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Inland stress accumulation in the Southwest Japan arc due to interseismic coupling along the Nankai trough and slab rollback under the Ryukyu trench

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In the last 20 years, Southwest (SW) Japan has experienced ∼M7 inland earthquakes, such as the 2016 Mw 7.0 Kumamoto earthquake. Korean Peninsula, which is regarded as a stable region, also suffered by the largest earthquake (Mw5.4) ever observed in 2016. The historical earthquake catalog based on paleographical studies implies that M7-class inland earthquakes were activated from ∼50 years before interplate earthquakes beneath the Nankai Trough, which repeatedly occurred with the interval of 100-200 years. Considering that 70 years has passed since the last interplate ruptures in 1944 and 1946, the recent ∼M7 inland earthquakes appear related with stress accumulation before an interplate earthquake. We attempt to reveal this relation between the inland activity and the interplate earthquakes using a 3-D finite element model (FEM) including the viscoelastic feature in the mantle. Our FEM considers a region of 3700 km x 4600 km x 700 km, incorporating the Pacific and the Philippine sea slabs by interpolating models for the Northeast (NE) and SW Japan arcs, as well as the Ryukyu, Kuril and Izu-Bonin arcs. In particular, the complex geometry of the Philippine Sea slab with the large bend due to the subduciton of the Kyushu-Palau ridge is crucial to creat the stress field in SW Japan. The model region is divided into about 1000,000 tetrahedral elements with dimension ranging from 5-100 km. Using a distribution of interplate coupling on the plate interface from previous studies, we calculated velocity field and stress accumulation rate. Calculated velocity field and stress accumulation pattern well reproduced the observed velocity field and the mechanism of the recent inland earthquakes, respectively, in the middle region of the SW Japan. However, these results cannot explain the velocity and stress fields in the southern part of the Kyushu island, which is affected by the slab rollback occurring in the Ryukyu trench. We calculate the effect of slab rollback by assigning slip-rate excess along the Ryukyu trench. Initial results show the velocity field created by the slab rollback well explains the observed and the stress accumulation pattern matches with the seismic activity on the southern part of the Kyushu island.