Geophysical Research Abstracts
Vol. 16, EGU2014-6370-1, 2014
EGU General Assembly 2014

Quantifying uncertainties in location and source mechanism for Long-Period events at Mt Etna, Italy.

Léna Cauchie (1,2), Gilberto Saccorotti (1), and Christopher Bean (2)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Pisa, Italy (lena.cauchie@pi.ingv.it), (2) School of Geological Sciences, University College Dublin, Dublin, Ireland

The manifestation of Long-Period events is documented at many volcanoes worldwide. However the mechanism at their origin is still object of discussion. Models proposed so far involve (i) the resonance of fluid-filled cracks or conduits that are triggered by fluid instabilities or the brittle failure of high viscous magmas and (ii) the slow-rupture earthquakes in the shallow portion of volcanic edifices. Since LP activity usually precedes and accompanies volcanic eruption, the understanding of these sources is important in terms of hazard assessment and eruption early warning.

The work is thus primarily aimed at the assessment of the uncertainties in the determination of LP source properties as a consequence of poor knowledge of the velocity structure and location errors.

We used data from temporary networks deployed on Mt Etna in 2005. During August, 2005, about 13000 LP events were detected through a STA/LTA approach, and were classified into two families on the basis of waveform similarity. For each family of events, we located the source using three different approaches: (1) a single-station-location method based on the back-propagation of the polarization vector estimated from covariance analysis of three-component signals; (2) multi-channel analysis of data recorded by two seismic arrays; (3) relative locations based on inversion of differential times obtained through cross-correlation of similar waveforms. For all these three different methods, the solutions are very sensitive to the chosen velocity model. We thus iterated the location procedure for different medium properties; the preferred velocity is that for which the results obtained with the three different methods are consistent each other.

For each family, we then defined a volume of possible source location and performed a full-waveform, moment tensor (MT) inversion for the entire catalog of events. In this manner, we obtained a MT solution for each grid node of the investigated volume. The MT solutions are parametrised through the ratio of the MT eigenvalues. The spatial changes of these ratios allow gaining a complete picture of the uncertainties in the source mechanism/geometry associated with the location errors. We observed in fact the λ_i / λ_1 (i=2,3) ratios varying in between (0.2-1.4) and (0.5-2.5), respectively. By the same taken, the volumetric component of the retrieved mechanism were observed to vary by almost one order of magnitude throughout the investigated volume.