

Source characteristics of interplate earthquakes estimated from broadband strong motion modeling

Wataru Suzuki[1]; Tomotaka Iwata[1]

[1] DPRI, Kyoto Univ.

We estimated the strong motion generation area (SMGA, Miyake et al., 2003) of earthquakes in the off-shore of Tokachi and Kushiro regions. We analyzed eight Mw 6-7 earthquakes which are thought to be interplate earthquakes from moment tensor solution. In order to synthesize broadband strong motion waveforms, we used the empirical Green's function (EGF) method formulated by Irikura (1986). By fitting synthesized horizontal components of S-waves to the observed records, we estimated the length, width, and rise time of SMGA, and rupture starting subfault within SMGA. We used seismograms recorded at four to eight stations for each event. Waveforms were bandpass filtered between 0.2 or 0.3 and 10 Hz. The lower limit of analyzed frequency range depends on the S/N ratio of EGF event. The rupture of the SMGA was assumed to start at the hypocenter determined by JMA and propagate radially with 70 % of S-wave velocity in the source region. To estimate the parameters, we performed the genetic algorithm search for ten times changing sets of initial values. Evaluation function of the genetic algorithm was the sum of the residuals of the velocity waveforms up to 1 Hz and acceleration envelopes up to 10 Hz so as to fit synthetics over the wide frequency range. Except for one event, we could simulate broadband strong motion records fairly well assuming one SMGA. For the exceptional event, we needed to assume two SMGAs to explain the observed waveforms.

The size of the derived SMGAs is smaller than the asperity size of crustal earthquakes with the same seismic moment predicted from empirical relationship. Earthquakes analyzed here, therefore, have larger stress drop on the SMGA than crustal earthquakes. Earthquakes in the off-shore of Tokachi region have smaller stress drop than those in the off-shore of Kushiro region. The former events are aftershocks of the 2003 Tokachi-oki earthquake, while the latter are thought to be independent of the Tokachi-oki earthquake. The difference in the stress drop may reflect the regional characteristics or the difference between aftershocks of large earthquake and earthquakes which occurred in the ordinary condition. The location of estimated SMGA is compared to the slip distribution inferred by other researchers using strong motion or teleseismic data for three earthquakes. The SMGA tends to be located in the large slip area, while its size is smaller than the stretch of large slip region. This would show that strong motion of interplate earthquakes which is higher than 0.2 or 0.3 Hz is mainly generated from small region where stress drop is concentrated in the large slip area.

We are grateful to K-NET, KiK-net, F-net, and JAMSTEC for providing waveform data. We also thank JMA for hypocentral information and F-net for moment tensor solutions.