Source process of tremor at Guagua Pichincha Volcano, Ecuador, inferred from waveform inversion

Alexander Garcia-Aristizabal[1]; Hiroyuki Kumagai[2]; Masaru Nakano[3]

[1] Geophys. Inst., Nat'l Polytech. School, Ecuador; [2] NIED; [3] Sch. Env., Nagoya Univ

Guagua Pichincha located immediately west of Quito, Ecuador, is an active volcano in the Pichincha volcanic complex. Beginning on August 7 1998, Guagua Pichincha entered into volcanic activity characterized by phreatic eruptions, dome growth and collapse, and pyroclastic flows, accompanying volcano-tectonic earthquakes, tremor, and long-period events. In January 2003, after a two-year-long quiescent period, we observed tremor showing harmonic oscillations with a dominant spectral peak at around 2 Hz, which occurred periodically with active and inactive periods at around 11 and 30 minutes, respectively. This type of tremor activity continued from weeks to a few months, and has intermittently occurred until the present. Since the tremor signals were recorded only by three seismic stations (2 three-component stations and 1 vertical-component station), a waveform inversion for a general moment tensor is not applicable to these signals. We use an approach proposed by Nakano and Kumagai (Programme Abst. Seismol. Soc. Jpn., C072, 2004) to quantify the source of the tremor. In this approach, waveform inversions assuming possible source geometries are performed to find the best-fit solution. We assume horizontal and vertical cracks and vertical pipe as possible source geometries for the tremor. Results of our waveform inversions show that the observed waveforms are best explained by a vertical crack. The source location is determined at a position close to a dome at a depth of 200 m below the caldera floor. The tremor may be interpreted as resonances of a vertical conduit excited by repetitive releases of hot gases originated from the contact of hydrothermal water with hot magma beneath the dome.