Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SSS38-10 Room:303 Time:May 23 11:30-11:45

Dynamic Simulations for the Seismic Behavior of Shallow Part of the Fault Plane during Mega-Thrust Earthquakes

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Splay faults branching from the plate boundary have been found around the shallow part of plate of mega thrust earthquake. They cause huge vertical displacements being ruptured simultaneously with Mega-Thrust earthquakes. This leads to the huge tsunami. Baba *et al*. (2006) mentioned that splay faults around Kumano-nada were ruptured during the 1944 Tonankai earthquake and the 1946 Nankai earthquake, and these ruptures gave rise to huge tsunami. Additionally, the 2011 Tohoku events produced the huge slips without radiating strong ground motions on the shallow part of the faults. This gets attentions as the distinct features when the rupture of the mega-thrust events reaches to the shallow part of the faults including splay faults. Although various kinds of observations for the seismic behavior (rupture process or ground motion features etc) of splay faults as well as the shallow part of the fault plane from inter plate earthquakes have been reported, the number of analytical or numerical studies based on dynamic simulation is still limited. Wendt *et al*. (2009), for example, revealed that the different initial stress distribution brings huge difference in terms of the seismic behavior (rupture simultaneously or not) and vertical displacements on the surface.

In this study, we have carried out the dynamic simulations in order to get better understandings about the seismic behavior of splay faults as well as shallow part of the plate boundary. We use the spectral element methods (Ampuero, 2009) that can not only incorporate the complex fault geometry but save computational resources. The simulation utilizes the slip-weakening law (Ida, 1972). Even the results of simulation did not reproduce much about the observed features of seismic behavior of shallow part of the plate boundary during the Tohoku events, the parameter studies that vary material parameters, constitute law, and initial stress distribution etc, leads to better understandings about the seismic behavior of shallow part of the plate boundary including splay faults.

Keywords: Megathrust event, Dynamic Simulation, Shallow Part of Fault Plane, Spectral Element Method