

Evaluation of background seismicity and potential source zones of strong earthquakes in the Sichuan-Yunnan region

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Based on the time-space epidemic-type aftershock sequence (ETAS) model and stochastic declustering method, a retrospective study was conducted to investigate whether long-term seismicity anomalies exist before the May 12, 2008, Wenchuan $M_s8.0$ earthquake, and to evaluate the current potential risks of strong earthquakes in the Sichuan-Yunnan region. We analyzed the background and clustering seismicity of earthquakes above $M_l3.0$ in the period from 1977 to the day before the Wenchuan $M_s8.0$ earthquake, the results showed that seismic activity in the Sichuan-Yunnan region is significant clustered, heterogeneously spatiotemporally distributed and that earthquake sequence are usually with foreshock events. Through the analysis on the spatial variation of the clustering seismicity ratio, we found that there existed a long-term and large area of low clustering seismicity ratio in the middle-south section of Longmenshan faults, which implied that this region had been in a state of stress barrier before the Wenchuan $M_s8.0$ earthquake. Several statistical parameters including cumulative numbers of background and total seismicity, b value and newly defined Δb value were conducted to evaluate the current potential risk of strong earthquakes in the areas of low clustering seismicity ratio in the Sichuan-Yunnan region. The results showed that the seismic activity is correlated significantly between the Longriba and Longmenshan faults, and that the Qiaojia region and the southern segment of Longmenshan faults with high potential of strong earthquakes. Moreover, we also found that the b value trends to reflect the local variations of stress field, while Δb can reveal sensitively the relative variation of the stress field in a larger spatial range.

Keywords: Long-term seismic hazard evaluation, Potential source zones of strong earthquake, ETAS model, Sichuan-Yunnan region, Wenchuan $M_s8.0$ earthquake