



Long-lived aftershock sequences around Beijing, China

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SUMMARY

Most aftershock sequences are relatively transient, decaying over months or years to background levels. However, in some intra-plate areas, persistent clusters of events can occur over much greater time scales, for example the ongoing sequence in the New Madrid zone of the eastern US. Here we examine the evidence for such long-lived aftershock sequences around Beijing, China. First we introduce a metric known as the 'seismic density index' that quantifies the degree of clustering of seismic energy release. For a given map location, this multi-dimensional index depends on the number of events, their magnitudes, and the distances to the locations of the surrounding population of earthquakes. We apply the index to modern instrumental catalogue data between 1970 and 2014, and identify six clear candidate zones for long-lived aftershocks. We then compare these locations to earthquake epicenter and seismic intensity data for the six largest historical earthquakes. Each candidate zone contains one of the six historical events, and the location of peak intensity is within 5km or so of the reported epicenter in five of these cases. In one case – the great Ms 8 earthquake of 1679 – the peak is closer to the area of strongest shaking (Intensity XI or more) than the reported epicenter. These observations are consistent with the hypothesis that the modern clusters are long-lived aftershocks. However, there is no systematic reduction in the seismic event rate in these candidate zones with time since 1970, as one might expect from a transient decay by the Omori law. This could be due to the decay rate being too slow to be detected, or that the index is instead picking out the location of persistent weaknesses in the lithosphere. In either case the results imply that areas of high seismic density index could be used in principle to indicate the location of unrecorded historical of palaeo-seismic events in areas of intra-plate continental seismicity.