



Seismic patterns around the epicenters of great historical earthquakes in North China

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We develop a new method of quantifying the degree of clustering in the spatio-temporal distribution. Unlike other methods that rely solely on the distance r between epicentre pairs, our formulation allows the earthquake size to be taken into account. For a given point, the seismic density index is proportional to the magnitude, and inversely proportional to the distance r measured from the earthquake epicenter. The method is applied to an instrumental catalogue of earthquakes in Northern China for the time period 1970 to 2005.

In North China, there are abundant historical earthquake documents. A great earthquake occurred in A.D.1303 in Shanxi province which was large and devastating enough to be recorded in a large written archive. Using these disaster recordings, an isoseismal map of this historical earthquake has been used to estimate the magnitude of this earthquake as 8. Another great historical earthquake occurred in A.D.1668 in Shandong province, with a macroseismic magnitude of 8.5. Although these extreme events occurred several hundred years ago, small and moderate earthquakes continue to occur around the epicenter. We calculate the seismic density index around these locations using modern instrumental data. The isolines of the present-day index are very similar with the isoseismal map of the historical earthquakes. We also analyze the temporal distribution of small and moderate earthquakes. Mechanism of phenomena will be probed, including variation of crustal medium state, from integrity to fragmentation, condition of strong earthquake recurrence and earthquake disaster diversity. The results may provide a useful additional parameter for evaluating the spatiotemporal properties of earthquake populations and in hazard mitigation