AGU Fall Meeting 2009

ID# V23D-2119
Location: Poster Hall (Moscone South)
Time of Presentation: Dec 15 1:40 PM - 6:00 PM

Regimes of Volcanic Activity at Mt. Etna in 2007-2009 inferred from Unsupervised Pattern Recognition on Volcanic Tremor Data

S. M. Falsaperla[1]; B. Behncke[1]; H. K. Langer[1]; A. Messina[1, 2]; S. Spampinato[1]
1. Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania, Catania, Italy.
2. Istituto Nazionale di Geofisica e Vulcanologia, Sezione Roma 2, Rome, Italy.

Mt Etna is a well monitored basaltic volcano for which high-quality, multidisciplinary data set are continuously available for around-the-clock surveillance. Particularly, volcano-seismic data sets cover decades long local recordings, temporally encompassing different styles of eruptive activity, from Strombolian eruptions to lava fountains and lava flows. Intense earthquakes swarms have often heralded effusive activity. However, from the seismic point of view, volcanic tremor has proved to be one of the most reliable indicators of impending eruptive activity. Indeed, changes in the volcano feeder show up in the signature of tremor, its spectral characteristics and source location. Some of us (Langer and Messina) have recently developed a new software for the classification of volcanic tremor data, combining Self Organizing Maps (also known as Kohonen Maps) along with Cluster and Fuzzy Analysis. This software allows us to analyse the background seismic radiation at permanent broadband stations located at various distance from the summit craters to identify transitions from pre-eruptive to eruptive activity. Throughout the analysis of the data flow, the software provides an unsupervised classification of the spectral characteristics (i.e., amplitude and frequency content) of the signal. The information embedded in the spectrum is interpreted to assign a specific state of the volcano. An application of this new software is proposed here on the eruptive events at Etna of 2007-2009, which consisted of 7 episodes of lava fountaining, periodic Strombolian activity at the summit craters, followed by lava emissions on the upper east flank of the volcano, with start on 13 May 2008 and end on 6 July 2009. In the study period the source of volcanic tremor was always shallow (less than 3 km) and within the volcano edifice. The upraise of magma to the surface was fast and associated with changes of volcanic tremor features, which covered time windows of variable duration from several hours to a few minutes. We discuss the possible reasons of such variability in the light of the characteristics of the overall seismicity preceding the eruptions in the study period, taking into account field observations and rheology of the ascending magma as well.

Contact Information

Susanna M. Falsaperla, Catania, Italy, 95123, click here to send an email