

## Review, data collection and preliminary investigation for magnitude 7 earthquakes in the southern Kanto region

Takeo Ishibe<sup>1\*</sup>, Akihito Nishiyama<sup>1</sup>, Kenji Satake<sup>1</sup>, Kunihiko Shimazaki<sup>2</sup>

<sup>1</sup>ERI, Univ. of Tokyo, <sup>2</sup>A.E.D.P.

Earthquakes occurring in the southern Kanto region are classified into (1) earthquakes on active faults such as the 1931 W-Saitama earthquake, (2) interplate earthquakes along the upper surface of the Philippine Sea Plate (PHS) such as the 1923 Kanto earthquake, (3) intraslab earthquakes in the subducting PHS, (4) interplate earthquakes at a boundary between PHS and Pacific Plate (PAC) and (5) intraslab earthquakes in the subducting PAC. The recurrence interval of the Kanto earthquake is estimated to be 200-400 years (Earthquake Research Committee, 2004) and an urgency of the next Kanto earthquake is low considering a lapse time from the most recent Kanto earthquake. On the contrary, the probability of magnitude 7 earthquakes in the southern Kanto region during the next 30 years is estimated to be 70 % based on five earthquakes (i.e., the 1894 Meiji-Tokyo earthquake, the 1921 and 1922 Ibaraki-ken Nanbu earthquakes, the 1922 Uruga-channel earthquake and the 1987 Chiba-ken Toho-Oki earthquake) assuming the Poisson process. However, hypocentral locations and their classifications for most earthquakes described above have not obtained consensus. Moreover, there is an argument that this probability is overestimated taking long-term seismicity rate changes related to occurrences of the Kanto earthquakes into consideration (Seno, 2007). Therefore, it is necessary to classify these earthquakes into interplate and intraslab earthquakes, and to estimate their recurrence intervals. In this study, we review previous studies, collect the data and preliminarily discuss about the hypocentral locations and focal mechanisms.

The 1894 Meiji-Tokyo earthquake (M7.0; Utsu, 1979) caused damages especially around Tokyo and Yokohama, and 31 casualties. The S-P times are different for each study; i.e., 7, 10 or 14 sec (Kayano, 1975), 7-8 sec (Hashida, 1993), 7 or 10 sec (Katsumata et al., 1999) and 5.6-7.0 sec (Furumura et al., 2005, 2006). Katsumata (1999) regarded as intraslab earthquake occurred in the subducting PAC or PHS. The Earthquake Research Committee (2004) regarded as intraslab earthquake occurred in the subducting PAC. On the other hand, Furumura et al. (2005, 2006) regarded as intraslab earthquake occurred in the subducting PHS.

The 1895 Ibaraki-ken Nanbu earthquake (M7.2, Utsu, 1979) caused 6 casualties. Seismic intensity VI exists in Katsumata (1975)'s map although a maximum seismic intensity remains V in Ishibashi (1975)'s map. There are few researches discussing the hypocentral depth though there is a report suggesting a relation to earthquake clusters observed in recent years. The S-P time reported at Tokyo is 11.3 sec (Omori, 1899).

The 1921 Ibaraki-ken Nanbu Earthquake (M7.0; Utsu, 1979) caused damages such as fissures of road, tumble of gravestones and collapse of walls in the northwestern part of Chiba and southwestern part of Ibaraki, and accompanied a humming aftershock activity. The hypocentral locations estimated by previous studies are spacious due to different S-P times. Focal mechanism by Katsumata (2000) is a strike-slip fault-type with compression axis in NE-SW direction. It is consistent with neither low-angle reverse fault type dipping to W or NW occurring at a boundary between PHS and PAC, nor a typical focal mechanism occurring in earthquake cluster of southwestern part of Ibaraki.

The 1922 Uruga-channel Earthquake (M6.8; Utsu, 1979) caused damages like a break of houses

or godowns, burst of pipes and landslides, and caused 2 casualties. The hypocenters estimated by previous studies are spacious due to low quality data.

The 1987 Chiba-ken Toho-Oki Earthquake (M6.7; JMA) occurred at about 50 km depth nearby the Kuju-Kuri beach of Boso peninsula. This earthquake is thought to be a strike-slip intraslab earthquake occurring in the subducting PHS (e.g., Okada and Kasahara, 1990).

Keywords: 1894 Meiji-Tokyo earthquake, 1895 Ibaraki-ken Nanbu earthquake, 1921 Ibaraki-ken Nanbu earthquake, 1922 Uraga-channel earthquake, 1987 Chiba-ken Toho-Oki earthquake, Magnitude 7 earthquakes