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Analysis of Earthquake Hazard and Perceptibility Study in Çanakkale, NW Turkey

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Keeping in mind the epicenter distributions of earthquakes in and around the city of Çanakkale and faulting, hazard study was performed for the region in 4 seismic sub-zones. Using the seismic data for 4933 earthquakes with magnitudes M≥3 that took place between the years 1903-2009, seismic hazard input parameters a and b were calculated using empirical relations. The probabilities of earthquake occurrences and recurrence periods have been obtained by using Poisson and Gumbel extreme values statistical distribution model. In order to determine the regions where strong and destructive earthquakes may occur, distribution maps for a, b and a/b values have been prepared. For the studied region of Çanakkale and its surroundings the values of a and b were determined to be 5.85 and 0.80 respectively. According to the analysis made with respect to seismic sub regions, the region where the risk of an earthquake occurrence is greatest has been determined to be the region taking in Gelibolu-Tekirdag-West Marmara Sea. Whereas the risk of an earthquake occurrence within a 100 year period with a magnitude of 7.3 was determined to be 46% according to the Poisson distribution, the same value was determined to be 71% according to Gumbel distribution and the recurrence period was calculated to be 50%. The region extending NW-SE between North of Edremit Bay, west of Saros Bay, Yenice Gönen is where the seismic hazard is high.

When we analyze the a/b modal distribution maps for the b-value tectonic parameter of the study region, comparatively higher a/b values are observed at low b values. When the earthquakes with magnitudes of M≥ 3.0 that have taken place within the last 100 years are analyzed, the regions where Saroz- Gazikoy and Yenice-Gonen faults are located at are the regions where b value has decreased relatively and where the risk of earthquake occurrence has increased. The b values range between 1.0 and 1.15 in this region. High magnitude earthquakes have not been observed in the past. However this doesn't mean that it won't be affected by high magnitude and destructive earthquakes that might take place at the faults. That is why peak ground acceleration (PGA) distribution maps have to be formed in order to see the effects of a possible high magnitude earthquake at this region. The occurrence probabilities and recurrence periods obtained especially for earthquakes with magnitudes of 7 and above by using either Gumbel or Poisson distributions support this region and the studies containing this region. Whereas the probability of occurrence for an earthquake with a magnitude of 7 and above is 90% for the next 100 years, its recurrence period is 50 years average. The probability of occurrence was determined to be 65% by using the Poisson distribution whereas the recurrence period was calculated to be 100 years. When the values of tectonics and seismicity compatible a, b and a/b value distributions are analyzed, it is seen that regions related with large magnitude earthquakes and weak zones are determined. Accordingly, north of the Gulf of Edremit, offshore Tekirdag-NW-SE extension region between Yenice Gonen and west of the Gulf of Saros are regions with high risks of earthquake occurrence.

Another region which is shown to have lower b and higher a/b values on maps and for which fault zone is specified is the region north of the Gulf of Edremit. Lower a/b values and higher b values have been obtained in the western part of the Gulf of Edremit. When the general geology of the region is looked at, this may be due to the units known as Kestanbol granites that display a sturdier lithology.