Enhancement and diffusion of seismic activity around large intraplate earthquakes in Japan

Akio YOSHIDA (National Institute of Polar Research)
Gen AOKI (Sendai District Meteorological Observatory)

Abstract
Spatio-temporal characteristics of seismic activity around large intraplate earthquakes in Japan are investigated statistically by stacking the data about the time elapsed and epicentral distance of moderate earthquakes with $M \geq 5$ from the origin time and focus of each of $M \geq 6$, $M \geq 6.5$ or $M \geq 7$ earthquakes since 1926 when a modern seismograph network was deployed in the Japanese islands. It is found that the occurrence rate of moderate earthquakes is increased significantly in a broad area around the foci of large earthquakes. A tendency is seen that the occurrence rate of moderate earthquakes is decreased within 100 days and 50km from the focus of each of $M \geq 5$ earthquakes which occurred within 100 days and 50km from the origin time and epicenter of each of $M \geq 6$ earthquakes are removed. The largest shock in each of the clusters is left in the declustered file.

Procedure of the statistical analysis
First, we stack distribution of $M \geq 5$ earthquakes around all the large earthquakes to obtain frequency of earthquakes with $M \geq 5$ as a function of distance from the focus of large earthquake. Then, we calculate normalized frequency of earthquakes with $M \geq 5$ in each doughnut zone by dividing the number of earthquakes in the zone by the area. Finally, the sum of the normalized number of events in the adjoining zones (for example, 0-10km and 10-20km) is regarded as a number at a distance between the zones (10km).

Removal of aftershocks
The JMA catalogue is declustered by using a criterion that earthquakes, which occurred within 100 days and 50km from the origin time and epicenter of each of $M \geq 6$ earthquakes are removed. The largest shock in each of the clusters is left in the declustered file.

Magnitude-frequency distribution of earthquakes in the period 1926-1940.
It is estimated that earthquakes with $M \geq 5$ have been detected completely during the whole period of analysis.

Spatio-time distribution of normalized occurrence rate of earthquakes with $M \geq 5$ around $M \geq 6$ earthquakes.
Spatio-time distribution of normalized occurrence rate of earthquakes with $M \geq 5$ around $M \geq 6.5$ earthquakes.
Spatio-time distribution of normalized occurrence rate of earthquakes with $M \geq 5$ around $M \geq 7$ earthquakes.

Location of the peak of the enhanced seismic activity as a function of distance and elapsed time

Magnitude-frequency distribution of earthquakes in the period 1926-1940.
It is estimated that earthquakes with $M \geq 5$ have been detected completely during the whole period of analysis.

Decay of the enhanced activity near foci of large earthquakes can be expressed by the modified Omori’s law.

\[ n(t) = K(t+c)^{-p} \]
\[ t : \text{year} \]