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Entropy maximization, p-moments and power-type distributions in nature

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Choosing a proper probabilistic model for geophysical processes is not a trivial task. The common practice of choosing one of a few popular (among infinitely many) distributions is subjective and relies too much on empirical considerations e.g., the summary statistics of the data record. In contrast, the principle of maximum entropy offers a robust theoretical basis in selecting a distribution law, based on deduction rather than on trial-and-error procedures. Yet, the resulting maximum entropy distribution is not unique as it depends on the entropic form maximized and the constraints imposed. Here we use the Boltzmann-Gibbs-Shannon entropy and we propose a rationale for defining and selecting constraints. We suggest simple and general constrains that are suitable for positive, highly varying and asymmetric random variables, and lead to distributions consistent with geophysical processes. We define a generalization of the classical moments (the p-moments) which naturally leads to power-type distributions avoiding the use of generalized entropic measures.