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Source complexity of the Mw 6.5, 2016, October 30th central Italy earthquake

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In this work, we study the October 30th 2016 Norcia earthquake (MW 6.5) to retrieve the rupture history by jointly inverting seismograms and coseismic GPS displacements obtained by dense local networks.
We noted that some preliminary attempts to model the slip distribution of the October 30th main shock using a single fault plane oriented along the Apennines did not provide convincing fits to the observed waveforms when both strong motion and GPS data are inverted. In addition, the deformation pattern inferred from satellite observations suggested the activation of a multi-fault structure, that is coherent to the extension of the geological surface deformation. We investigated the role of multi-fault ruptures and we found that this event revealed a remarkable complexity of the rupture geometry and its evolution. We found that the coseismic rupture propagated almost simultaneously on a normal fault of the Mt. Vettore-Mt. Bove fault system and on a blind fault inherited from compressional tectonics belonging to the Olevano-Antrodoco-Sibillini system. The kinematic parameters of the presented rupture models comprising two fault planes have been selected iteratively by performing more than 20k inversions and by measuring the fit through the variance reduction. In order to investigate the stability of the proposed solution and its uncertainties, we calculated the mean slip of the retrieved models and the associated standard deviation.
This earthquake raises serious concerns on our understanding of fault segmentation and seismicity evolution during sequences of normal faulting earthquakes and has important implications on seismic hazard assessment and on the maximum expected magnitude in this tectonic area.