

Rupture process of March 11, 2011 Ibaraki oki earthquake obtained from back-projection approach using MeSO-net data

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Introduction

The largest aftershock (M7.6) of the giant M9.0 Tohoku-oki earthquake occurred near the coast of Ibaraki prefecture about thirty minutes after the main shock. We report here results of back-projection analysis that makes an image of the rupture process of the M7.6 earthquake.

Data and method of the analysis

In investigating the rupture process of the M7.6 earthquake by the back-projection analysis, we used waveforms observed by the MeSO-net. We integrated the original acceleration seismograms, then, band-pass filtered the seismograms in a frequency range of 0.1 ~ 1.0Hz. In this study, we adopted the plate boundary model obtained from source mechanism analysis (Nakajima and Hasegawa, 2006) as the fault model. A fault plane with a length of 100 km and a width of 100 km was taken and it was divided into 112 sub faults. Travel times from subfaults to observation sites are calculated by using 3-D velocity structure model (Matsubara and Obara, 2011). As constraints, we assumed that the rupture velocity is smaller than 4 km/s, and rupture duration on each sub fault is less than 100 sec. By projecting the power of the stacked waveforms onto the assumed fault plane, rupture propagation image was successfully obtained.

Result and discussion

The estimated asperity is located down dip extension of the M7.0 earthquake that occurred on May 2008. The rupture seems to have propagated westward or south-westward avoiding the asperity of the 2008 event as well as the area where pretty large seismic energy was radiated during the main shock.

In the region off the coast of Ibaraki prefecture, M 7 class earthquakes have occurred repeatedly in the past. Such a recurrence of large earthquakes is considered to be caused by high frictional strength due to existence of subducted seamounts. Around the region the Philippine Sea plate contacts with the Pacific plate as well. We think our results will be of help to understand stress accumulation process in the tectonically complex region.

Keywords: The 2011 off the Pacific coast of Tohoku Earthquake, Back-projection, The largest aftershock, MeSO-net