Reconsideration of the slip distribution of the 1944 Tonankai earthquake derived from tsunami waveforms

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Coseismic slip distribution on the plate boundary during the 1944 Tonankai earthquake was estimated from an inversion of tsunami waveforms. Our inversion method incorporated four improvements in comparison with previous studies. (1) We constructed an improved plate model based only on seismic survey results, and assumed it to be the fault plane of the 1944 Tonankai earthquake. (2) The fault plane was divided into subfaults that were as small as possible. (3) We included the effect of horizontal displacement of the ocean bottom on tsunami generation. (4) We performed a checkerboard resolution test. The largest slip zone occurs off Shima Peninsula. The eastern subfaults near the trench have almost zero slip. However, there is considerable slip in the western subfaults along the coast of Kii Peninsula to the trough axis, giving better agreement with the spatial extent of an existing splay fault (Park et al. 2002) than previous studies. We tested the possibility of slip on the splay fault off the Kii Peninsula for the 1944 Tonankai earthquake. Although we cannot distinguish whether slip is dominant on the splay fault or on the plate interface, slip on this splay fault is also consistent with the data. Further, it is also clear that the upper edge of the Enshu fault off Shima and Atsumi peninsulas, is consistent with the up-dip limit of our slip model. The Enshu fault is a right lateral strike slip fault that includes a thrust component, and stretches over 100 km in a southwest direction. According to submarine observations of the Enshu fault (Ashi et al., 1997), some gray patches and biological communities (tube worms) are present near the fault, indicating that deeply sourced fluids exude from the accretionary prism. Thus, the Enshu fault may be also be a kind of splay fault derived from the plate interface, although the shape of the fault beneath the seafloor has not yet been revealed. Taking into consideration the role of splay faults as fluid conduits, the relationship between the spatial extent of the splay faults and the slip distribution, the probability that slip occurred on these two splay faults during the 1944 Tonankai earthquake is significant.