Dependence of earthquake stress drop on scaling of frictional parameters

Shingo Yoshida\(^1\)*, Naoyuki Kato\(^1\)

\(^1\)ERI, Univ. Tokyo

To understand dependence of stress drop on scaling of frictional parameters, we conducted numerical simulation of earthquake cycles on plate interface. We assume a circular asperity which obeys a rate- and state-dependent friction law. If the critical slip length \(L\) is proportional to the asperity radius \(r\), and \(b-a\) is a constant, stress drop is independent of the ruptured area size \(R\). On the other hand, if \(L\) is a constant independent of \(r\), stress drop decreases with increasing \(R\) because earthquake occurs before large stress is accumulated compared with the former case. Numerical simulation shows the stress drop is proportional to \(R^{[-0.43]}\). Such a phenomenon is not observed for natural earthquakes. Kato (2012) reported that stress drop is proportional to \(R^{[-0.5]}\) on the basis of 2-d simulation results and theory of fracture mechanics if fracture energy is independent of asperity size.

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