

Initiation of the dynamic rupture of the 2011 Tohoku earthquake

UCHIDE, Takahiko^{1*}

¹DPRI, Kyoto University

The 2011 Tohoku earthquake (M 9.0) is characterized by a shallow huge slip more than 40 m, which produced the devastating tsunami. For modeling this earthquake, the stress accumulation and the kinematic rupture process should be understood. Here I focus on the kinematics of this earthquake in the early stage. A couple of studies already came out. Chu et al. (2011) found that the first 4 s of the rupture is equivalent to an Mw 4.9 thrust event. Uchide et al. (AGU, 2011) reported the source process in the first 20 s in detail by the multiscale slip inversion analysis (Uchide and Ide, 2007). Their result implies that rupture propagated eastward until 8 s, and after that the rupture propagated westward. The peak slip rate is around 1 m/s, which implies the dynamic rupture.

Hi-net data in Tohoku area shows that the velocity amplitude increases stepwise. Hi-net data are eventually clipped but they work at least in the first 20 s. The steps are found around 4 s and 16 s. In the first 1 s, the velocity amplitude of the M9 event is comparable to that of nearby M4 events (Mw 4.3 - 4.9). A deconvolution analysis using an M4 event (Mw 4.6 on Dec. 19, 2004 at 10:16 (UTC)) indicates a small event in the first 0.5 s.

I will also report the result of the multiscale slip inversion and the comparison of it to the seismicity between the M7.3 foreshock on March 9, 2011 and the mainshock (Ando and Imanishi, 2011).

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