New dynamic model of slow earthquakes considering stochasticity in rupture simulation

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Slow earthquakes are often modeled under the heterogeneous distribution of the frictional parameters of rate-and-state friction law. To consider heterogeneity at smaller scales than the grid size, we adopt stochastic governing equations, which we traditionally assume deterministically. An external force including tidal stress is known to affect both regular and slow earthquakes not deterministically but stochastically, so we also add a stochastic body force. In this study, we solve mode III problem using BIEM scheme, but we add stochastic perturbations in the governing equations. To focus on the classic effect of introducing stochasticity, we select simple conditions including slip-weakening friction law and homogeneous initial/boundary conditions. As a result, we reproduced slow rupture propagations without introducing any heterogeneity explicitly. We may need to consider the origin of the stochasticity more carefully, we could use rate-and-state friction laws instead, and we could assume heterogeneous initial/boundary conditions, but it is pivotal finding that only stochasticity could reproduce slow rupture propagations.

