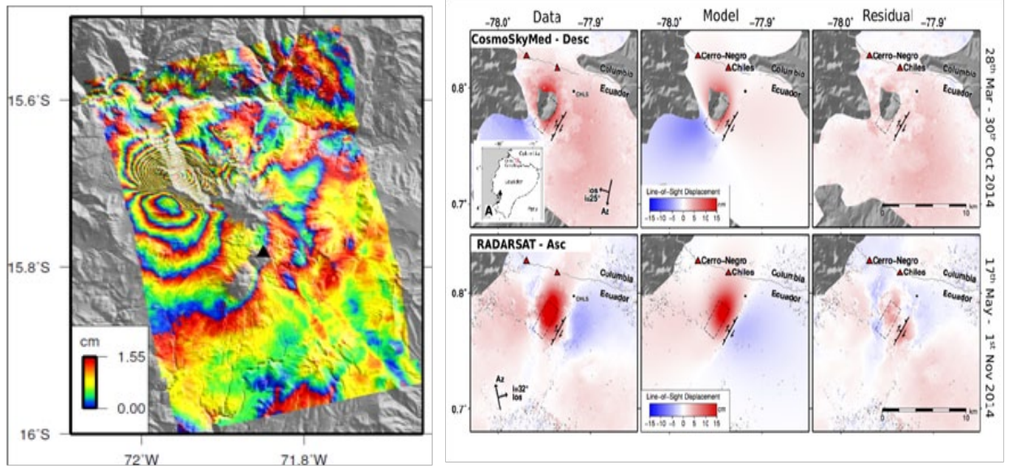
Global Partnership using Space-based technology applications for disaster risk reduction – GP-STAR

Volcano Monitoring using Earth Observing Satellites – CEOS WG Disasters Volcano Pilot

Priority for Action 1: "Understanding Disaster Risk"
Priority for Action 4: "Enhancing disaster preparedness for effective response"



Left: Interferogram from TerraSAR-X radar satellite shows ground displacement and active faults around Sabancaya volcano in Peru in May to July 2013. This data supported the local Volcano Observatory to make informed decisions about the potential eruptive hazard. (Image credit: Jay et al. 2015)
Right: Observed (left), modelled (middle), and residual deformation (data minus model) caused by an earthquake near Chiles and Cerro Negro volcanoes in 2014, based on COSMO-SkyMed and RADARSAT-2 data. All deformation can be explained by the earthquake, suggesting that any magma accumulation or transport associated with the episode of unrest was small. (Image credit: Ebmeier et al. 2016)

Application field: About 1500 volcanoes worldwide are known to have erupted in the last 12.000 years. Yearly, ca. 50 of them have observable eruptions. It is estimated that less than 10% of active volcanoes are monitored on an on-going basis. Modern space-borne radar satellites provide recognized techniques for the early detection of possible magma injections, for monitoring the stability of volcanoes, and for creating 3D digital elevation models anywhere on Earth. Such techniques provide key information for identifying volcanic hazards and assessing associated risks.

The **Volcano Pilot** activity of the **CEOS Disasters Working Group** in which volcanologists, remote sensing specialists, and Space agencies work together pursues the following aims:

a. Demonstrate the utility of integrated, systematic space-based EO as a volcano monitoring tool on a regional basis and for specific case studies;
b. Provide space-based EO products to the existing operational community (such as volcano observatories and VAACs) that can be used for better understanding volcanic activity and reducing impact and risk from eruptions;
c. Build the capacity for use of EO data at the majority of the world's volcanoes (particularly those that are not monitored by other means).

GP-STAR Fact sheet

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Application status: pre-operational Pilot

The pilot activity consists of a **regional study in the Latin American volcanic arc** (from Mexico through to Chile) to develop methodologies and protocols. The regional demonstration is a precursor to **showcase how volcano monitoring would work on a global scale.** It has shown that local observatories can highly benefit from satellite-based observations, especially from interferometric analyses of ground deformations based on radar-satellite data. Such geospatial information significantly adds to other sources of information, such as point data from GPS stations and visual observation from the ground. The Volcano Pilot is well on its way towards demonstrating that space-based remote sensing has exceptional value in monitoring and assessing volcanic risks.

Workflow: SAR data is analysed to assess deformation of volcanoes, providing insights on the types of data and repeat times best suited to monitoring volcanoes in different environments and supplying deformation information to local users.

Key results:
- Identification of volcanoes that are in a state of unrest in Latin America;
- Demonstration of the feasibility of operational volcanic monitoring using satellite-based EO;
- Tracking of unrest / eruptive activity using satellite data in support of hazards mitigation;
- Validation of EO-based methodology for improved monitoring of surface deformation;
- Improved EO-based monitoring of key parameters for volcanoes;
- Capacity-building in countries that do not currently have access to abundant EO data and/or the ability to process and interpret such data.

Innovative impact: The activity is ongoing. Noteworthy results have been yielded for numerous volcanoes. In all cases, these results were either achieved collaboratively with, or communicated to, local scientists and stakeholders. Feedback from several local stakeholders confirms the relevance of these results to local decision-making.

References:
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http://ceos.org/ourwork/workinggroups/disasters/ **Contact: Jens.Danzeglocke[at]dlr.de**