Source inversion using EGF for the 2008 Iwate-Miyagi earthquake based on precisely relocated aftershock distribution

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During the 2008 Iwate-Miyagi Nairiku earthquake, the peak ground accelerations at several stations exceeded 1G. The faulting mechanism of this event was considered to be the west-dipping reverse fault from the CMT solution, initially estimated aftershock distribution and the location of surface deformation. On the other hand another source model that the conjugate faults are ruptured simultaneously has been proposed recently based on the precisely relocated aftershock distribution (Yoshida, 2013) and the geodetic data detected by the GPS and the In-SAR (Abe et al., 2013). The source modeling using strong motion data was also carried out assuming conjugate fault plane, and significant slips are estimated on both the fault planes (Hikima and Koketsu, 2013). In this study the conjugate fault planes model and west-dipping plane model are prepared based on the aftershock locations by Yoshida (2013) and the waveform inversion using the empirical Green's function is applied.
The initial conjugate fault model for the inversion analysis in this study consists of three planes. For the west-dipping fault I assume two planes with different strike and dip angles according to the latest aftershock distribution and the trace of surface deformation. Furthermore the east-dipping conjugate fault plane is added. Observed records from two aftershocks of Mj 4.2 and 4.0 occurring near the northern and southern fault planes are adopted for the empirical Green's functions. Velocity motions of two horizontal components for 20 near-source stations are used for the source inversion in the frequency range from 0.1 to 1 Hz. The difference of the radiation patterns between the main shock and EGFs are corrected following Boore and Boatwright (1984).
The obtained source model from the conjugate fault indicates large slips mainly in the southern part from the hypocenter on the west-dipping northern fault plane and secondary large slips on the east-dipping fault. The slip distribution of the source projected on the horizontal plane shows that the slips on the conjugate faults are complementary. The maximum slip reaches 5.3 m. While the source model with west-dipping fault plane implies the main slips are estimated on the almost same area and the peak value is 6.1 m. For both cases though the asperity on the west-dipping fault is located beneath the trace of observed surface deformations, it lies in rather deeper position. It is considered to be consistent with the fact that the surface fault ruptures are not observed clearly.

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