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New insights on fault system of the Pollino swarm from relative location

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The Pollino area was affected between 2010 and 2014 by a swarm of thousands of small-to-moderate earthquakes, reaching maximum magnitud Mmax=5.0 on the 25th October 2012. We relocate the hypocenters of the 2010-2014 Pollino seismic swarm, using recordings of the two main periods of activity (November 2011-March 2012 and September 2012-May 2013), to precisely image and characterize the fault(s) responsible for the swarm. Seismic waveforms used in this work were recorded by several permanent and temporary stations installed in the area during the swarm.

We filtered the waveforms between 3 Hz and 15 Hz and we applied the normalized cross-correlation analysis to them 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 0.85 and S-waves amplitude threshold of 1500 counts we found in the first period of activity (November 2011-March 2012) 18 clusters which include a total of almost 3000 events. Assuming that 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. For each of the analyzed cluster the 3D relative hypocenter distribution was plotted and the best fitting plane was computed. Then, the focal mechanisms and the rupture lengths of the source patch were estimated for each cluster.

The same analysis (using the same parameters but different seismic stations, based on their availability) have been applied to the hypocenters of cluster events selected in the second period of intense activity (September 2012 - May 2013). From this analysis we obtained a clear imaging of the main fault which produced many of the earthquakes occurred in the second period of the seismic sequence.