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V23B-08 - Tracking changes in the co-eruptive tremor characteristics and associated magma degassing processes, application to Piton de la Fournaise, La Réunion, France



Tuesday, 14 December 2021



20:40 - 20:45



Convention Center - Room 348-349

Abstract

The dynamics of volcanic eruptions is controlled by physico-chemical parameters of the magma depending on different processes such as the degassing of ascending magma in volcanic conduits. This degassing is often invoked as a possible source for long-period seismicity generation. Therefore, associated seismic signals constitute an important source of information that can lead to a better understanding of the underlying mechanism. At Piton de la Fournaise (PdF) volcano, the onset of eruptions is marked by the occurrence of co-eruptive seismovolcanic tremor, linked with magmatic fluid motion in the sub-surface. Considering the typical broad PdF tremor spectrum (0.5 – 10 Hz), seismic signals might result from different processes but continuous degassing of shallow magma seems to be one of its main components.

In the present study, we propose to track in time varying characteristics of the tremor to gain insight into underlying magma properties. We first apply a multiplet detection method to scan the tremor waveform that allows us to characterize its state (continuous or discontinuous). Change from continuous tremor to intermittent gas-pistons events marks a change in degassing regime and often occurs at the end of PdF eruptions. Following a network-based covariance matrix approach, we observe positive spectral gliding during continuous tremor for several short-lived eruptions and during the detected gas-pistons events with higher modes for 4 different eruptions.

We finally propose a simple resonator model based on an analytical equation for the resonance frequencies of a fluid-filled crack and explore different scenarios to interpret the observed spectral gliding of continuous tremor and gas pistons events from resonator length variation to change in magma properties.

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