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Multidisciplinary investigation of the seismogenic structure of the Matese 2013-2014 seismic sequence (Southern Apennine, Italy)

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The December 2013 seismic sequence (ML 5.0 mainshock) of the Sannio-Matese area, one of the most seismically active segments of the Apennine Chain, struck in the internal part of the Matese massif (southern Italy), in a sector where no evidence of active faulting were recorded so far. A recent analysis of geodetic velocities suggested current strain accumulation on an array of NW-SE striking, SW-dipping high-angle normal faults (Matese Lake Fault System) which borders a >30 km long asymmetric basin nested in the interior of the massif. GPS sites straddled by the Matese Lake Fault, when resolved on a geologically constrained fault model, were found to be consistent with an horizontal extension at $\sim$0.8$\pm$0.5 mm/yr, with a left-oblique component at $\sim$0.7$\pm$0.4 mm/yr. As a matter of fact, if the fault is (at least partially) locked, the significant geodetic strain accumulation on the fault may be of concern, in light of its recent seismic activation. This finding is consistent with the seismicity of the Matese-Sannio area which is characterized by the occurrence of isolated events within the massif (M<2.5), and by low magnitude seismic sequences and swarms, which mainly concentrate at the tips of seismogenic sources of destructive historical events. Spurred by the sudden activation of this “silent” fault, we used geologic-structural data, long-term morphological data, seismicity and geodetic data in order to: 1) correlate the seismic sequence with a crustal fault model; 2) provide geologic source parameters and a numerical model for the seismogenic structure; and 3) refine the current understanding of the coupling between strain accumulation and release. The projection of the relocated seismicity provide information on which part of the NW-SE striking array has activated during the sequence and the results of the computed focal mechanisms for the most energetic events of the sequence are compared with the results of the pseudo-focal mechanisms obtained from fault slip inversion from different portions of the faults. Finally, refining of the existing GPS-based analysis provided an update map of the strain-rate field, geodetic-moments and strain accumulation-rate, as well as a broad reconstruction of the spatiotemporal coseismic dislocation for the mainshock (ML 5.0).