Flood peaks theoretically derived distribution based on the variable contributing area with annual maximum rainfall GEV distributed

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Supporting statistical analysis of floods with an approach able to take into account the physical behavior of underlying natural processes, should be considered an advisable procedure in approaching flood frequency analysis. Into this framework, theoretical distributions of flood peaks represent a valuable tool for understanding and modelling physical mechanisms which are responsible of floods related to rainfall inputs (Eagleson, 1972). Several approaches have been proposed in literature for modelling derived distributions of floods. Among these, the Iacobellis and Fiorentino (IF) distribution (Iacobellis and Fiorentino, 2000) relies on the basic hypotheses that the peak of the direct streamflow can be derived by the product of two random variables: average runoff per unit area and the contributing area to the peak runoff, which is modelled using Gamma probability distribution. Rainfall intensity, instead, is assumed Weibull distributed and, if the rate of occurrences follows a Poisson distribution, the theory of compound Poisson processes ensures that rainfall annual maxima are distributed according to the Power Extreme Value (PEV) distribution. In this work the IF distribution structure is revisited by exploiting the Generalized Pareto (GP) distribution for modelling rainfall intensities exceedances. This distribution will be hereafter referred to as IF-GP distribution. The use of GP for the description of rainfall allows to extend the domain of application to all available rainfall annual maximum series which follows the Generalized Extreme Value (GEV) distribution. Hence, the IF-GP model incorporates a rainfall structure which could benefit of a high number of worldwide diffused implementations of GEV distribution to rainfall modelling.

Abilities of IF-GP model were tested on annual maximum of flood series of two gauged sites located in Poland, characterized by annual maximum rainfall series GEV distributed. Local parameters for which an estimate could not be obtained with reliable a priori assumptions were evaluated using a least squares approach. Results showed a good ability of IF-GP distribution in fitting annual maxima of peak discharges in investigated catchments, demonstrating the ductility of IF-GP distribution and leading to promising extensions to a wider domain of potential applications.

References

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