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Structural features of the Pernicana Fault (M. Etna, Sicily, Italy) inferred by high precise location of the microseismicity

S. Alparone, S. Gambino, A. Mostaccio, S. Spampinato, T. Tuvè, and A. Ursino
Istituto Nazionale di Geofisica e Vulcanologia, INGV - Sezione di Catania, Catania, Italy (ursino@ct.ingv.it)

The north-eastern flank of Mt. Etna is crossed by an important and active tectonic structure, the Pernicana Fault having a mean strike WNW–ESE. It links westward to the active NE Rift and seems to have an important role in controlling instability processes affecting the eastern flank of the volcano. Recent studies suggest that Pernicana Fault is very active through sinistral, oblique-slip movements and is also characterised by frequent shallow seismicity (depth < 2 km bsl) on the uphill western segment and by remarkable creeping on the downhill eastern one. The Pernicana Fault earthquakes, which can reach magnitudes up to 4.2, sometimes with coseismic surface faulting, caused severe damages to tourist resorts and villages along or close this structure. In the last years, a strong increase of seismicity, also characterized by swarms, was recorded by INGV-CT permanent local seismic network close the Pernicana Fault. A three-step procedure was applied to calculate precise hypocentre locations. In a first step, we chose to apply cross-correlation analysis, in order to easily evaluate the similarity of waveforms useful to identify earthquakes families. In a second step, we calculate probabilistic earthquake locations using the software package NONLINLOC, which includes systematic, complete grid search and global, non-linear search methods. Subsequently, we perform relative relocation of correlated event pairs using the double-difference earthquake algorithm and the program HypoDD. The double-difference algorithm minimizes the residuals between observed and calculated travel time difference for pairs of earthquakes at common stations by iteratively adjusting the vector difference between the hypocenters.
We show the recognized spatial seismic clusters identifying the most active and hazarding sectors of the structure, their geometry and depth.
Finally, in order to clarify the geodynamic framework of the area, we associate these results with calculated focal mechanisms for the most energetic earthquakes.