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# Rupture Kinematics of the 2016 Mw6.1 Amatrice (central Italy) Earthquake from the Joint Inversion of Seismic and Geodetic Data

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In this study, we investigate the rupture process of the 2016, Mw6.1 Amatrice earthquake, occurred on August 24th at 01:36 UTC, the first main event of a seismic sequence characterized by three damaging earthquakes occurred in Central Italy between 2016 August and October. On October 26th (19:18 UTC) a Mw 5.9 occurred 25km to the NW, 3km West of Visso; and few days later, on October 30th (06:40 UTC), a third major earthquake (Mw 6.5) nucleated 6km North of Norcia. The three main events show normal focal mechanisms, striking NNW-SSE, in agreement with the extensional tectonic regime of the central Apennines.
The entire 2016 Central Italy sequence extends about 60km, and involves a region bordered by the 1997 Umbria-Marche sequence to the North, and the 2009 L'Aquila earthquake to the South. Geological survey and geodetic observations reveal the activation of the Mount Gorzano – Mount Vettore - Mount Bove normal fault system.
The Amatrice event struck a populated region, causing about 300 fatalities, significant damaging the economy of the region.
In this study we retrieve the rupture history of this event, by separately and jointly inverting of Strong Motions, continuous High-rate GPS data, GPS displacements and DInSAR data; and by adopting ad-hoc velocity profiles of the crust below each station. We use a two-stage non-linear inversion technique to extract the most stable features of the earthquake rupture process that are consistent with the data, and to estimate the variability of each kinematic parameter. In order to obtain a fault geometry consistent with both geodetic and seismological data we perform several inversion by taking into account different published solutions. The final fault geometry is consistent with the hypocenter location, the surface ruptures and InSAR coseismic displacement maps.
The goal of our work is to constrain the earthquake rupture history and to analyse the associated model complexity, to better understand the mechanics of each causative fault activated during the sequence and their interaction.