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Complex Seismic Sources for LP Events in Volcanic Environments: Model and Radiation Patterns

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Long period (LP) seismicity is direct evidence of magma movement in the plumbing system and, therefore, it has implications for volcanic hazard forecast such as dome collapse. Following classic seismology seismic sources are assumed to involve planar fault surfaces. However, in volcanic plumbing systems there is evidence of more complex geometries which we explore as possible seismic sources, where magma undergoes brittle failure in zones where strain rate is high, e.g. at the conduit wall.
LP events comprise a short period onset, which gives information about the source, and a long period coda, which contains information about the properties of the plumbing system. Here we test seismic sources for these events with geometries following the boundaries of dykes and conduits.
We approximate these complex sources by superimposing several double couple sources to create both, seismic radiation patterns and use the QSEIS software to create synthetic seismograms. We find that the resulting waveforms represent the second derivative of the source time function which are used for each double couple, and the amplitude depends on the geometry of the complex source.
Classic interpretations by moment tensor inversion could lead to misinterpretations of the source time function since complex source geometries are not taken into account.