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Characterizing volcanic tremor sources associated with collapses in Halema‘uma‘u Crater at the beginning of the 2018 Kilauea eruption

Jean Soubestre[1], Bernard Chouet[2], and Phillip Dawson[3]
[1]Instituto Volcanológico de Canarias (INVOLCAN), Tenerife, Spain (jsoubestre@iter.es)
[2]Now at Arzier-Le-Muids, Switzerland
[3]U.S. Geological Survey, Moffett Field, CA, USA

We analyze data from one tiltmeter and twelve broadband seismic stations recorded at the beginning of the 2018 Kilauea eruption, to provide an integrated view of distinct tremor sources that preceded and accompanied this eruption. Studying the beginning of the eruption is challenging because of the diversity and complexity of signals that were recorded during this phase. But such undertaking represents a key aspect for understanding the dynamics of the different processes that took place at the start of the lava lake withdrawal on May 2 and during the twelve major collapses that occurred in Halema‘uma‘u Crater through May 26. The application of a network-based method to automatically detect and locate seismic tremor, combined with physical modeling of the underlying source processes, enables a characterization of these tremor sources in unprecedented detail.

Our analyses document one tremor source active during the period preceding the eruption, which is attributed to the quasi-steady radiation from a shallow hydrothermal system located at the south-southwest edge of Halema‘uma‘u Crater. These analyses further document two newly described sequences of gliding tremor. The first sequence is attributed to progressive jerky intrusions of a rock piston into a shallow hydrothermal reservoir between May 7 and May 17. The second sequence is attributed to the gradual degassing of a bubbly magma within an east striking dike below Halema‘uma‘u Crater, impacted by repeated roof collapses, and resulting in a quasi to totally degassed magma by May 26.