LEVEL CROSSING APPROACH IN SPATIAL AND TEMPORAL DEPENDENCE IN EARTHQUAKE

Mansoor BEHTAJ
MSc *Student of Geophysics, International Institute of Earthquake Engineering and Seismology, Tehran, I.R.Iran*
Behtaj1@gmail.com

Mostafa ALLAMEHZADEH
Assistant Professor, International Institute of Earthquake Engineering and Seismology, Tehran, I.R.Iran
mallam@iiees.ac.ir

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INTRODUCTION

In recent years, a vast majority of researches have been devoted to the study of seismic data that contain information about the complex events that lead to the earthquake [1]-[5].

We live in a world where random processes are ubiquitous. Although the random values of a stochastic process at different times may be independent random variables, but in most cases they are considered to indicate complicated statistical correlations. So, over the past decade, several different methods have been introduced to study the properties of the process. Spatial and temporal fluctuations of earthquake form time series. The purpose of the application of statistical mechanics is to describe the behavior of the time series that can help to better understanding of the stochastic processes. After that, we lie in an effort to reproduce or predict some experimental facts with extraction of useful information. An important question is what is the probability of obtaining or losing a certain level of return at different time intervals? For the first time, Jenson the *inverse method* in turbulence, and Simonsen et al. presented the *inverse statistics* to apply on similar financial data to answer the similar questions [6]-[7]. Inverse statistics suggests the inverting of the structure function equation, and instead of considering the average moments of distance between two points, gives the difference value between these two points. In the inverse statistics method is used of another popular technique called the *level crossing method (LC)*. In the level crossing method no scaling feature is explicitly required [9-14] and this is the main advantage of this technique for estimating the statistical information of the series. Level crossing based on stochastic processes that grasp the scale dependence of the time series.

What is the reason for the formation of level crossing? This method was developed for the study of a series of different insight. The memory, non-Gaussianity and waiting time (length) (an average time (length) interval that we should wait for an event to take place again [15]–[16]) could be measured by level crossing method. Since the fractional Gaussian noises are well-known examples, their comparison with empirical data can be used as a criteria to better understanding the results obtained from the level crossing method applied to unknown empirical data.

Here, the total amount that is designated as N^{+}_{tot}, which represents the total number of upcrossings of a series, reflects how memory plays role. To better assess the effects of memory, we have calculated shuffled counterparts of each underlying time series and compared their associated total number of so-called crossings, N^{+}_{sh}, with that given by their original time series N^{+}_{tot} to obtain the change percentage in the system. The autocorrelations are destroyed by the shuffling procedure.