Predictive Dynamic Rupture Simulation of the 2011 Tohoku Megathrust Earthquake

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We investigate the dynamic rupture process of the recent megathrust earthquake east off Tohoku, Japan. Here, we focus on the issue whether a predictive simulation approach proposed by *Hok et al.* (2010, AGU Fall Meeting) works for the future megathrust earthquake or not. We started using the slip deficit rate distribution estimated by *Hashimoto et al.* (2009, Nature Geoscience). We constructed the slip deficit distribution assuming that the strain was accumulated for 100 years south of 39°N and for 150 years north of 39N. Because several M8 earthquakes occurred in recent 50 years north of 39°N but very few occurred south of 39°N. Then we computed the stress change distribution, which is used as the stress drop distribution during the dynamic rupture computation. By assuming a uniform strength distribution and final slip-dependent slip weakening constitutive law (i.e., slip weakening distance is assumed to be proportional to the final slip). Finally, we assume the initiation zone close to the foreshock location of the M7.2 earthquake occurred on March 9, 51 hours before the mainshock. Actually, the mainshock initiated at the edge of the aftershock zone of this foreshock. The computed result shows rather similar rupture process as those obtained by the waveform inversion. The rupture propagated for 50s to the north then propagated to the south and total rupture duration was about 150s. We think this rupture scenario making simulation could be useful for the future large earthquakes although we could not apply this methodology to the recent M9.1 earthquake.