



Committee on Earth Observation Satellites

CEOS WG Disasters Report

Stéphane Chalifoux

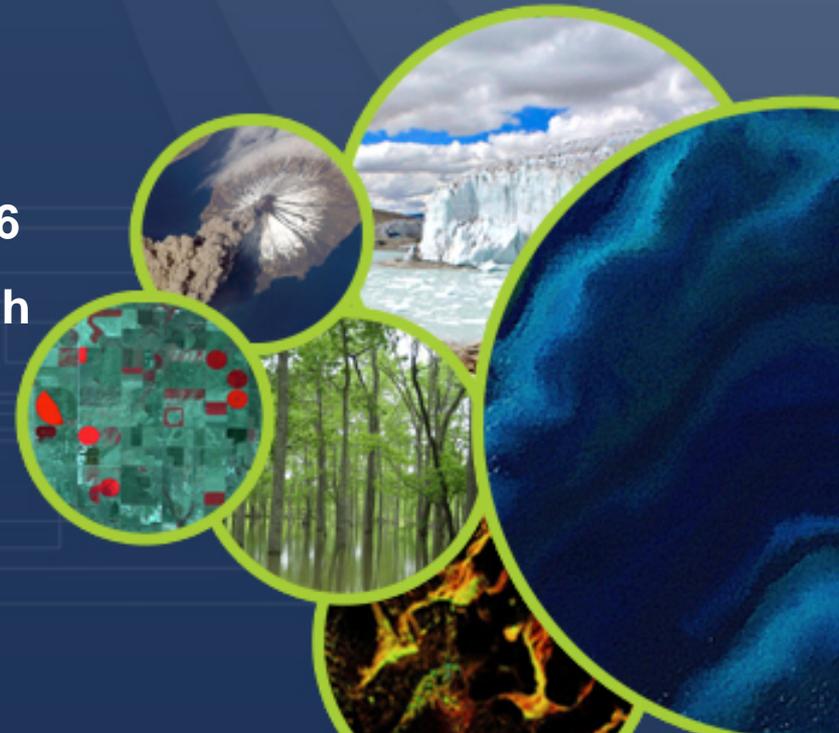
SIT Tech Workshop 2016 Agenda Item # 16

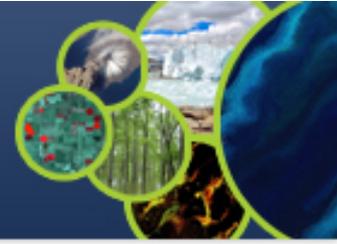
CEOS Strategic Implementation Team Tech

Workshop

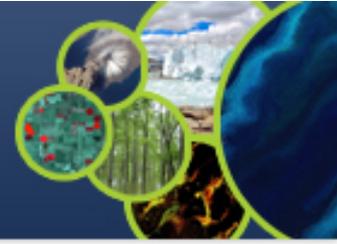
Oxford, UK

14th-15th September 2016





- **Status of pilots**
- **Key successes:**
 - **Flood**
 - **Seismic Risks**
 - **Volcano**
 - **Recovery Observatory**
- **New pilot – Landslide**
- **Challenges**
 - **Reporting on success and User engagement**
 - **Identifying partnerships for sustainability**
- **GEO-DARMA**
- **GSNL**
- **Issues for Plenary**



On Wednesday August 14, 2016, a 6.0 magnitude earthquake struck central Italy, near Amatrice.

The earthquake has left more than 280 people dead.

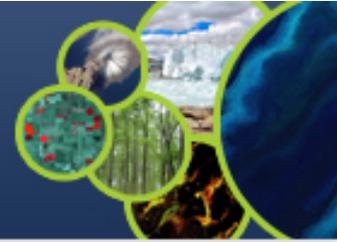
Seismic pilot Obj. C has been triggered to generate rapid science products to support response.

- The EQ is of moderate magnitude but caused strong impact in some villages due to site amplification effects.
- The national Civil Protection and other local bodies are the final end users using scientific support products provided by the pilot.
- CEOS Space Agencies support the pilot by providing imagery throughout the crisis.



Amatrice: Most of the pretty, historic town is now rubble, blanketed in grey dust

Photo credit: <http://www.bbc.com/news/world-europe-37181933>



Can EO help in predicting such events? Earthquakes cannot be predicted with current technology or science, but EO mapping of interseismic crustal strain can help identify areas where EQs are more likely to occur. During the crisis, the post-mainshock redistribution of stress can provide information on future fault activations.

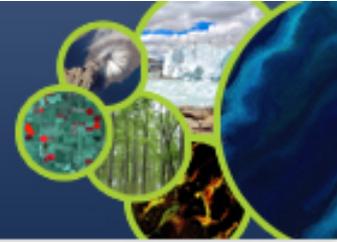
How fast must information derived from EO be made available?

Rapid science products must be available in the hours and days following a quake to be used in situational awareness and response; longer-term science products support prevention and mitigation activities, and have less stringent timeliness requirements.

What kind of information is needed by public safety agencies? Civil protection agencies need continuously updated information on damage to buildings and infrastructures (very quickly), on likely aftershocks (quickly), on response status and recovery progress...

Flood, Seismic Hazards, Volcano, and RO pilots are progressing very well with positive feedback from end users:

- Series of on-going end-to-end projects (end in 2017) to demonstrate benefits of satellite EO to ALL DRM phases, with strong user involvement.
- CEOS Agencies have provided imagery and coordinated value-adding support with non-CEOS partners.
- Excellent collaboration with the International Charter Space & Major Disasters.
- Initial discussion begun on pilot evaluation and on sustainability strategy.
- CEOS Web story: Earthquake struck island of Cephalonia (Jan. 26, 2014), Greece.

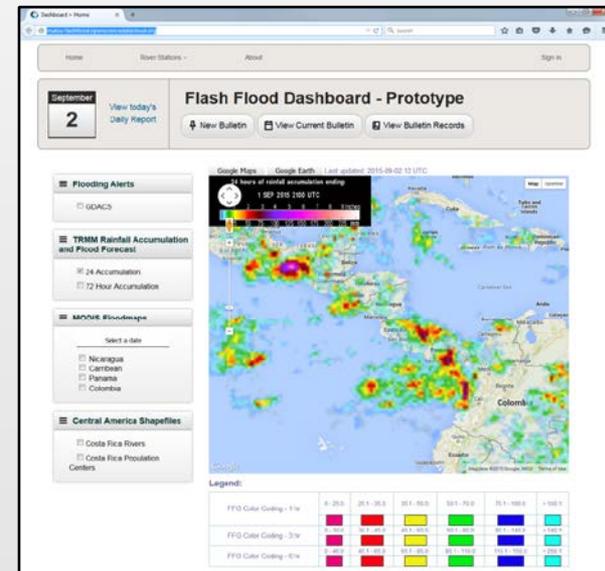
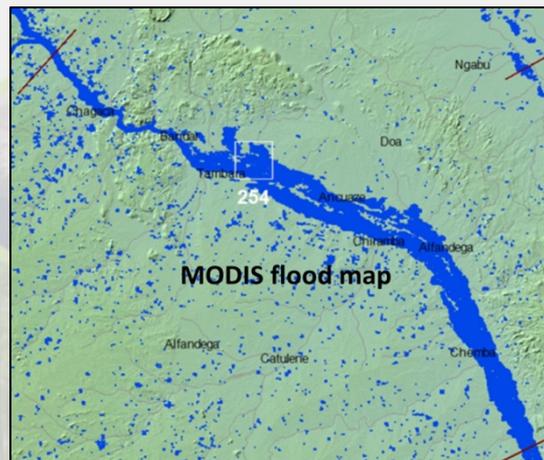


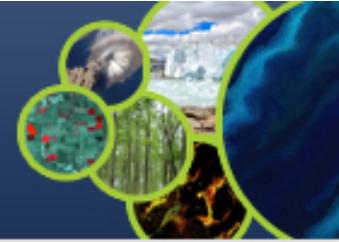
Demonstrate effective application of EO to the full cycle of flood management at all scales

Global Flood Dashboard (single access for multiple existing systems)

Three **regional** pilots showcasing end user benefit of frequent high spatial resolution observations (Caribbean, Southern Africa, Mekong/Java)

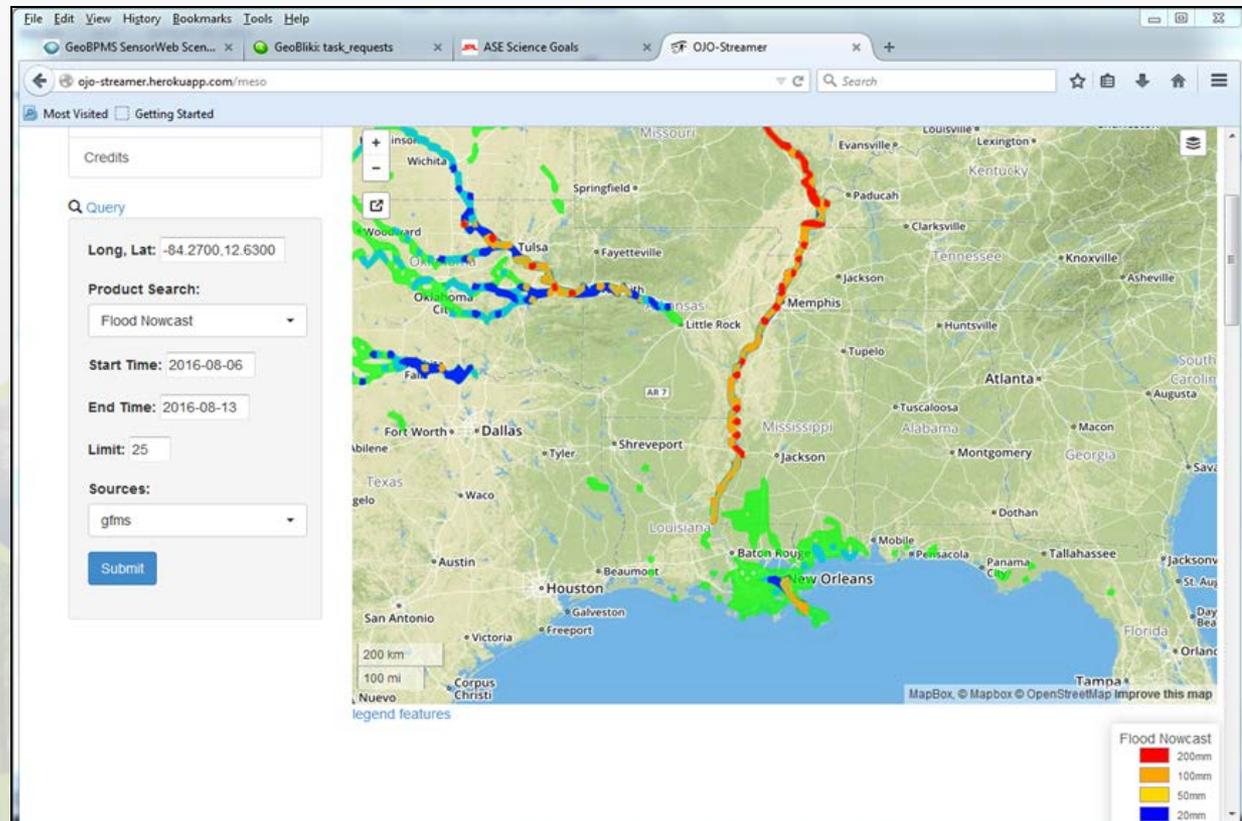
Encouraging at least base-level in-country **capacity** to access EO data and integrate into operational systems and flood management practices.

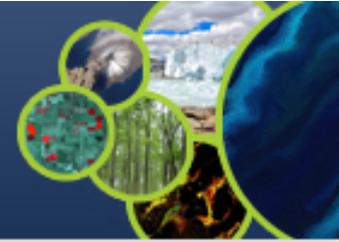




Global Flood Monitoring System (GFMS) flood products converted to GIS layers and distributed via application programming interface (API)

*C. Vaughan of FEMA's flood hazard mapping program: “This is absolutely the **direction we want to head.**”*



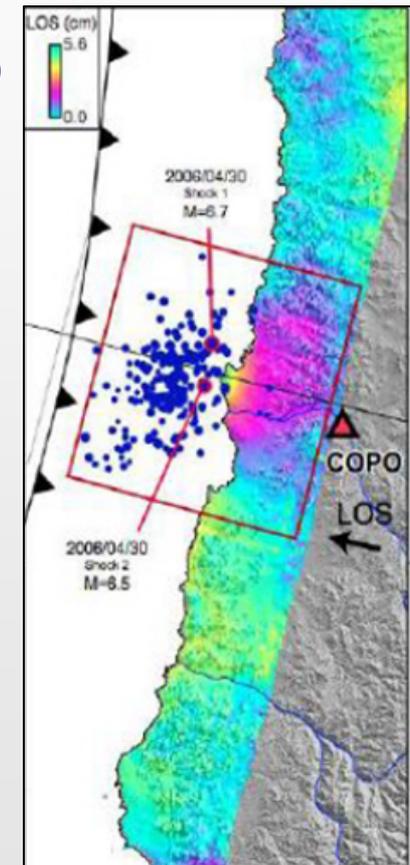
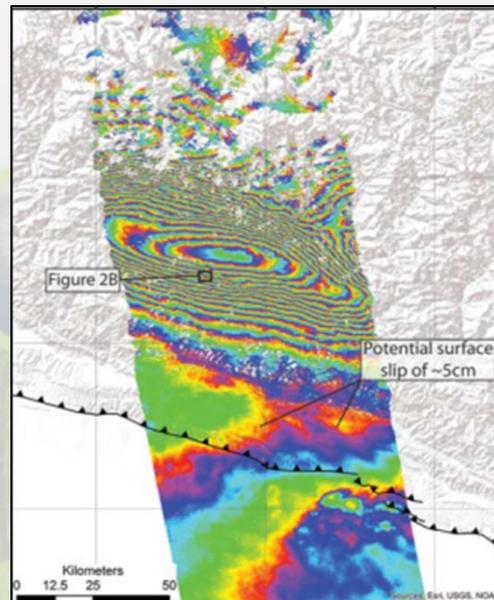


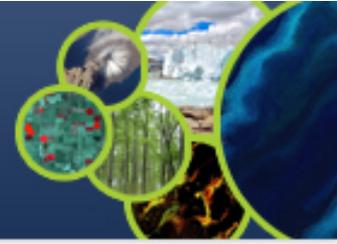
Demonstrate how satellite EO can be used to improve seismic monitoring and response to seismic events

Demonstrator for EO-based **global strain map (main focus on Turkey, Himalayas and Andes)**

Exploitation platform for large data set analysis (strain map, **supersites**)

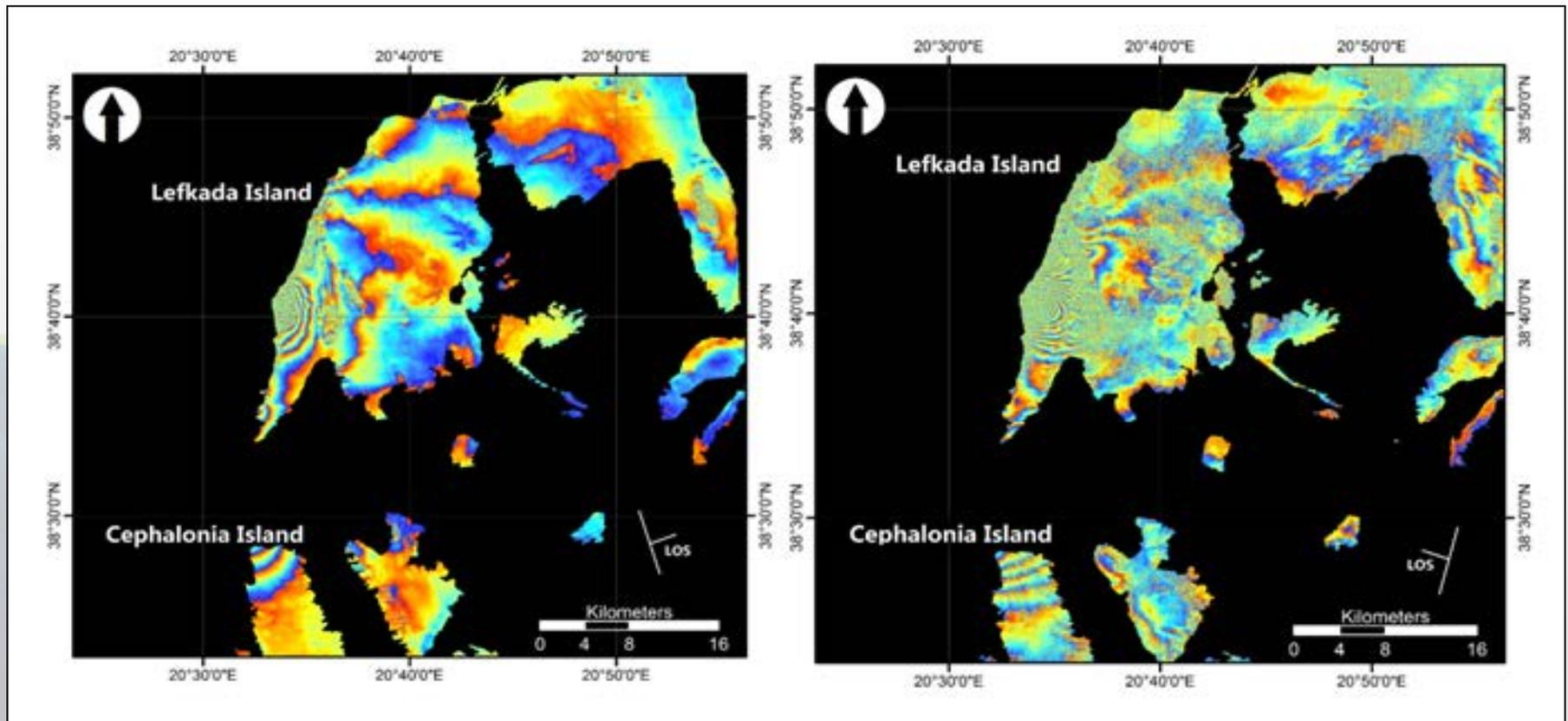
Rapid scientific products for 4 to 6 earthquakes per year (>M5.8)



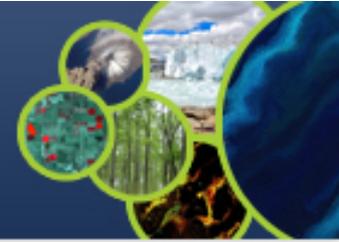


Study of the surface deformation caused by the November 2015 seismic event.

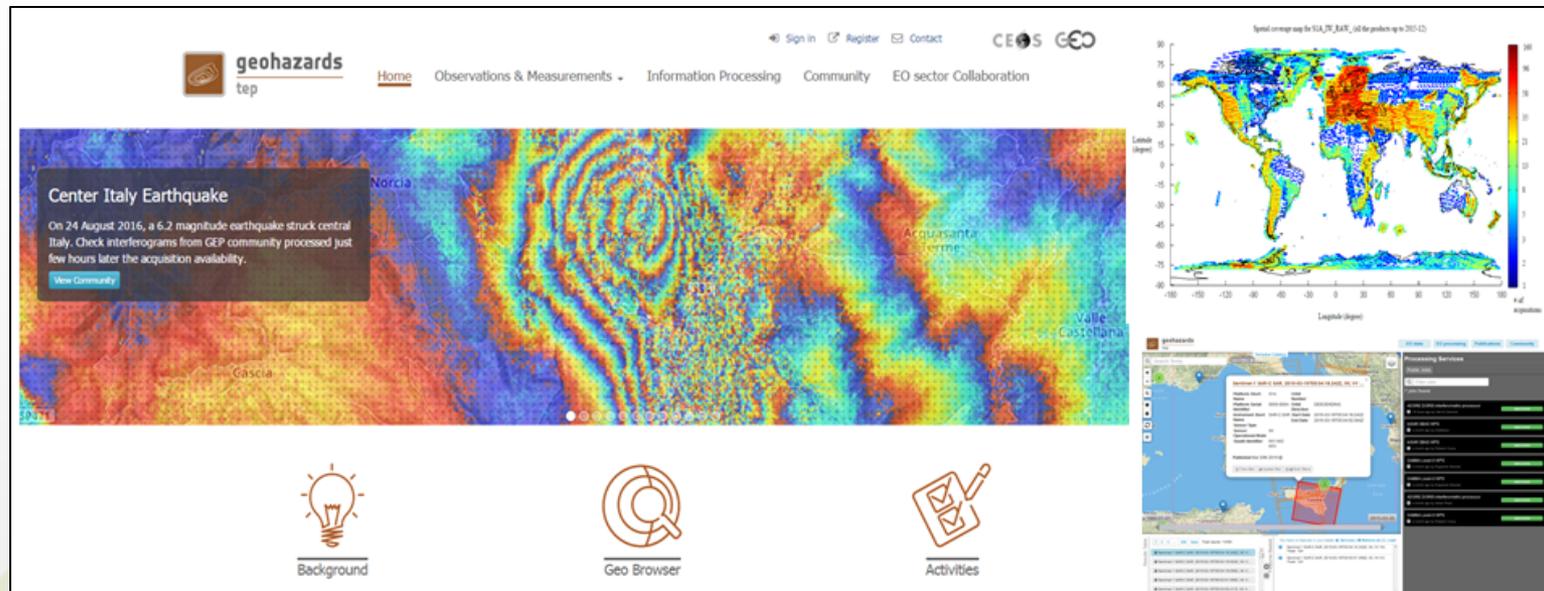
Sentinel-1A differential interferograms of the ascending pair (left) and descending (right)



H. Kontoes, NOA: Sentinel-1 data

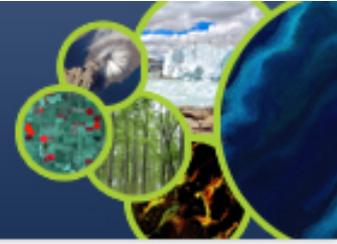


Geohazards Exploitation Platform (GEP): an innovative response



An Exploitation Platform sourced with **data and processing** relevant to the GeoHazards theme:

- EO data **storage** concerning wide extent tectonic analysis for which large data stacks are needed (typically 1000+ and 5000+ scenes and larger)
- Access to **advanced processing tools** (e.g. InSAR and Optical based)
- A **collaborative** work environment and scientific animation
- 2016: **32 users** on board; end of 2017: **60 users**
- One of the *6 Thematic Exploitation Platforms* originated by ESA
- Follows the GPOD, SSEP and TEPQwin precursors

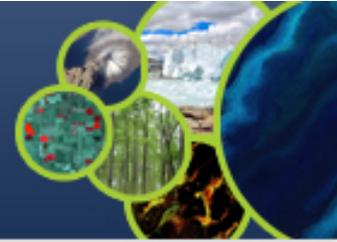


*“The main benefit of technologies such as GEP is that they give users the possibility to **perform complex processing of SAR data in a very user-friendly way**. The user has immediate access to vast data archives, and the processors available need very little user interaction. In the case of the Kumamoto earthquake, the interferogram was processed on GEP within hours after the availability of the first post-event acquisition.”*

Patrick Ordoqui, TRE ALTAMIRA

*“One of the more useful tool in a web-platform such as GEP is the possibility to **run multi-temporal interferometric processing**, implementing different algorithms such as SBAS or other Persistent Scatterer Inteferometric chains, and exploiting the large computing power and storage capabilities present in GEP.”*

Cristiano Tolomei, EO expert, INGV

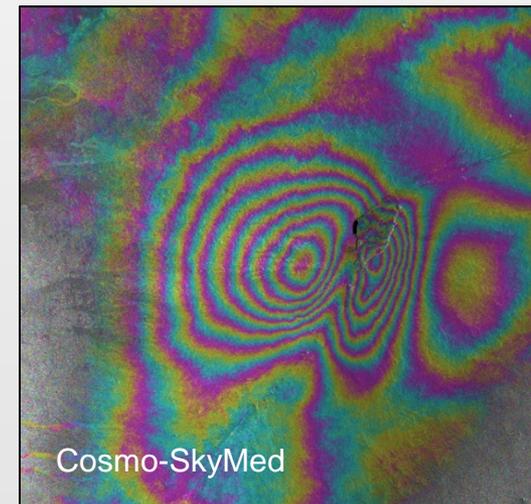


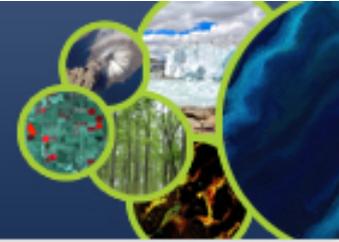
Improve coordination of satellite data acquisition over volcanoes, demonstrate efficiency of EO-based monitoring methodologies as a complement to in-situ measurements, and support and continue the GSNL initiative

Demonstrate feasibility of systematic **global monitoring in regional arc (Latin America)**

Develop new EO-based monitoring products at **supersites**

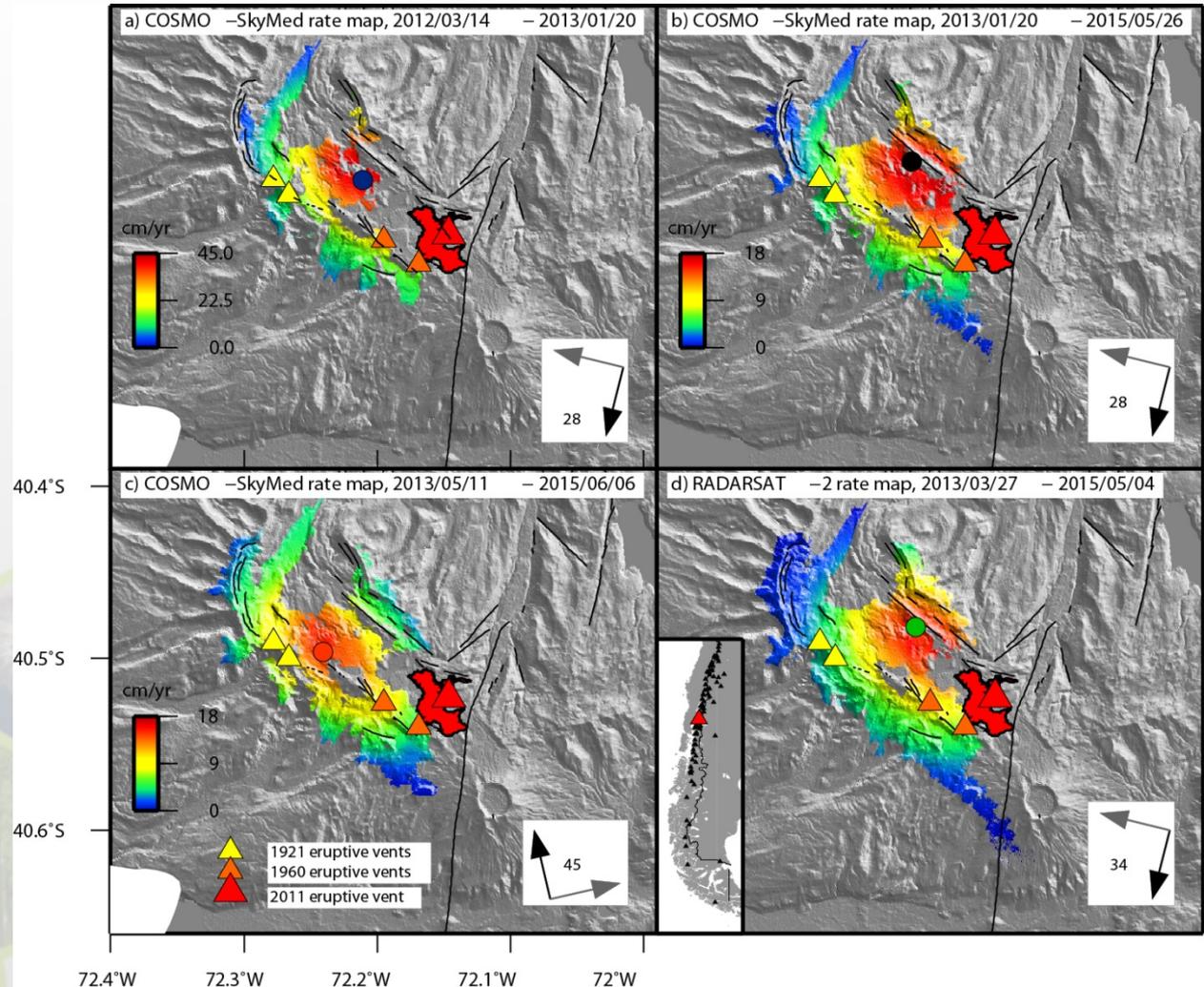
Real-time in-depth monitoring of one '100-year' category **major eruption**

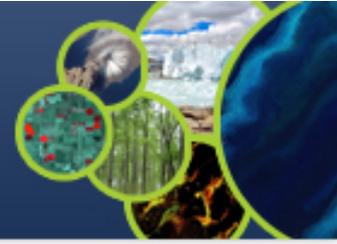




Monitored volcanoes with no ground networks and motivated installation of new sensors

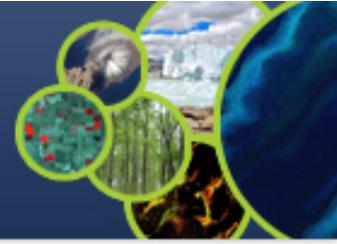
Observatorio Volcanológico de los Andes del Sur (OVDAS) installed 3 continuous GPS stations in response to interferograms showing inflation of Cordón Caulle





*“These InSAR results surprised OVDAS, as the volcano does not have geodetic instrumentation, and will **lead to the deployment of the first continuous GPS stations** over the volcano.”*

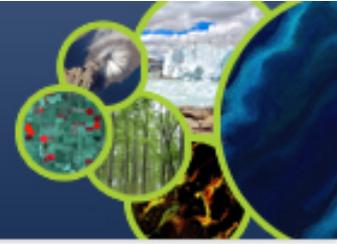
Luis Lara, Director, OVDAS



CEOS Agencies continue to ensure readiness to activate the Disaster Recovery Observatory (RO) for a one-time demonstration in the 2016–2017 period.

- Working with GFDRR/World Bank and the Government of Malawi, a **Malawi Demonstrator** is being implemented in order to validate applications relevant to recovery needs, including development of specific tools tailored to provide easy access to data over affected areas (pre-event data, response data and coordinated post event acquisitions).
- Other **demonstration activities** being pursued in Nepal (housing reconstruction) and possibly Syria (agricultural monitoring to determine ability to support livelihoods)
- A sub-group is working on an overarching Data Licensing document for Disasters.



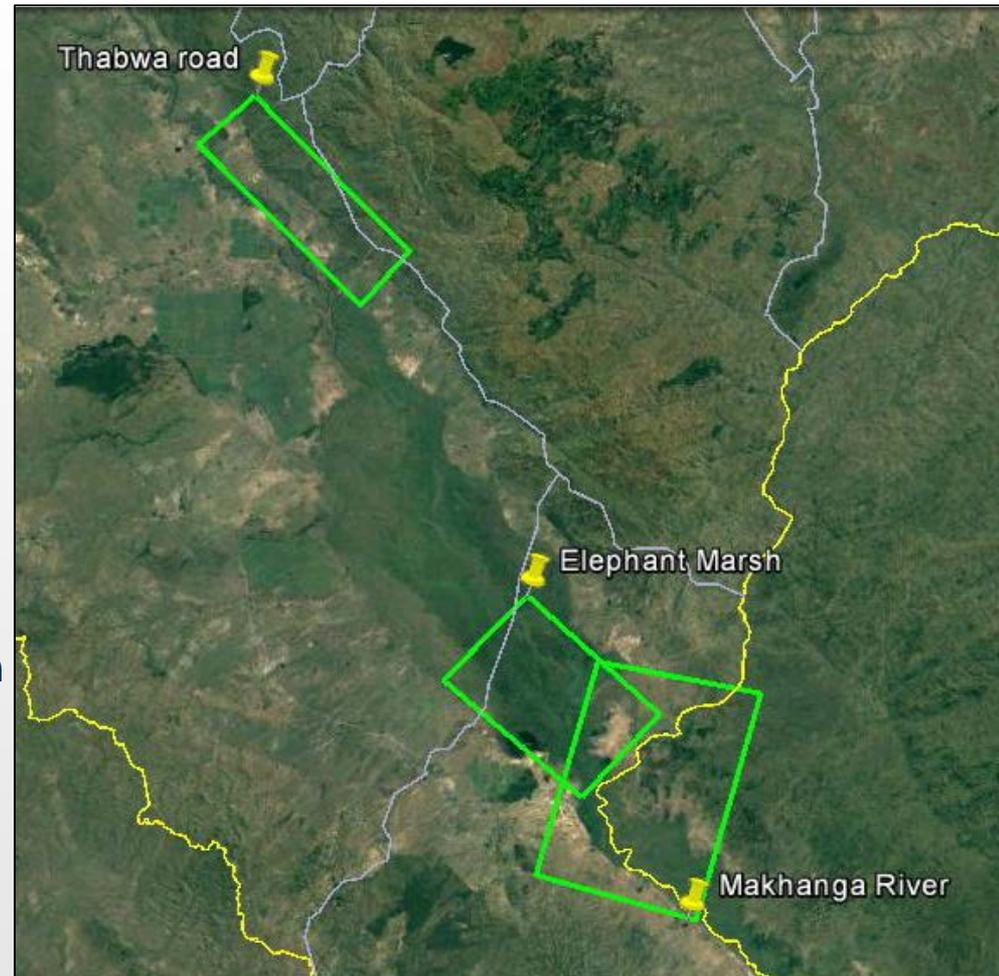


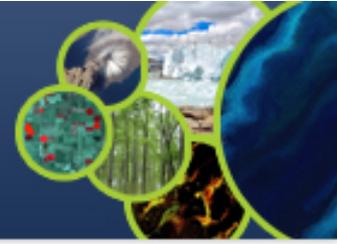
Final sign-off of Government of Malawi expected September 2016. Agreement in principle is given.

Activities identified are extracted from Malawi National Disaster Recovery Framework (NDRF)

Three sites retained :

- **Makhanga river bed assessment (DEM)**
- **Monitoring for agricultural damage in « Elephant Marsh »**
- **Thabwa road reconstruction**

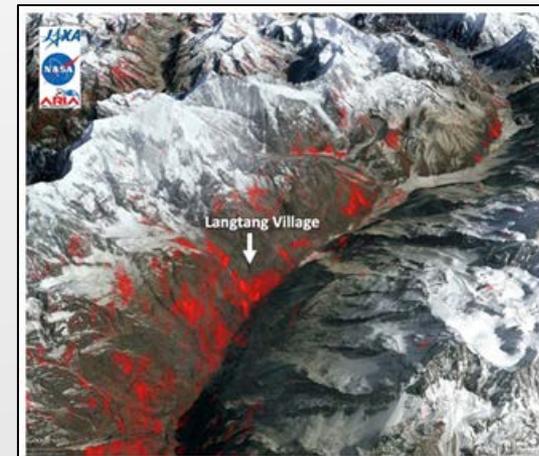




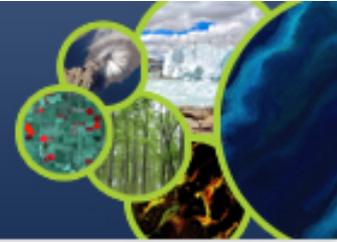
Main Goals:

- To demonstrate the **effective exploitation** of Earth observations (EO) data and technologies to **detect, map and monitor landslides**, in different physiographic and climatic regions.
- To apply satellite EO across the **cycle of landslide disaster risk management**, including preparedness, situational awareness, response and recovery with a distinct multi-hazard focus on cascading impacts and risks.

View from the ground (Photo credit USGS)



Damage Proxy Map (DPM) from ALOS-2 Data



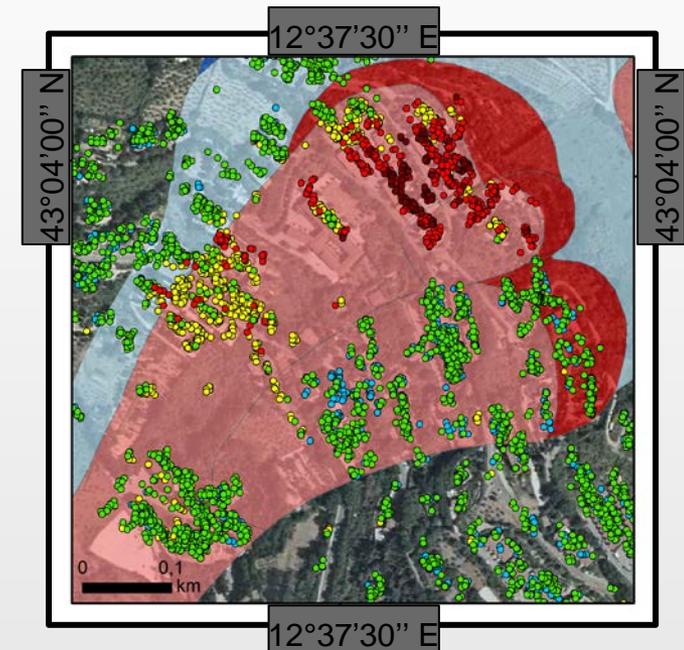
The Landslide Pilot will focus on two primary regions (Nepal and the Pacific Northwest in North America) and five experimental regions (Southeast Alaska, Cuba and Caribbean, Sri Lanka/ India, China, Norway).

Interest in Data Access:

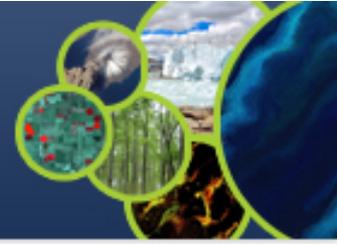
SAR: Sentinel-1, RADARSAT-2, COSMO-SkyMed, ALOS-1 and 2, TerraSAR-X

Optical: Landsat, IRS, Worldview, Pleiades, SPOT5, SPOT-6/7, QuickBird, RapidEye, Sentinel-2

DEM: TanDEM-X



X-Band, Cosmo-SkyMED
02/12/2009 – 22/02/2012



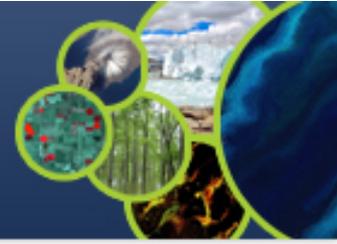
Reporting on success and user engagement

Hardcover “glossy” report being prepared for early 2017 to showcase success in each thematic area

Website reporting being developed for each thematic area to shift focus from results reporting to invitation to partner for sustainable EO stakeholder involvement in each area

Sustainability

Partnerships being elaborated with end users and other interested stakeholders with a view to defining a path to sustainability; regional organisations to be engaged through new initiatives, such as GEO-DARMA

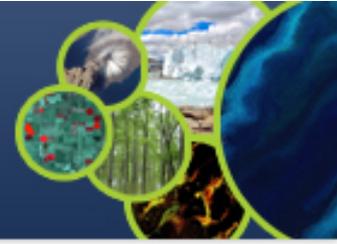


GEO-DARMA aims to establish an inclusive, comprehensive process to **increase effectiveness of local DRM actions by addressing EO requirements for DRR, and encouraging uptake of EO-based DRR solutions within projects of leading regional DRM stakeholders.**

From a CEOS perspective, the long-term outcome of GEO-DARMA is to **foster use of EO data and EO-based risk information by end users, and to **increase awareness within donor agencies** of EO solutions.**

In the concept phase: One of the major tasks during the early Concept phase will be to select projects and related user needs to be implemented as a priority.

- **Sub-group will be formed within WG Disasters, and secretariat being organized.**
- **Proposal being reworked and approach to partners to begin this fall.**

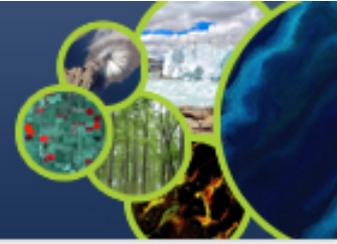


Biennial report submitted to the CEOS WG Disasters for assessment

- Marmara Supersite
- Etna Supersite
- Vesuvius/Campi Flegrei Supersite

New supersites being proposed:

- Gulf of Corinth site (Greece)
- San Andreas Fault site (USA)



CEOS Plenary Action to WGDIsasters:

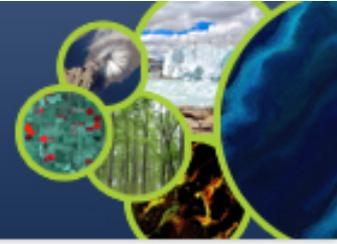
- Prepare for approval the implementation plan that includes a strategic data acquisition plan in response to the Landslide Pilot EO requirements.
- Prepare for approval the strategic data acquisition plan in response to the Greek and San Andreas supersites EO requirements.

Landslide Pilot

Requested decision: CEOS Principals are asked to endorse the implementation plan in response to the Landslide Pilot EO requirements.

Geohazard Supersites and Natural Laboratories (GSNL)

- **Greek Supersite:** Research Unit Institute of Engineering Seismology and Earthquake Engineering of the Earthquake Planning and Protection Organization (ITSAK)
- **San Andreas Supersite:** U. S. Geological Survey



Landslide affecting houses in a village of central China's Hunan Province.

Published on July 19, 2016

https://www.youtube.com/watch?v=gXNdV9_8kCk/