Comparison of Models of Long-term Seismic Hazard and with An Application to North China

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In this study, we used two variable kernel function estimation methods, proposed by Stock and Smith, and Zhuang, the Bayesian Delaunay tessellation smoothing method by Ogata (ODTB), and a newly proposed Incomplete Centroidal Voronoi tessellation (ICVT) method, to calculate the total and background seismic spatial occurrence rates for the study area. And we apply these four methods to obtain optimal estimates of the earthquake hazard in North China based on the modern earthquake catalogue.

The results were compared and analyzed through the cross-validation method, to ensure accurate reflection of the seismic activity in North China. The sophisticated ODTB method is more stable than the others, but is relatively expensive, in terms of computation demands, while Zhuang et al.’ s kernel estimate and the new ICVT method are able to provide reasonable estimates and easier to implement.

We also calculated the spatial variations of the b-value, using the Bayesian method with smoothness prior proposed by Ogata. By combining the results of seismicity rate distribution and b-value distribution, we simulate the earthquake catalogue. Compared with the original catalogue, it turns out that these four models are effective in reproducing the seismicity of the study region, suggesting their feasibility of estimating future seismic hazard.

Using comparative analyses and simulation experiments, we show that all of methods give similar spatial patterns of seismic occurrences.

