

A linear-circular model to determine sub-annual flood probabilities

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Abstract

Flood probabilities for periods less than one year are necessary for variety of practical applications. For example, in case of construction works within a river it is necessary to know the probability of a flood occurring within the construction time. However, flood probabilities are usually estimated as the occurrence per year, not least because the underlying data are often maximum annual discharges. Several approaches have been recently developed to estimate flood probabilities for periods less than one year. When applying these methods in practice they are subject to some substantial limitations: for example, users are left to choose some subjective parameters, or the results are not consistent with annual probabilities of occurrence. In this contribution, different approaches to determine seasonal flood probabilities are reviewed and evaluated with respect to their suitability for practical applications. In addition, a novel methodological approach based on a linear-circular statistical model is presented. In this new approach, flood discharges (linear measure) are determined using a classical POT approach. Additionally, the times of occurrence within a year (circular measure) are modelled using a circular kernel density estimate. The combination of both distributions with a two dimensional linear-circular distribution function subsequently allows the determination of the probability of occurrence of a flood value within any sub-annual season.