Title: Of faults and faucets

Abstract: The seismic cycle in simplest terms is an apparent cycle of rapid fault failure and quiescence. Beyond this simple concept, though, lies great complexity, among which is that a given fault hosts earthquake-generating ruptures over a wide range of scales, which in turn may or may not appear to have organization in space and time.

Current models of the cycle reduce it to a product of the interaction among fault slip and (i) the surrounding crust’s response to that slip, (ii) the dependence of a fault’s strength on that slip and (iii) the external forcing provided for by tectonic plate motion at a larger scale.

One is left to wonder: to what extent does each of those components contribute to the observed complexity? Or, what aspect of any of those can account for the kind of complexity observed? Or perhaps more tractable for a seminar: how simple could a model be while still giving rise to any complexity at all?

We’ll briefly review some interesting earthquake observations, as well as how the above interaction is represented in current cycle models, before focusing on one aspect of that system: the frictional strength of the fault. We’ll explore the consequences of assuming that lab-derived empirical friction laws adequately describe the strength of faults. Along the way we’ll find similarities with some seemingly disparate problems in fluid mechanics and the implication such similarity has for one stage of the cycle (earthquake nucleation); we’ll find that even the best laid plans (here, a near-perfect fault), can oft go awry.