Physics-based simulation for possible interplate earthquakes along the Nankai trough

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In order to numerically generate possible earthquake scenarios for the Eurasian-Philippine Sea plate interface along the Nankai trough in southwest Japan, we need to assimilate diverse observation data into a physics-based 3-D model of earthquake generation cycles. Hashimoto *et al.* (2014) developed a numerical simulation system which consists of the quasi-static tectonic loading model and the dynamic rupture propagation model, based on the common 3-D model of plate interface geometry. In the theoretical framework of this system, our problem is to simulate time evolution of stress states so that the past slip history at plate interfaces estimated from observation data is adequately reproduced. Given the stress state and fault constitutive relation just before the earthquake occurrence, we can compute the subsequent rupture propagation process. In the numerical methods to reproduce realistic stress states and to generate possible earthquake scenarios, it is essential to assign a proper fault constitutive relation to control both the processes of quasi-static tectonic loading and dynamic rupture propagation. In the present study, we use the slip- and time-dependent fault constitutive law proposed by Aochi and Matsu'ura (2002), where time evolution of macroscopic relation between fault slip and shear strength is prescribed by the abrasion rate and the adhesion rate of microscopic fault surface topography and a constant representing mechanical properties of the contact zone, and therefore we need to examine distribution of these parameters. Interseismic increase rates of slip deficit along the Nankai trough inferred from GPS data inversion are used to constrain the constitutive parameters and to verify the numerical results. The sequence of the past large interplate earthquakes and their rupture initiation points and coseismic slip distributions are also used. Setting proper distribution of the constitutive parameters, we can generate possible earthquake scenarios with the method developed by Hok *et al.* (2011), which enables us to discuss potential earthquakes along the Nankai trough in terms of stress states at the moment and the relevant possible dynamic ruptures under inherent stress disturbances.

