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Dynamic Simulation of the Seismic Behavior on the Shallow Part of the Fault during Mega-Thrust Earthquakes Part.3

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The recent mega-thrust earthquakes, such as the 2011 Tohoku-Oki earthquake (M9.0), the 2004 Sumatra earthquake (M9.2) and the 2010 Chile earthquake (M8.8) showed some distinct features. For example, huge slips on the order of several ten meters on the shallow part of the fault without radiating short-period seismic waves (strong ground motions) are detected. Another is that the deep part of the fault radiates strong ground motions (e.g. Lay et al., 2012). The feature of seismic behavior especially shown on the shallow part of the fault has been highlighted if the rupture of the mega-thrust earthquakes reaches to the shallow part. Although various kinds of observations for the seismic behavior (rupture process and ground motion characteristics etc.) on the shallow part of the fault plane during the mega-trust earthquakes have been reported, the number of analytical or numerical studies based on dynamic simulation is still limited.

In this study, we carried out the dynamic simulations in order to get better understandings about the seismic behavior on the shallow part of the fault during mega-thrust earthquakes. We used the two-dimensional spectral element method (Ampuero, 2009) that can incorporate the complex fault geometry into simulation as well as to save computational resources. The simulation utilizes the slip-weakening law (Ida, 1972). In the simulation, we investigated the seismic behavior with changing some parameters such as the critical slip distance (Dc), the material parameters, and the rupture directivity in addition to the stress drop whose results are shown in Tsuda et al. (2012). The results of simulations are useful to get better understandings about the seismic behavior on the shallow part of the fault during the future mega-thrust earthquakes along the Nankai Trough, Japan.

Keywords: mega-thrust earthquake, shallow part of fault plane, seismic behavior, dynamic simulation, spectral element method