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Long term predictability for the earthquake recurring a few times

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Sequential recurrent large/medium earthquakes listed in seismic catalog are not so many, usually considerably few due to long return period, which are available to calculate the long term probability. We study the predictability for those cases using 127 sequences of small interplate repeating earthquakes along the Japan Trench which have been applied for an experiment of prospective forecast. Two to five events closely preceding forecast are picked from each sequence to calculate the probabilities for qualifying event in 2008.

We use three models to calculate the probabilities, as follow:
(1) LN-Bayes: A Bayesian approach for lognormal distribution of recurrence interval with inverse gamma prior distribution.The parameters of inverse gamma are shape; phi=0.25, and scale; zeta=0.44.
(2) LN-SST: Lognormal distribution model base on the small sample theory.
(3) EXP-Pin: Exponential distribution model and the parameter being plugged in with the sample mean.

The ”Mean log-likelihood” and ”Brier score” mentioned below are used to score the forecast results.
Mean log-likelihood : Average of Ev∗log(P)+(1-Ev)∗log(1-P)
Brier score : Average of (P-Ev)ˆ2
Here P means forecast probability for event and Ev means presence (Ev=1) or absence (Ev=0) of the qualifying event. The model is considered to be superior to the alternative one, if the Mean log-likelihood is larger and Brier score is smaller than those of the alternative, respectively.

Keywords: recurrent earthquake, forecast, Bayesian approach, Small sample theory, Mean log-likelihood, Brier score