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EARTHQUAKE HAZARD IN KERMANSHAH AFTER A MAINSHOCK IN EZGELEH

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Considering seismicity and earthquake hazard is important in a high seismic area. Studying the aftershocks is important from different aspects; for instance, the impact of aftershocks on the structures damaged in the earthquake from the one hand, and the disturbance caused in the rescue process from the other hand (Hough & Jones, 1997).

The importance of study the distribution of aftershocks can be used to estimate the amount of energy release in most seismic zones, the seismic zones, length of the activate faults and the process of migration of aftershocks (Ogata & Shimazaki, 1984).

The main purpose of this study is to study the probability for strong aftershocks or larger mainshocks for Kermanshah zone using the Reasenberg-Jones relation (Reasenberg & Jones, 1989). To this end, the catalogue of the Kermanshah earthquakes between 2017/11/12 and 2019/03/16 has been collected and homogenized among which five earthquakes have been selected to study their aftershock decay rates.

Catalogue of aftershocks has been collected, based on the distribution of the aftershocks and the fault trajectories of each earthquake. The Gutenberg-Richter diagram has been plotted separately for each earthquakes, and the variables A, b, and Mc has been obtained for each seismic zone (Table 1). The next step, modify the catalogue and remove smaller earthquakes from the Mc, and then the modified Omori law has been applied to the new catalogue and the variables P, C and K has been calculated (Table 1) (Ogata, 1983). By placing the variables in Equation 1, the probability for strong aftershocks or larger mainshocks has been calculated for Kermanshah zone (Table 2) (Reasenberg & Jones, 1989; Lolli & Gasperini, 2003; Ommi et al., 2016).

Table 1. Seismic variables for 7.3 Ezgeleh, 5.6 Somar, 5.7 Tazehabad, 5.9 Tazehabad, 6.4 Ezgeleh earthquakes and calculation average and middle theirs (Without regard 5.7 Tazehabad).

Kermanshah zone											
	P	**Err. P**	**C**	**Err. C**	**K**	**Err. K**	**b**	**Err. b**	**A**	M_C	**a**
7.3 Ezgeleh	0.7	0.02	0.116	0.035	70.6	4.22	1.06	0.04	5.67	2.4	-3.34
5.6 Somar	1.02	0.04	0.232	0.091	66	8.5	0.831	0.04	4.69	2.4	-0.84
	2.7	0.47	0.479	1.558	10	14.16					-1.66
5.7 Tazehabad	1.09	0.07	0.267	0.085	111.5	15.99	0.829	0.03	4.35	2	-1.02
5.9 Tazehabad	0.97	0.03	0.283	0.084	106.5	11.31	0.931	0.03	4.91	2.2	-1.41
6.4 Ezgeleh	1.01	0.09	0.155	0.046	90.3	9.44	0.699	0.02	4.25	2	-1.11
	0.89	0.23	0.031	0.155	15.4	7.01					-1.88
average	1.197	0.13	0.223	0.293	67.18	10.09	0.87	0.032	4.77	2.2	-1.60
middle	1.01	0.07	0.232	0.085	70.6	9.44	0.831	0.03	4.69	2.2	-1.41
average*	1.215	0.146	0.216	0.328	59.8	9.106	0.88	0.032	4.88	2.25	-1.706
middle*	0.99	0.065	0.19	0.087	68.3	8.97	0.881	0.035	4.8	2.3	-1.535

$$P = 1 - exp\left[-\int_{M_1}^{M_2}\int_{S}^{T}\lambda(t.M)dtdM\right] \quad (1)$$

$$\lambda(t.M) = \frac{10^{a+b(M_m-M)}}{(C+t)^P} \quad (2)$$

Therefore, the probability for strong aftershocks or larger mainshocks for Kermanshah zone after the 7.3 Ezgeleh earthquake of 2016/11/12 is shown in Table 2. Probabilities for damaging aftershocks and greater mainshocks are typically well constrained after the first day of the sequence, with accuracy increasing with time.

Table 2. Interval probabilistic, P(M_l, M_2, S, T) for the Kermanshah aftershock sequence for strong aftershocks or larger mainshocks ($M_l = M_m - 1$, $M_2 = \infty$), and for larger mainshocks only ($M_l = M_m$, $M_2 = \infty$). Time interval are described by S (interval start time, in day after the mainshock) and (T - S) (duration, in days). Model parameters for the generic sequence are (b = 0.831, p = 1.01, a = -1.41, c=0.232).

Earthquake with $M \geq M_m - 1$ (6.3)									
				S					
T-S	**0.01**	**0.25**	**0.5**	**1**	**3**	**7**	**15**	**30**	**60**
1	0.202	0.143	0.111	0.078	0.036	0.017	0.008	0.004	0.002
3	0.3	0.238	0.2	0.155	0.085	0.045	0.023	0.012	0.006
7	0.373	0.313	0.275	0.227	0.144	0.087	0.049	0.027	0.014
30	0.482	0.431	0.397	0.354	0.269	0.197	0.135	0.087	0.051
60	0.527	0.480	0.449	0.409	0.329	0.257	0.191	0.134	0.087
90	0.552	0.507	0.478	0.439	0.362	0.292	0.226	0.166	0.113
365	0.627	0.589	0.565	0.532	0.467	0.406	0.345	0.286	0.225
1000	0.672	0.639	0.618	0.589	0.532	0.478	0.423	0.369	0.312
Earthquake with $M \geq M_m$ (7.3)									
1	0.032	0.022	0.017	0.012	0.005	0.002	0.001	0	0
3	0.051	0.039	0.032	0.024	0.013	0.006	0.003	0.001	0
7	0.066	0.053	0.046	0.037	0.022	0.013	0.007	0.004	0.002
30	0.092	0.079	0.072	0.062	0.045	0.031	0.021	0.013	0.007
60	0.104	0.092	0.084	0.074	0.057	0.043	0.030	0.021	0.013
90	0.111	0.099	0.091	0.081	0.064	0.049	0.037	0.026	0.017
365	0.135	0.123	0.115	0.106	0.088	0.074	0.060	0.048	0.037
1000	0.152	0.140	0.132	0.123	0.106	0.091	0.078	0.066	0.054

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