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Spatial distribution of triggered seismicity and application to time-dependent seismic hazard.

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Using a pair-correlation method described in Huc and Main (2003), we present results on the spatial distribution of inter-earthquake triggering. Assuming a null hypothesis of spatially clustered, temporally random seismicity we compare real data from global and regional catalogues with time-randomised datasets. The difference in the real and randomised data allows a triggering signal to be observed above the temporally random background. The null hypothesis can then be rejected for distances less than 150 km. This does not preclude individual triggered events at greater distances, but implies instead that such events are rare relative to the background.

Analysis of this triggering signal allows characteristic length scales to be calculated. Their evolution over time shows that they can be fitted, to first order, to a power law of the form $r(t) \sim t^H$. , where r is distance and t is time. The exponent H provides an indirect measurement of stress diffusion. On closer examination, H can be seen to fall into 2 regimes, increasing at times greater than a few hundred days. This change in the diffusion exponent can be attributed to viscoelastic stress transfer, and is seen in both the global data and nearly all regional data sets. Regional variations in the amplitude and magnitude of the diffusion signals suggest some dependence on the underlying seismotectonic structure.

By considering magnitude dependencies, it is possible to determine some parameters for the ETAS model, in particular the proportion of triggered events for each parent event of a particular magnitude. We also show how results generated using this process can be used to provide estimates of time-dependent seismic hazard.