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Deformation history of Mauna Loa (Hawaii) from 2003 to 2014 through InSAR data: understanding the shorter-term processes

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Geodesy allows detecting the deformation of volcanoes, thus understanding magmatic processes. This becomes particularly efficient when time series are available and volcanoes can be monitored on the mean-term (decades), and not only during a specific event. Here we exploit the SBAS technique, using SAR images from ENVISAT (descending and ascending orbits; 2003 - 2010) and COSMO-SkyMed (descending and ascending orbits; 2012 - 2014), to study a decade of deformation at Mauna Loa (Hawaii). These data are merged time series data from 24 continuously operating GPS stations, which allows us to calibrate the InSAR time series. Our results show a long-term inflation of the volcano from 2003 to 2014, reaching a peak of $\sim$11 cm/yr on the summit area between mid-2004 to mid-2005 and then slowing down. Within this frame, we were able to identify five main periods with approximately linear deformation behavior. The inversion of the deformation data in the first four periods suggests the repeated, though not constant, intrusion of one or more dikes below the summit caldera and the upper Southwest Rift Zone. Moreover, the dike intrusion coincides with minor acceleration of flank slip. Such a behavior is distinctive and, with the exception of the nearby Kilauea, has not been observed at any other volcano on the mean term. It is proposed that continuous, even though not constant flank instability of the SE flank may promote semi-continuous intrusions in a volcano with a ready magma supply.