EXAMPLES OF EARTHQUAKES AS A SOURCE OF VOLCANIC TREMOR

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ABSTRACT

It has been proposed that shallow, frequently-repeating long-period earthquakes (LPE) are the underlying source of volcanic tremor. We demonstrate for several andesitic and dacitic volcanoes that repeating earthquakes and tremor do share a common source. This hypothesis is based on similar spectral content and the observations of earthquakes merging into or out of tremor, as inter-event times gradually change. Additionally, we construct synthetic tremor from repeating earthquake wavelets and compare to observed tremor.

HOW COMMON ARE EARTHQUAKES AND TREMOR WITH SIMILAR SPECTRA?

If tremor is a sum of many earthquakes too frequent to resolve, they should share similar spectra. We demonstrate this for four different volcanoes:

ARE EARTHQUAKES AN “IMPULSE RESPONSE” OF CONTINUOUS VOLCANIC TREMOR?

Earthquakes and tremor are prolific during nearly all volcanic eruptions. Determining what produces them and why may aid in our understanding of volcanic behaviors. We have observed that earthquakes merged into/out of tremor on several volcanoes, and infer that the two signals likely share a common source.

WHAT IS THE MECHANISM OF THE EARTHQUAKES AND ASSOCIATED TREMOR?

Earthquakes can form harmonic tremor if they occur regularly in time. We explore how much this regularity can vary and still produce visible overtones by creating synthetic tremor out of many earthquake copies.

ARE EARTHQUAKES REGULARLY Timed Enough to Form Harmonic Tremor?

On Augustine, we found a swarm of repeating earthquakes that occurred with sufficient regularity in timing to produce harmonic overtones if a long enough window was used:

WHAT DOES THIS HAVE TO DO WITH MAGMA TRANSPORT DURING AN ERUPTION?

The earthquake swarm on Redoubt was located almost directly beneath the surface vent, suggesting it may have occurred very near the conduit. We propose that the tremor and earthquakes result from repeated stick-slip failure of (or very near) the conduit wall as magma moves upward. This could occur both prior to an explosion and during extrusion.

For an extended discussion of how increasing stressing rates may produce the harmonic tremor as described here, see paper V33B-2635.