Statistical analysis of low flows: The role of higher-order moments

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The occurrence probability of low flows is relevant for such hydrological studies as the design of water storage structures and hydroelectric power plants, the fulfillment of minimum flow requirements for water quality for fish and other wildlife (e.g., assessing the probability that a stream will have sufficient flow to meet the need for discharging wastewater from manufacturing industries). Low-flow probabilities are typically estimated using frequency analysis at the site of interest. In the literature, many analytical distribution functions have been used, but most of them, when fitted to the bulk of recorded data, do not fit the low-flow extremes satisfactorily. The present work shows how probability distributions with a power-law behavior in the low-flow domain, such as the Gamma-Laguerre and the Beta-Jacobi functions, are appropriate for fitting annual low flows.