Dynamic Fault Model of the 2016 Tottoriken-chubu Earthquake Based on Kinematic Source Inversion

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We constructed a dynamic fault model based on slip distribution obtained by the kinematic inversion of the observed neighbouring seismic waveforms by Kobayashi et al. (2016) for the Tottoriken-chubu earthquake (Mw 6.2), which occurred in central Tottori prefecture, south western Japan on 21 October 2016. This was a shallow crustal earthquake with a left lateral strike slip faulting, and fault size is assumed to be 19.5 km (along strike) and 18 km (along dip).

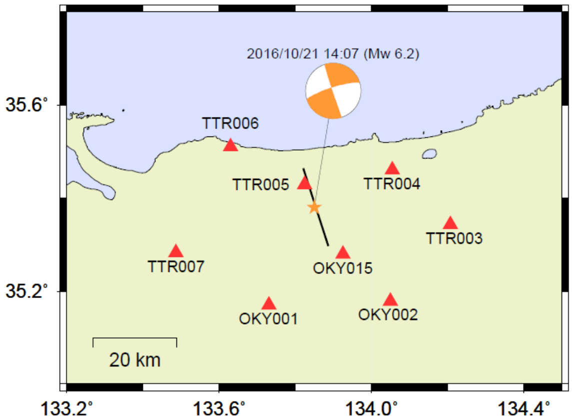

Figure 1 Spatial distribution of strong motion observation stations for numerical calculation (red triangles with station name). The black solid line denotes trace of the vertical fault plane of the Tottoriken-chubu earthquake, and the orange star shows epicenter with focal mechanism.

In this study, we obtained the temporal change of shear stress, using the slip distribution and its temporal change of the kinematic inversion. One-dimensional underground velocity structure model was assumed [Earthquake Research Research Promotion Headquarters, 2012]. Temporal changes of the slip and the shear stress were obtained for each subfault. Using thus obtained spatial distribution of the stress drop amount, numerical simulations of dynamic fault rupture and seismic wave field were carried out to obtain values of peak stress and critical slip weakening distance (hereafter referred to as τ_p and D_c, respectively) to fit the observed seismic waveforms by forward modeling. We employed the boundary integral equation method [Fukuyama and Madariaga, 1995; 1998; Aochi et al., 2000] for dynamic fault rupture calculation, and finite difference method [Aochi and Madariaga, 2003] for seismic wave field calculation, respectively. The distribution of stress drop amount obtained above was used as the initial stress distribution, and the values of τ_p and residual stress were set to be constant on the fault plane. To obtain the values of τ_p and D_c, we changed the values so that the calculated seismic waveforms fit the observed ones by a trial-and-error method.

For comparison between observed and calculated seismic waveforms, eight strong motion observation stations were used (Figure 1), and the frequency range is set to be 0.02-0.4 Hz, which is the same as that used in the kinematic inversion. Preliminary results show that additional slips to the ones obtained by the kinematic inversion are required in the northern part of the fault plane to explain the observed waveforms.