Stochastic reconstruction of clustering features of earthquakes

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Based on the epidemic type aftershock sequence (ETAS) model and the thinning procedure, this paper firstly gives the method about how to classify the earthquakes in a given catalogue into different clusters stochastically. The key points of this method are the probabilities of one event being triggered by another previous event and being a background event. Making use of these probabilities, we can reconstruct the functions associated with the characteristics of earthquake clusters, to test a number of important hypotheses about the earthquake clustering phenomena. We applied this reconstruction method to the shallow seismic data in Japan and also to a simulated catalogue. The results show the following assertions: (a) The function for each component in the formulation of the space-time ETAS model are good enough as a first approximation for describing earthquake clusters; (b) a background event triggers less offspring in expectation than a triggered event of the same magnitude; (c)the magnitude distribution of the triggered event depends on the magnitude of its direct ancestor; (d) the diffusion of the aftershock sequence is mainly caused by cascades of individual triggering processes, while no evidence shows that each individual triggering process is diffusive; (e) the scale of the triggering region is still an exponential law as it is formulated in the model, but not the same as the one for the expected number of offspring.