Geophysical Research Abstracts,
Vol. 11, EGU2009-4558-1, 2009
EGU General Assembly 2009

Earthquakes location and stress field inversion for the 1984 seismic crisis at Campi Flegrei caldera (Southern Italy)

C. Satriano (4,5), P. Capuano (1,2), R. De Matteis (3), G. Pasquale (3), and A. Zollo (5)

(1) Dept. Matematica e Informatica, University of Salerno, Fisciano, Italy (pcapuano@unisa.it), (2) Istituto Nazionale di Geofisica e Vulcanologia, sez. Osservatorio Vesuviano, Napoli, Italy, (3) Dept. Studi Geologici e Ambientali, University of Sannio, Benevento, Italy, (4) RISSC-Lab, AMRA scarl, Napoli, Italy, (5) RISSC-Lab, Dept.of Physics, University of Naples "Federico II" , Napoli, Italy

he Campi Flegrei (CF) alkali-trakitic caldera is an active volcanic system located 15 km west of the city of Naples, southern Italy, covering an area of about 400 km2. It is located within a NE-SW trending large graben (Campanian Plain) formed, at eastern margin of the Tyrrhenian sea, in the Plio-Pleistocene that is bordered by mostly Mesozoic carbonaceous rocks. CF is the northernmost of a group of Pleistocene volcanoes three of which (Ischia, CF and Vesuvius) have erupted in historical times. CF caldera is characterized by the presence of sparse volcanic craters as the results of several explosive eruptions. Like other calderas, CF periodically experiences significant unrest episodes which involve ground deformations and seismic swarms. Recently, two marked ground uplift took place in the area in 1970-1972 and 1982-1984. The latter, began in the second half of 1982 and was characterized by a total vertical displacement of 1.8 m accompanied by a seismic swarm of more that 10,000 shallow microearthquakes with a maximum duration magnitude of 4.2.

A database, recently reconstructed, containing thousands of seismic waveforms collected by a digital network during the last 1984 strong crisis at Campi Flegrei caldera has been used to perform new earthquake locations, focal mechanisms determination and the estimation of the local stress field using a novel 3D P-wave velocity model of the caldera. The 3D P-wave velocity model has been constructed using the results of a recent active/passive seismic tomography inversion and it incorporates the main 3D features of the area, including the buried rim of the caldera, and shows velocity ranging from 1 km/s ca. at the surface to 7 km/s ca. at a greater depth.

About 700 earthquakes have been relocated using a probabilistic global search method, determining the best Vp/Vs ratio. The earthquakes are mostly clustered in the caldera centre near the Solfatara crater with hypocenter depth of about 1-4 km inside the volcano-sedimentary coverage. In addition, trying to infer more accurate characteristics of locations a double difference procedure has been applied. Focal mechanisms for a selected subset of 198 earthquakes (the larger focal mechanism database currently available for the area) have been computed by using first-motion polarities and they indicate predominantly NNE-SSW to near vertical direction for the compression axes and E-W to sub-horizontal direction for the tension axes.

Starting from focal mechanisms, a stress field inversion has been performed by using an iterative procedure identifying three earthquake subsets. The main subset indicates the presence of a normal stress regime with the most extensional principal stress axis nearly horizontal trending N15°. The other two subsets are instead coherent with strike-slip stress field with different normal and thrust component and variable strike direction.

Our results confirm that the analysis of focal mechanisms, in relation to the present stress field orientation, is a useful tool for studying the correlation between seismicity and ground deformation. The link between regional faulting and seismicity during uplift episodes falls into the framework of the interplay between local phenomena and the response of volcanic system to the regional stress field, and is one of the major research issues to be addressed in the near future.