Modeling of Nankai great earthquakes with scale-dependent frictional property

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In order to estimate the rupture timing and area for the coming earthquakes along the Nankai trough, it is necessary to reveal the mechanism of variation in earthquake size and recurrence time. The variation of recurrence time is fairly large and shows time predictable behavior (Shimazaki and Nakata, 1980). We have proposed a new conceptual model to reproduce such variation in recurrence time related to earthquake size (Hori and Miyazaki, 2008). In this model, multi-scale heterogeneous distribution of fracture surface energy and scale-dependent slip weakening distance are introduced in earthquake generation cycle with rate- and state-dependent friction law (as rupture models in Matsu'ura et al., 1992; Ide and Aochi, 2005).

A simple two-scale model is tested and time-predictable behavior is reproduced. Furthermore, the results show significant variation in slip pattern among earthquake generation cycles. We apply this model to the Nankai trough with slip response functions of realistic plate geometry. Although our previous model (Hori, 2006; Kodaira et al., 2006) failed to reproduce large variation in recurrence interval with realistic plate geometry, the new model demonstrates large variation from 140 years to 220 years in recurrence time for the Nankai events. The time interval between Tonankai and Nankai also shows large variation. However, the distribution of frictional parameter given here is fairly simple and it is a next step to reproduce the realistic pattern as seen in historical earthquakes.