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1 Crustal dynamics of Mt. Vesuvius from 1998 to 2005: effects on seismicity and fluid circulation

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This study presents the results of hydrogeochemical and seismological studies carried out at Mt. Vesuvius during the period June 1998 – December 2005.

The data-set used for the seismological analysis was collected by:

1. The permanent seismic network of the INGV - Osservatorio Vesuviano, at the present composed of 11 short-period 1-Hz Mark L4C and Geotech S13 geophones and 2 broad band (40s) Guralp CMG40T seismometers;
2. Five digital stations (Lennartz PCM 5800) equipped with 3-component 1-Hz Lennartz LE-3Dlite sensors also operate in the area, in local recording mode.

The monitored geochemical parameters (water temperature, pH, Eh, major ions, dissolved gases, $^{18}\text{O}/^{16}\text{O}$ ratios of groundwater) were detected at 10 private wells and 1 spring. Continuous soil temperature of the fumarolic fields was measured by a permanent device Gemini Tinytag Plus logger.

Hydrogeochemical data show the occurrence of smooth long-term variations in the total dissolved salts (TDS) and bicarbonate contents of the groundwaters, accompanied by a general decline of water temperatures. These variations do not depend on changes in hydrologic regime, as suggested by the analysis of temporal distributions of air temperature and rainfall amount in the Vesuvius area. The changes in the geochemical parameters are accompanied by a slight variations in both the seismicity rate and energy release.

A further relationship between seismic activity and fluid discharge rate is highlighted by a particular episode occurred in August 2005, when a soil thermal anomaly was observed few weeks before the occurrence of a very shallow earthquake. Moment tensor analysis of this earthquake suggests that the most plausible source mechanism is a shear faulting combined with a tensile crack opening. This feature is often observed in volcanic areas and it is usually related to fluid-/gas-driven rock fracturing.

The observed seismological, hydrological and geochemical temporal changes are interpreted not as changes of the volcanic system, but in terms of an external forcing, identified in the variation of the regional and local stress field acting on the volcano.