

Source process of the 2005 West Off Fukuoka earthquake inferred from strong motion and 1-Hz GPS data

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We analyzed strong motion and 1 Hz GPS data recorded during the 2005 West Off Fukuoka earthquake for its source process. Two models were obtained from different fault planes, methods, and strong motion datasets. These models are consistent with each other.

For the first model, strong motion data recorded at 12 stations of K-NET and KiK-net were used. The records were bandpass-filtered between 0.05 and 0.5 Hz, resampled at a rate of 2 Hz, and windowed for 30 seconds, starting from 1 s before the P-wave arrival. For the fault geometry we referred to the aftershock distribution determined by Kyushu University and the fault model of the Geographical Survey Institute. We adopted a focal mechanism of (strike, dip, slip)=(123, 87, -1) and the hypocenter determined by Kyushu University (latitude 33.75N, longitude 130.16E, depth 14.0 km). The fault plane was divided into fifty-six 4 x 4 km² subfaults. The 1-D structures for the Green's functions were based on Ide (1999). We used an inversion method developed by Yoshida et al. (1995). We chose a rupture front velocity of 3.1 km/s that minimize the variance, and a smoothness parameter that minimize ABIC. The resultant slip distribution indicates an asperity on the shallow, the southeast!

part of the fault plane. The maximum slip is 1.0 m and the total seismic moment is 1.0×10^{19} Nm (Mw 6.6). Most of the seismic data were well recovered, but the synthetic seismograms at Tsushima and Iki are not in good agreement with the observed ones, suggesting that the seismic structures should be modified.

For the second model, we first determined the focal mechanism (strike, dip, slip)=(120, 87, -2) by an inversion of the teleseismic data. We adopted a focal depth of 10.5 km and the epicenter of Kyushu University (latitude 33.75N, longitude 130.16E). The fault plane was divided into sixty 3 x 3 km² subfaults. The strong motion data were inverted by using an inversion method of Ide et al. (1996). The resultant slip distribution indicates an asperity on the shallow, the southeast part of the fault plane, as also shown in the first model, and small slips on the deep, the northwestern part. The maximum slip is 1.2 m and the seismic moment is 1.1×10^{19} Nm (Mw 6.6). The synthetic seismograms were better recovered than those of the first model.

The 1 Hz GPS data were taken from Nippon GPS Data Service Corporation and analyzed by using GIPSY-OASIS 2 developed at the Jet Propulsion Laboratory and rapid products of International GPS service. The position of Usuda, Aoshima, and Tonaki are strongly constrained (the coseismic displacements at these stations assumed to be negligible), and the receiver clock at Usuda is used as the reference clock. At 021062 (FUKUOKA) near the source region, clear seismic waveforms and static displacements were obtained. We will invert the 1 Hz GPS data with or without the strong motion data for the source process.