Geophysical Research Abstracts, Vol. 9, 02707, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02707

Multivariate analysis of gravity and geomagnetic time sequences from Etna volcano (Italy)

F. Greco (1), C. Del Negro (1), R. Napoli (1), G. Nunnari (2)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Catania, Italy.

(2) Dipartimento di Ingegneria Elettrica, Elettronica e dei Sistemi, Università di Catania, Italy

Paroxysmal volcanic events lead to a wide range of underground processes that induce modifications of the thermodynamic state and/or stress field within the volcanic edifice, and thus changes in several geophysical parameters measurable at the surface. In particular, changes in potential fields have proven to be effective for early-warning purposes, in some edge cases, the only measurable effect of the ascent of the multiphase magmatic mixture through the plumbing system of a volcano.

This study summarizes results obtained by using multivariate methods for reducing gravity and magnetic data continuously recorded by the permanent monitoring networks on the Mt. Etna volcano in the last years. Detection within the gravity and magnetic time series of anomalies related to volcanic activity requires the characterization of the signals under unperturbed conditions. This information is essential to define the background level and thus to specify change-detection criteria for each signal, as well as the criticality levels that define the transition between different stages of volcano activity. The definition of the background level is strictly tied to the ability to eliminate natural fluctuations of external origin, whose amplitude is, generally, comparable or greater than geophysical variations. The Adaptive Neuro-Fuzzy Inference System (ANFIS) and Independent Component Analysis (ICA) methods are capable of finding the underlying factors or sources when the classic methods fail. These approaches allow local features of the signal to be studied in the time domain and transient signals to be represented effectively. This is an important chance since the gravity and magnetic signals could include volcanic effects with a wide range of evolution rates.