RSQSim - A regional scale earthquake simulator incorporating rate- and state-dependent friction

Keith Richards-Dinger and James Dieterich

Current methodologies for assessing earthquake probabilities, such as those used by successive Working Groups on California Earthquake Probabilities, rely on idealized generic probability distributions for earthquake occurrence and employ highly simplified approximations of the physical processes and interactions that determine the onset and extent of earthquake slip. These assessments have become exceedingly complex, but unfortunately remain quite uncertain, in part because site-specific recurrence statistics for infrequent large earthquakes are unknown. Recent advances in large-scale simulations of earthquakes in fault systems make it possible to accurately model earthquake rupture processes and stress interactions in high resolution representations of fault systems for large numbers of earthquakes (typically 10^5 to 10^6 events, M5.0 to M8.0). The simulations incorporate clustering processes including foreshocks and aftershocks. Possible applications of simulators in assessments of earthquake probabilities include the generation of site-specific empirical density distributions of earthquake recurrence times, characterization of stress interactions and possible clock-resets for use with conditional probability estimates, and probabilistic evaluation of the effects of segment-to-segment ruptures and fault branching. We also plan to present results of recent enhancements to RSQSim allowing the simulation of slow slip events in subduction zones as well as phenomena related to continuous creep such as behavior of small repeating earthquakes and deep afterslip following large events.