

Probabilistic forecast for small events with identical waveform repeating on the interplate asperities east off north Japan

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We tried to estimate the probabilities of recurrence earthquake with identical waveform repeating on the small interplate asperity in the east off Hokkaido and Tohoku, Japan. Repeating much more frequently at many asperities than large events, they are useful to evaluate the probability model for earthquake recurrence.

A Bayesian approach was applied for the renewal model with lognormal distribution for time interval between successive events. We supposed that the prior was uniform and reverse gamma for the mean and variance of logarithm of time intervals, respectively. The shape- and scale- parameters in reverse gamma distribution were regarded as 2.5 and 0.437, respectively, which we had obtained for the repeating events. The expected probability of recurrence earthquake in the forthcoming period is theoretically calculated with t-distribution from the number of events in the sequence, mean and variance of logarithm of time intervals, parameters in the reverse gamma prior distribution, lapsed time from the last event to the forecasting time, and the interval of forecasting.

Frequencies of estimated probability for the period from July 9 through December 31, 2006, for 103 sequences with five or more events were as follows:

0-10%: 27(2), 10-20%: 24(4), 20-30%: 32(10), 30-40%: 8(2),
40-50%: 6(4), 50-60%: 4(2), 60-70%: 2(2), and 70-100%: 0(0).

The numbers in parentheses show the number of recurrence earthquakes. Expected number of recurrence earthquakes was 21.9, and they are observed in 26 sequences. The difference between estimate and observation is not significant statistically. Brier score, an index for the accuracy of probabilistic forecast, was 0.161, which is slightly better than that of weather forecasts of 72 hours at Tokyo.