

Tsunami source model of M7 earthquakes occurred in the Sea of Japan

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Eastern margin of the Sea of Japan has been considered as a nascent plate boundary between the Eurasian and North American plates but not a typical subduction zone, hence the maximum magnitude ($M < 8$) of earthquakes is considered to be smaller than those in the Pacific Ocean. Nevertheless, several large earthquakes with $M > 7.5$ in the last century caused seismic and tsunami damages, such as the 1993 Southwest off Hokkaido (Mjma 7.8), 1983 Japan Sea (Mjma 7.7), 1964 Niigata (Mjma 7.5), or 1940 Shakotan-oki (Mjma 7.5) earthquakes. Detailed studies of source process were performed for these earthquakes. There are many active faults along the eastern margin of the Sea of Japan. Smaller ($M \sim 7$) earthquakes also cause seismic and tsunami damages if their hypocenters are near the land. However, there are few analyses for earthquakes around M7. Therefore, we study the characteristics of the $M \sim 7$ earthquakes in the Sea of Japan using seismic waveform and tsunami waveform data.

We analyzed the 1983 West off Aomori (Mjma 7.1), 1971 West off Sakhalin (Mjma 6.9), and 1964 off Oga Peninsula (Mjma 6.9) earthquakes. We made teleseismic waveform inversion using Kikuchi and Kanamori (1991, BSSA)'s code to obtain the heterogeneous slip distribution. We then computed tsunami waveforms using JAGURS code (Baba et al., 2015, PAGEOPH) at the tide gauge stations and compared with the observed tsunami waveforms. The tsunami waveforms were also computed from simpler rectangular faults with uniform slips. For the 1971 earthquake (Mw 6.8) and the 1983 earthquake (Mw 6.7), the amplitudes of tsunami waveforms calculated from the heterogeneous slip model did not reproduce the observed tsunami waveforms; to match with the observed tsunami amplitudes, larger seismic moment and average slips are required. Furthermore, for all the earthquakes, we have to examine the locations and parameters of each fault to reproduce the travel times and the agreements between observed and calculated waveforms.

Keywords: tsunami source model, fault parameter, tsunami waveform analysis, eastern margin of the Sea of Japan