Source characteristics for the 1923 Kanto earthquake, its large aftershocks, and the 1703 Genroku earthquake

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Recent advance in the studies based on the seismic intensity and old seismogram data for the 1923 Kanto earthquake, its large aftershocks with M larger than 7, and the 1703 Genroku earthquake are reviewed as follows.

(1)Seismic intensity inversion for the 1923 Kanto and the 1703 Genroku earthquake

Kanda et al. (2003) newly developed the inversion method for the seismic intensity data and ever since, the short-period seismic wave radiation zones (SPRZ) have been evaluated for the historical great earthquakes in and around Japan. Kanda and Takemura(2007) also identified SPRZs for the Kanto earthquake and the Genroku earthquake. The result shows that there were two separate SPRZs in east and west both sides across the Miura peninsula during the Kanto earthquake. The both of energy centroids of the SPRZ correspond to the terminus part of large slip areas derived from the existing waveform inversion study. The SPRZs of the Genroku earthquake are similar to those of the Great Kanto earthquake as for the areas from Kanagawa to the south of Chiba. In addition to those, the SPRZ is deduced to spread southeastward off the Boso peninsula, which borders on the source area of the slow slip event off the Boso peninsula in 1996. The centroid of that SPRZ is located at the Fault-B of the Genroku earthquake by Shishikura(2003) and adjacent to a large back slip area evaluated from GPS data by Sagiya(2003).

(2)Large aftershocks of the 1923 Kanto earthquake

There were 6 large aftershocks of M larger than 7 of the 1923 Kanto earthquake (Takemura, 1994; Takemura, 2003). The origin time of the main shock is 11:58:32 on the September the 1 st. Two events of M=7.2 and 7.3 occurred in succession at 12:01 and 12:03. Seismic intensities were estimated 6 and 4 to 5 at Tokyo in JMA scale, respectively. The epicenter of the first event was in or around northern Tokyo bay and it was indicated that the damage distribution from this event is similar to the 1855 Ansei-Edo earthquake (M=6.9). The epicenter of the second event was identified at the border of Kanagawa, Yamanashi, and Shizuoka prefectures, and was similar to the 1924 Tanzawa earthquake (M=7.3), one of the 6 large aftershocks. These results were deduced from old seismograms at the Gifu observatory and descriptions of more than 500 personal experiences by Takemura (1994, 1999). Ishibashi(1976) indicated that slip vector of the Tanzawa event is almost the same as the main shock.

Two big events also occurred on the September the 2 nd and the locations of epicenters were east off the Boso peninsula. The first event occurred at 11:46 with a small tsunami and M=7.5 to 7.6 and it is the largest aftershock. This event was classified into the low-frequency event from seismograms and seismic intensity distribution, while it collapsed some structures in southern part of the Boso peninsula (Utsu,1979; Ishibashi,1986; Takemura,1994). Takemura et al (2000) carried out the data processing for the seismograms of this event. Tectonic implications of this event are important in special relation to the study of the Genroku earthquake. Another event occurred at 18:47 with M=7.0 to 7.1. Seismic intensity at Hongo in Tokyo was 3 from this event, which is the same as the largest aftershock. We compared displacement seismic waves after the instrumental corrections at the Gifu and the Takada observatories with those from the 1987 event (M=6.7) east off the Boso peninsula. It is found that the wave forms of the two events are similar to each other, while the amplitudes of the 1923 event is about 1.5 times larger than the 1987 event. This result strongly suggests that the 1923 event is similar to the 1987 event, which is an intra-slab event of the Philippine Sea plate.