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Rupture process of the 2014 Northern Nagano earthquake as deduced from near-source strong motion records

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The 2014 Northern Nagano, central Japan, earthquake (M_{JMA} 6.7) is a moderate-size crustal event with prominent surface rupture along the southern part of Kamishiro fault (e.g., Katsube et al., 2015 this meeting). I inferred the rupture process of this earthquake, inverting near-source (epicentral distance of less than 30 km) strong motion records. The original accelerograms were band-pass filtered between 0.1-1.0 Hz, and then numerically integrated into displacement. The inversion methodology adopted in this study is the same as that of Horikawa (2001, BSSA). I conducted preliminary inversion analysis to choose a focal mechanism among those of (centroid) moment tensors of the Global CMT, the National Research Institute for the Earth Science and Disaster Prevention (NIED), and the Japan Meteorological Agency (JMA). I then adopted the focal mechanism of the JMA centroid moment tensor (strike of 18 degrees, dip of 58 degrees, and rake of 59 degrees), assuming a fault plane with length of 23 km and width of 21 km. The inversion analysis revealed that the overall rupture finished within 10 s. After subtle moment release of the first 1 s, a large amount of moment release abruptly occurred with duration of 4 s. This large moment release comes from two patches of large slip: one is just beneath the hypocenter and with the maximum slip of more than 1 m, the other is located to the northeast of the hypocenter. The seismic moment of this earthquake was estimated to be 2.0 x 10^{18} Nm (M_w 6.1), and smaller than those of (centroid) moment tensor analysis (e.g., 3.0 x 10^{18} Nm from the global CMT). The two patches of large slip are deeper than the hypocenter (5.4 km below the ground surface around the source region), and little slip was found at the shallow part of the fault, which does not agree with the distinct surface rupture. A speculative interpretation of this discrepancy is that the moment release at the shallow part proceeded with long (maybe tens of seconds) duration that does not heavily affect the frequency components analyzed in this study. However, further analysis is required for validation of this interpretation.

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