

Simulation of the Great Earthquakes along the Nankai Trough: An Attempt to Simulate Event History, Slip Areas of the Showa Tonankai / Nankai Earthquakes, Heterogeneous Slip Deficit Rate Distribution, and Long-term Slow Slips

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We constructed a 3-D numerical simulation model based on the rate- and state-dependent friction law with heterogeneous frictional parameters to simulate various phenomena comprehensively including seismic and aseismic slip that have occurred on the plate interface along the Nankai trough. This model showed that eastern (named Tonankai) and western (named Nankai) events separated at off Kii peninsula tended to occur in pairs with time difference, and sometimes occur simultaneously. The Tonankai earthquake rarely occurred alone. The rupture area of a pair of events as well as simultaneous case was rich in variation. In addition, even if the rupture area was the same, there was a difference in the amount of the largest displacement and magnitude. The fraction of paired events with time difference was 91%, and 94% among them occurred within successive three years in the remained area. Our model also simulated long-term slow slip events recurring on deeper parts of the seismogenic zone. We modeled general aspects of historical events to some extent, but our model differs from them in detail, which may mean it is not good enough to use as a prediction model. However, the background idea constructing our model may be useful to understand the physical basis of earthquake interaction along the Nankai trough.

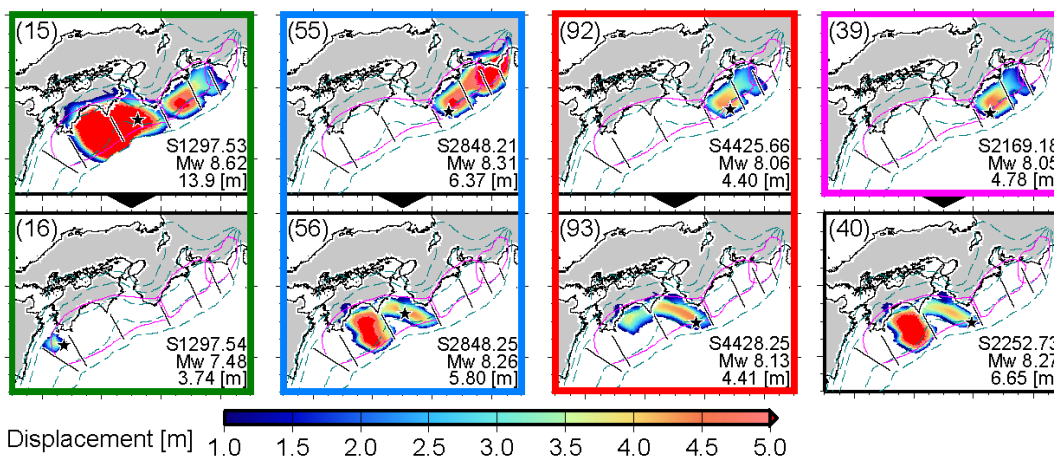


Figure 1. Examples of spatial distribution of slip on the plate interface during each earthquake. A solid star indicates the starting point of each earthquake. The numerals at right-lower of each panel indicate an elapsed time (years) from commencement of the simulation, the moment magnitude, and maximum slip. Events enclosed by green, blue, red, and purple lines indicate modeling of the Hoi, Ansei, Showa and an isolated Tonankai earthquakes, respectively. Broken blue lines are contours of depth to the top of the Philippine Sea plate [Hirose *et al.*, 2008, JGR]. Areas enclosed by purple lines represent the postulated source regions of the Tokai [Central Disaster Management Council, 2001], Tonankai and Nankai earthquakes [Earthquake Research Committee, 2001]. Black thin lines indicate segment boundary.