Geophysical Research Abstracts
Vol. 13, EGU2011-6663, 2011
EGU General Assembly 2011


# Localization of volcanic tremor at Stromboli volcano, using seismic amplitude distribution.

Luciano Zuccarello, Daniele Carbone, Andrea Cannata, Giuseppe Di Grazia, Placido Montalto, and Domenico Patanè

Istituto Nazionale di Geofisica e Vulcanologia, sezione di Catania, Italy (zuccarello@ct.ingv.it)

Volcanic tremor is one of the most difficult signals to interpret for seismologists. The lack of clear body-wave phase arrivals, and the rapid loss of signal coherence with increasing station spacing, makes it impossible to retrieve source location by means of the hypocenter determination techniques, adopted in classical seismology. Nevertheless, location of the tremor source is a critical aspect toward a better understanding of the evolution of the volcanic activity, because of its strict relationships with eruptive mechanisms and, more generally, with fluid flows through the volcano's feeding system.
Between the 1st and 5th of September 2008, a multiparametric experiment was performed in the summit zone of Stromboli (Aeolian Islands, Italy), with the aim of improving our understanding of the characteristics of its upper plumbing system. During the experiment, a spring gravimeter and four broad-band seismic stations were installed, close to the summit craters, in order to temporally improve the permanent monitoring system. Here we propose a preliminary analysis of the volcanic tremor recorded during the multiparametric experiment.
Most seismic energy, at both summit and lower stations, is concentrated in the 2.5-5 frequency band, as already found by other authors. After filtering the signals in that frequency band, we retrieve source locations using the spatial distribution of tremor amplitudes, recorded by both permanent and temporary seismic networks,. We first calculate tremor amplitude ratios between a set of independent station pairs. Then we grid the volume of interest and, for each grid node, we calculate the theoretical amplitude ratios under the assumption of propagation in a homogeneous medium. The source location is eventually retrieved by searching for that grid position at which the difference between observed and expected amplitude ratios is minimized. Empirical tests, with different combinations of propagation parameters, show that, for the values of v and Q reported in the literature, a geometrical spreading coefficient of 1 gives better results in terms of (i) average misfit; (ii) number of not clipped solutions; (iii) consistency of the source. The centroid of the tremor source is found to be located behind the crater area, at a depth of about 450 m (a.s.l.). Interestingly, a temporary shallowing of the tremor source coincides with a gravity anomaly observed through the continuously recording gravimeter.
Overall, our results highlight that the amplitude ratios method is an efficient and quick tool for location of the tremor source. Its main advantage resides on the fact that it may be applied to data from those large-aperture networks which are generally deployed to the purpose of earthquake analysis. More generally, this approach of tremor analysis in volcanic areas provide an important instrument for improving the predicting capabilities of personnel in charge of public safety.