On the exact distribution of maximum annual daily precipitation

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The maximum annual daily precipitation, i.e. the maximum value within the year of the daily amounts, is the variable used to quantify the high values, or extremes. In hydrology, this variable assumes a key role in the design of several hydraulic structures. The determination of its quantile with a fixed level of probability, or return period, is fundamental for the sizing of hydraulic structures. This operation requires the statistical analysis of data sample, and the determination of the probability distribution of maximum annual daily precipitation. In Literature, the asymptotic (or ultimate) distribution of extreme values, rather than pre-asymptotic (or penultimate) approximations have been used to this aim. Here, conversely, we investigate the exact distribution of maximum annual daily precipitation. Some case studies are illustrated and comparisons with existing results are discussed.