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Multivariate modelling of storm characteristics on the basis of copulas in Switzerland

L. Gaal (1,2), P. Molnar (1), and J. Szolgay (2)

(1) ETH Zurich, Institute of Environmental Engineering, Zurich, Switzerland (ladislav.gaal@ifu.baug.ethz.ch, molnar@ifu.baug.ethz.ch), (2) Slovak University of Technology, Faculty of Civil Engineering, Bratislava, Slovakia (ladislav.gaal@stuba.sk, jan.szolgay@stuba.sk)

Copula-based estimation methods of hydro-climatological extremes have increasingly been gaining attention of researchers and practitioners in the last decade. Unlike the traditional estimation methods which are based on bivariate cumulative distribution functions, copulas are a relatively flexible tool which allows for modelling dependencies between two or more variables without making strict assumptions on their marginal distributions.

This study focuses on the analysis of the interdependence of critical storm properties (such as rainfall duration, intensity and total rainfall amount) in Switzerland. The data base for the analysis consists of rainfall records with 10 minute resolution, which are available at about 70 SwissMetNet stations and span the period of observations of 26 years. The storm characteristics are estimated from this data both on an annual and seasonal basis. First, the storm variable combinations are analyzed in terms of their distribution functions. Then, the choice of the copula functions that best fit the data is carried out. The cornerstone of the study is an analysis of seasonal and spatial differences that appear in the patterns of the copula parameters and the dependence models. It is attempted to relate the dependence characteristics to the dominant generating mechanisms of precipitation as well as to climatological factors. The aim of the study is to contribute to our understanding of the spatial and seasonal variability of dependence characteristics of storm properties in an orographically complex environment.