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

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In Kii peninsula, Kita et al. [2021] has reported that short-term slow slip events on the plate interface can change the stress field and seismicity within the subducting Philippine Sea plate, examining ~40 times slow slips events over 17 years. These results suggested that it is possible to infirectly monitor the reduction of locking on the plate boundary using time-space variations of in-slab seismicity. In the present study, we also examined relationships between in-slab events and shallow slow slip events (SSEs) in the Bungo channel, where there are in-slab earthquakes and long-term SSEs (L-SSEs) with recurrence time of ~7 years and ~1 year duration. We applyed a stress-tensor inversion method to focal mechanisms of in-slab events for 19 years and examined time change of stress axis relative to the duration time of the three L-SSEs. In general, the Sigma 3 axes of inversion results strike in the east-west direction, whereas the Sigma 1 axes are close to vertical and parallel to the direction of plate motion of the subducting plate. During the period of one year just before the L-SSEs, the strike of the Sigma 1 of in-slab events rotated ~30 degrees clockwise direction and plunge of it rotate ~10 degrees becoming less vertical. Then, the plunge of the Sigma 1 rotated several degrees again becoming much less vertical and the strikes of it rotate back to the direction of the plate motion of the subducting plate after the initiation of the two L-SSEs. During the period of one year after the end of the L-SSEs, the plunge of the Sigma 1 rotated back to the initial position. Stress ratio R is generally ~0.5, but it become ~0.3 during the period of one year just after the end of the L-SSEs and become back to ~0.5 during the period of 1.5 years after it. The stress axis change in the southern portion of fault plane of the L-SSEs is generally larger than that in the northern portion of the fault plane of it. The stress ratio R before and after the L-SSEs is respectively ~0.8 and ~0.15 in the southern portion, whereas the ratio in the northern portion is almost constant (~0.5) before and after them. It suggests that the more stable sliding in the northern portion of the fault plane of the L-SSEs. These results suggest the potential of using in-slab events to anticipate the timing of the L-SSEs and to monitor ongoing reduction in locking of the plate boundary by aseismic slip.

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