Cities on Volcanoes 9
November 20-25, 2016
Puerto Varas, Chile
'Understanding volcanoes and society: the key for risk mitigation'

3-D displacement map of a large volcanic landslide surge

Lauren N . Schaefer [1], Teng Wang [2], Rudiger Escobar Wolf [1], Thomas Oommen [1], Zhong Lu [2], Jinwoo Kim [2], Greg Waite [1], Paul Lungdren [3]

[1]Department of Geological Engineering and Sciences, Michigan Technological University, Houghton, Michigan, USA

[2]Roy M. Huffington Department of Earth Sciences, Southern Methodist University, Dallas, Texas, USA

[3]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA

Keywords: Pacaya Volcano, slope stability, pixel tracking, 3D displacements, interferometric synthetic aperture radar (InSAR)

Massive flank failure is a fairly common process in the evolution of volcanoes, having occurred at over 400 volcanoes worldwide. Although an average of four sector collapses occur per century, measurements of flank movement indicative of instability are rare. Of these measurements, many are attributed to slow gravitational processes that may ultimately lead to collapse. Here, 3-D displacements from airborne radar amplitude images derived from an improved pixel offset tracking technique show that during eruptions in May 2010, the west and southwest flank of Pacaya Volcano in Guatemala experienced large (~4 m), discrete landsliding that was ultimately aborted. Pixel offset tracking improved measurement recovery by nearly 50% over classic interferometric synthetic aperture radar (InSAR) techniques, revealing measurements in areas that are otherwise decorrelated in SAR interferograms. The 3-D displacement field shows that the edifice moved downslope along a complex failure surface, involving both rotational and along-slope movement. The high magnitude and large spatial extent of the slide, which includes material nearly 3000 m from the summit vent on the shallow (~10?) lower flanks, is distinctive from other measurements of active flank movement at volcanoes. Notably, the lack of continuous movement of the sliding area in the years leading up to the event emphasizes that active spreading should not always be expected at volcanoes for which triggering factors (e.g. magmatic intrusions and eruptions) could precipitate sudden major flank instability.