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The simulation of seismic nucleation by modified RSF law added stress dependent term.

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We simulate earthquake nucleation of faults with revised rate- and state- dependent friction law proposed by Nagata (PhD thesis, 2008). The major revisions in the friction law are (1) parameters a and b (direct effect and strength healing rate, respectively) are three times larger than the traditional believed values and (2) the strength evolution law is revised incorporating a newly noticed weakening effect by an increase of shear stress.

We consider a planar fault with a revised friction in an infinite isotropic homogeneous medium. We simulate quasi-static slip evolution process controlled by (a) the revised friction law and by (b) the traditionally believed slowness law. We compare the results so that we can extract the effect of the newly proposed friction law.

We first investigate nucleation process under a high loading rate. In this case the strength healing is negligible and strength weakening is dominant. Simulation results for both friction laws shows a similar tendency: the most rapidly slipping portion of the fault patch constricts to a sub patch with a certain length. This is because the modified law produces significant difference in only the strength evolution compared with the original slowness law, that is, the evolutions of slip-rate and stress are similar to those of the original law.

We second investigate nucleation process under a slow loading rate. In this case the strength healing is comparable to that of weakening. Our preliminary simulation results show significant difference that nucleation length tends to be shorter with the modified law than the original slowness law. This is because larger healing occurs out side the sub patch and it prevents the sub path to grow larger.

Keywords: earthquake, nucleation, RSF