Investigating the aftershocks sequence following the Mw 7.3 Iran earthquake (November 12, 2017)

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A major earthquake, with magnitude Mw=7.3, struck the Northwestern part of Iran on November 12 2017, causing extended damage and casualties. The aftershock sequence is still ongoing, as testified by the two recent M6.4 (November 25, 2018) and M5.9 (January 6, 2019) events that occurred in the area more than one year after the mainshock. Thus, we investigate the aftershock sequence following this earthquake, with the aim to understand whether it fits the classical laws of aftershocks occurrence (e.g. the Omori Law), and to explore whether observed deviations from these laws could provide some insights about the occurrence of possible further large aftershocks.

The *Delta/Sigma* method (Caccamo et al., 2005. Physics of the Earth and Planetary Interiors 153, 175–180), is used for this purpose, which is based on the observation of possible anomalies in the temporal decay of an aftershock sequence. Specifically, if the decay can be modeled as a non-stationary Poissonian process, where the intensity function is equal to $n(t) = K \cdot gt + c)^{-p} + K_1$, the number of aftershocks in a short time interval Δt is the mean value $n(t) \cdot \Delta t$, with a standard deviation $Sigma^2 = n(t) \cdot \Delta t$. Given the difference between observed and estimated number of events $Delta = |N_{obs}\text{-}N_{calc}|$, it was found that, before the occurrence of large aftershocks, the *Delta/Sigma* ratio may reach rather high values, which can be considered as seismic anomalies. The *Delta/Sigma* method has been applied to several aftershocks sequences worldwide and different improvements of the method have been developed during the last years, but it still requires rigorous and extensive testing to assess its capability in describing observed aftershocks occurrence.

The basic data used in this study have been extracted from the regional catalog of the Iranian Seismological Center (IGTU catalog), which is available at http://irsc.ut.ac.ir/bulletin.php/. The IGTU catalog lists events with magnitude M≥2.5, recorded in the Iranian plateau and adjacent areas since 1 January 2006.

Various experiments are carried out in order to verify if this method could identify the large aftershocks (with M≥4.8), which occurred in the region surrounding the Mw 7.3 mainshock occurred in November 2017. Different input parameters and configurations of the method are considered, in order to check the stability and statistical significance of the obtained results. The preliminary results of the study indicate that the application of *Delta/Sigma* method to the Northwestern region of Iran, surrounding the Mw 7.3 earthquake occurred in November 2017, could highlight the possible occurrence of several significant aftershocks. Based on these results, the analysis is expanded to ANSS global data provided by USGS, in order to assess the stability of the detected pattern, which might provide relevant information for seismic risk assessment.