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# ON THE POISSON DISTRIBUTION OF THE IRANIAN DE-CLUSTERED EARTHQUAKE CATALOGUE

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Two main goals are considered in this paper; First is modification and computation local coefficients of the space-time windows in the well-known window algorithm developed by Gardner and Knopoff in 1974, and the second one is to check the independency of the mainshocks obtained from applying updated model. To modify the space-time windows, the well-documented events of Iranian earthquake catalogue in the time period of 1972 to 2008 were used (Karimiparidari et al., 2013). The data contains 21 different sequences of mainshocks and aftershocks with the magnitude of the mainshocks ranged between Mw 5.4 and 7.1. The updated temporal and spatial windows were applied to the seismic catalogue in different seismotectonic zones of Iran.

To fit the Poisson model to the observed data, we need to know how well the model actually reflects the data. One statistical test that addresses this issue is the Chi-square goodness-of-fit. The Chi-square test statistic is of the form

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i} \qquad (1)$$

where $\chi^2$ is the Pearson's cumulative test statistic, Oi is the observed frequency and Ei is the expected frequency. This test is useful for the discrete variables (Hassanipak, 2001), which makes it suitable for statistical seismicity studies. However, two points must be considered: a) the approximation to the Chi-squared distribution breaks down if the expected frequencies are too low, though it will normally be acceptable as long as no more than 20% of the events have expected frequencies below 5 (Moore, 2004) and b) the results of this test are greatly affected by the number of bins and the time intervals.

An alternative statistical test is the Kolmogorov-Smirnov test (KS-test), which attempts to determine whether two datasets differ significantly. The benefit of using this test compared with the Chi-square goodness-of-fit in this type of study is that the KS-test uses the original data and does not need to classify the data for low-frequency observations. The KS-test statistic is

$$max(|F(x) - G(x)|) \qquad (2)$$

where F(x) is the empirical cumulative distribution function, and G(x) is the fixed reference cumulative distribution function.

The inter-event times are marginally independent and identically distributed exponential random variables. The rate of the exponential distribution is related to the rate of the Poisson process (Luen and Stark, 2012).

After de-clustering, the seismic catalogues were found to follow a Poisson distribution in all studied zones based on the results of the Kolmogorov-Smirnov test. The same test on times between successive de-clustered events shows that the inter-event times of all catalogues follow an exponential distribution.

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