Analysis of the stability of geoelectric fluctuations, prior to a M6.3 earthquake, by means of non-extensive statistics and multifractal spectrum.

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The stability of geophysical systems is an important topic whose study can contribute to the knowledge of the dynamics underlying processes in the preparation of earthquakes. One of the mathematical tools that allows characterize the stability of complex systems is the non-extensive statistics based in the generalized Tsallis' entropy (S_q). As is known, the Tsallis' entropy [1] is characterized by means of a q-value and when $q \rightarrow 1$, $S_q \rightarrow S_{BG}$, the Boltzmann-Gibbs entropy, for equilibrium systems. In the Tsallis' non-extensive formulation of entropy all-length scale interactions are allowed.
On the other hand, the multifractal analysis has been able to describe many features of dynamical systems. The relationship $1/(1-q) = 1/\alpha_{min} - 1/\alpha_{max}$ allows to obtain the minimum and maximum values (α_{min}, α_{max}) of the multifractal distribution; moreover the q-value is associated with S_q. The q-value is a quantitative measure of the length scale of the spatial interactions. We link the Tsallis' entropy and the Generalized Pareto distribution (GPD) [2] through the scale and shape parameters of the distribution followed by the exceedances over thresholds in the analyzed values, by considering these values as point process.
The aim of this work is to analyze the geoelectric fluctuations along the time monitored a few days prior a M6.3 earthquake occurred in México and characterize their stability by calculating the q-values and obtain the (α_{min}, α_{max}) values associated with the studied geoelectric fluctuations by means of GPD.

References

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