Deep structures control the source process of the Nankai earthquakes

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Recent seismic surveys in southwest Japan reveal that some characteristic deep structures exist in the earthquake source region of the Nankai trough subduction zone along which great interplate earthquakes have occurred repeatedly. For example, Kodaira et al. [2000] images a subducting seamount in the central part of the source region of the 1946 Nankai earthquake, Park et al. [2000] images some splay faults along the Nankai trough, Park et al. [2001] shows that some strong reflectors exist just above the plate boundary landward of decollement zone, and so on. These deep structures are well correlated to the slip pattern estimated from tsunami wave forms by Baba et al.[2002].

To reveal that how such structures control the source process of the Nankai earthquakes, we demonstrate some simulations of dynamic rupture propagation on a plane. The numerical technique is based on a boundary integral equation method in 3D elastic medium [Aochi et al., 2000]. We give a slip-weakening law as a fault constitutive law and assume that the residual stress level is consistent with the stable frictional stress level estimated for the Nankai subduction zone [Wang and Suyehiro, 1999]. The break down stress drop is constant on a fault except at the subducting seamount. We assume that the normal stress acting on a plate boundary at the seamount is fairly high (+100MPa or more) than the surrounding portion [Sholz and Small, 1997].

The results show that rupture propagates avoiding the seamount and goes through the deeper portion of the plate boundary. This rupture propagation pattern is consistent with the result from the subevent analysis by Cummins et al. [2002]. The total slip is relatively high on the deeper western portion of the fault and low on the seamount. This pattern is similar to the tsunami wave analysis [Baba et al., 2002], although slip on the shallower western portion and the deeper eastern portion of the fault is different. The difference may caused by some other structures that are not included in the simulation such as deep reflectors or splay faults.