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April 7, 2009, Mw 5.5 aftershock of the L'Aquila earthquake: seismogenic fault geometry and its implication for the central Apennines active extensional tectonics (Italy).

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On April 6, 2009 (at 01:32 UTC) a Mw 6.3 earthquake hit the town of L'Aquila (central Italy) and surrounding villages causing fatalities and severe damage in the area. After few days, a nearly 40-km-long extensional fault system was activated generating both northward and southward seismicity migration along the NW-SE trending sector of central Apennines. During the intense aftershocks sequence, different sesmogenic sources with a distinct geometry, size and the degree of involvement were reactivated. Among the relevant aftershocks with Mw 5.0 to 5.5, the largest one occurred on April 7 (at 17:47 UTC), 9 km SE-ward of the mainshock involving a source seated at much greater depths ($\sim$14 km). Despite the enormous number of studies of the 2009 L'Aquila earthquake, mainly focused on the various geological and seismological aspects of the main Paganica source, the April 7 strongest aftershock (Mw 5.5) has not yet been deeply investigated. Consistent geometric and kinematic correlations between the geological and seismological data about this seismogenic source are missing. There are still open questions concerning its unresolved geometry and the unknown style of the central Apennines structure activated at greater depths during the 2009 L'Aquila seismic sequence. Furthermore, some authors (Lavecchia et al., 2012) have supposed that the April 7, 2009 aftershock (Mw 5.5) occurred onto an high dip segment ($\sim$50°) of an east-dipping extensional basal detachment with a potential surface expression outcropping in the area of the eastern Sabina-Simbruini Mts.
In this work we propose a seismological analysis of the April 7, 2009 aftershock (Mw 5.5) rupture process. In order to define the unresolved source geometry, we computed the focal mechanism through the time domain, moment tensor full waveform inversion (Dreger and Helmberger, 1993). Also, we estimated the apparent source time functions (ASTFs) by deconvolution of the impulse response of the medium from the recorded data, using the empirical Green's function (EGF) method (Vallée, 2004). We finally inverted the ASTFs to obtain a kinematic rupture model by the isochrone back-projection technique (Festa and Zollo, 2006) constraining the rupture plane geometry. Afterward, we integrated our results with surface and sub-surface geological data in order to define the seismotectonic role of the April 7 aftershock (Mw 5.5) fault structure in the intra-Apennine Quaternary extensional system. As preliminary results, our analysis constrains an east dipping extensional basal detachment and extends the knowledge of the complex fault pattern activated during the 2009 L'Aquila sequence also at greater depths (> 10 km).