Dynamic source parameters estimated by the kinematic source inversion results

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We invert source models of the 1997 Kagoshima-ken hokuseibu earthquake (Mw6.1) and 1997 Yamaguchi-ken hokubu earthquake (Mw5.8) by the kinematic source inversion. For obtaining high-resolution source models that are reliable in the frequency range up to 2Hz, we tune up the underground structure models using M3-M4 class earthquake records. We apply R/V (Radial/Vertical) receiver function method to the records and estimate 1D structure models down to 2km depth through fitting the observed and theoretical R/V functions. Using the kinematic source inversion results, we solve elastodynamic equations using a finite difference method to estimate spatiotemporal stress distribution and dynamic source parameters.

The result is shown below.

1997 Kagoshima-ken hokuseibu earthquake
dynamic stress drop (asperity) : 11 MPa, dynamic stress drop (off-asperity) : 4 MPa
strength excess (asperity) : 1 MPa, strength excess (off-asperity) : 2 MPa,
critical displacement (asperity) : 0.7 m, critical displacement (off-asperity) : 0.3 m

1997 Yamaguchi-ken hokubu earthquake
dynamic stress drop (asperity) : 7 MPa, dynamic stress drop (off-asperity) : 2 MPa
strength excess (asperity) : 2 MPa, strength excess (off-asperity) : 2 MPa,
critical displacement (asperity) : 0.3 m, critical displacement (off-asperity) : 0.1 m

(1)The dynamic stress drop in the asperity area is about three times as large as that in the off-asperity area. The dynamic stress drop is corresponding to the stress drop in SMGA (Strong Motion Generation Area) estimated by using the empirical Green's function method(Miyake, 2003).
(2)There is little difference of strength excess in asperity area and off-asperity area.
(3)Critical displacement is about 80% of the final slip. Overshooting process is not confirmed.
(4)The rupture velocity slows in the part of high strength excess.