Modelling the finite source effects in ShakeMap through synthetic seismograms: tests on the 2009 M=6.3 L'Aquila earthquake

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On April 6, 2009 a strong earthquake with Mw=6.3 occurred in L'Aquila area (central Italy) causing many human losses and large damages on infrastructures and buildings. ShakeMaps were generated few minutes after the earthquake occurrence but the lack of near field data combined to the ignorance about the finite source parameters took to large uncertainties on ground motion estimates and macroseismic field in area closer to the epicenter.

To overcome such situation that could be very common in absence of recorded data in the near field or in case of gaps in data transmission, we aim to generate fast and reliable ShakeMaps integrating the recorded data with synthetic seismograms generated including the main source effects.

To be effective the procedure requires a fast estimation of the main features of the finite fault and a quick computation of the synthetic seismograms. In our study we estimate a rough slip model and the directivity of the rupture process by teleseismic body wave inversion. The finite fault parameters are then used to compute synthetic seismograms for near field receivers placed on a grid or on sites of missing stations; peak ground motion parameters (PGA, PGV and SA) are extracted and the ShakeMaps are generated integrating real data and computed ones.

The comparison of the ShakeMap computed for L'Aquila earthquake using real and synthetic data with those ones obtained after several hours from the event, when all the recorded data were available, evidences that our approach is promising and that the use of synthetic seismograms can ameliorate the ShakeMaps when near field data are not available.