Geophysical Research Abstracts
Vol. 20, EGU2018-12690, 2018
EGU General Assembly 2018

Mechanical interactions between pressure sources and rift zones at Kīlauea Volcano, Hawai[U+02BB]i

Marco Aloisi (1), Daniele Carbone (1), Michael Poland (2), and Sergio Vinciguerra (3)

(1) INGV, Osservatorio Etneo - Sezione di Catania, Catania, Italy (daniele.carbone@ingv.it), (2) USGS - Cascades Volcano Observatory, Vancouver, USA, (3) Department of Earth Sciences, University of Turin, Italy

Geophysical observations have shown that, at different volcanoes, underground pressure sources and rift zones may act jointly during phases of activity. Indeed, pressurization of a magma body at shallow to intermediate depth, along with degradation of the mechanical properties of the host rock, can enhance tensile stress along zones of weakness, thus favoring magma intrusion. Such interactions were modeled in terms of coupling between pressurization and mechanical properties of the host medium at Mt. Etna, based on gravimetric, geodetic and seismic data. Similar interactions have been hypothesized at Piton de la Fournaise, from seismic noise analysis, and at Montserrat and Laguna del Maule volcanic field, from gravity and ground deformation data.
Here, we perform a study aimed at quantitatively understand possible mechanical interactions between a shallow pressure source beneath the summit caldera and the east and southwest rift zones at Kīlauea Volcano (Hawai‘i). Past studies have demonstrated a strong connection between the two structures, for example, with increases in seismic activity along the upper part of the east rift zone and extension across the rift, both coincident with inflation of the summit. These observations suggest a coupling between pressure changes at the summit and the mechanical response of the weakened rift zone within the volcanic edifice, which may modulate magma accumulation and transport processes. In order to understand and address this complex issue, we use a finite-element modeling approach. In particular, the elastic parameters of the medium are deduced from the available seismic tomography results and we assume a lower Young's modulus in correspondence of the rift zone. A set of simulations is performed to study how the degradation of the mechanical properties of rocks along the rift zone changes the ground deformation pattern induced by pressurization of the shallow magma body.