ABSTRACT OF THE DISSERTATION

Fluctuation of Power Law Parameters in Earthquake Interevent Time Distribution and Development of Fitting Model

by

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Complex spatio-temporal patterns of seismicity, together with our limited ability to detect and measure earthquakes, combines to present challenges for the estimation and the fit of earthquake interevent time distribution. This dissertation examines implication of these challenges and presents methods for addressing them.

First, for the earthquake catalogs of Japan, southern California and Turkey, a preliminary assessment of completeness magnitudes, and effective starting time of aftershock sequences is performed. This allows us to derive a series of complete seismicity models on which analysis and inference are made more reliable. Then, a new iterative sampling algorithm (Earthquake Random Sampling-ERS), which accounts for space-time clustering of earthquakes at different distances from a given source, is proposed. The algorithm is used to simulate different interevent time statistics, in particular the mean distribution.

After the estimation of the interevent time distribution, we introduce formalism for testing the hypothesis of the observed doubly power law scaling. In this formalism, short and long time range power law exponents obey a simple characteristic equation, with parameters linked to the probability at the distribution tails. It is shown that such characteristic equation is not satisfied for small magnitude cutoffs (m_c=2.5, 3.5, 4.5), and consequently the doubly power law scaling hypothesis is rejected.

Finally, Palm-Khintchine equations are used to construct a new model for fitting interevent time distribution. In this model, the whole distribution is viewed as weighted mixture of background and dependent distributions. The theoretical fit is implemented in practice using several hypothetical background distributions: Exponential, Gamma and Weibull. The best fit is found to be provided by a Weibull distribution.