“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 LENGER<br />ERS & ADM-Aeolus Mission Manager

Falk AMELUNGEN<br />Univ. Miami

Marc PAGANINI<br />ESA responsible for CEOS task: “Vulnerability Mapping and Risk Assessment” on Supersite
Outline

• Geo-hazard Supersite Initiative
  – overview & science examples
  – collaboration & contribution

• ESA Virtual Archive (very fast & easy data access)

• GMES Sentinel Data Policy “Principle”
  Sentinel-1 stands for at least 5 C-Band SAR satellites ensuring long term data continuity (European Commission)
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, …
What is a “Super Site”?  

Facilitating access to data over a certain number of regional areas.

In order to be eligible as a “Super Site” a regional area should meet at least one of the following criteria:

– people are exposed to geological threats,

– an event is expected to occur in the near future, or a slow process is already ongoing.

– it should be an appropriate place to stimulate basic geohazard research.
Relevant “Super Site” data set

- **Earthquake**
  - Seismic monitoring
  - Topography
  - Soil behavior
  - Hydrogeology

- **Volcano**
  - Topography
  - Seismic monitoring
  - Deformation
  - Gases

- **Ground Instability**
  - Topography
  - Deformation
  - Hydrogeology

- **+ Tsunami**
  - Bathymetry
  - Seismic monitoring
  - Buoys...

- **Geo-referenced data**

- **InSAR images**

- **Seismological stations**

- **Boreholes**

- **GPS**
## Potential Geo-hazard Super Sites

### Geohazards

<table>
<thead>
<tr>
<th>SuperSites</th>
<th>Active Volcanoes</th>
<th>Faults</th>
<th>Landslide prone Areas</th>
<th>Areas subject to subsidence</th>
</tr>
</thead>
</table>
| Best Candidates | - Mauna Loa, Kilauea, Hawaii (USA)  
- Etna (I)  
- Vesuvius / Campi Flegrei (I)  
- Nyiragongo (Congo)  
- Yellowstone (US)  
- Piton de la Fournaise (Fr) | - Lipari (I)  
- Los Angeles, US  
- Vancouver (CA) | - Landslides prone areas in:  
- Ecuador  
- Japan  
- Italy  
- Pakistan (Quetta)  
- India | - Cities:  
- Amsterdam  
- Tokyo  
- Istanbul  
- Los Angeles  
- Vancouver (CA)  
- Tokyo  
- Istambul (Turkey) | - Mining sites (2):  
- Poland  
- Loraine (France) |
| Other Candidates | - Nyiragongo (Congo)  
- Yellowstone (US)  
- Piton de la Fournaise (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? |
Objective

- Encourage collaboration to improve and coordinate Observation Systems
- Provide easy & fast Access to a complete data set
- Foster Use (Science, Applications, Capacity Bldg)
- Access to the data sets to the Geohazards scientific community **worldwide**, 

- Access to **space observations** and **in-situ data**, 

- An open and seamless data access with **as little restrictions as possible**, (e.g. ESA asks for T&C, National Geological Surveys considers to release data with time delay) 

- The selection of the Geohazards SuperSites shall be **equally distributed geographically** and cover the different types of Geohazards, 

- Access to the **archive** for long term study on consistent data sets, 

- Possibility of **fast and easy access**, 


Missing:

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

- more GPS & seismic data
- more ESA SAR data
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
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
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 Flegrei
- 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
• Geo-hazard Super Site Initiative
  – ESA
  – User collaboration & contribution

• **ESA Virtual Archive** *(very fast & easy data access)*

• GMES Sentinel Data Policy Principle
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
1 mission across 3 satellites

Combination of:

• EO LI
• Quicklooks at ESA catalogue
• Virtual Archive;

SAR products stored

Close to the user (Europe, North America, Asia)

Geo-hazard Super Site technical set-up

"Cloud Computing" infrastructure
Thanks to Suzanna Gross (UNAVCO) the archive is growing quickly:

- 7000 ERS / Envisat SAR scenes are currently in the archive production
- other Supersites are also continuously growing, with currently 3000 scenes in production

Data are available at no cost to approved users.
• Geo-hazard Super Site Initiative
  – ESA
  – User collaboration & contribution

• ESA Virtual Archive (very fast & easy data access)

• GMES Sentinel Data Policy Principle

  Sentinel-1 stands for 5 C-Band SAR satellites ensuring long term data continuity (European Commission)
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
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 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
Summary

• Super Site has the potential to become **global collaborated structure** focusing on Geo-hazard

• ESA Virtual Archive allows utmost performance allowing fast & easy data access for **no** cost to the user

• GMES Sentinel Data Policy introduces a new paradigm
  ➔ Full and open access to Sentinel data
  ➔ concerning ERS/Envisat retro-adaptation still needs to be done

To make the Super Sites work, collaboration is required between;
- data provider (satellite operator, ground measurement operators)
- scientists
- Operational National Authorities
Example 1: L’Aquila earthquake (April 2009)
Example 4: Istanbul Seismic Hazard

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