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Long Period (LP) volcanic earthquake source location at Merapi volcano by using dense array technics

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Since 2010, Merapi shows unusual activity compared to last decades. Powerful phreatic explosions are observed; some of them are preceded by LP signals. In the literature, LP seismicity is thought to be originated within the fluid, and therefore to be representative of the pressurization state of the volcano plumbing system. Another model suggests that LP events are caused by slow, quasi-brittle, low stress-drop failure driven by transient upper-edifice deformations.
Knowledge of the spatial distribution of LP events is fundamental for better understanding the physical processes occurring in the conduit, as well as for the monitoring and the improvement of eruption forecasting.
LP events recorded at Merapi have a spectral content dominated by frequencies between 0.8 and 3 Hz.
To locate the source of these events, we installed a seismic antenna composed of 4 broadband CMG-6TD Güralp stations. This network has an aperture of 300 m. It is located on the site of Pasarbubar, between 500 and 800 m from the crater rim. Two multi-parameter stations (seismic, tiltmeter, S-P) located in the same area, equipped with broadband CMG-40T Güralp sensors may also be used to complete the data of the antenna.
The source of LP events is located by using different approaches. In the first one, we used a method based on the measurement of the time delays between the early beginnings of LP events for each array receiver. The observed differences of time delays obtained for each pair of receivers are compared to theoretical values calculated from the travel times computed between grid nodes, which are positioned in the structure, and each receiver. In a second approach, we estimate the slowness vector by using MUSIC algorithm applied to 3-components data. From the slowness vector, we deduce the back-azimuth and the incident angle, which give an estimation of LP source depth in the conduit.
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