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Estimation of slip distributions of the 1923 Kanto and 1703 Genroku earthquakes using curved fault plane

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Great earthquakes along the Sagami trough, where the Philippine Sea slab is subducting, have repeatedly occurred. The 1703 Genroku and 1923 (Taisho) Kanto earthquakes (M 8.2 and 7.9, respectively) are known as typical ones, and cause severe damages in the metropolitan area. The recurrence periods of Genroku- and Taisho-type earthquakes inferred from studies of wave cut terraces are about 200-400 and 2000 years, respectively (e.g., Earthquake Research Committee, 2004).

We have inferred the source process of the 1923 Kanto earthquake from geodetic, teleseismic, and strong motion data (Kobayashi and Koketsu, 2005; Sato et al., 2005). Kobayashi and Koketsu (2008, AGU Fall Meeting) introduced a new curved fault plane by integrating models of the Philippine Sea slabs (Sato et al., 2005; Hagiwara et al. 2006; Takeda et al. 2007), and inverted geodetic data for the slip distributions of the 1703 earthquake and inverted simultaneously geodetic and teleseismic data for the source process of the 1923 earthquake.

The inversion method is based on Yoshida et al. (1996). We modified it for triangular subfaults. For source process, to obtain the times when the rupture front with a given constant velocity reaches at the point source, the distance between hypocenter and each point source is measured because rupture propagate along the curved fault plane. We applied the Dijkstra method to measure the distance.

The Green's functions are calculated by the frequency-wavenumber method of Zhu and Rivera (2002) for geodetic data, and by a ray theory for teleseismic data. At the present stage, we assumed a 1-dimensional seismic structure model for both geodetic and teleseismic data. The strikes and slips of subfaults differ from those of others.

We inverted the same geodetic and teleseismic data as those of Kobayashi and Koketsu (2005) and Sato et al. (2005) for the source process of the 1923 Kanto earthquake by using the developed method for a curved fault plane. The preliminary result of the slip distribution is roughly consistent with that of Sato et al. (2005), suggesting that our method is considered to be adequate.

We improved the geodetic Green's functions so that the fitness between observed and synthetic data. Previously we distributed one point source at the centroid of each subfault, and calculated the Green's function. Slips on the shallowest part of subfaults can cause large displacements at closest stations. The Green's functions with one point source can not reflect such effects. Thus we divided the subfaults into 16 small triangles and located point sources at the centroids of the small triangles. We calculated 16 Green's functions and average them. The average is a new Green's function of the subfault.

We also attempt to update the curved fault plane, because several seismic surveys have been performed recently and new upper surface models of the Philippine sea plate have been presented. We incorporate the new models into our fault plane model.

Keywords: the 1923 Kanto earthquake, the 1703 Genroku earthquake, asperity