Dynamic rupture scenarios of anticipated Nankai-Tonankai earthquakes, using the subduction interface coupling rates inferred from GPS data.

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Hazardous earthquakes (Mw¿8) along the Nankai-Tonankai subduction zone (Japan) are expected in the following decades. Therefore, it is important to evaluate in advance potential strong ground motions and tsunamis that could be generated by these earthquakes. To do this, we propose a methodology to construct reliable scenarios, by integrating the different stages of earthquake cycle and assimilating observed data. Here we focus on the dynamic rupture modelling, and present the different rupture scenarios obtained.

We use the 3D geometry of the plate interface constructed by Hashimoto et al. (2004, PAGEOPH). A laterally heterogeneous stress drop is constrained by the Hashimoto et al. (2009, SSJ meeting)'s slip deficit rate estimation on the interface, assuming that the slip deficit accumulated since the previous earthquakes (1944 Tonankai and 1946 Nankai earthquakes) will be released completely by the next earthquake. The obtained stress drop defines seismogenic asperities that are consistent with the supposed segments of Nankai-Tonankai subduction zone, ensuring reliable earthquake source location. We introduce simple assumptions for the constitutive friction parameters, which are poorly constrained by data. We investigate these assumptions, with respect to their influence on the dynamic propagation between the segments.

For instance, assuming uniform static strength, and initiation of the rupture in the Kii peninsula area (where the 1944 and 1946 earthquakes initiated), we show that the intersegment Dc value is a critical parameter, which controls the final size of the earthquakes. When Dc is taken the same on the intersegment as on the Nankai and Tonankai segments, then the rupture propagates bilaterally and the complete Nankai-Tonankai area breaks within a single event. When Dc inside the intersegment area is twice as large as that outside, we obtain unilateral ruptures that break either the Tonankai or the Nankai segment only, depending on which side of the intersegment the rupture is initiated at. After this two-earthquake sequence scenario, similar to the 1940 s sequence, the whole Tonankai-Nankai area has been broken and unloaded. Using the same initial conditions, we also computed ruptures that initiate at the western edge of the Nankai segment, or at the eastern edge of the Tonankai segment. Interestingly, in those cases, the intersegment zone broke, and the complete Tonankai Nankai area was broken in the same earthquake. This latter kind of scenarios is supposed to have been occuring in the past.

Including data constrained parameters, such as plate geometry and stress drop, we propose several rupture scenarios for the potential earthquakes in the Nankai-Tonankai subduction zone. A smooth barrier between Nankai and Tonankai segments

could explain equally the sequential rupture of the plate boundary, or a giant rupture in a single event. These different rupture scenarios are ready to be used for tsunami and ground motion simulations.