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A geophysical data processing tool for active volcanoes monitoring: the 2006 Etna (Italy) eruption case study

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A modular software architecture devoted to the automated elaboration of geophysical data recorded at active volcanoes is presented. To improve the effectiveness of volcano monitoring, it is essential that data gathered over a volcanic area are processed quickly and effectively. To pursue this goal, the Laboratory of Gravimetry and the Laboratory of Geomagnetism have been developing an automated system for geophysical data acquisition and reduction, called GEODAP (by GEOphysical DAta Processing). It is a library of open-source software for geophysical signal processing and analysis, the detection of significant events using both classic techniques and novel methods based on statistical physics and nonlinear dynamics, the interactive display and characterization of signals, the creation of new databases, the quantitative evaluation and comparison of analysis methods, and the analysis of non-stationary processes. It currently includes databases of gravity, magnetic and self potential measurements gathered in the last ten years on Mt. Etna volcano.

The combination of signal database and different analytic tools can provide the basis for reliable interdisciplinary research in active volcanic environments.

As a case study, a gravity and a magnetic sequence, both encompassing the 2006 Etna eruption, are presented to demonstrate the potential of GEODAP to perform real-time analyses and detect forerunners of paroxysmal volcanic events.