An index-flood statistical model for drought estimation

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Hydrological extremes modeling, more specifically drought modeling, has been receiving much attention in past years due to increased frequency of severe drought events and their impacts. Variety of concepts have been applied to modeling droughts, ranging from simplistic empirical approaches to more complex process-based models. The aim of this study is (a) to develop a robust statistical model for drought indices using extreme value theory and the index-flood method and (b) to utilize this model in the return period estimation for the of maximum deficit volumes of total runoff. For the latter, deficit volumes for 133 catchments in the Czech Republic (1901-2015) were simulated by hydrological model BILAN. The characteristics of simulated deficit periods were validated regarding severity, intensity and length of drought events and correspond well to the observational records. In line with the index-flood method, it is assumed that the deficit volumes within each homogeneous region are identically distributed after scaling with a site-specific factor. The goodness-of-fit of the statistical model is assessed by Anderson-Darling statistics. For the estimation of critical values, various sampling methods allowing for appropriate handling of years without drought were devised.