



The 27 September 2012 ML 4.1 Benevento earthquake: a case of strike-slip faulting in Southern Apennines (Italy)

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On 27 September 2012 at 01:08 (UTC) an ML 4.1 earthquake started a seismic sequence approximately 10 km east of Benevento, in Southern Apennines (Italy). During the following four days about 40 events occurred in the area, whose seismic hazard is the highest of the Italian Peninsula and where several historical and destructive events of $Io \geq IX$ took place like the 1456, 1688, 1702, 1732, 1930 and 1962. The background seismicity of Benevento area is characterized by low-energy isolated events and seismic sequences with magnitude generally equal or less than 3.7. In this area, where a geological complexity and high seismic potential are evident, low magnitude seismicity studies represent a fundamental tool to better constrain the precise location, geometry, and character of fault structures causative of moderate to large earthquakes.

In order to investigate the spatio-temporal pattern and to identify the seismogenic source geometry, a detailed analysis of the Benevento seismic sequence was performed integrating data recorded at 31 seismic stations of different networks. The first P- and S-wave arrival times were manually picked and first P-wave polarities were read. To minimize errors due to unmodeled 3D velocity anomalies the earthquakes were relocated using the double-difference technique and focal mechanisms were calculated using the first P-wave motions and inverting the waveform data for the moment tensor solution. Also, to better understand the rupture process, seismic source parameters were estimated and source time functions were inverted for the largest magnitude event. Finally a seismotectonic interpretation of this seismicity is given to explain its relation with the known seismogenic sources and its role in the regional tectonic context.

The earthquake spatial distribution and focal mechanisms show the existence of two small nearly sub-vertical and roughly E-W striking fault planes with a right-lateral strike-slip kinematics, seated at mid-crustal depths (10-20 km). These results reveal a characteristic seismicity quite different from that typically associated to the outcropping NNW-SSE-striking active normal faults that are responsible of moderate to large earthquakes in the Southern Apennines axial sector.

In this work, we address questions concerning i) the structural-kinematic similarities of the Benevento 2012 earthquake with the Potenza 1990-1991 (ML 5.7) and Molise 2002 (ML 5.7) earthquakes in the Apulian foreland; ii) the presence in the Benevento area of previously unrecognized mid-crust seismogenic strike-slip faults and its correlated seismic potential; iii) the existence of a strike-slip tectonic regime that uniformly extends across Southern Italy, in the whole Apulian foreland crust and in the footwall of the Apennines thrust at relevant depth, not only in easternmost sector, as demonstrated to date, but also under the mountain chain axial zone.