One-day forecasts generated by the ETAS and Reasenberg-Jones models for the aftershocks following the 2017 Linzhi, Tibet, M_S6.9 earthquake, China

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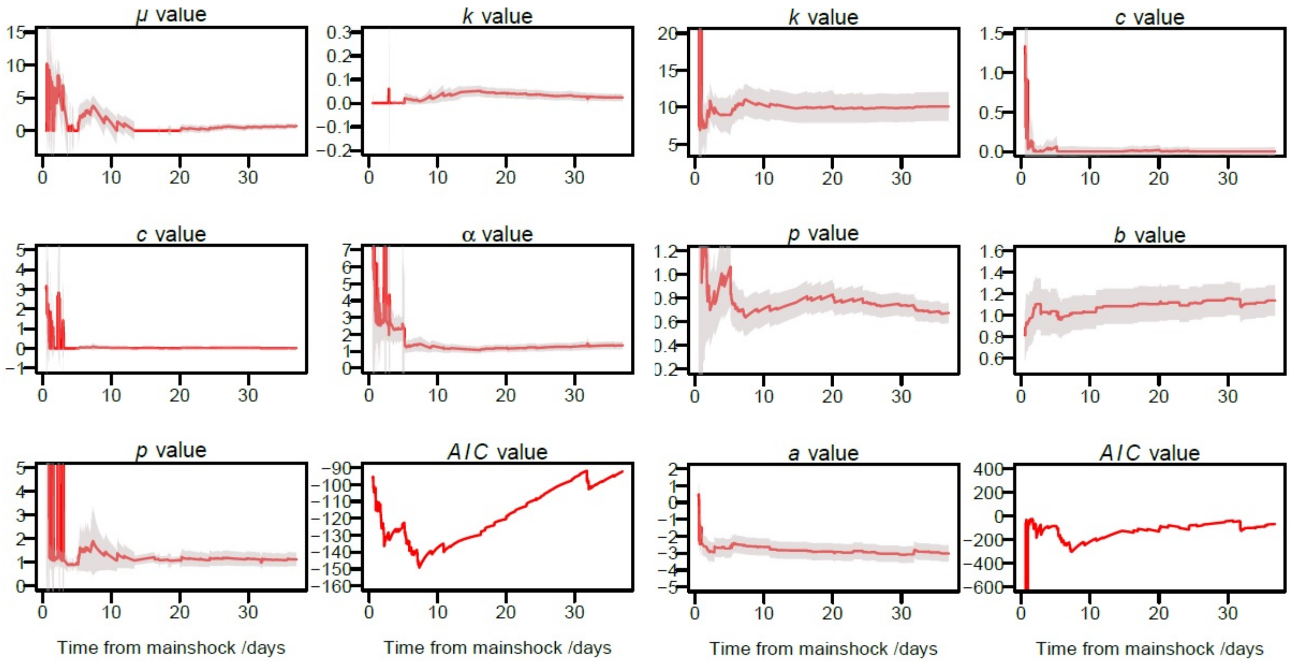
We fit the Epidemic Type Afterhsock Sequence (ETAS) model and Reasenberg-Jones (R-J) model to the 2017 Linzhi, Tibet, M_S6.9 earthquake sequence, using the earthquake catalog of fast report provided by China Earthquake Networks Centers (CENC), dated from the occurrence time of mainshock to 2017/12/12 and containing 856 events in total. A magnitude-ranking method is used to determine the temporal variation of the earthquake detection ability. In our calculation, we set the cut-off magnitude M_C =3.0 and the start time tc=0.032 day, considering the time variation of the earthquake detecting ability.

Main results are listed below.
The ETAS parameters are μ0.7056, p 1.1177, c 0.0206, k 0.0236 and α1.3511. Compared to the average value of parameters p and $\alpha$for other historical events of the same magnitudes, the sequence of Linzhi M_S6.9 earthquake has a relatively quick decay in occurrence frequency and a relatively weak triggering capability. The residual analysis shows a relative quiescence in the transformed time sequence domain and an increased activity, starting from the 2.5th day and on 23th day, respectively. To study the stability of these two models, starting from 0.5th day after the mainshock, we update the calculation of the model parameters every 0.02 day. The results show that the ETAS and R-J models are unstable in the early time after the mainshock and start to be stable after 10th days and 7th days, respectively.
Retrospective one-day probability forecasts of aftershock occurrence were produced based on these two models. To evaluate forecast performance of these two models, we use the N-test method to process the statistical test over time. The results show that the ETAS model have a slightly better performance in the early time after the mainshock than the R-J model.
Figure 1. Temporal variations of estimated parameters of (a) ETAS model and (b) R-J model since the mainshock of the Linzhi M_S6.9 earthquake sequence, updated every 0.02 days. The shaded areas in the plots show the corresponding standard errors.

Keywords: ETAS model, Reasenberg-Jones model, earthquake probability forecasting



(a) ETAS model (b) Reasenberg-Jones model