Seismicity Parameters and Scaling Properties of Earthquakes in Marmara, western NAF

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The 17 August 1999, Gölcük and 11 November 1999, Düzce earthquakes have conspicuously reminded us of how seismic hazard assessment is necessary in terms of loss of life, casualties and finance. Moreover, a possible drastic earthquake in Marmara, western North Anatolian Fault (NAF) has exceptional importance concerning to its economical and social impacts, for whole Turkiye. Herein, statistical investigations on earthquakes and evaluation of results according to physical conditions which cause earthquake phenomenon are outstanding tasks. On this purpose, statistical properties of earthquakes in the area are analyzed by means of fractal analysis and seismic parameters.

Objects which are self-similar and show scale invariance are called as fractals. If a system does not have a characteristic length or scale, it is a good approximation to understand its behaviour using fractal analysis. Every fractal is characterized by a fractal dimension. Having fractal distribution requires that number of objects larger than a specified size has a power-law dependence on the size. The exponent of the power-law stands for the fractal dimension and characterizes the chaotic behaviour of system. Most of the phenomena or objects in geophysics and geology such as frequency-size distribution of earthquakes, faults, and fractures are scale invariant and show multifractal properties.

Using power-law relations for statistics of seismicity is not a new subject in geophysics. The b-value of Gutenberg and Richter, which is a good example, defines a relationship between occurrence rates and magnitudes of earthquakes and has been used as the indicator of seismic activity. Additionally, p-value of Omori is also a power-law relation and defines the decay rate of events' frequencies with time.

The present work aims to contribute to a better understanding of the occurrence systems of earthquakes in the area, by means of multifractals, b-value and p-value, using the data obtained from the web site of the Bogazici University Kandilli Observatory and Earthquake Research Institute. Earthquakes in the investigation area are examined by depth and contour maps of capacity dimension of active faults, information and correlation dimensions of epicentral distribution, b-value and p-value are prepared for time intervals of 0.5 days. Then correlations between these seismicity and scaling parameters are evaluated according to earthquake mechanisms and tectonic characteristics of the region.

Key words: *multifractal analysis, fractal dimension, b-value, p-value, Marmara, North Anatolian Fault.*