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Spatio-temporal analysis of aftershock sequences in terms of Non Extensive Statistical Physics.

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Earth's seismicity is considered as an extremely complicated process where long-range interactions and fracturing exist (Vallianatos et al., 2016). For this reason, in order to analyze it, we use an innovative methodological approach, introduced by Tsallis (Tsallis, 1988; 2009), named Non Extensive Statistical Physics. This approach introduce a generalization of the Boltzmann-Gibbs statistical mechanics and it is based on the definition of Tsallis entropy Sq, which maximized leads the the so-called q-exponential function that expresses the probability distribution function that maximizes the Sq. In the present work, we utilize the concept of Non Extensive Statistical Physics in order to analyze the spatiotemporal properties of several aftershock series. Marekova (Marekova, 2014) suggested that the probability densities of the inter-event distances between successive aftershocks follow a beta distribution. Using the same data set we analyze the inter-event distance distribution of several aftershocks sequences in different geographic regions by calculating non extensive parameters that determine the behavior of the system and by fitting the q-exponential function, which expresses the degree of non-extentivity of the investigated system. Furthermore, the inter-event times distribution of the aftershocks as well as the frequency-magnitude distribution has been analyzed. The results supports the applicability of Non Extensive Statistical Physics ideas in aftershock sequences where a strong correlation exists along with memory effects.

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