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

Ground deformation at Laguna del Maule volcanic field from InSAR measurements: interplay between tectonics and magmatism

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Keywords: uplift, volcanic unrest, InSAR

The extraordinary uplift episode started in 2007 at Laguna del Maule volcanic field (LdM) in Chile, is characterized by high uplift rates affecting the most recently (<20 ka) erupted region of the volcanic field. The spatial and temporal pattern of uplift was interpreted as the result of a new magma injection in the reservoir (Le Mével et al., 2016). In addition to this large-scale inflation pattern, new small-scale ground deformation signals have been revealed in two peripheral areas, using Interferometric Synthetic Aperture Radar (InSAR) data. In this study we use SAR images from ALOS-1, ALOS-2, TerraSAR-X, and Sentinel satellite missions acquired between 2007 and 2016 to characterize the ground displacement over two main areas around LdM: one on the Southwest side of the basin near the Troncoso fault and the other on the Southeast side near the Barrancas volcanic complex. Both of these regions are also notable for their seismic activity characterized by seismic swarms of hundreds of small magnitude earthquakes occurring on average every two months (OVDAS). The goal of this study is to determine the source of the observed deformation and its relation to the main uplift signal at LdM. To determine the ongoing processes, we use analytic source models to characterize the location, type and geometry of the source of the observed motion. The modeling results allow us to differentiate between active faulting, dike injection and/or magma reservoir inflation/subsidence. Are they transient or persistent tectonic processes? Are they linked to the temporal evolution of the uplift and/or the seismicity? To answer these questions, we calculate time series of displacement. This study of deformation signals will help improving the conceptual model of the current unrest episode at LdM by considering the role of tectonic processes and their interplay with magmatism.