房総半島スロースリップイベントによる応力変化と群発地震活動との対比
A comparison of the stress evolutions due to Boso slow slip events and the accompanying earthquake swarms

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Around the Boso peninsula, central Japan, slow slip events (SSEs) lasting for one to two weeks recur every 2-7 years in association with the subduction of the Philippine Sea plate along the Sagami trough (Sagiya, 2004; Ozawa et al., 2003, 2007, 2014; Hirose et al., 2012, 2014). One of the intriguing characteristics of the Boso SSEs is that an SSE accompanies an earthquake swarm activity. Previous studies show that the slip evolutions of the two Boso SSEs in 2007 and 2011 correlate spatially and temporally with the activities of the earthquakes (Hirose et al., 2014). A causal relationship between the SSEs and the accompanying earthquake swarms has been suggested, but its physical mechanism is poorly known. In this study, we compare time-varying stress changes due to the SSEs at some locations where their hypocenters were spatially concentrated (``clusters'') with the number of earthquakes at the corresponding clusters to examine a quantitative relationship between stress change and the number of earthquakes.

We select three locations on the subducting plate interface in and around the Boso SSE source area where the earthquake activity during the SSEs in 2007, 2011, and 2014 are relatively high. Source slip processes for the three SSEs estimated based on GNSS displacements and tilt change records (Hirose et al., 2014) are assumed and the time-dependent stress changes caused by the slip processes are calculated with Okada's (1992) expression for a homogeneous elastic half-space. The Hi-net routine earthquake catalog (Obara et al., 2005) is used for measuring the earthquake activities.

There are many earthquake clusters where shear stress increases during the SSEs, but there are also a few clusters where shear stress decreases. For the earthquake clusters with stress increase, the maximum in shear stressing rate precedes the largest seismicity rate for a few days at most of these locations. In addition, an earthquake activity in a cluster begins when the share stress change reaches a similar level at most of these locations. These lines of evidence suggest that the stress is one of the most important factors that govern an earthquake activity, but also suggest that there may be other controlling factors since some of the clusters activate during stress decrease.

We should note that the calculated stresses likely include large uncertainties because the spatial resolution in the geodetic inversion for the SSE source slip processes are limited but heavily affects the stress calculation.

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