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Effect of lateral velocity heterogeneities and topography on slip inversions: case study of the Mw6.3 2009 L'Aquila earthquake

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Earthquake slip inversions aiming to retrieve rupture characteristics typically assume 1D velocity models and a flat Earth surface. However, the heterogeneous nature of the crust and the presence of rough topography lead to seismic scattering and other wave propagation phenomena, thus introducing complex 3D effects on ground motions. In this study we investigate how do such realistic velocity perturbations and topography affect source imaging results. In particular, we create a set of synthetics using complex 3D crustal model and topography and invert them in a flat 1D structural model, considering various strengths of smoothing and several near-fault station configurations. We find that peak slip-rate time is the source parameter that is least affected by the imperfection of the velocity model and station coverage. We extend our investigation to the real recordings of the Mw 6.3 2009 L'Aquila, Italy, earthquake. Taking into account the lessons learned from the inversion tests, we find a relatively complex propagation of the earthquake rupture.