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The use of massive integrated ground deformation datasets to analyze spatial and temporal evolution of Mauna Loa volcano (Hawaii)

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We exploited a massive, multiparametric dataset of DInSAR and GPS measurements to achieve a time-varying imaging of the magma transfer processes and its interaction with main structural features of Mauna Loa volcano (Big Island, Hawaii) from 2005 to 2015. The dataset consists of 23 continuous GPS time series and of 307 SAR images acquired from ascending and descending orbits by Envisat and Cosmo Sky-Med satellites. Envisat data have been automatically processed using the recently developed P-SBAS approach within the ESA G-POD environment.
The analysis of this dataset has been realized using a novel method, allowing a time-varying imaging of complex ground deformation sources. Results have shown that the deformation pattern in the considered interval, is related to the rapid ascent of magma within a subvertical, pipe-like conduit, located beneath the summit caldera of Mauna Loa and its propagation within the dike systems along both the south and east branches of the rift. Furthermore, we evidenced as the intrusion of the magma within the rift dike system triggers a sliding of the SE portion of the volcanic edifice along the basal decollement.
We demonstrated as the proposed approach is an effective tool in exploiting big variety of data in order to gain detailed information about the volcano dynamics, but eventually also in other geodynamical contexts.