

Revised hypocenters of Two Destructive Earthquakes in Meiji Era

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For earthquakes from 1885 to 1922, the catalogue by Utsu (e.g. Utsu, 1979) has been widely used. We have been collecting additional information about earthquakes of Meiji and Taisho era to add events to the catalogue on behalf of the Headquarters of Earthquake Research Promotion (HERP) to increase seismicity information of old terms. On the way, I noticed the hypocenters of 1894 Oct. 7th in Kanto district and 1911 June 15th near Kikaijima Island are different from the current catalogue. Here I report these new hypocenters.

The event on Oct 7th, 1894 is M6.7 and located at the northern part of Tokyo Bay, and the inter- or intra-plate earthquake. It was believed an aftershock of Meiji Tokyo Earthquake on June 20th, 1894. Utsu used seismic intensities and amplitudes observed at only five stations of the Central Meteorological Observatory (CMO) to determine the size and the hypocenter of this event. Ishibe et al. (2012) concluded this event as the earthquake of intra-PAC-plate from the seismic intensity contour map made by the CMO (1897). However, when we make the distribution of seismic intensity reported in Japanese Gazette (1894) and the Meteorological report at Lighthouses (1894), it is different from the intensity distribution of an intra-plate earthquake of PAC as the one under the northeastern end of Tokyo Bay on July 23rd, 2005 M6.0. It resembles to the M5.9 intra-plate event under the Uraga Channel on Feb. 2nd, 1992. I propose the new hypocenter for this event as: 35.2 deg. N, 139.8 deg. E, 90km depth. The new hypocenter assures that this event is not an aftershock of Meiji Tokyo Earthquake.

For the event on June 15th, 1911, Imamura (1913) obtained epicenter off the north-east of the Amami Island, while Shida (1911) and Gutenberg and Richter (1954) determined an epicenter off the west of the island. Goto (2013) confirmed that the arrival time data show an epicenter near that of Imamura's. For this event, Utsu (1979) showed some hesitation, and concluded that the epicenter is the east off the island and the depth is 100km, and M8.0. I examined all information available on seismic intensities, damage reports, and tsunami reports.

I also checked waveforms at Mizusawa, Osaka, Florence, and Riverview. I compared waveforms of this event to several other events, which occurred near Amami Islands, and concluded that the 1911 earthquake is shallow and the largest observed inter-plate event in the northern part of Ryukyu trench. I would not move the epicenter from Utsu's, 28 deg. N, 130 deg. E, but change depth to Shallow in his term, which is equivalent to about 40km in this area. The reason that Gutenberg obtained 160km depth for this event is that he interpreted the sea-surface reflection phase as the solid earth surface reflection. We will continue the effort to compile information of old events as much as possible, including waveform data remained in smoked papers.

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