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A time series analysis of the largest earthquakes in forest-fire models: large deviation functions and time interval distributions.

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The statistical properties of large, disastrous earthquakes have significance in the study of deviations from the regular behavior of earthquakes. In this study, to help understand the irregular behavior of earthquake occurrences, the large deviation function for the frequency of earthquakes is calculated for the first time. We study the temporal sequence of the largest earthquakes in simple models of earthquakes, one-dimensional forest-fire models in which the fluctuation in loading and fracture process are taken into consideration. We introduce four different models of fixed trigger sites to represent the starting points of rupture propagation. The size-frequency distributions and scaled large deviation functions for the frequency of the largest earthquakes in the system are calculated and their behaviors are classified. The calculated large deviation functions are compared with those of the homogeneous Poisson process and of the one-site forest-fire model. We find that the large deviation function largely depends on the model parameters and the fixed trigger sites, and in most cases the large deviation function deviates from that of the homogeneous Poisson process. The relation between the size-frequency distribution and the large deviation function for the frequency is discussed, with reference to the time interval distributions of the largest earthquakes.

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[1] T. Mitsudo and N. kato, ArXiv/1209.0879.