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A global survey on the distribution of annual maxima of daily rainfall: Gumbel or Fréchet?

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Theoretically, if the distribution of daily rainfall is known, or, assumed with confidence, then one could argue, based on extreme value theory, that the distribution of the daily annual maxima would resemble one of the three limiting types: (a) type I, known as Gumbel, type II, known as Fréchet and, type III, known as reversed Weibull. Yet, the parent distribution usually is not known and many times only records of annual maxima are available. So, the question that naturally arises is which one of the three types better describes the annual maxima of daily rainfall. The question is of great importance as the naive adoption of a particular type may lead to serious underestimation or overestimation of the rainfall amount assigned to specific return period. To answer this equation, we analyse 15137 records of annual maxima of daily rainfall, from all over the world, with lengths varying for 40 to 163 years. We fit the Generalized Extreme Value (GEV) distribution, as it comprises the three limiting types as particular cases for specific values of its shape parameter, and we analyse the results focusing on the estimated shape parameter values. Finally, we investigate the relationship of the GEV shape parameter with record length and we construct a global map form its values to reveal possible geographical patterns.