# Long-term probability forecast of the regional seismicity that was induced by the M9 Tohoku-Oki earthquake

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Seismicity of the eastern Japan has become active, induced by the M9 Tohoku-Oki earthquake of 11 March 2011. Since November 2009, Japan Testing Center of the CSEP has been evaluating some probabilistic forecasts of seismic activity in and around the Japanese islands, including the Kanto region and inland areas. However, it now accepts re-submissions of the probability forecasts due to the influence of this M9 mega-earthquake. Originally, these were relatively short-term forecasts that assumes the space-time probability forecasts. However, recently, long- and mid-term forecast of probability of large earthquakes in the Tokyo metropolitan area has been attracting wide attention.

In this report, I will consider such a forecasting method for each region of Japan. If the region does not contain the M9 earthquake in it, I predict the seismicity rate by the superposed model of the ETAS model and the Omori-Utsu formula. Here, the ETAS model represents the triggered earthquake chains within the region, and the Omori-Utsu formula represents the induced seismic activity by the M9 earthquake. This superposed model fit well to data for period up until now. Hence, I will use this to forecast of seismic activity of the region in the future.

A sequence of earthquake magnitudes may be generated by use of the Gutenberg-Richter's law. However, this is not quite suitable for an unbiased prediction of frequency of large earthquakes because the b-value can be different depending on the threshold magnitude. Alternatively, I will simulate them by bootstrap re-sampling based on the magnitude data of the earthquakes in that region of the Utsu catalog (1885-1925) and the JMA catalog before and after the unification (November 1997). Here, the re-sampling weights considering the detection rate and duration of each catalog.

After obtained the magnitude series of earthquakes, I simulate the seismic activity using the superposed model of the ETAS and Omori-Utsu formula. Repeating this procedure, we estimate long-term probability of occurrence of large earthquakes. In this report, we will see probabilities of large earthquakes during the passage of up to 30 years period in South Kanto metropolitan area, the Tohoku inland region and the Itoigawa-Shizuoka Tectonic zone

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