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Surface deformation analysis of the Mauna Loa and Kilauea volcanoes, Hawaii , revealed by InSAR measurements

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The Big Island of Hawaii is home to three volcanoes that have historically erupted. Hualālai, on the east side of the island, Mauna Loa, the largest volcano on the planet which has erupted 39 times since 1832 (most recently in 1984) and Kilauea, which has been in a state of continuous eruption since 1983 from vents on the volcano's east rift zone. Deformation at Kilauea is characterized by summit and rift zone displacements related to magmatic activity and seaward motion of the south flank caused by slip along a basal decollement.
In this work we investigate the deformation affecting the Mauna Loa and Kilauea volcanoes, Hawaii , by exploiting the advanced Interferometric Synthetic Aperture Radar (InSAR) technique referred to as Small BAseline Subset (SBAS) algorithm. In particular, we present time series of line-of-sight (LOS) displacements derived from the SAR data acquired by the ASAR instrument, on board the ENVISAT satellite, from the ascending (track 93, frame 387) and descending (track 429, frame 3213) orbits over a time period between 2003 and 2008. For each coherent pixel of the radar images we compute time-dependent surface displacements as well as the average LOS deformation velocity. We also benefit from the use of the multi-orbit (ascending and descending) data which permit us to discriminate the vertical and east-west components of the revealed displacements. The retrieved InSAR measurements are also favourably compared to the continuous GPS data available in the area in order to asses the quality of the SBAS-InSAR products. The presented results show the complex and articulated deformation behavior of the investigated volcanoes; moreover, the possibility to invert the retrieved DInSAR products, in order to model both deep geological structures and magmatic sources, represents a relevant issue for the comprehension of the volcanoes dynamics.