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Return period estimation for time-dependent hydrological observations

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Since independence is usually invoked for the derivation of the classical equation of return period (the inverse of the exceeding probability), it is common practice in hydrological applications to implement some techniques for data selection that allows to achieve the statistical independence of the available observations. These techniques constitute the basis for the extreme value frequency analysis, whose objective is to quantify the stochastic behavior of a process at unusually large (or small) levels that potentially lead to the failure of a system. Classical methods for extreme and independent value selection are the block maxima approach, where the block generally coincides with the year (Annual Maxima, AM), and the peak-over-threshold approach (POT). Hence, frequency analysis usually relies on fitting a probability distribution to a series of independent observations for defining the probability of occurrences of an event of interest or estimating the event magnitude corresponding to a chosen return period or risk of failure. In this work, we show how the return period can be directly estimated starting from an observed record of a time-dependent process; some examples are presented and discussed for illustrative purposes.