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Strong motion inversion for slip distribution on a finite fault using strong motion data: L'Aquila 2009 earthquake

A. Gallo, G. Costa, and P. Suhadolc
Department of Mathematic and Geosciences, University of Trieste, Italy (antonella.gallo_79@libero.it)

3-component accelerograms have been inverted obtain an estimate of the rupture history and the spatial distribution of slip over the fault area for the Mw 6.3 earthquake occurred in central Italy on April 6, 2009. This earthquake ruptured a normal fault striking along the Apennines axis and dipping to the SW. Using the representation theorem, the displacement record at a station on the earth surface can be expressed in terms of the slip distribution over the fault as a linear system. The method of linear programming is used for the inversion and the simplex method is applied to solve the linear programming problem (Das and Kostrov, 1994). For the numerical solution, the problem has to be discretized and adapted to the near source conditions (Das and Suhadolc, 1996). All known parameters such as fault geometry, crustal structure and station distribution are kept fixed in the inversion and a large enough fault area is considered. The best average rupture speed, kept fixed, has been determined with a trial and error procedure. Physical constraints such as the positivity of the slip rates on the fault and total seismic moment are used to stabilize the solution. Using synthetic data with a checkerboard slip distribution shows that the obtainable spatial resolution is 2 km. Observed records acquired from the national strong-motion network RAN (Rete Accelerometrica Nazionale) are inverted. Only data from rock stations distributed uniformly around the fault at epicentral distances less than 80 km are used. The accelerograms are filtered at 1 Hz and the first 10-15 seconds of the selected signals are modelled. The obtained slip distribution and the slip on the surface, in agreement with other similar studies of L'Aquila earthquake, confirm that the maximum energy during the event was released in the SE part of the fault and shows a single major asperity.