



The interior of a volcanic summit: TerraSAR-X interferometry reveals complex conduit system at Volcán de Colima, Mexico

Jacqueline T. Salzer (1), Mehdi Nikkhoo (1), Thomas R. Walter (1), Gabriel Reyes-Dávila (2), Mauricio Bretón (2), and Raul Arambula-Mendoza (2)

(1) GFZ Potsdam, Potsdam, Germany (salzer@gfz-potsdam.de), (2) Observatorio Vulcanológico, Universidad de Colima, Colima, Mexico

The dimensions and shape of the volcanic conduit is one of the main parameters controlling the dynamics and style volcanic eruptions and their precursors, but also one of the main unknowns. Different types of pre-eruptive signals originate from this region, such as changes in the gas composition, earthquakes, tremors and long periodic seismicity, as well as deformation on different scales, all of which strictly depend on the source geometry. However, vulnerability of near-summit stations during explosive eruptions leads to a sparse spatial resolution and hence poor a knowledge of the shallow source process and its parameters. Such incomplete observations also increase the difficulty of identifying episodes of unrest that will lead to eruption.

At Volcán de Colima, Mexico, the plumbing of the shallow conduit system caused detectable and characteristic volcano deformation during the days prior to the renewal of the volcanic activity in 2013, which was initiated by an explosion. Here we present a model of the shallow conduit system at Colima, based on pre-explosive summit deformation detected in high resolution satellite radar and camera observations. The radar data are interferometrically processed to provide displacement maps up to 7 hours before the explosion, and are synthetically well reproduced using a boundary element method. This allows constraining a complex, possibly curved ascent path, with at least two hydraulically connected pressurized regions at shallow levels beneath the dome. The locations of the sources coincide with the later path of magma ascent. Our results highlight the geometrical complexity of the shallow conduit system at Colima, which can conditionally become detectable when being plumbed prior to explosive eruptions. The small temporal and spatial extent of the deformation signal may explain why many volcano eruptions occur without precursory deformation activity.