SEISMICITY OF THE NORTH ANATOLIAN FAULT SYSTEM IN THE DOMAIN OF SPACE, TIME AND MAGNITUDE

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North Anatolian fault system is one of the seismically most active tectonic units of the world. The fault is approximately 1000 km long and is oriented almost east-west across the entire extent of Northern Turkey. The North Anatolian fault has in the past, and into the present, caused great damage to human life and economy. However the seismicity of the fault has not been studied systematically. Most of the studies are of the order of field reports which were prepared after destructive earthquakes.

In this study in order to establish inter-relations of earthquake activity along the fault, different aspects of seismicity of the fault are studied systematically. For this purpose the fault zone is divided into 18 equal area regions.

In order to examine the similarity of seismic activity between the 18 regions of the fault, and then to group those segments which show strong similarity into larger seismic provinces, correlation coefficients between the various regions were evaluated. The 6 sets of correlation coefficients have been evaluated by testing the number of earthquakes

versus time as functions of each segment with every other segment. Then the confidence level of each correlation coefficient is determined by applying the Weierstrass-M test. From the super position of the 6 sets of correlation coefficients, each of which is evaluated with a different number of degrees of freedom, five such seismic provinces are ultimately determined.

Since the amount of strain energy release is an objective measurement of seismic activity, the total seismic energy release in 64 years for the 18 regions of the North Anatolian fault is evaluated. According to this, regions 3 and 14 are seismically the most active. Regions 1, 2, 5, 7, 8, 11 and 16 have approximately the same moderate level of seismic activity, while regions 4, 6, 9, 10, 12, 13, 15, 17 and 18 show the lowest level of seismic activity when compared to the others. To investigate the seismic energy release along the fault as function of time, the seismic energy release is computed for the 18 regions of the North Anatolian fault zone for 8 year time intervals.

From this, it is established that the North Anatolian fault was very active between 1939 and 1954, but that since then the seismic activity is less intensive. In order to display the migration of

seismic activity, the epicenters of the earthquakes along the North Anatolian fault are plotted in the space and time domain. The graph shows a definite pattern of migration of seismic activity from east to west between 1939 and 1945, and from west to east between 1945 and 1958. The remaining data show no evidence of migration.

The magnitude-frequency relationship ($\log N = a - bM$) of earthquakes of the North Anatolian fault zone is investigated. The seismic parameters of the above relationship are evaluated by graphical and maximum likelihood methods and found to be $\underline{a} = 5.43$, $\underline{b} = 0.65$. The $\underline{b}$ value evaluated in this study is +0.05 larger than that obtained by Karnik (1971). From the seismic parameters of the fault, the seismic risk values are evaluated for 10, 25, 50, 75 and 100 year periods, for $M \geqslant 7$ and $M \geqslant 8$ earthquakes. For example, the seismic risk values for a 50 year period for $M \geqslant 7$ is 98%, and for $M \geqslant 8$ is 57%.

The variation of the magnitude-frequency relationship is investigated along the fault by dividing the fault zone into 3 sections (western, central, and eastern) and evaluating the $\underline{b}$ value for each section.

These $\underline{b}$ values are found to be $\underline{b} = 0.79$

for the western, $\underline{b}$ = 0.56 for central and $\underline{b}$ = 0.53 for the eastern sections. The seismic risk values evaluated from these $\underline{b}$ values indicate that the western section of the fault has lower seismic risk than that of the central and eastern sections.