Seeking periodicity within sequences of POT-moments of daily runoff time series.

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This report investigates periodicities within sequences of peaks over threshold (POT) moments of river discharges. The method for the identification of periodicities was proposed in Lyubushin et al. (1998), and can be regarded as the generalization of the spectra for the sequence of events. The graphic of this function indicates which probe values of the frequency provide the maximum gain in the log-likelihood function increment with respect to a pure random model. Thus, the points of maximum of the function detect periodic components of the point process.

The next generalization of the proposed approach in this paper is the estimation the generalized spectral function not over the whole time interval of observation $(0, T]$, but within moving time window of a certain length T_W. Let τ be a time coordinate of the right-hand end of the moving time window. Then we have a generalized spectral function of 2 arguments, ω and τ which could be visualized as a 2D map within the plane of ω and τ values. The time-frequency diagrams allow the description of the dynamics of periodic components within point processes.

The proposed methods in this paper are applied to a moving time window of length 24 years on a daily river runoff time series at the location Cologne along the river Rhine over the period 1816 - 2004.

The results obtained in this paper are useful and necessary for river engineering studies. Design of river flood defenses needs accurate descriptions of the water level variations, in particular its spectral densities, as was also stressed by Cox and Lewis (1966) and Van Gelder et al. (2000).

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