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Recurrence interval modulation of slow slip events by two types of earthquake loading

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Geodetic studies have discovered recurrent spontaneous slow slip events (SSEs) at major faults. The SSE recurrence intervals should reflect mechanical states at the faults, including load effects of large earthquakes in neighboring areas. Here, we focus on temporal changes of the SSE recurrence intervals. We perform numerical model experiments with the rate- and state-dependent friction to simulate the SSE recurrence interval changes by the earthquake loading effects. One result is gradual shortening of the SSE recurrence intervals owing to nucleation process of nearby earthquakes, as revealed by several previous studies. When the distance between the SSE and earthquake areas is almost zero, a short-term further decrease of the SSE recurrence intervals precedes the earthquake occurrence (∼ by a decade). The other result is that external stress perturbation, as large as 0.1 MPa, can reduce the SSE recurrence intervals to a similar extent. Furthermore, the interval modulation by the stress perturbation continues for a prolonged period until the occurrence of the adjacent earthquake. Both effects may be observable, as is advancing at the Boso zone, Japan, but their separation is difficult under the present circumstances.

Keywords: Slow slip events, Stress perturbation, Rate- and state-dependent friction law, Earthquake preparatory process