# Exploring variations of earthquake moment on patches with heterogeneous strength

*Yen-Yu Lin[1], Nadia Lapusta[2,1]

1. CalTech Seismological Laboratory, 2. CalTech Mechanical and Civil Engineering

Finite-fault inversions show that earthquake slip is typically non-uniform over the ruptured region, likely due to heterogeneity of the earthquake source. Observations also show that events from the same fault area can have the same source duration but different magnitude ranging from 0.0 to 2.0 (Lin et al., 2016). Strong heterogeneity in strength over a patch could provide a potential explanation of such behavior, with the event duration controlled by the size of the patch and event magnitude determined by how much of the patch area has been ruptured. To explore this possibility, we numerically simulate earthquake sequences on a rate-and-state fault, with a seismogenic patch governed by steady-state velocity-weakening friction surrounded by a steady-state velocity-strengthening region. The seismogenic patch contains strong variations in strength due to variable normal stress. Our long-term simulations of slip in this model indeed generate sequences of earthquakes of various magnitudes. In some seismic events, dynamic rupture cannot overcome areas with higher normal strength, and smaller events result. When the higher-strength areas are loaded by previous slip and rupture, larger events result, as expected. Our current work is directed towards exploring a range of such models, determining the variability in the seismic moment that they can produce, and determining the observable properties of the resulting events.

Keywords: Earthquake Dynamic, Earthquake Source

 