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Nonlinear kinematic inversion of the October 2000 Tottori, Japan earthquake

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A nonlinear kinematic inversion method is applied to the Mw=6.8, October 2000, Tottori (Japan) earthquake. The earthquake region was well instrumented and provided a good strong motion data set that has been intensively studied. The algorithm used for our inversion is the Neighbourhood Algorithm. The method is applied to a set of 9 high quality strong motion recordings located within 30 km of the epicenter.

All computations were performed using the absolute time of the recordings. We relocated the hypocenter to a depth of 14 km. The data were filtered using a forward fourth-order Butterworth bandpass filter in the frequency range of 0.05-0.5 Hz. The fault was parameterized with a model containing 63 patches of size 3.7x5km. The fault dimensions were 45x26km. Since the fault does not break the surface, the first layer was constrained to have zero slip. We performed inversions both with fixed and variable rupture velocity. When only slip is inverted, the actual number of inversed slip patches is 20. Slip on intermediary patches is then interpolated using the Akima interpolation scheme. When both time and slip are inverted, only 15 fault patches are inverted, giving a total of 30 inversed parameters. Two misfit functions are 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 second method gives more emphasis to the farther stations.

Excellent convergence of the algorithm search and best waveform fits were obtained for the following parameters: a 2 second rise time, a constant rupture velocity of 2.4 km and a maximum slip of 4 m occuring beneath and north of the hypocenter. The fault model shows three well defined patches of slip amplitude between 2.5 and 4 m distributed evenly around the hypocenter. Most of the slip occurs away from the hypocenter and from the surface. The rupture starts propagating north of the hypocen-

ter, with maximum slip happening after just a few seconds, and then propagates south, parallely to the surface. Finally the collection of computed models is tested through comparison with GPS data as well as dynamic modelling.