TO Brownbag Seminar
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Testing a velocity-weakening to -strengthening friction law as an explanation for slow slip events

We investigate the behavior of simulated slow slip events using a rate and state friction model that is steady state velocity-weakening at low slip speeds but velocity-strengthening at high slip speeds. The simulations are on a one-dimensional (line) fault, but we modify the elastic interactions to mimic the elongate geometry frequently observed in slow slip events. The simulations exhibit a number of small events as well as periodic large events that propagate steadily along strike. The recurrence interval of the large events can be determined by considering what is essentially an energy balance requirement for long-distance propagation. It is possible to choose parameters such that this model can match the stress drops, slip velocities, and propagation rates observed in Cascadia.

However, for this friction law to be a viable candidate for slow slip, the model must also match additional observations. We examine the effect of tidal loading in our models and show that it is difficult to simultaneously reproduce the observed stress drops and tidal modulation. Finally, we examine small fronts that arise during the event and propagate in the opposite direction of the main front. Unless the stress drop in these back-propagating fronts is comparable that of the entire slow slip event, they propagate too slowly to be reasonable representations of the observed tremor reversals.