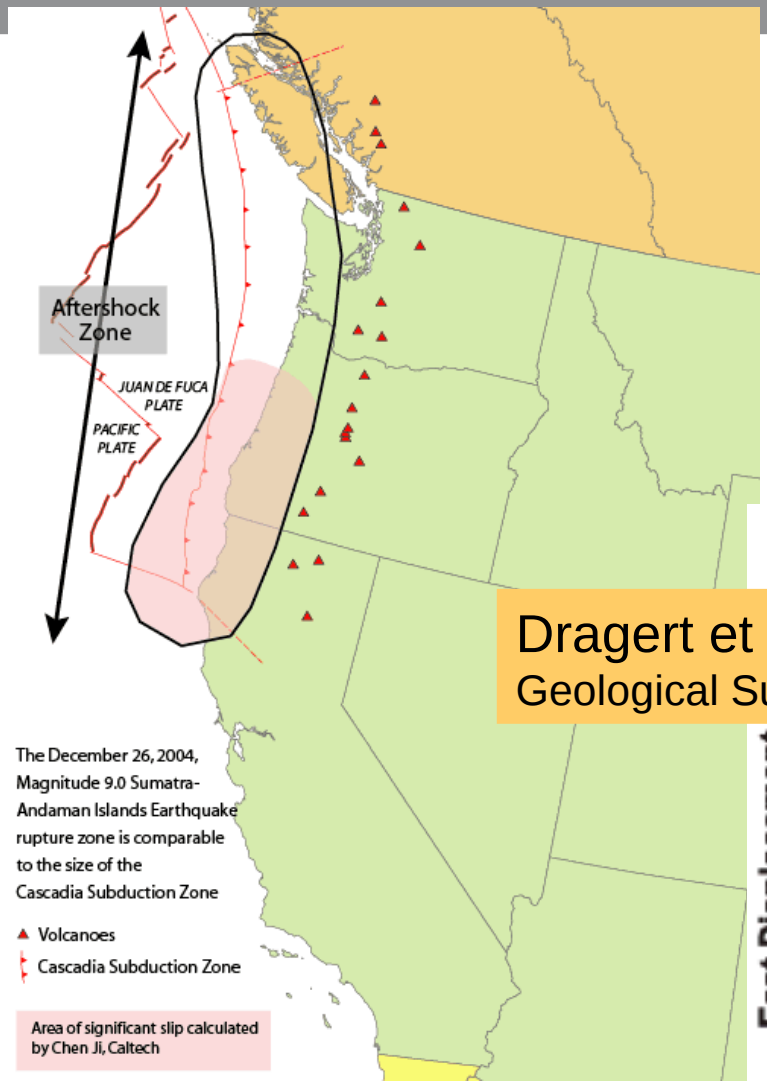
Poland et al., 2008

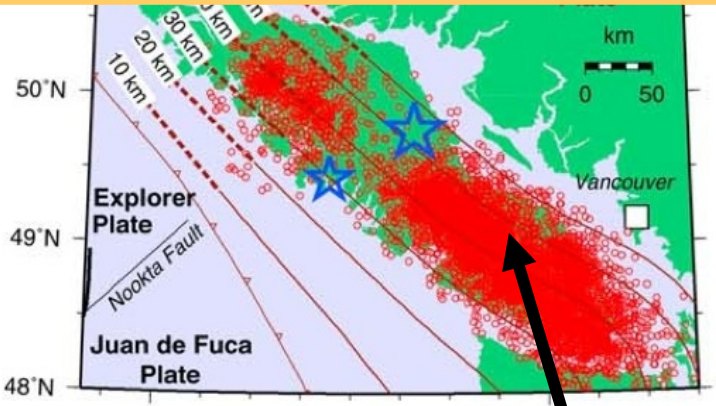
Eos, Vol. 89, No. 5, 29 January 2008

Example 3: Vancouver/Seattle

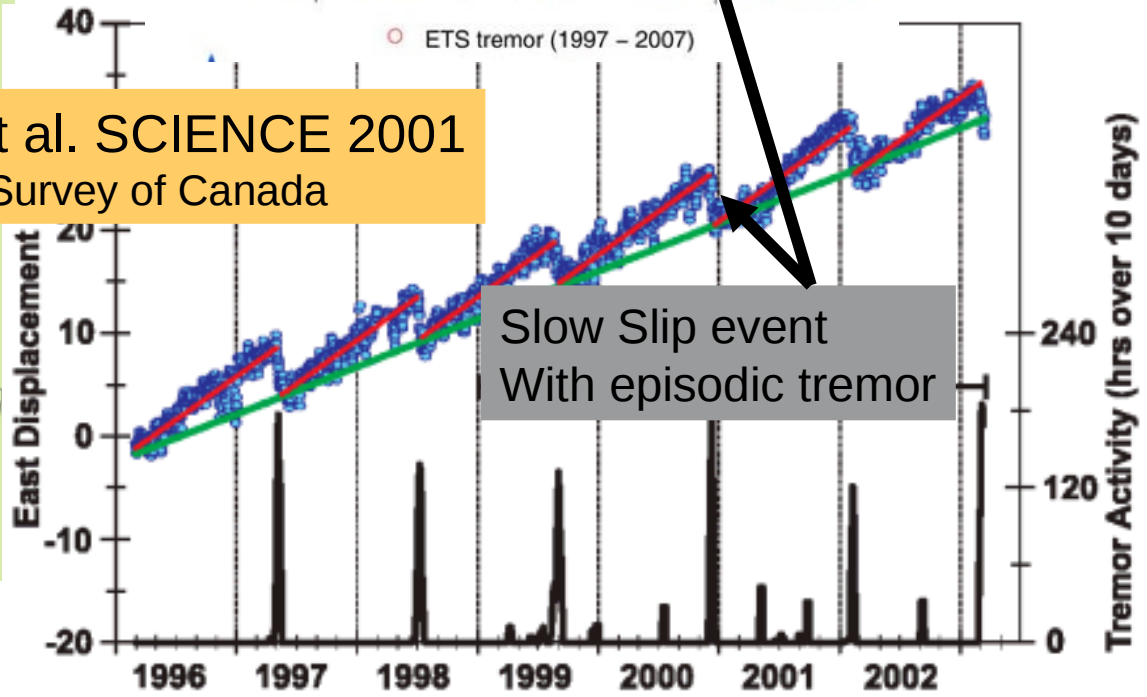
Image surface displacement associated with Episodic Tremor and Slip (ETS) events

JGR: 21 Nov 2009
Kao, Honn et al. Geological Survey of Canada





Dragert et al. SCIENCE 2001
Geological Survey of Canada



Slow Slip event
With episodic tremor

Objective of Geo-hazard initiative

Formal Requirement:

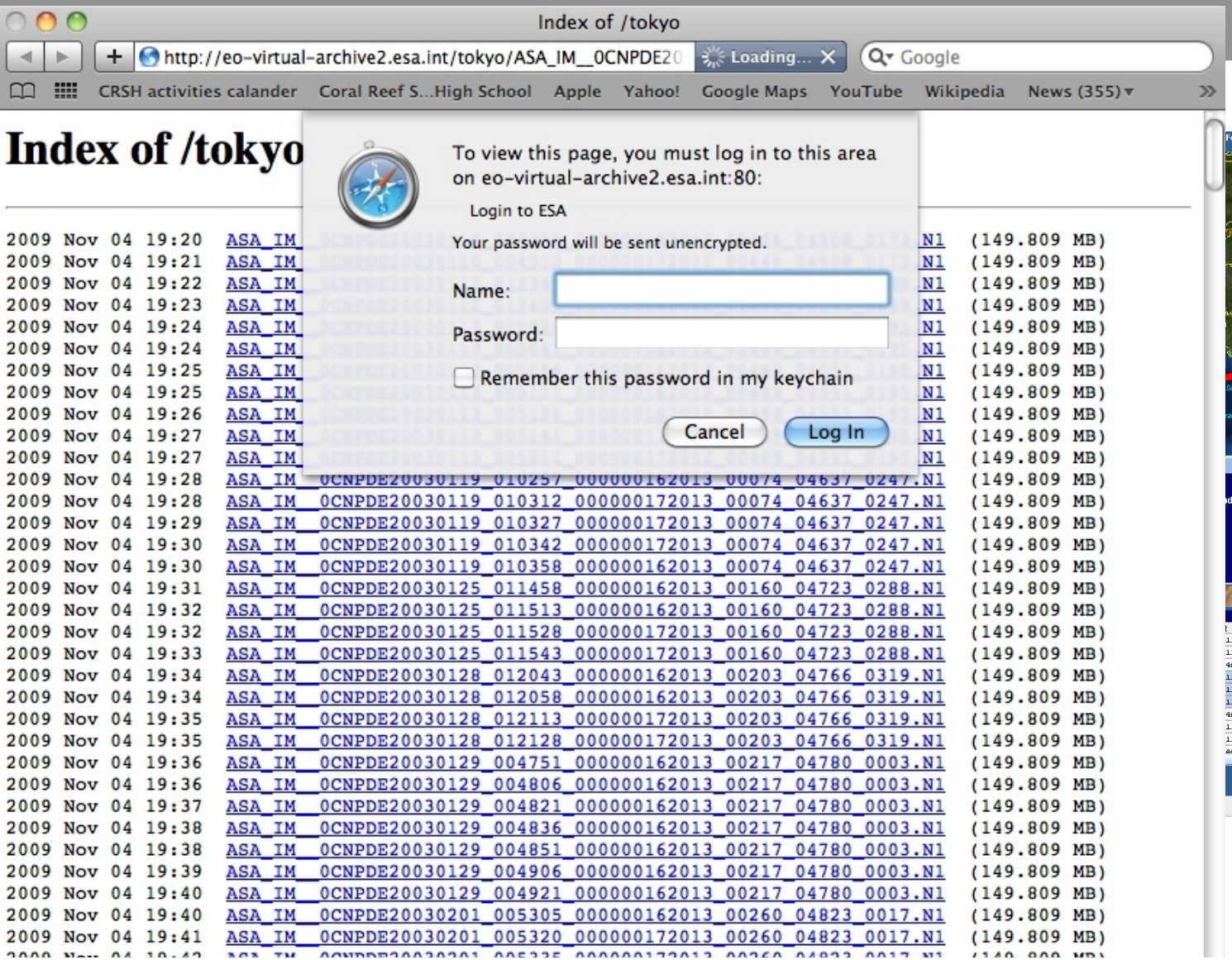
2009-11 GEO workplan, issue July 2009:

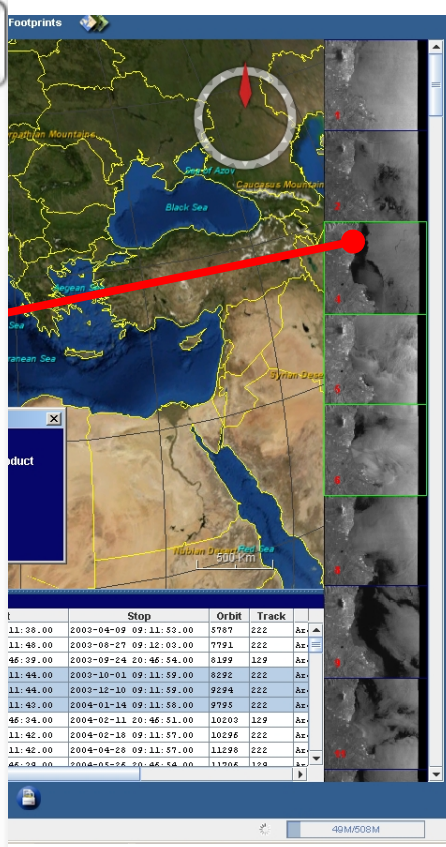
… is to respond to the scientific and operational geospatial information needs for the prediction and monitoring of geological hazards, namely earthquakes, tsunamis, volcanoes and land instability.

Informal Requirement:

Geohazard community: stated in workshops, reports, …

eo-hazard Super Site technical set-up
"Cloud Computing" infrastructure





Super Site next steps:

- FRINGE 2009,
- CEOS Disaster SBA Team meeting (1, 2 December at ESRIN)
- AGU (14 – 18 December 2009)
- ESA Living Planer Symposium in Bergen (28 June – 2 July 2010) http://www.esa.int/LivingPlanet2010/

➔ Users recommendations, collaboration, contribution are essential for setting up a sustainable system

➔ drafting White Paper outlining objectives and structure (partners, science-, operational advice). Also structure of how to become a Super Site needs to be clarified. ➔ break-out session on Thursday in Magellan room 10:00 – 12:00

➔ Setting up an Office enabling structured coordination
  - Geohazard Super Site Portal,
  - ensuring that data policy of each data provider is maintained (latency, quantity, access rules, ...)
  - Interfacing to Space Agencies with respect to satellite tasking
  - Reporting to partners

Very fast & easy data access

- ESA Virtual Archive:

Procure ICT capacity to bring large data volumes faster to the user by putting SAR product copies close to the user, distributed around the world.

Download Performance:

- 80 SAR scenes in 300 sec
- Bottleneck is the infrastructure of the user

Supersite SWAT analysis

Strengths

- Centralized data access (one-stop shopping, no talking, use scientist's time for science)
- Long time-series, more data (e.g. daily or semi-daily SAR acquistions, capture dike or quake during occurrence)
- state-of-the art technology (computing clouds, internet, Google Earth era)
- supports novel science (analysis of 1000s of SAR scenes; can't write paper anymore using 1 interferogram)
- Long-term data preservation and access (heritage datasets).
- small investment, high pay-off (e.g. 3rd party data)
- Change is good in Science!
- Comparibility of results, modeling methods. Learn by comparing. Progress in science. Could publish solutions on web obtained using different algorithms.
- Follows decade volcano concept
- Data for young researchers, teaching (L'aquila example)
- Inline with GEOESS prinicples, Sentinel data policy, encouraging new generation of data policies.
- Don't brake U.S. laws
- Helps future satellite design
- (Public safety, civil protection, new can of worms)
- validation, possible cal-val sites
- fascilitates collaborations

Weakness

- Lack of selection process (feeling to be left out)
- Too much competition for junior scientists (students)
- Difficult to adapt to cultural change (last 20 years were not too bad)
- Internet infrastructure required (may not work in Africa)
- resources required (for data provider)
- different data access policies for each dataset

Possible problems:

- Incomplete data sets

Comments:

(need transparent way, need opportunity to add more Supersites (phase-B Supersite candidates)
agencies name scientists-in charge, call for Supersites)
(need timetable)
(algorithm developers prefer very few supersites)
(don't worry about details, be relaxed, change in culture is the most important)
(need way to share results)

Opportunities

- Super-testsites for new analysis and measurement techniques
- Community building
- Cyberinfrastucture(*) (new research environment)
- multi-disciplinary investigations facilitated.
- New advanced techniques may be developed

Threats

- undermine authority of geological surveys/volcano observatories (misuse) (solution 6 month time-delay)
- blackout of infrastructure ("what happens when Google disappears")
- interference with commercial interests, value-added companies maybe worried
- national security concerns

Sentinel Data Policy Principles (2/2)

What does it mean?

Technically: Improved availability and easier access to EO data, simple data dissemination system and interfaces to users

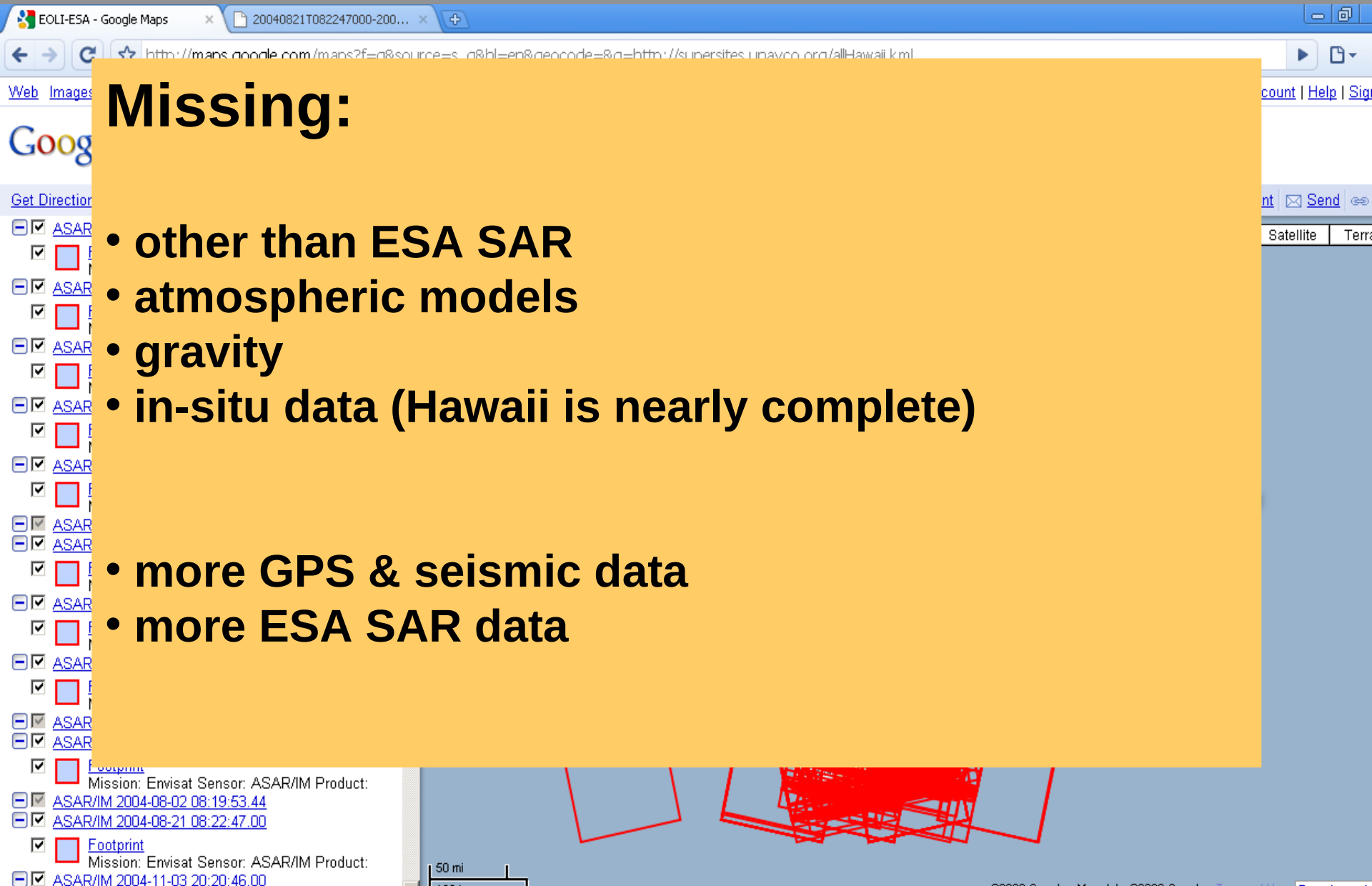
Politically: Continue international trend for full and open access to EO data, in line with GEO data sharing principles, setting context for future data policies

Economically: Supports growth of VACs' business, thus enabling growth and job creation; Increased uptake of EO data opens new markets and supports development of new products

What does this mean for the current Data Policy?

The current data Policy needs gradually adopted to GMES.

Super Site coordination
Temporarily managed by UNAVCO



Missing:

- other than ESA SAR
- atmospheric models
- gravity
- in-situ data (Hawaii is nearly complete)

- more GPS & seismic data
- more ESA SAR data

ESA and GHCP
Expectations & Interactions

“Geohazard Supersite” Initiative to ….

“stimulate an international effort to study selected sites by establishing open access to relevant datasets according to GEO principles fostering the collaboration between all partners and end-users”

Wolfgang LENGERT
ERS & ADM-Aeolus
Mission Manager