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Strong motion simulation for the 2004 Chuetsu earthquake with special reference to large vecocity at Ojiya

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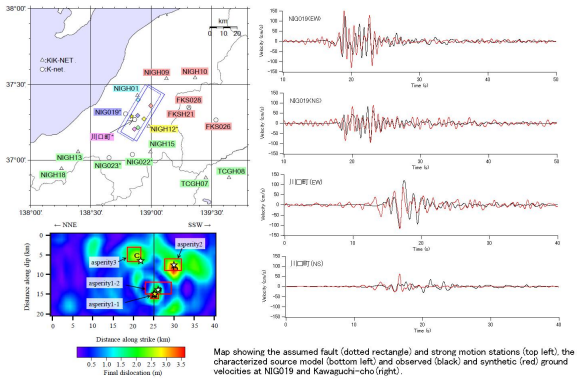
According to studies in the field of engineering seismology after the 1995 Hyogo-ken Nanbu earthquake, it was revealed that near-source velocity pulses can cause serious damage to structures (*e.g.*, Kawase, 1998) and that these velocity pulses can be simulated using characterized source models quite accurately (*e.g.*, Kamae and Irikura, 1998). These were the pulses that resulted from forward directivity effects. Since then, however, there have been many cases in which large amplitude (about 100 cm/s or more) ground velocities, which cannot be attributed to forward directivity effects, were observed in the near-source region of large crustal earthquakes in Japan. The strong ground motion observed at Ojiya during the 2004 Chuetsu earthquake is one of the examples. It is important from engineering point of view to investigate the validity of characterized source models for these cases.

For the 2004 Chuetsu earthquake, there have been several trials to construct characterized source models (*e.g.*, Kamae et al., 2005) but none of them seemed to be quite successful in reproducing ground velocities including those at K-NET Ojiya and Kawaguchi-cho. In this study, the authors propose a new characterized source model, which is capable of reproducing near-source ground velocities including those at K-NET Ojiya and Kawaguchi-cho.

Empirical site amplification and phase characteristics were considered (Kowada *et al.*, 1998; Nozu *et al.*, 2009) in the simulation. There were two key factors that contributed to the reproduction of strong ground motions at K-NET ojiya in this study. One of them was selecting appropriate aftershock records to take into account phase characteristics. The other was taking into account nonlinear site response at K-NET Ojiya as revealed by Tokimatsu *et al.* (2006) and Tokimatsu and Sekiguchi (2006).



Map showing the assumed fault (dotted rectangle) and strong motion stations (top left), the characterized source model (bottom left) and observed (black) and synthetic (red) ground velocities at NIG019 and Kawaguchi-cho (right).

Keywords: strong ground motion, characterized source model, site amplification factor, phase, nonlinearity, The 2004 Chuetsu earthquake