EGU24-3516, updated on 09 Aug 2024
https://doi.org/10.5194/egusphere-egu24-3516
EGU General Assembly 2024

Patterns of deformation and connectivity at Western Galápagos Volcanoes

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The Western Galápagos volcanoes of Alcedo, Cerro Azul, Darwin, Fernandina, Sierra Negra, and Wolf have exceptionally high rates of eruption and unrest. Deformation rates measured using Interferometric Synthetic Aperture Radar are high magnitude during eruptions and episodes of magmatic intrusion, but also significant during inter-eruptive periods. There are characteristic differences in deformation and unrest styles between the volcanoes that have persisted for at least three decades, indicative of the impact of topography, magmatic zone maturity and magmatic flux.

Here, we focus on analysing the trends in displacements at these six volcanoes over the past three decades. These show correlations not only in long-term uplift and subsidence, but also in short term fluctuations in displacement rate. Correlation is especially high during episodes of high melt flux into the shallow crust, indicating some degree of connectivity in the subsurface. We are able to rule out static stress changes, shallow hydraulic connections and radar processing artefacts, and suggest that the mechanism for connectivity lies in pore pressure diffusion at the base of the crust, as inferred at Hawai'i.

Volcanic deformation is generally interpreted in the context of shallow magmatic reservoirs treated as discrete independent systems. However, in the Western Galápagos, and potentially many other places around the world, they are actually the most accessible expression of vertically extensive, heterogeneous magmatic systems.