MONITORING AND MODELLING HYDROTHERMAL PANAREA SYSTEM (AEOLIAN ISLAND): GPS AND VOLCANOLOGICAL DATA

Alessandra Esposito, Grazia Pietrantonio, Roberto Devoti, Marco Anzidei, Guido Giordano, Antonio Pio Rinaldi, Micol Todesco, Simone Artzori

Abstract

In November 2002 a submarine gas eruption started offshore 3 Km east of Panarea island (Aeolian Island) on top of a shallow rise of 2.3 km^2 surrounded by islets forming a small archipelago. This event has posed new concern on a volcano generally considered extinct. Panarea island and its archipelago (~ 3.3 km^2) are the emergent portion of submarine stratovolcano more than 2000 m high and 20 Km across; exhalative activity due to a shallow hydrothermal system is well known since historical times. To monitor and study ground deformation associated with anomalous gas emission, a local GPS network (PANAREA) was designed, set up and measured during time span December 2002 - October 2006. The network consists of nine sites (six constructed after 2002) located on Panarea and on the islets.
GPS data analysis was performed combining episodic campaigns of Panarea and other local networks located in the Aeolian area, carried out between 1995 and 2006, and data of continuous European and Italian sites. The results show at Panarea volcano two distinct crustal domains characterized by different kinematics and styles of deformation.
The merging of GPS and structural data suggest the relationship among gas vent distribution, submarine volcanological structures and ground deformations. The actual distribution of the estimated strain-rate is consistent with the structural setting.The general subsidence and shortening in the islets area can be interpreted as the response of the surface to the variation of the hydrothermal system reservoir which is progressively reducing its pressure after the gas eruption. A simple first order approach to the modelling of the hydrothermal system is the use of Okada sources.To evaluate the coupled thermo-hydro-mechanical processes going on in Panarea, a two-step model will be implemented. The model first involves the simulation of pore pressure and temperature changes due to fluid circulation. Then the mechanical response of the porous rock is calculated based on the linear theory of poro-elasticity.