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Analysis of tsunami waveforms for the 1923 great Kanto earthquake

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The 1923 great Kanto earthquake (M_s 8.1) was one of the most devastating earthquakes in history. The source process of the earthquake was previously studied using the geodetic and seismological data [Wald and Somerville, 1995]. The large slip region was estimated beneath the Miura peninsula by Wald and Somerville [1995]. The seismic moment was 7 to 8 x 10^{20} Nm (M_w 7.8 to 7.9).

The tsunami was observed at the tide gauges along the Pacific coast of Japan. Among them, four tide gauges, Yokusuka, Shibaura, Fukagawa, and Chiba, were in the Tokyo Bay located just above the source region. The seismic shaking was also recorded on these tide gauges, so the relative time between the origin time of the earthquake and the arrival time of the tsunami waves were reliable.

First, we try to find whether the slip distribution estimated by Wald and Somerville [1995] can explain the observed tsunami waveforms at the four tide gauges in the Tokyo Bay or not. We simplify the slip distribution estimated by Wald and Somerville [1995] by using six subfaults with average slip amounts in the subfaults. The vertical deformation computed from the six subfaults is used as an initial water surface elevation of the tsunami. The tsunami is numerically computed using the actual bathymetry. The finite difference computation of the linear long wave equation is carried out with a grid size of 12 seconds (about 50m).

The computed tsunami waveforms are compared with the observed tsunami waveforms at four tide gauges. The observed tsunami waveforms are well explained by the computed ones. Especially, at Yokosuka tide gauge, first observed depressive wave, next small upheaval, and large depressive waves are well explained by the computed tsunami waves. This indicates that the tsunami waveforms in Tokyo Bay are consistent with the slip distribution estimated by Wald and Somerville [1995]. However, in order to estimate the slip distribution only from tsunami waveforms, the observed waveforms recorded at the tide gauges outside the Tokyo Bay are necessary to be included.

References

[1] D. J. Wald and P. G. Somerville, *Bull. Seism. Am.* **83**, 159 (1995).