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Error Structure of Metastatistical and Generalized Extreme Value Distributions for Modeling of Extreme Rainfall in Austria

Harald Schellander (1), Alexander Lieb (2), and Tobias Hell (2)

(1) ZAMG - Zentralanstalt für Meteorologie und Geodynamik, Kundenservice Tirol und Vorarlberg, Innsbruck, Austria (harald.schellander@zamg.ac.at), (2) Department of Mathematics, University of Innsbruck, Austria

The wrong estimation of daily rainfall extremes can have severe consequences in hydrological and engineering applications. Up to date, the Generalized Extreme Value distribution (GEV) is considered the de-facto standard for the estimation of daily rainfall extremes, although there exist some evidence that fitting yearly maxima might violate the asymptotic assumption underlying extreme value theory.

To overcome this problem, the Metastatistical Extreme Value distribution (MEV) was recently proposed. With the MEV, the distribution of the bulk of the daily rainfall data ("ordinary events") is considered to be Weibull right-tail equivalent, describing the intensity of daily rainfall. By additionally considering the number of wet days in a year as random variable, daily rainfall occurrence can be taken into account simultaneously. Recent advances in the study of extreme rainfall showed that the MEV should be preferred over the GEV for the estimation of daily rainfall extremes, whenever the number of years used for fitting is small compared to the return period of interest.

In the present study, a break-even analysis for a large number of sample years and return periods for Austrian daily rainfall data shows that the MEV outperforms the GEV when the number of sample years is smaller than, and the estimated return period is larger than 30 years. This advantage almost vanishes when smooth spatial extreme value modeling is performed with the MEV instead of the GEV. However, the computational effort is drastically decreased when using an averaged version of the MEV.