

Rupture processes of the tsunami earthquakes and seismic activity of the normal-faulting earthquake

EZAKI, Hayaki^{1*}, YAGI, Yuji¹

¹Life and Env. Sci., Univ. of Tsukuba

A 'tsunami earthquake' excites considerably larger tsunamis than expected from its magnitude estimated by seismic wave (Kanamori, 1972). Tsunami earthquakes seem to occur in shallow part of subduction zones. It had been difficult to find clear characteristics of tsunami earthquakes, since observed waveforms are contaminated by multi-reflected waves due to heterogeneity of sea floor structure. The 2011 off the Pacific coast of Tohoku earthquake broke an area such as near trench where the 1896 Meiji-Sanriku tsunami earthquake occurred. The characteristics of tsunami earthquakes are also important to understand nature of mega-thrust earthquakes.

We applied new waveform inversion, introducing uncertainty of Green's function (Yagi and Fukahata, 2011), to tele-seismic body-waves of tsunami earthquakes detected by other studies (e.g., Bilek and Engdahl, 2007) so as to estimate stable and detailed rupture process. We collected tele-seismic body waveforms (P-wave) recorded at Federation of Digital Broad-Band Seismograph Network (FDSN) and Global Seismograph Network (GSN) from IRIS-DMC.

We found that slow slip (about 0.1 m/s) continued over 50 sec near trench and trapezoidal moment-rate function is in 3 earthquakes : the 1992 Nicaragua earthquake, the 2006 Java earthquake and the 2010 Mentawai earthquake. From final slip distribution of the three earthquakes, large slip area located along trench excites large tsunamis.

We also investigated seismic activities of the normal-faulting earthquakes in and around seismic source area of the great thrust earthquakes. Normal-faulting earthquakes in and around seismic source area of the three tsunami earthquakes become active after the tsunami earthquakes, which is also observed in aftershock activity of the 2011 off the Pacific coast of Tohoku earthquake. The long slip duration near trench and normal-faulting earthquake in and around seismic source area implied that the earthquake released roughly all of the accumulated elastic strain on the plate interface owing to exceptional weakening of the fault.

Keywords: tsunami earthquake, source process, uncertainty of Green's function, normal-faulting earthquake