Numerical simulation of earthquake generation cycles with a realistic 3D geometry of the subducting Philippine Sea plate

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As shown from hypocenter distribution and seismic surveys, the geometry of the subducting Philippine Sea plate beneath Southwest Japan is not simple. Especially, dip angle significantly varies along the trough axis. This variation in dip angle results in the variation of seismogenic zone width, which is controlled by depth-dependent frictional property of the plate boundary. Hori et al. (2004) reveals that heterogeneous distribution of depth-dependent frictional property causes heterogeneity of stress accumulation rate in the seismogenic zone. However, they did not use 3D curved fault but a flat fault plane in their model. To confirm the effect of the variation in dip angle on the earthquake generation process, it is necessary to model the 3D realistic geometry of the plate boundary.

In order to model the curved plate geometry, we used small triangular cells. Slip response function for each triangular cell was calculated using the code by Stuart and Simpson. We demonstrated numerical simulations of earthquake generation cycles with the slip response function and rate- and state-dependent friction law. The distribution of frictional property, relative plate motion, initial condition are all identical with those in Hori et al. (2004). The result shows the similar rupture pattern: preslip occurs off the Kii peninsula, rupture start there and propagate to east and west. This indicates that the dip angle variation affect on the earthquake generation process mainly through the distribution of frictional property.