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Aborted eruptions at Mt. Etna (Italy) in spring 2007 unveiled by an integrated study of gas emission and volcanic tremor

S. Falsaperla, B. Behncke, S. Giammanco, M. Neri, H. Langer, E. Pecora, and G. Salerno

Istituto Naz. Geofis. Vulcanol., Sezione di Catania, Osservatorio Etneo, Catania, Italy (susanna.falsaperla@ct.ingv.it)

In spring 2007, a sequence of paroxysmal episodes took place at the Southeast Crater of Mt. Etna, Italy. Eruptive activity, characterised by Strombolian explosions, lava fountains, emission of lava flows and tephra, were all associated with an outstanding increase in the amplitude of volcanic tremor. In periods of quiescence between the eruptive episodes, recurring phases of seismic unrest were observed in forms of small temporary enhancements of the volcanic tremor amplitude, even though none of them culminated in eruptive activity. Here, we present the results of an integrated geophysical and geochemical data analysis encompassing records of volcanic tremor, thermal data, plume SO₂ flux and radon over two months. We conclude that between February and April 2007, magma triggered repeated episodes of gas pulses and rock fracturing, but failed to reach the surface. Our multidisciplinary study allowed us to unveil these 'aborted' eruptions by investigating the long-temporal evolution of gas measurements along with seismic radiation. Short-term changes were additionally highlighted using a method of pattern classification based on Kohonen Maps and Fuzzy Clustering applied to volcanic tremor and radon data.