



Inside the shallow Mt. Etna plumbing system from analysis of infrasonic signals (August 2007-December 2009)

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We investigated the link between different active crater vents on Mt. Etna volcano and the dynamics of magma inside the conduit by means of infrasonic signals. Infrasonic signals, continuously recorded by the permanent infrasound network managed by Istituto Nazionale di Geofisica e Vulcanologia (Catania Section), were analysed during an extensive period spanning from August 2007 to December 2009. We performed two different spectral analyses on ~40000 infrasonic events: FFT and Somp analyses. We also localized those events, characterized by good signal to noise ratio at least at three stations, applying the semblance algorithm. Three main active sources have been recognized during this period: one located in North East Crater (NEC), and the others coinciding with South East Crater (SEC) and Eruptive Fissure (EF), which gave rise to 2008-2009 eruption. Infrasonic signals radiated from NEC (NEC events) are characterized by frequency content generally lower than 2.5 Hz and a duration up to 10 seconds. Events from SEC and EF (SEC and EF events) are very similar in waveforms; the former are short infrasonic transients (1-2 seconds) with dominant frequency higher than 2.5 Hz and higher peak to peak amplitude than NEC events, while the latter have dominant frequency mainly comprised in 2-4 Hz band, and show the shortest duration and the highest peak to peak amplitude at all. Furthermore, NEC events are radiated continuously during the whole period. Indeed, they are numerically dominant in respect to SEC and EF events, whose radiation is strictly related to the periods characterized by explosive activity.

We highlight that infrasonic activity at NEC is correlated with eruptive activity occurring at SEC-EF, revealing the existence of a link among those vents. Indeed we observed that the dominant frequency of NEC events systematically decreased after the beginning of eruptive activity at SEC-EF, and later in times it gradually went back to its previous value. We investigated this change in frequency content focusing on three main periods, containing important eruptive episodes such as lava fountains occurring on 4 September and 23 November 2007 from SEC, and the increase of strombolian activity that took place from 8 to 21 June 2008 from EF. The decrease of dominant frequency of NEC events, accompanied in most cases by an increase of quality factor, can be interpreted in two ways. It can be caused by variation in geometrical characteristics of the resonating part of NEC conduit (i.e. a lengthening, caused by a drop in the level of free magma surface). Alternatively it could be caused by a variation in acoustic velocity inside NEC conduit, induced from a change in composition of the fluid in which infrasonic waves propagates (e.g. increase in the ash content in a mixture with gas) just after the beginning of the eruptions at SEC-EF.