Probability Forecast for Recurrent Earthquakes with Uncertain Events

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We discuss parameter inference and forecast in renewal processes for recurrent earthquakes suffering from uncertainties in their occurrence. Exact likelihood and hazard evaluation in point process theory involves multiple integral with respect to uncertain occurrence dates and are often difficult to calculate even numerically. Alternatively, Monte Carlo simulation of the uncertain occurrence histories can be used for the evaluation by calculating the integrated functions for respective simulated histories and simply averaging them. We apply a renewal model with the Brownian Passage Time (BPT) distribution to Japanese paleoseismic site such as Yoro-Kuwana-Yokkaichi fault zone and Sarobetsu fault zone. We define an exact likelihood when there are possibly missing events in paleoseismic catalog using reproductive properties of the BPT distribution. Using Bayesian posterior distribution, we introduce Bayesian inference and forecast to obtain stable estimates of parameters and probability forecasts. We also evaluate possibility of missing events in those catalogs.

Keywords: Recurrent earthquakes, Renewal process, Bayesian forecast

