

Modelling Hydrological Time Series Using Wakeby Distribution

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Abstract : The statistical modelling of precipitation data for a given portion of territory is fundamental for the monitoring of climatic conditions and for Hydrogeological Management Plans (HMP). This modelling is rendered particularly complex by the changes taking place in the frequency and intensity of precipitation, presumably to be attributed to the global climate change. This paper applies the Wakeby distribution (with 5 parameters) as a theoretical reference model. The number and the quality of the parameters indicate that this distribution may be the appropriate choice for the interpolations of the hydrological variables and, moreover, the Wakeby is particularly suitable for describing phenomena producing heavy tails. The proposed estimation methods for determining the value of the Wakeby parameters are the same as those used for density functions with heavy tails. The commonly used procedure is the classic method of moments weighed with probabilities (probability weighted moments, PWM) although this has often shown difficulty of convergence, or rather, convergence to a configuration of inappropriate parameters. In this paper, we analyze the problem of the likelihood estimation of a random variable expressed through its quantile function. The method of maximum likelihood, in this case, is more demanding than in the situations of more usual estimation. The reasons for this lie, in the sampling and asymptotic properties of the estimators of maximum likelihood which improve the estimates obtained with indications of their variability and, therefore, their accuracy and reliability. These features are highly appreciated in contexts where poor decisions, attributable to an inefficient or incomplete information base, can cause serious damages.

Keywords : generalized extreme values, likelihood estimation, precipitation data, Wakeby distribution

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