

Seismic Activity Investigation of Elazığ and Surroundings, Eastern Anatolia

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ABSTRACT

The frequency-magnitude distribution of the earthquakes occurred in the city of Elazığ and surrounding area was analysed. This region is located in Eastern Anatolia and tectonically very active and has a high seismic hazard risk. A complete set of 1550 earthquakes of $M_d \geq 1$ from 1 January 2010 to 28 February 2019 was used. The spatial mapping of frequency-magnitude distribution was produced. Outstanding variations in the b-value were detected with $b \approx 1.3$ and the region is not homogeneous.

Introduction. The tectonic structure of the Anatolian plate is very complex because of the many plates such as the Eurasian, the Arabian and African plates significantly influenced its tectonic and geodynamic structure (Şengör and Yılmaz 1981). An interplay of this movement and also the geological process of the Mediterranean layer to a lower place the Anatolian plate causes aN-S expansion and E-W shortening in western Turkey. As a consequence of this, the area is underneath expansion in a NNE-SSW direction. The interactions cause a large variety of complex tectonic processes like collision, subduction, back-arc extension, strike-slip faulting and rotation of different blocks and microplates at intervals a comparatively little region (Ketin 1966). Elazığ located in Eastern Anatolia (Fig.1), where has a complex and active tectonic structure (Hempton 1983, Çetin et al. 2003). The aim of the study is to investigate the seismic activity of the studied region by using a-value and b-value.

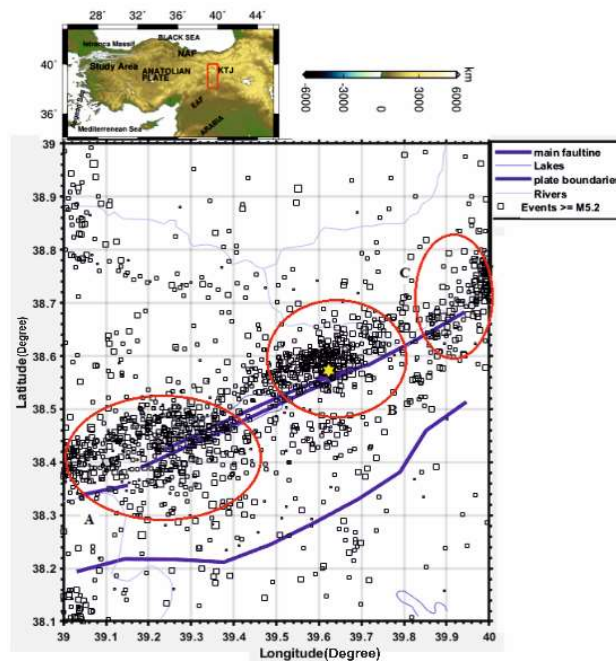


Figure 1. The location of the study area within Turkey and the epicentres of the earthquakes.



Data and methods. To calculate seismic parameters consisting of a-value, b-value and M_c (Magnitude of Completeness) of the study area, a complete set of 1550 earthquakes of $M_d \geq 1$ from 1 January 2010 to 28 February 2019 taken from Bogazici University, Kandilli Observatory and Earthquake Research Institute, Regional Earthquake-Tsunami Monitoring Center (KOERI) was used. The spatial mapping of frequency-magnitude distribution was produced for the study region. $\log_{10} N = a - bM$ is used to define the frequency of occurrence of earthquakes as a function of magnitude where N denotes the cumulative number of earthquakes with magnitude greater than M (Gutenberg and Richter, 1944).

Results. Seismotectonic b- and a-values of the study area are investigated by the analysing of region-time characteristics of earthquakes in Elazig, Turkey. The b-value is computed as 1.33 ± 0.06 with a completeness level of 2.6, and this result indicates that frequency-magnitude distribution of seismicity in Elazig is well represented with a b-value slightly greater than 1.0. The spatial b-value map for the region (Fig.2) indicated that the b-values of seismicity for the whole region is not homogeneous. The observed variations in b value are probably related to changes in locally and regionally stresses accumulated in the region.

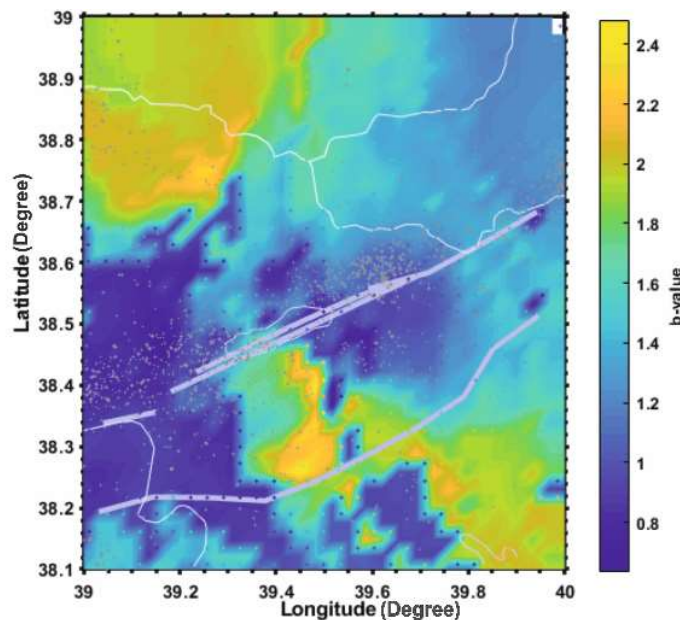


Figure 2. Regional variations of b-value changes between 1 January 2010-28 February 2019.

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