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Multidisciplinary geophysical study of the NE sector of the unstable flank of Etna volcano

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On volcanic areas, usually characterized by complex structural environments, a lot of independent geophysical studies are usually performed. The non-uniqueness of the geophysical inverse models, the different level of resolution and sensitivity of the results spurred us to integrate independent geophysical datasets and results collected on Mt. Etna volcano, in order to obtain more accurate and reliable model interpretation.
Mt. Etna volcano is located along the eastern coast of Sicily and it is characterized by a complex structural setting. In this region, the general N-S compressive regime related to the Africa – Europe collision interacts with the WNW-ESE extensional regime associated to the Malta Escarpment dynamics, observable along the eastern coast of Sicily.
At Mt Etna, a great number of studies concerns the existence of instability phenomena; a general eastward motion of the eastern flank of the volcano has been measured with always increasing detail and its relationship with the eruptive and magmatic activity is being investigated. The unstable flank appears bounded to the north by the E–W-trending Provenzana - Pernicana Fault System and to the SW by the NS Ragalna Fault system. Eastwards, this area is divided by several NW–SE trending faults. Recent studies consider this area as divided into several blocks characterized by different shape and kinematics. Ground deformation studies (GPS and InSAR) define the NE portion of the unstable flank as the most mobile one.
In the frame of the MEDiterranean Supersites Volcanoes (MED-SUV) project, ground deformation data (GPS and INSAR), 3D seismicity, seismic tomography and two resistivity model profiles, have been analyzed together, in order to put some constraints on the deep structure of the NE sector of the unstable flank.
Seismic data come from the permanent network run by the Istituto Nazionale di Geofisica e Vulcanologia (INGV) - Sezione di Catania, Osservatorio Etneo.
Ground deformation data comes from InSAR Permanent Scatterers analyses of different spaceborn sensors.
The resistivity models come from a MT survey carried out on the eastern flank of the volcano and consisting of thirty broad-band soundings along N-S and NW-SE oriented profiles.
We found that the NE sector of the sliding volume, modeled by ground deformation data inversions and characterized by the highest displacement velocity, is characterized low resistivity values and it is bounded by two seismic clusters. The northern one is clearly related to the Pernicana fault and it's not deeper than 3 km b.s.l. while the second one is located southwards, beneath the northern wall of the Valle del Bove, not related to any evident structure at the surface. An evident layer with very reduced seismicity lies at 3 km of depth and well corresponds to the simplified analytic models of a sliding planar surface resulting from GPS data inversions.