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PROBABILISTIC SEISMIC HAZARD ASSESSMENT OF SINOP REGION

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Sinop is one of the most beautiful and historic cities that lie in Black Sea Coast of Turkey, located in the north of North Anatolian Fault (NAF) Zone. The region is being considered as a candidate for Sinop Nuclear Power Plant (NPP) site for over 35 years; therefore numerous unpublished site reports and seismic hazard assessment reports have been prepared until this date. The latest active fault map published by General Directorate of Mineral Research and Exploration (MTA) (Emre et. al. 2011) shows new tectonic structures defined as "probable-quaternary fault" or "lineament" which may affect the design ground motions for Sinop City. Therefore, the seismic hazard assessment needs to be renewed considering these seismic sources.

Primary objective of this study is to develop seismic source characterization models to be used in probabilistic seismic hazard assessment (PSHA) considering the seismic sources within 320 km proximity of Sinop City. For this purpose, geometry of the fault segments (length, width, dip angle and segmentation points) were determined with the help of previously conducted studies, new fault maps provided by MTA, and previously published literature. The Integrated Homogeneous Turkey Earthquake Catalogue (KOERI, 2007) including the events with M_w>4 that occurred between 1900 and 2005 in Turkey was utilized over the seismic sources. The seismic sources that are expected to affect the area; the NAF Tosya - Erbaa Segment (1942-1943 earthquakes rupture zones), Merzifon-Esençay Fault Zone, Sungurlu-Ezinepazarı Fault, Ekinveren Fault, Erikli Fault, Balıfakı Fault and Pontic Escarpment Zone along with the catalogue seismicity is shown in Figure 1.

Two different types of seismic sources were defined. Planar fault zones and composite magnitude distribution model (Youngs and Coppersmith, 1985) are used to properly represent the characteristic behavior of NAF Tosya - Erbaa Segments, Merzifon-Esençay Fault, Ekinveren, Erikli and Balıfakı Faults without an additional background zone. Fault segments, rupture sources, rupture scenarios and fault rupture models are determined using the USGS Working Group on California Earthquake Probabilities (WGCEP-2003) terminology and multi-segment rupture scenarios are considered. Events in the earthquake catalogue are attributed to the individual seismic sources using buffers and scenario weights are determined by balancing the accumulated seismic energy with the catalogue seismicity on each source. For each of these sources, the regional b-value that calculated using maximum likelihood analysis is employed (0.88, Yılar, 2014). Areal sources are defined for two particular seismic sources, the Pontic Escarpment on the shores of Black Sea and for the seismicity located beneath the Merzifon-Esençay Segment, including the Sungurlu-Ezinepazarı Fault and other lineaments in the south (Figure 1). The magnitude distributions of these areal sources were modeled with truncated exponential frequency-magnitude relationship and b-values specific to each source is used.

Contribution of each seismic source to the hazard outcome is evaluated in Figure 2. Analysis results presented in this figure does not intend to discuss the activity of the seismic sources in the vicinity of Sinop, such a task requires additional information and expertize on the field. The actual objective is to present the effect of the nearby seismic sources given in Emre et. al. (2011) on the

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design ground motion levels for Sinop City. Since the total hazard is significantly affected by the ground motion variability, we prefer to use the global ground motion models for this study. The Abrahamson and Silva (2008) NGA-W1 model is selected among many available global models just for the sensitivity analysis. Details of the ground motion characterization and logic tree for teh final work is provided in Yılar (2014). Figure 2 implies that the contribution of the seismic sources on the north, the Erikli and Balıfakı Faults and Pontic Escarpment Zone, is minor for the larger hazard levels.

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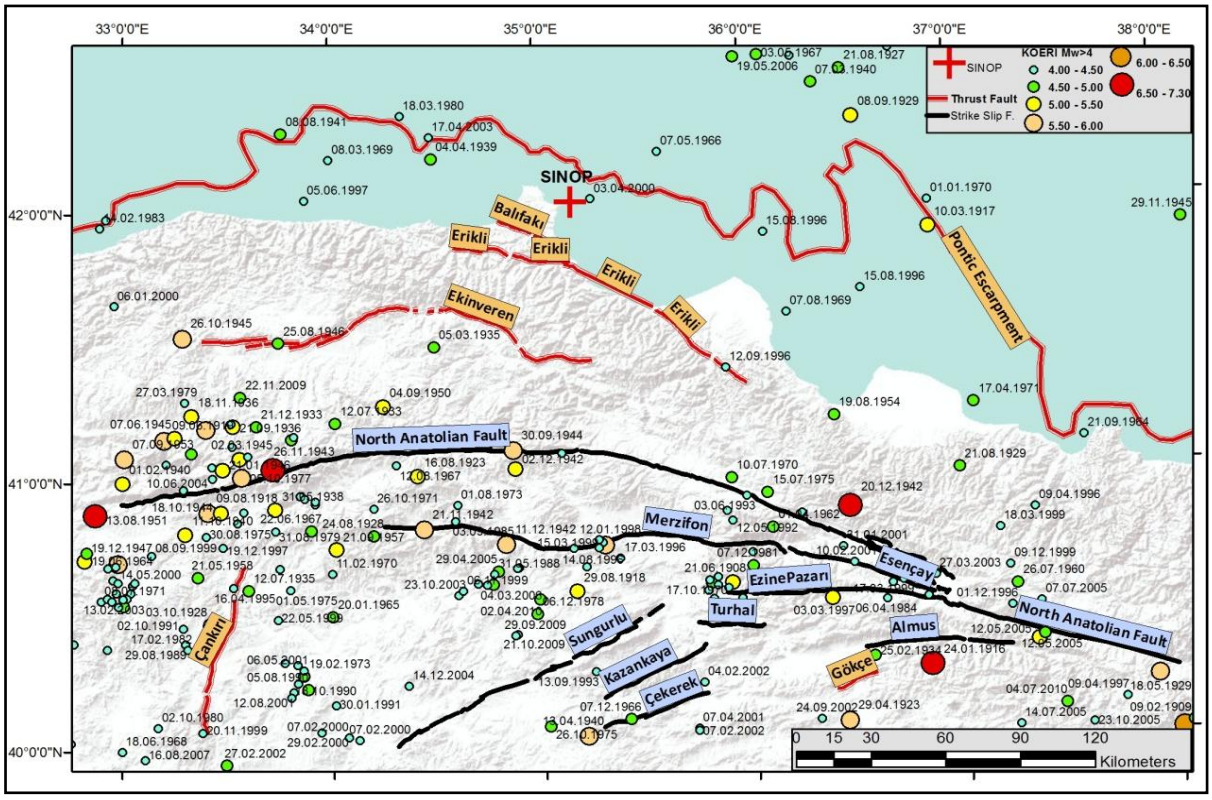

Figure 1. Seismic sources in the close vicinity of Sinop City and the spatial distribution of catalogue seismicity.

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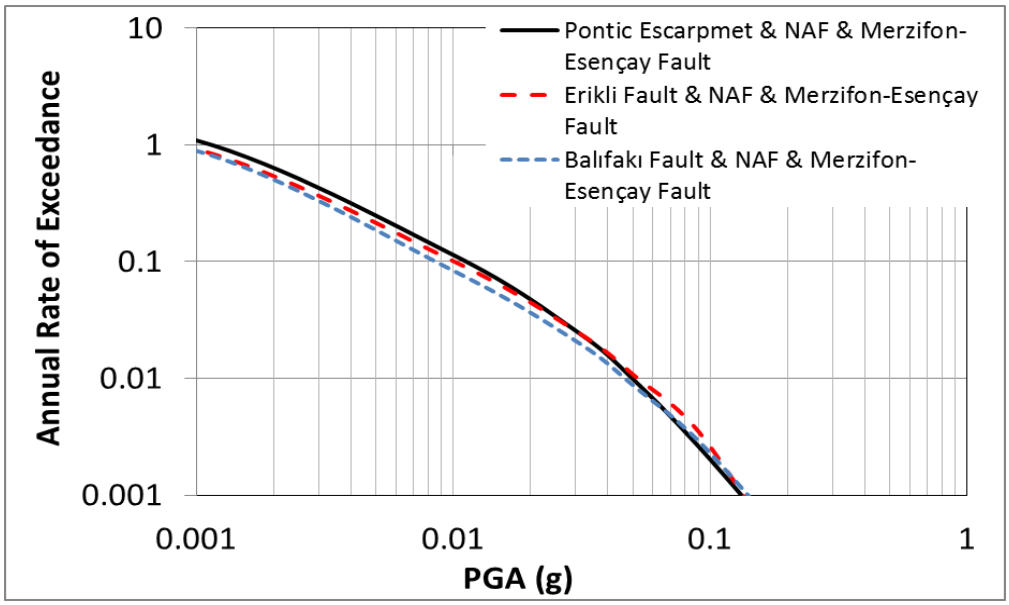

Figure 2. Sensitivity of the hazard in the area to the seismic sources.

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