



The role of North East Crater in the 13 May 2008 eruption at Mt. Etna by means of seismo-infrasonic events

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On 13 May 2008 an eruption took place on Mt. Etna from an eruptive fissure located on the upper eastern flank of the volcano. The early phase of the eruption was characterized by strong seismic energy release and marked ground deformation in the summit area as well as changes in low frequency seismic signals (volcanic tremor and long period events). Low frequency signals, due to their strict relationship with the dynamics of volcanic fluids, help to obtain information about variations in magmatic system conditions. In recent studies infrasound signal analyses have turned out to be useful in conjunction with seismic and volcanic monitoring to understand the style of an eruption and the processes inside the conduit.

In this work we focused the analyses on infrasonic signals recorded a couple of days before the eruption beginning. The infrasonic network at that time was made up of 5 microphones, 4 in the summit area and 1 at lower altitude. Since 12 May until the onset of the eruption 157 infrasonic events and the related seismic transients, were collected. We carried out several analyses obtaining dominant frequencies, pseudo-spectrograms and peak-to-peak amplitudes. Spectra show the presence of two spectral peaks, that exhibit changing frequency values in the bands 0.4-1 Hz and 1.2-2.5 Hz. The former frequency band had never been observed in Mt. Etna infrasonic events before this episode. Infrasonic and the associated seismic events show marked similarity in waveforms and spectral content. This fact led us to hypothesize a model in which infrasonic and seismic events were excited by the same source process. Under this assumption we evaluated the temporal variation of the lag between each infrasonic event and the associated seismic event at a reference station. Successively, using the semblance method both seismic and infrasonic events were separately localized below the North-East-Crater, where no ash emission or strombolian activity were observed. Spectral and waveforms characteristics of infrasonic events led us to attribute their source mechanism to resonance phenomena of fluid inside the conduit of North-East-Crater. Therefore, changes in frequency content and in amplitudes of the infrasonic events, as well as the decrease of the infrasonic-seismic lag, occurring a few hours before the eruption onset at the eruptive fissure, are indications that something was changing inside the conduit of the North-East-Crater. Spectral features of low frequency infrasonic and seismic events and lag depend on properties (physical and geometrical) of the radiating source. For instance, a lag decrease could mean a shallowing of the source.

The occurrence of these infrasonic-seismic events and their variations in time, together with other geological and geophysical evidences, highlighted the link between North-East-Crater activity and the eruption taking place at fissure on the upper eastern flank of the volcano.