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Diverse Long-Period Tremors Reveal Temporal Variations in Shallow Conduit Geometry/Fluid Properties at Aso Volcano, Japan

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Long period volcanic tremors (LPTs), typically termed as VLP, have been widely observed in many volcanic systems around the world. LPTs in different volcanic settings are often repetitive, suggesting a nondestructive source and providing critical insights into the fluid dynamic processes operating inside a volcanic system. The diversities of LPTs in a single volcanic system, however, are not necessarily well understood and they could potentially help monitor the state of shallow volcanic conduit and its link to upcoming eruptions.

In the southwest Japan, LPTs are repetitive beneath Aso volcano and previous efforts have characterised LPTs of $\sim$15 second period and a duration of several tens of seconds. These LPTs are regarded as a result of resonance of fluid-filled crack-like conduit located near the hydrothermal reservoir at the sea level. To explore diverse LPTs (DLPTs) at Aso volcano, we carry out systematic analysis of continuous data at V-net and JMA volcanic seismic network between 2011 and 2016, during which Aso volcano became very active with frequent phreatic eruptions, intermittent Strombolian eruptions (2014) as well as two phreatomagmatic eruptions in September 2015 and October 2016.

A two-step process is applied to the detection of DLPT and construction of the catalog. The first stage involves continuous wavelet transformation to search for LPTs with spectra features comparable to that of the template. We identify 3 families of LPTs with virtually the same polarisation, but different waveform shapes, resonance period, or/and polarities. These LPT families are subsequently used in the second stage to conduct an exhausted search through a matched filter algorithm.

We will present the DLPTs catalog and summarise the similarity and difference among DLPTs. Most importantly, we find different LPT families are not mutually exclusive in time, but each LPT family does exert dominance over the pre-eruptive, syn-eruptive or inter-eruptive stage, respectively. While the resonance period and quality factor Q of each LPT family do vary over time, these temporal patterns are highly correlated among different LPT families. In the context of fluid-filled crack-like conduit, this observation may allow us to monitor changes in triggering source properties (e.g., location, spatial extent), conduit geometry and fluid properties inside the shallow volcanic conduit.