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Nonlinear kinematic inversion applied to the SPICE blindtest on kinematic source inversion

C. Francois-Holden

Laboratoire de Geologie Laboratoire de Geologie - Ecole Normale Superieure

A nonlinear kinematic inversion method is applied to the set of strong motion data generated for the SPICE blindtest on kinematic source inversion. In this first part of the exercise, the unknown parameters are a constant rupture velocity and the distribution of slip on a fault plane of given finite dimensions.

The algorithm used for our inversion is the Neighbourhood Algorithm. The data have not been filtered since their high frequency cutt-off is originally about 1 Hz. Our synthetics are computed using the Axitra algorithm developped by O. Coutant. The fault is parameterized with a model containing 91 patches of size 2.5x2.5km. The fault dimensions are 32.5x17.5km. Since the fault does not break the surface, the first layer is constrained to have zero slip.

We have performed inversions with fixed and variable velocity. When only slip is inverted, the actual number of inversed slip patches is 28. Slip on intermediary patches is then interpolated using the Akima interpolation scheme. When both constant rupture velocity and slip are inverted, 28 fault patches plus one parameter for rupture velocity are inverted, giving a total of 29 inversed parameters. Two misfit functions are also tested. The fit between observed data and synthetics is firstly mesured with an L2 norm and secondly with an L2 norm weighted by the amplitude of the recorded signals. The last measurement gives more emphasize on the farther stations. We observe that these various inversion tests give a collection of qualitatively very similar source models. The fits between synthetic and simulated seismograms are very good. At a large scale the collection of computed fault models is similar to the initial model. Nonetheless, there are still some significant differences between models. Therefore these results need now to be analysed and interpreted quantitatively.