Analyzing foreshock features by using stochastic reconstruction

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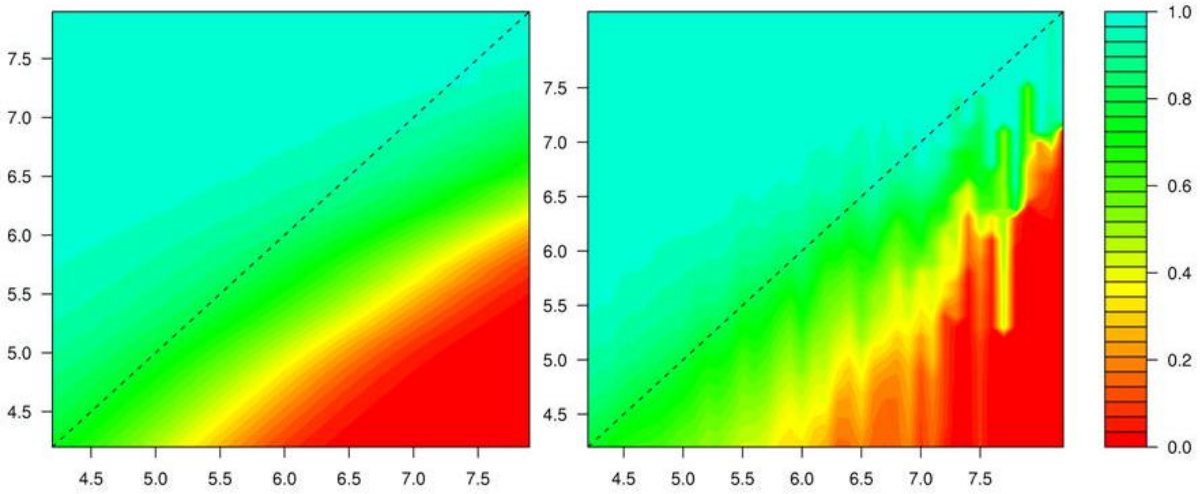
The space-time epidemic-type aftershock sequence (ETAS) model is a stochastic process in which seismicity is classified into background and clustering components and each earthquake triggers other earthquakes independently according to some rules. Given an earthquake catalog, we can stochastically decluster it according to the estimated probabilities that one event is produced by another previous event or from the background seismicity. In this way, a foreshock is defined as a background event that has at least more than one child of a larger magnitude. We have derived the formula of the probability that an event of a given magnitude have no descents larger than another given magnitude and of the probability that there is at least one event larger than a magnitude in an arbitrary cluster. Furthermore, we evaluate the distributions of the magnitudes of foreshocks. We verify these theoretic results by analyzing the shallow events in the Japanese JMA catalog. We found that there is no clear evidence that the foreshocks are different from the mainshocks that have larger aftershocks.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