**Japan Geoscience Union Meeting 2010**
(May 23-28 2010 at Makuhari, Chiba, Japan)


SSS011-04 Room: 303 Time: May 28 09:45-10:00

# A possible explanation for difference in stress drop between intraplate and interplate earthquakes

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It is known that stress drop of intraplate earthquakes is higher than that of interplate earthquakes on average. The cause of the difference in stress drop has not been clarified yet. Laboratory experiments of rock friction indicates that static friction increases with a stationary contact time between sliding surfaces, and this fact is qualitatively consistent with that stress drop of intraplate earthquakes is higher because intraplate strain rates are generally lower and the recurrence intervals of intraplate earthquakes are longer than those at plate boundaries. However, a few percent increases in static friction coefficient per tenfold increase in contact time observed in the laboratory cannot quantitatively explain the difference in stress drop. Some other mechanisms such as the difference in maturity of a fault were proposed, though no quatitative explanation for the difference is stress drop exists.
In the present study, numerical simulations are carried out in order to quantitatively explain the difference in stress drop between intraplate and interplate earthquakes. In the present model an intraplate fault is assumed to be loaded uniformly, and the slip area is surrounded by an unbreakable barrier. In contrast, it is assumed that the seismic slip area (an asperity) on a plate boundary is locked during an interseismic period and it is nonuniformly loaded by surrounding aseismic sliding. A rate- and state-dependent friction is assumed on the model fault planes in the numerical simulations. The same friction parameters are assumed on the seismically slip areas in both the models. For the surrounding areas, the fault is perfectly locked in the intraplate earthquake model and velocity-strengthening friction is assumed in the interplate earthquake model. Because the model intraplate fault is uniformly loaded, stress drop is nearly uniform over the fault with a larger average value. In contrast, stress concentration is generated at a boundary region between locked area and aseismic sliding area for a model interplate earthquake. This stress concentration hastens earthquake occurrence, resulting in lower average stress drop in the interplate earthquake model. The stress drop of simulated intraplate earthquakes is several tens percent larger than that of simulated interplate earthquakes. This is quantitatively explain recent reports on earthquake stress drop.

Reference
Kato, N. (2009), A possible explanation for difference in stress drop between intraplate and interplate earthquakes, Geophys. Res. Lett., 36, L23311, doi:10.1029/2009GL040985.

Keywords: earthquake mechanics, earthquake parameters, friction, numerical simulation