



Investigation of the Volcano-tectonic dynamics of Vulcano Island by long-term (40 years) geophysical data

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Vulcano island is a composite volcanic edifice located in the south-central sector of the Aeolian Archipelago (Tyrrhenian Sea, Italy). It is the southernmost tip of the southern branch of the Y-shaped archipelago; in particular, it is part of the bigger Lipari-Vulcano volcanic complex that comprises the two southernmost islands of the archipelago. This branch of the archipelago is NNW-SSE oriented and represent the off-shore prolongation of the Tindari-Letojanni tectonic lineament in the NE Sicily, splitting the Appennine chain on the west, from the Calabrian arc on the East. N-S compression seems to affect the western side of this NNW-SSE lineament, while extension affects the eastern one, with active volcanism and a NW dipping Benioff plane. Historic activity at Vulcano has been characterized by frequent transitions from phereatomagmatic to minor magmatic activity. The last eruption in 1888-90 was characterized by energetic explosive pulses and defines the so-called “vulcanian” type of activity. Since then, volcanic activity has taken the form of fumarolic emanations of variable intensity and temperature, mainly concentrated at “La Fossa” crater, with maximum temperatures ranging between 200° and 300° C; temperature increases and changes in the gas chemistry, were often observed. The most recent episode began in the 80’s when fumarole temperature progressively increased to 690°C in May 1993. Vulcano is active and this favoured monitoring and research studies, in particular focussed on the most recent structures.

In the frame of DPC-INGV “V3” project, we investigate the dynamics of the island through ca. 40 years of ground deformation and seismicity data collected by the discrete and continuous INGV monitoring networks. We considered levelling, GPS, EDM, seismic and tilt data. EDM and levelling measurements began in the middle 1970s and since the late 1990s the same EDM network has been surveyed by GPS.

By combining and comparing geodetic data and seismicity we are able to distinguish three different scales of phenomena: the first one seems to be linked to the regional tectonics, with a general transpressive kinematics; the second one affects the northern half of the island and could be related to the caldera dynamics; the third one affects only the cone of La Fossa. Regional tectonic stress seems to play an important role in the transition of the volcanic system from a phase of stability to a phase of unrest, inducing the heating and the expansion of shallow hydrothermal fluids. Current local ground deformation at Vulcano may be linked to the geothermal system rather than magmatic sources.