RECOGNIZING AFTERSHOCKS OF 2017 HOJEDK EARTHQUAKES USING SEISMICITY PARAMETERS

Nadereh AMERIAN
M.Sc. Graduate of Geophysics-Seismology, Urmia University, Urmia, Iran
n.amerian70@yahoo.com
Ramin NIKROUZ
Associate Professor, Urmia University, Urmia, Iran
rnikrouz@gmail.com

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Within 12 days, three earthquakes about 6 magnitudes occurred in Hojedk in Kerman region. The first one occurred on the first of December 2017 and the other ones occurred on the 12th of December 2017 at 13-hours time interval. The spatial distances of the first event from the second event, the first event from the third event and the second event from the third event are 4.42 km, 8.79 km and 9.09 km respectively. According to a relocation of these earthquakes and their aftershocks seems that these three earthquakes occurred along different adjacent faults (Mahdavi-omran and Gheitanchi, 2018). Since spatio-temporal difference in occurrence of the three events that mentioned above is small, distinguishing their aftershocks is impossible by ordinary space-time windows. In this paper, a quantitative metric which quantified correlation between earthquakes is used to distinguish the aftershocks of the three earthquakes. The metric uses statistical properties of seismicity which present quantitative seismicity in each region. If we take the magnitude m_i of the i^{th} event, the spatial distance l_{ij} and the time interval $t_{ij}=T_j-T_i$ between the two earthquake epicenters, the expected number of events of magnitude within Δm of m_i occurring in the particular space-time domain bounded by events j and i is (Baiesi and Paczuski, 2004):

$$n_{ij}=Ct_{ij}l_{ij}^{df}\,\Delta m 10^{-bm} \tag{1}$$

For any earthquake *j* in the seismic region, looking backward, there are an earthquake i to which earthquake j is most correlated and in this case n_{ij} is minimized. in Equation 1, *C* is a constant depending on the overall seismicity in the region and time interval under consideration and df is fractal dimension, in order to estimate df , characteristic function C(r) is calculated first (Grassberger and Procaccia, 1983):

$$C(r)=\frac{2N_{R<r}}{n(n-1)} \tag{2}$$

where N is the number of point pairs sepaeated by a distance R less than r, and n is the total number of events in the catalog. The important results of this study are as follows:

The value of df that is the slop of the best straight line fitting C(r) versus r on the log-log plot was estimated df=0.987 (Figure 1). b=0.9 value was estimated using Gutenberg and Richter law, so with these values and considering $\Delta m=0.1$, C= 7.5×10^{-4} was estimated using Equation1, finely, aftershocks of the three events that are mentioned above are recognizable using Equation 1, aftershocks of each of these main events are separated from one another in Figure 2. The method that used to collect aftershocks in this study has a spatial radius that changes with time as follows:

$$r_i(T)=[n_c(T-T_i)^{-1}10^{bm_i}]^{1/df} \tag{3}$$

Considering b=0.9, df=0.987, n_c=2 (n_c is a threshold value for n) and m_i=6.2, hyperbolic space-time windows used in this study is obtained using Equation 3 (Figure 3).

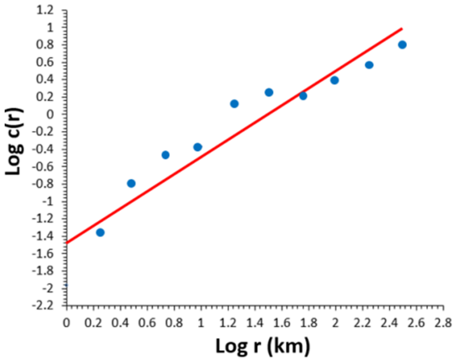

Figure 1. Log-log plot of C(r) versus r, in order to estimate df.

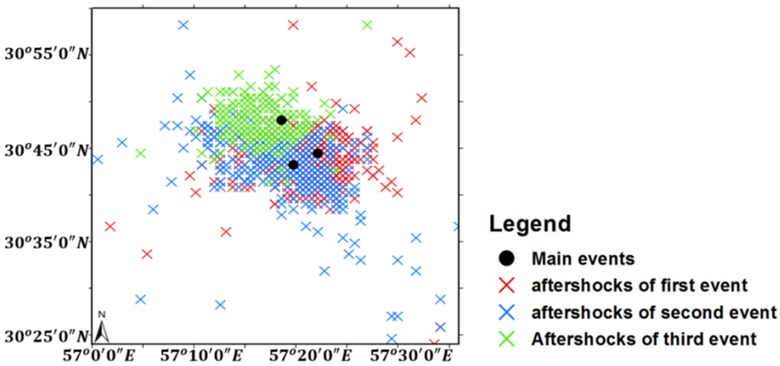

Figure 2. Epicenter of separated aftershocks relate to 2017 Hojedk three main events.

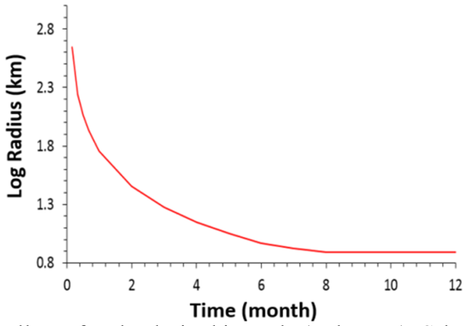

Figure 3. Hyperbolic space-time window used to collect aftershocks in this study (red curve), Schematic examples of ordinary space-time windows to collect aftershocks (black rectangular).

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