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An index-flood model for deficit volumes assessment

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The estimation of return periods of hydrological extreme events and the evaluation of risks related to such events are objectives of many water resources studies. The aim of this study is to develop statistical model for drought indices using extreme value theory and index-flood method and to use this model for estimation of return levels of maximum deficit volumes of total runoff and baseflow. Deficit volumes for hundred and thirty-three catchments in the Czech Republic for the period 1901-2015 simulated by a hydrological model Bilan are considered. The characteristics of simulated deficit periods (severity, intensity and length) correspond well to those based on observed data. It is assumed that annual maximum deficit volumes in each catchment follow the generalized extreme value (GEV) distribution. The catchments are divided into three homogeneous regions considering long term mean runoff, potential evapotranspiration and base flow. In line with the index-flood method it is further 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 of the test several resampling strategies allowing for appropriate handling of years without drought are presented. Finally the significance of the trends in the deficit volumes is assessed by a likelihood ratio test.