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InSAR ground deformation, data inversion and stress transfer in basaltic volcanoes.

T. R. Walter (1), F. Amelung (2)
(1) GFZ Potsdam, Germany, (2) RSMAS Miami, USA

At many basaltic ocean islands, eruptions are associated with rift zone widening and the formation of a dike like fissure that is propagating laterally downrift, as well as flank movement along a decollement fault. The Hawaiian volcanoes are type examples of this eruption type, but similar processes are also suggested elsewhere. At Mauna Loa volcano, Hawaii, repeated dike intrusion result in long-term internal growth of the volcano and seaward motion of the volcano flanks, most of which is related to displacement along a subhorizontal fault at the base of the volcanic edifice at 12-14 km depth below the summit. Sometimes large earthquakes may occur at the decollement fault, such as the 1868 magnitude 8 Pahala earthquake and the 1951 magnitude 6.9 Kona earthquake. The last significant eruptions occurred in 1950 and in 1984. After almost 20 years of quiescence, since 2002 Mauna Loa is subject to inflation. We present new evidence from 2002-2005 InSAR data for secular inflation of a dike-like magma body in the intermediate and deep section of the southwestern rift zone. Through stress transfer models we can explain the location of the current intrusion: Magma intrusion occurs in a section of the rift zone that was unclamped by previous earthquakes and dike intrusions, suggesting that the transferred elastic stress influences magma accumulation in the rift zone. This shows that geodetic monitoring of the magmatic sources combined with stress change modeling may provide a tool to forecast the response of active basaltic volcanoes to magma intrusion.