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Rupture process of the 2011 off the Pacific coast of Tohoku earthquake derived from strong-motion data

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We derive the rupture process of the 2011 off the Pacific coast of Tohoku earthquake using the strong-motion data recorded by K-NET and KiK-net. We employ the multi-time-window linear waveform inversion method. Our fault model is a rectangle plane, length and width of which are 510 km along the Japan Trench and 210 km along subducting direction of the Pacific plate. Projection of the fault plane extends from the trench line to the coastal line of northeast Japan. The subfault size is 30 x 30 km and the slip history of each subfault is represented by 25 time windows having a duration of 6 seconds separated by 3 seconds. The derived rupture model has one main large slip area extending from the area near the hypocenter to the shallow part of the fault plane, located far off Miyagi prefecture. Seismic moment of the estimated model is 4.24×10^{22} Nm (M_w 9.0). There are two events that ruptured the main slip area at 20-45 seconds and at 65-95 seconds after the rupture initiation. This is consistent with the fact that the two wave groups separated by 40 seconds propagated along north-south direction with the stations of the similar latitude at the head. Our rupture model may give an important clue to understanding the generation mechanism of the shallow large slip during the Tohoku earthquake, which may be responsible for the catastrophic tsunami.

Keywords: The 2011 off the Pacific coast of Tohoku earthquake, Rupture process, strong-motion data