Relation between the rupture of a small asperity and frictional properties in the rate-hardening region surrounding the asperity

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We formulate 3D numerical simulation model to investigate the effect of frictional property on the fluctuation in activity of repeating small earthquakes. We assume that small repeating earthquakes are caused by repeated rupture of a small asperity (seismic patch with negative a-b). In the models, we locate two asperities (one is large and the other is small) on the subducting plate interface, and compare several models with different frictional properties in the stable sliding region surrounding the asperities.

The results show that the standard deviations of recurrence intervals and magnitudes for the earthquakes occurring on the small asperity become large when propagation speed of postseismic slip is small. The propagation speed is dependent on the frictional property in the stable sliding region.

We find that the postseismic slip caused by the rupture of the large asperity propagates faster and broader locally around the small asperity when sufficient slip deficit in the small asperity is released with the passage of postseismic slip of an event on the large asperity, and that slow slip events are likely to occur before or after the main event in the large asperity.