Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SSS025-P07 Room:Convention Hall Time:May 27 10:30-13:00

Numerical experiments of rupture process inversion using the 2.5 dimension finite difference method

Tatsuhiko Hara[1*], Naoki Nishimura[2], Taro Okamoto[3], Yuji Yagi[2], Hiroshi Takenaka[4]

[1]IISEE, BRI, [2]Life & Env. Sci., Univ. Tsukuba, [3]Tokyo Institute of Technology, [4]Kyushu University

We performed a numerical experiment to investigate accuracy and reliability of rupture process inversion using synthetic seismograms computed for a realistic structure model by the 2.5-D finite difference method (Takenaka and Okamoto, Proc. Int. Workshop on Scientific Use of Submarine Cables, 23-26, 1997; Okamoto and Takenaka, Advances in Geosciences, Vol.13, 215-229, 2009). The target event of this experiment is the 1994 far east off Sanriku earthquake (Mw 7.7 after Global CMT Catalog). Okamoto et al. (2010, P3-29, 2010 Fall Meeting, SSJ) constructed a structure model of crust and mantle surrounding the source region of this event, and showed that the observed waveforms of middle size (Mw 5.9-6.4) events that occurred near the source region were well reproduced by using the model. We constructed an earthquake source process model in this numerical experiment, which we call ”input source process model”, as follows. We placed three, localized asperities (small areas with large slips) in the shallow, middle and deep parts of the assumed fault plane, respectively. The rupture velocity was set to 2.5 km/s. The rupture starts from the shallowest asperity and propagates toward the deeper part of the fault. For this input source process model, we computed synthetic seismograms for teleseismic P waves using the 2.5-D finite difference method (Takenaka and Okamoto, 1997; Okamoto and Takenaka, 2009). Then, we performed rupture process inversion of these synthetic seismograms using inversion algorithm by Yagi and Fukahata (2008. Geophys. J. Int., 175, 215-221). Green’s functions were computed using the method of Kikuchi and Kanamori (1991, BSSA, 81, 2335-2350).

The obtained rupture process model showed three areas with large slips corresponding to three small asperities in the input source process model. This result suggests that it is possible to obtain overall feature of rupture process by applying inversion algorithm of Yagi and Fukahata (2008) to teleseismic P waves. We also note that the areas of asperities in the inversion result are much larger than those in the input source process model. Such ”smearing” effect has also been pointed out by Okamoto and Takenaka (EPS, 61, e17-e20, 2009) in the results of the synthetic experiments of the inversion for the slip distribution of tsunami earthquake. Because of the smearing effect, it might be difficult to reveal fine features in the ”true” slip distribution.

Keywords: Rupture process inversion, Numerical experiment, 2.5 dimension finite difference method