Effects of long-term slow slips on in-slab stresses in Bungo Channel, southwestern, Japan

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Several studies have reported that slow deformation on the plate interface can change the stress field and seismicity within subducting slabs. Indirect monitoring of the reduction of locking on the plate boundary using time-space variations of in-slab seismicity is important for future disaster prevention of megathrust earthquakes. Therefore, we examined relationships between in-slab events and shallow slow slip events (SSEs) in the Bungo channel, where there are long-term SSEs (L-SSEs), short-term SSEs (S-SSEs), repeating earthquakes, and in-slab earthquakes by applying a stress-tensor inversion method to focal mechanisms of in-slab events for 19 years. In general, the Sigma 3 axes of inversion results strike in the east-west direction, whereas Sigma 1 axes are close to vertical. Sigma 1 of in-slab events rotated several degrees becoming less vertical after the initiation of two large previously-studied L-SSEs which started in 2010 and 2018. Downdip of the northern slip area of these L-SSEs, there were also two additional increases in tremor rates in the periods from August 2006 to March 2007 and from July 2013 to July 2014, which accompanied increased activity of shallower repeating earthquakes. During these periods, the Sigma 1 axes of in-slab events also rotated in a similar way as in the known, large L-SSEs of 2010 and 2018. This allows us to infer the occurrence of transient aseismic slips during the secondary increases in tremor rates. The results suggest the promise of our methodology, using in-slab events to reveal the occurrence of previously-unknown transient aseismic slip episodes on the plate interface, and to monitor ongoing reduction in locking of the plate boundary by aseismic slip.

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