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On the tail of the daily rainfall probability distribution: Exponential-type, power-type or something else?

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While the traditional choice to describe the wet-day daily rainfall is the two-parameter Gamma distribution, many other distributions have been proposed and used, e.g., the two- and three-parameter Log-Normal, the Generalized Logistic, the Pearson Type III, the Pareto and the Generalized Pareto, the three- and four-parameter Kappa distributions, and many more. The asymptotic behaviour of the upper tails of these probability distributions may be generally categorized in two families: the exponential-type and the power-type tail families, where the latter family does not have all moments finite. However, there are exceptions such as the Log-normal family and the so-called stretched-exponential-tail family, which are generally acknowledged to be heavy-tailed, yet all their moments exist. The upper tail of the distribution governs both the magnitude and the frequency of the extreme events with the exponential-type distribution tails generating more "mild" and infrequent extremes compared to the power-type tails. This emphasizes the importance to assess correctly the tail behaviour and also to theoretically justify it. In general, the exponential-type distribution tails are the most commonly assumed; however, in the last years there is a shift towards the power-type-tail distributions. In this study, we investigate the assumption that the tail belongs to the stretched-exponential-type family that seems to be the "middle" way between exponential- and power-type tails. Additionally, theoretical justification is sought based on the principle of maximum entropy which is applied using some general constrains that give rise to a distribution belonging the stretched-exponential-type family. Finally, we use real-world daily rainfall datasets to examine this assumption empirically and to compare the performance of each tail family.