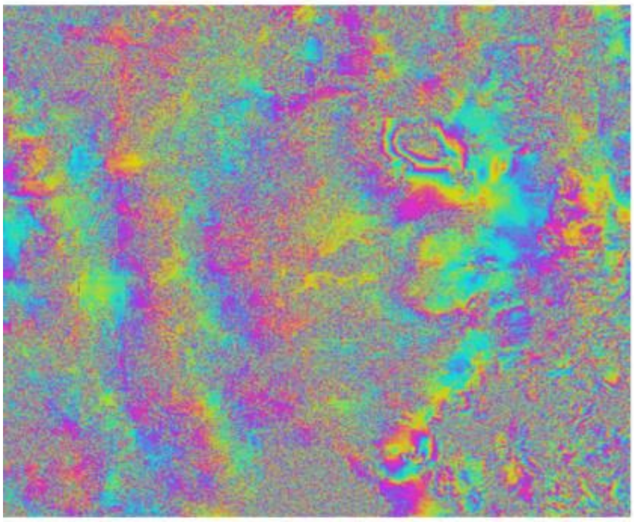
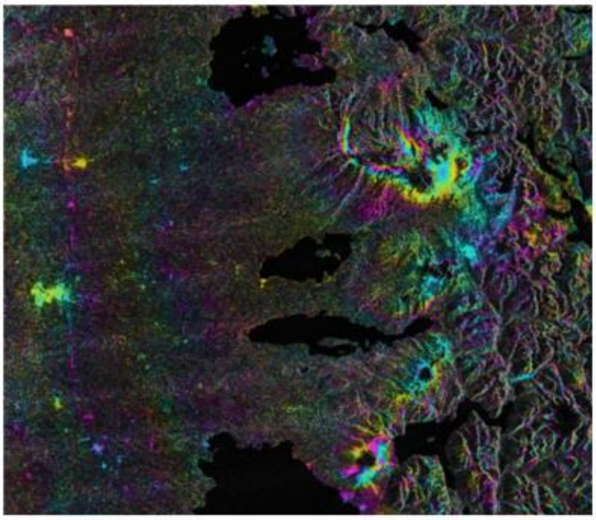
Objective A:
Demonstration of systematic monitoring in Latin America;

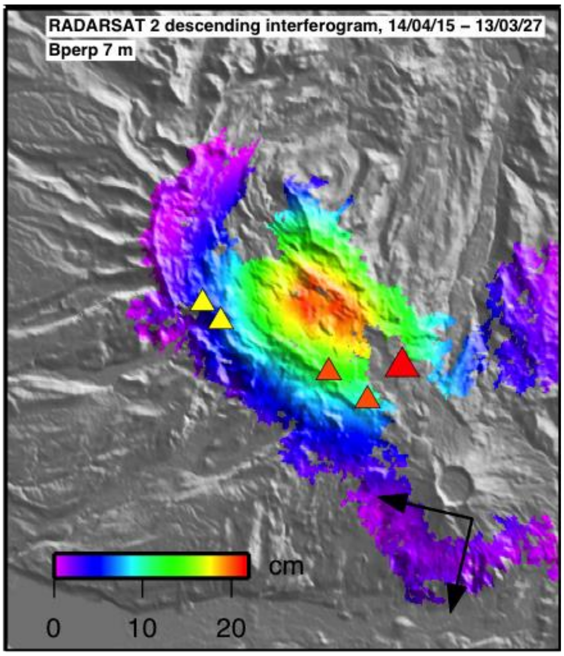
Cordon Caulle volcano (Chile)

Example of a RADARSAT-2 interferogram from Cordon Caulle volcano, Chile, spanning December 12, 2012 – March 27, 2013.



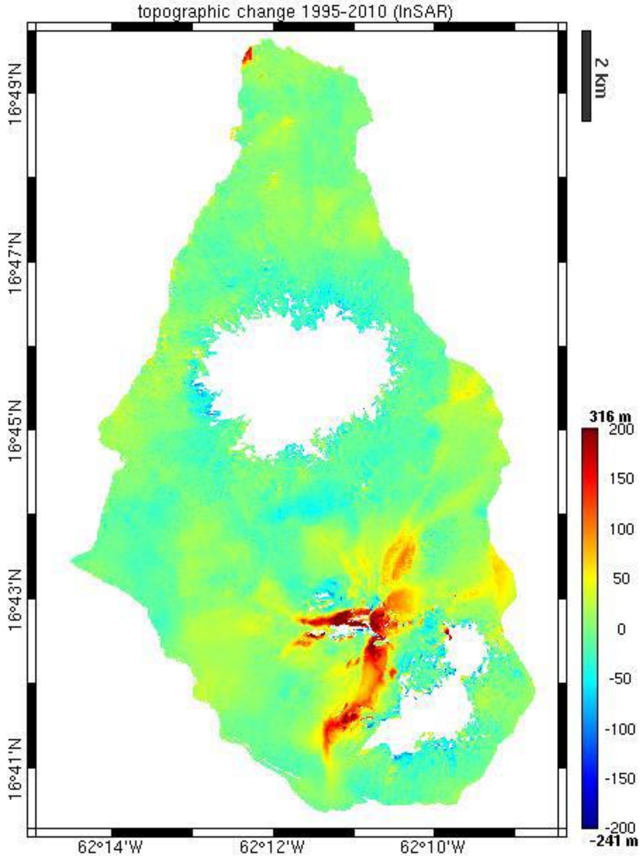


Left: phase difference; Right: phase difference overlain on amplitude image.
The volcano erupted in 2011-2012. This interferogram shows post-eruptive inflation which would not otherwise have been known without the CEOS pilot program. (C*ourtesy of Matt Pritchard, Cornell University).*



Two interferograms (RADARSAT 2) show an uplift signal located in the NW part of the volcano, which is also observed in ascending COSMO-SKyMed interferograms.
This signal is interpreted to be caused by the intrusion of a new magma batch after the large 2011-2012 eruption (VEI 4). Preliminary modeling shows that a sill at a depth of about 6.5 km can model the surface displacements. The location of this inferred sill is similar to some, but not all of the inferred sources responsible for the pre and coeruptive ground deformation (Jay et al., 2014, EPSL).
Eruptive events from 1921, 1960 and 2011 are shown as yellow, orange and red triangles, and the black arrows are the heading and the line of sight vectors.
(C*ourtesy of Matt Pritchard and Francisco Delgado, Cornell University)*

Topographic change at Soufriere Hills Volcano, Montserrat, where eruptive activity since 1995 has resulted in repeated growth and collapse of a lava dome.

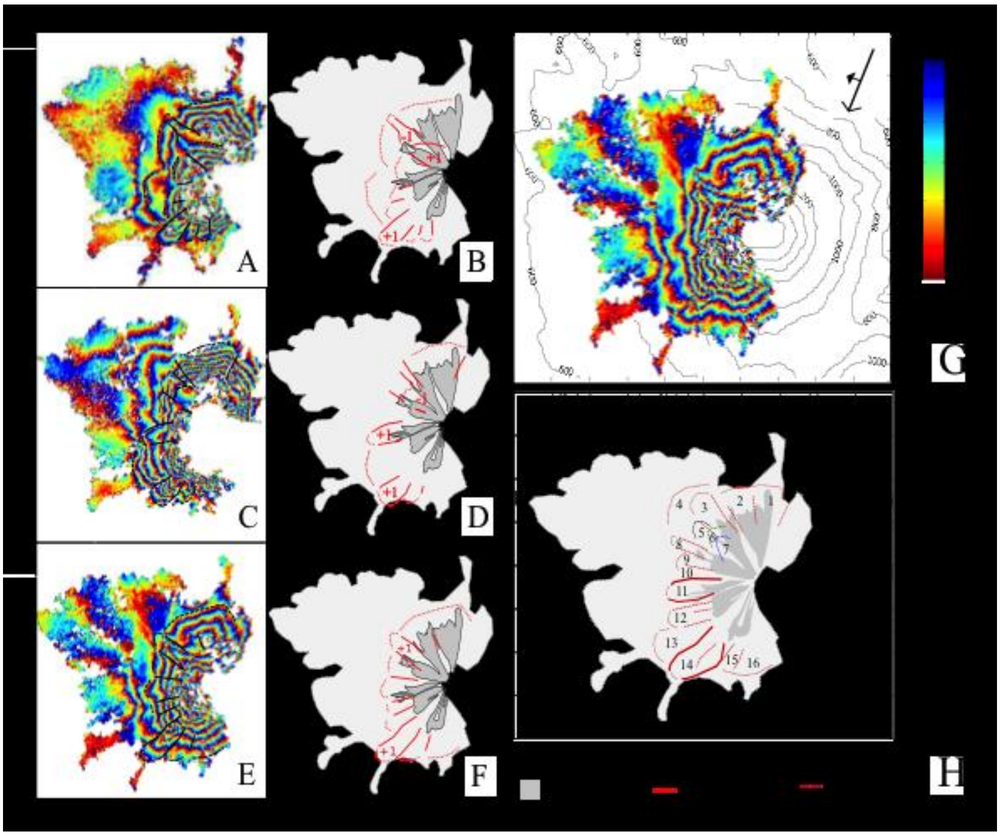


Results from ALOS-1 imagery spanning 2008-2010:

- ✓ No deformation was observed at 14 of the 15 volcanoes in the Lesser Antilles Arc from 2008-2010
- ✓ Large InSAR signals at Montserrat due to emplacement of volcanic material at the surface
- ✓ Comparison of pre-eruptive DEM to topography derived from post-eruptive InSAR (from ALOS) = Detect maximum 210 ± 30 m of lava dome growth and up to 200 m of valley infilling by pyroclastic flows

Courtesy of David Arnold (University of Bristol).

Mass wasting (landslide) behavior at Arenal volcano, Coast Rica



TerraSAR-X imagery 2011-2013

- ✓ 16 landslides of 5–11 meters in thickess were detected
- ✓ time-averaged displacement rates up to 12 cm/yr near summit
- ✓ • landslide motion varies through time

Courtesy of Susanna Ebmeier (University of Bristol).

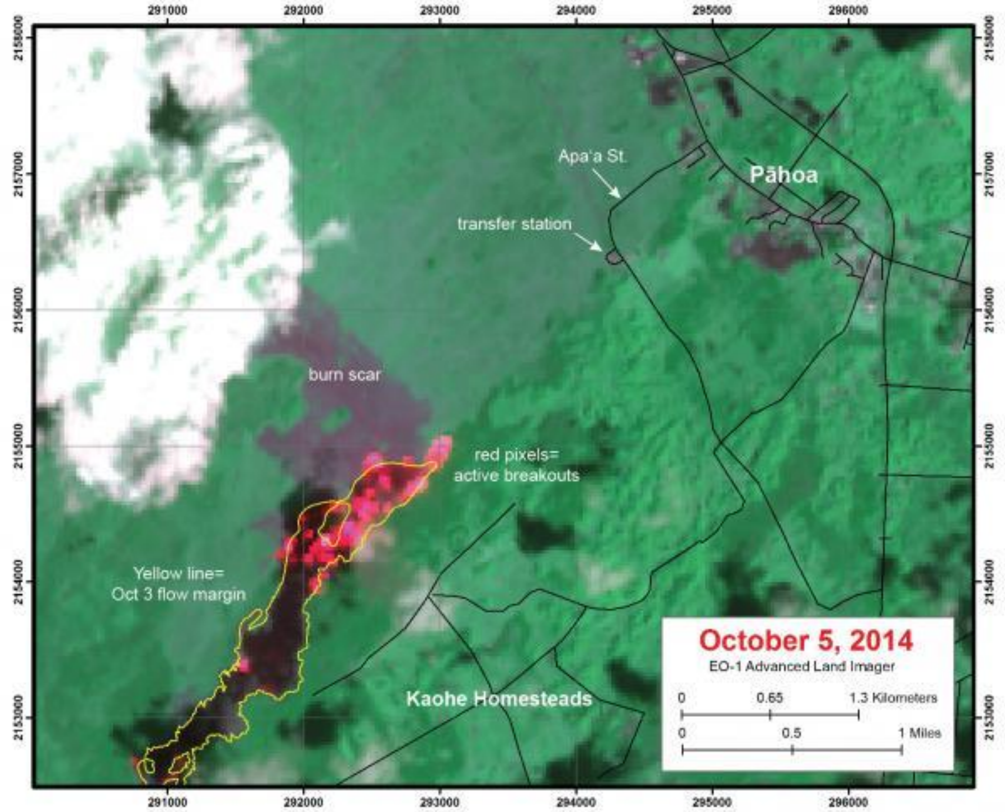
Objective B: Development of new products using monitoring from Geohazard Supersites and Natural Laboratories initiative

GEO Supersites

Hawaiian eruption: from June 2014.

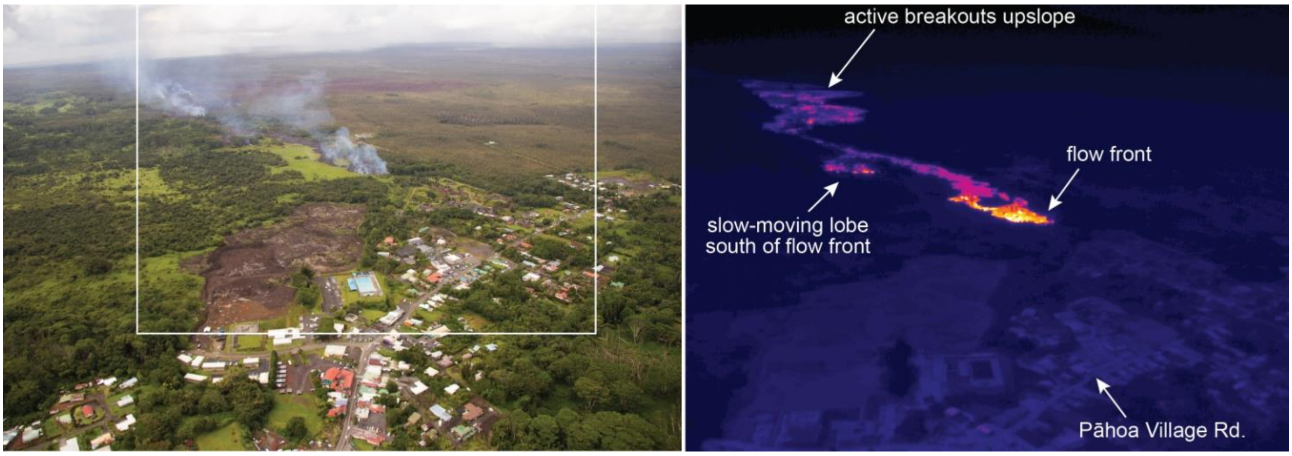
Haiiwan volcano observatory (USGS) is continuously monitoring the eruption and lavas flows using normal photography, thermal imagery, orthophotos and optical satellite images.
http://hvo.wr.usgs.gov/multimedia/

Advanced Land Imager instrument onboard NASA's Earth Observing 1 satellite image showing update on flow front position on 5 October 2014.



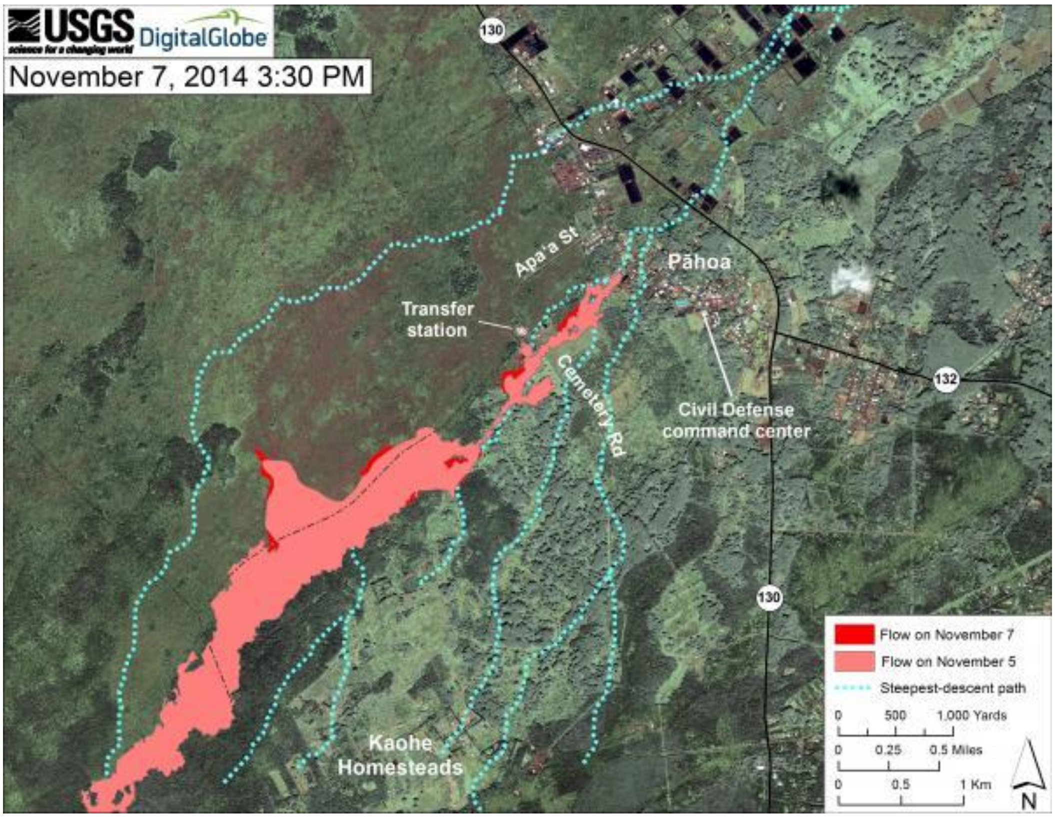
Bright red pixels depict areas of very high temperatures, and show active lava; white areas are clouds. The satellite image shows that active lava at the flow front has advanced approximately 240 meters (790 ft) beyond the point where it was mapped on Friday, October 3 (yellow line). The flow front today was 1.8 km (1.1 miles) from Apa'a St.

Comparison of a normal photograph with a thermal image.



Left: The white box shows the approximate extent of the thermal image. Right: the elevated temperatures (white and yellow areas) around the flow front indicate that significant activity is focused at the front, driving its forward movement. In addition, a slow-moving lobe was active upslope of Cemetery Rd. Farther upslope, scattered breakouts persist in the wider portion of the flow.

Map using a satellite image acquired in March 2014 (WorldView provided by Digital Globe) as a base to compare the flow areas in different dates



The area of the flow on November 5, 2014, at 1:00 PM in pink; widening and advancement of the flow as mapped on November 7 at 3:30 PM is shown in red.

Iceland eruption: Bárðarbunga volcano 2014 activity