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Long-period seismo-volcanic earthquakes revisited: similarity, λ/4-hypothesis and implications

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Seismic networks on volcanoes are often used to find earthquakes with similar waveforms which are then categorised in waveform families and used to detect accelerations in seismic activities. Similar seismic waveforms indicate both a constant source process and source location. According to the so-called λ/4-hypothesis by Geller & Mueller (1980), two earthquakes with similar waveforms originate from sources that are less than a quarter of the dominant wavelength apart. This important constraint can be used to identify particular "systems" of earthquake swarms and tremor that can be active over several days or weeks and changes within such systems can be indicative for the acceleration or deceleration of magma movement. Employing a finite difference approach, we revisit the generation and propagation of long-period seismic signals, triggered in a conduit, dyke, or crack, and redefine the λ/4-hypothesis for this event type. We find that for similar, long-period events the source volume must be by far smaller than for tectonic earthquakes and discuss implications for source location and migration.