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Rupture process of the 2011 Tohoku-oki earthquake obtained by tele-seismic body wave

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We estimated the rupture process of the 2011 off the Pacific coast of Tohoku earthquake using waveform inversion of tele-seismic body wave. In principle, we can never know the true Green's function, which is a major error source in seismic waveform inversion. Due to the propagation law of errors, the uncertainty of Green's function results in a data covariance matrix with significant off-diagonal components, which naturally reduce the weight of observed data in later phases. To estimate stable and detailed rupture process of mega-thrust earthquake, we introduced uncertainty of Green's function into waveform inversion analyses. Tele-seismic P-wave data recorded at FDSN network stations and Global Seismograph Network stations were retrieved from IRIS-dmc. 53 stations were selected from the viewpoint of data quality. From observed waveform, three noticeable wave packets exhibit azimuthal dependence in the arrival times, which implied rupture propagated asymmetric bilateral manner. From obtained seismic source model, we found repeated slips around the epicentral area, which led to a large maximum slip (29 m).

Keywords: 2011 Tohoku-oki earthquake, seismic source process, uncertainty of Green's function