

A large slip near the Nankai trough of the 1854 Ansei-Tokai earthquake estimated from an observed tsunami waveform at San Francisco

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The great earthquake has repeatedly occurred at the Nankai Trough subduction zone and has caused severe disasters in southwest Japan. Existing studies indicated that the 1944 Tonankai earthquake re-ruptured the large slip area of the 1854 Ansei-Tokai earthquake except the plate interface along the Sagami trough (Tokai area). However, recent studies also show the large variability of the rupture models for repeated great earthquakes in this region. Although the source process of the 1944 Tonankai earthquake has been studied vigorously using the seismological data and tsunami records, that of the 1854 Ansei-Tokai earthquake has been insufficiently discussed because of the lack of instrumental data. A tsunami generated by the 1854 earthquake, on the other hand, arrived at San Francisco, USA, and was observed at the tide gauge station of San Francisco.

This study, therefore, examines the source process of the 1854 Ansei-Tokai earthquake using the observed tsunami waveform. We fixed the fault area and the slip amount of 4m along the Sagami trough and the deeper part of the plate interface in Nankai trough as same as a previous study (Ishibashi, 1981), so the surveyed coseismic crustal deformation data should be explained. In this study, a slip amount of the shallower part of the plate interface near the trough was set to be an unknown parameter. A tsunami propagation under the scenario was simulated based on a linear dispersive model in order to determine the slip amount through a comparison between the estimated and observed tsunami heights, or their waveforms, at San Francisco. The result suggested that the slip amount at the plate interface near the trough was 5m, larger than the slip amount of 4 m at the deeper part of the fault model, and that the moment magnitude was 8.5. The result of this study indicates that the large slip area of the 1854 earthquake was different from the large slip region of the 1944 Tonankai earthquake estimated by the previous studies (Figure 1). Especially, the shallow part of the plate interface ruptured by the 1854 earthquake was not re-ruptured by the 1944 earthquake. The stress may have been accumulated at that part of the plate interface since 1854. We are now trying to verify the occurrence time of the 1854 earthquake using the far field tsunami computation method from wave dispersion curves estimated by Watada et al. (2014).

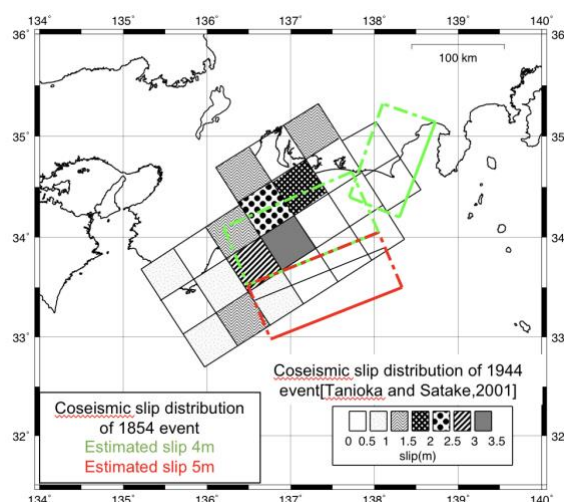


Figure 1. Coseismic slip distributions of 1854 and 1944 event.