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Seismogenetic fault characterization in the Pollino area

Ferdinando Napolitano (1), Anna Gervasi (2,3), Mario La Rocca (2), Danilo Galluzzo (3), Ignazio Guerra (2), and Roberto Scarpa (1)

(1) Dipartimento di Fisica, Università degli Studi di Salerno,Fisciano, Italy (fnapolitano@unisa.it, rscarpa@unisa.it), (2) DIBEST, Università della Calabria, Italy (mario.larocca@unical.it, anna.gervasi@ingv.it, ignazio.guerra@unical.it), (3) Istituto Nazionale di Geofisica e Vulcanologia, Italy (danilo.galluzzo@ingv.it)

The Pollino area (Southern Italy) was affected from 2010 to 2013 by a seismic swarm of thousands of small-to-moderate earthquakes (MMAX = 5.0, on 25 October 2012). We selected the time period of the maximum seismic activity in the region, namely from November 2011 to April 2012, and performed a detailed analyses with the aim of a precise relative location of the hypocenters in order to obtain the characterization of the seismogenetic fault responsible for the swarm. We applied cross-correlation analysis to earthquake signals filtered between 3 Hz and 15 Hz, on 3 second long windows including both P and S direct waves in order to identify events with very similar waveforms. By choosing a cross-correlation threshold of 0.8 and S-waves amplitude threshold of 1800 counts we found 13 clusters which include a total of almost 3000 events. Assuming that different earthquakes have very similar waveform if they are located very close to each other, they have very similar focal mechanism and similar magnitude, we performed the relative location between the reference event and all the other earthquakes of the cluster. The relative location, given a velocity model, is based on take-off angle and azimuth of the reference event computed for any stations. To check the result stability we computed the relative location several times by changing some parameters such as the frequency band of analysis and the window length used to compute the time lag. For each of the analyzed cluster the 3D relative hypocenter distribution was plotted and the best fitting plane was computed. The observed hypocenter distributions usually have extension of few hundred meters and fit very well a tilted plane. When the number and the gap of available stations were appropriate, we estimated focal mechanism of the cluster earthquakes through the software FOCMEC, which is based on the polarity of direct P and S waves. In some cases of very small earthquakes the signals were stacked among the cluster events to improve the signal to noise ratio, allowing for a better interpretation of wave polarity. At the end, we have estimated the source size of individual earthquakes and compared it with the extension of the hypocenter distribution obtained from the relative location.