

Frictional and Radiated Energy for the Shallow Fault of the 2011 Tohoku-oki Earthquake

*James Mori¹

1. Earthquake Hazards Division, Disaster Prevention Research Institute, Kyoto University

Recent results from the Japan Trench Fast Drilling Project (JFAST) estimated the level of dynamic friction on the shallow portion of the fault that had the very large slip during the 2011 Tohoku-oki earthquake. During this Integrated Ocean Drilling Program (IODP) expedition, borehole samples were obtained from the plate boundary fault zone at 820 meters below the sea floor. Also, temperature monitoring in the borehole across the fault zone measured the level of frictional heat generated at the time of the earthquakes. From both high-speed laboratory experiments on the fault zone material (Ujiie et al., 2013) and the temperature observations across the fault zone (Fulton et al., 2013), the shear stress during the earthquake rupture was estimated to be about 0.6 MPa. This shear stress corresponds to a coefficient of friction of about 0.08 to 0.1.

Comparing these results with estimates of the radiated energy, which are derived from teleseismic body waves, shows that the radiated energy is larger than the frictional heat for the shallow portion of the fault. However, for the deeper portions of the fault, the frictional heat is larger. The shallow and deep portions of the megathrust have different proportions for the energy balance and, thus, different styles of faulting.

Keywords: Tohoku earthquake, radiated energy, frictional heat, JFAST