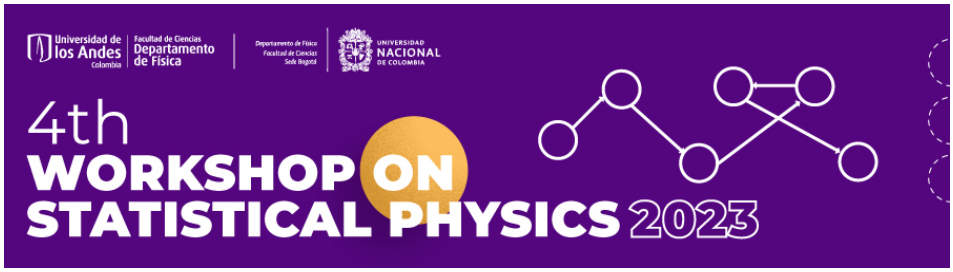

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Explaining the complexity of Colombian climate from the non-extensive extremal behavior

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The Tsallis' non-extensive statistical mechanics is a generalized framework for describing complex systems where ergodicity (and statistical equilibrium as its macroscopic manifestation) is just one of the dynamic possibilities of microscopical mixing. In practical manners, the generalization from Tsallis' theory introduces a non-extensive entropic functional Sq through the q-index, which accounts for how far is Sq from SBG, identifies non-additive universality classes, and provides physically based information about the underlying dynamics. The Tsallis' theory is being progressively applied in complex systems, in particular, relative to geophysical processes such as climate extremes, which are the result of weather conditions far from equilibrium emerging from spatiotemporal multi-scale interactions, long-term memory, a high degree of information content, and persistent positive feedback.

In this work, we evaluate the complexity of the Colombian climate via the extreme behavior of temperature and precipitation over a non-stationary detrended threshold. Based on a maximum likelihood estimation of the maximum entropy, we find the regional non-extensive parameters for the normalized q-exponential distribution with constant mean as a constraint.

The spatial structure of the regional q-index shows 59% (39%, 2%) of bounded (unbounded, in the Boltzmann-Gibbs limit) behavior for gauge temperature in the Caribbean Colombian Catchment (CCC) and 50% (50%, 0%) in Pacific Colombian Catchment (PCC). For gauge precipitation, we have 25% (67%, 8%) of bounded (unbounded, in the Boltzmann-Gibbs limit) in the CCC and 15% (77%, 8%) for the PCC. These results evidence an essentially nonextensivity in Colombian climate and furthermore, temperature and precipitation extremes do not share the same universality features.

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