Geophysical Research Abstracts
Vol. 18, EGU2016-15028, 2016
EGU General Assembly 2016

Fissure distribution at Mauna Loa (Hawaii) as an example to understand shallow magma transfer at volcanoes

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Mauna Loa (Hawaii) is the largest active shield volcano on the Island of Hawai'i, covering more than half of it and rising to 4,169 meters above sea level. The volcano hosts the Moku'aweoweo summit caldera, from which two elongated rift zones depart: the Northeast Rift Zone (NERZ) and the Southwest Rift Zone (SWRZ). Most of Mauna Loa's eruptions begin with lava fountains from a series of fissure vents in the summit region and then often migrate to vents down either rift zone.
Mauna Loa volcano shows a distinctive feature, being characterized by minor radial eruptive fissures (not related to the two main rifts) on the NW flank only. This study tries to explain such a selective distribution of vents, and thus of shallow magma transfer. To this aim, we run numerical models with different amount of opening of the two rift zones of Mauna Loa, as well as different amount of slip on its SE flank. Our results suggest that the selective occurrence of the radial fissures may be explained by the competition between two processes: a) rift intrusion (especially along the NERZ), promoting the development of radial dikes along the NW flank; b) flank slip, inhibiting the development of the radial dikes on the SE flank. The opening of the two non-parallel main rift zones of Mauna Loa promotes the local extension necessary to develop the radial dikes on the NW flank. A general model for the development of a third branch of radial rift, which may be also applied to Mt. Etna and some volcanoes on the Canary Islands, is proposed.