A quantitative analysis of daily change of detection capability of earthquakes

Takaki Iwata[1]

[1] none

Now completeness of an earthquake catalogue is one of the key issues in earthquake forecasting. Conventionally the completeness magnitude (Mc), the minimum magnitude of complete recording, is estimated for an earthquake catalogue ranging over several weeks, months or years [e.g., Wiemer and Wyss, 2000]. It is well known, however, that the detection capability of earthquakes is lower in daytime than in nighttime because of human activity [e.g., Rydelek and Sacks, 1989; Ishikawa, 2008]; an estimated Mc for a catalogue ranging over more than one day would be smaller than Mc in daytime. A quantitative analysis of daily fluctuation of detection capability is important to discuss the completeness of an earthquake catalogue.

In this study, we use a statistical model representing an observed magnitude-frequency distribution of earthquakes [e.g., Ringdal, 1975; Ogata and Katsura 1993]. The distribution is assumed to be the product of the Gutenberg-Richter law and a detection rate function $q(M)$. Following previous studies, the cumulative distribution of the normal function is used as $q(M)$. Using this model, instead of Mc, Mu, the magnitude where the detection rate of earthquake is 50 per cent can be estimated. Data used in this study is taken from the JMA catalogue for 100 days since 1 January 2008. The earthquake sequence is divided into one-day increments, and the divided sequences are stacked. Then, a Bayesian approach with a piecewise linear approximation [Iwata, 2008] is applied to this stacked data to estimate the daily modulation of Mu. In a case when the daily change of Mu is not allowed, Mu is estimated at 0.47; Mu is fluctuated between 0.34 around midnight and 0.59 around 2pm if daily change is allowed.

References
- Ishikawa, Y., Proceedings of the JPGU Meeting, S143-012, 2008.
- Ogata, Y., and Katsura, K., GJI, 113, 727-738, 1993.
- Ringdal, F., BSSA, 65, 1631-1642, 1975.
- Rydelek, P. and Sacks, I. S., Nature, 337, 251-253, 1989.
- Wiemer, S., and Wyss, M., BSSA, 90, 859-869, 2000.