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Volcanic tremor mechanisms constrained through field and laboratory comparisons

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Volcanic tremor is often observed at active volcanoes and is usually associated with the dynamics of fluids (hydrothermal, magmas) within the volcanic edifices. One possible model for tremor generation is the flow-induced oscillation in channels transporting magmatic fluids.
However recently, acoustic emissions derived from laboratory experiments on dry rock samples demonstrate characteristics similar to tremor signal, suggesting that fluids are not a necessary condition for the tremor source process on volcanoes.
The aim of this work is therefore to better understand constraints on tremor source signals based on a comparison between laboratory and field tremor data.

We analysed seismic data from Arenal Volcano, Costa Rica. The dataset under investigation is taken from recordings of a seismic network deployed in December 2008. Tremor is the most evident signal recorded at Arenal Volcano for the analysed time interval and lasts several hours per day. Two main types of tremor signals are observed : (i) harmonic tremor with the energy concentrated in narrow frequency bands and (ii) spasmodic tremor in which energy is distributed in a wide frequency band [1-6Hz]. The tremor episodes are located by applying a multichannel analysis (Plane Wave Fitting method and MUSIC method). Polarisation and amplitude scaling analysis is carried out on this located tremor episodes.
The amplitude analysis then is repeated on acoustic emissions data recorded from volcanic rock samples deformed during laboratory experiments.
A quantitative comparison of the datasets is performed by applying a statistical test on the amplitude distributions obtained for the field and laboratory datasets in an effort to constrain the causative mechanisms underlying field tremor.