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Investigation of seasonal low- and high-flow characteristics in a mesoscale basin using a process-based distributed hydrologic model

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The prediction of extreme hydrological events in mesoscale catchments under changing land use/cover and/or climate has been a major concern in hydrology because of their considerable societal impacts. In this study, we deal with the research question: How well a hydrologic model is in describing the extreme runoff characteristics in a mesoscale basin? To answer this question, several seasonal low- and high-flow runoff characteristics are estimated from the daily streamflow time series predicted by the hydrologic model HBV-UFZ. Among these characteristics are: the maximum drought duration, the total drought duration, the maximum drought intensity, and the cumulative specific deficit of low-flows; and the total duration, the specific discharge, the volume of discharge, the peak discharge and the frequency of high-flows. Investigation of these seasonal flow characteristics during summer and winter helps us to better understand the hydrological processes and gives insight to further model improvements.

HBV-UFZ is a process-based distributed hydrologic model based on some of the original HBV concepts and it is driven by 12 h precipitation, temperature, and PET grids which are acquired either from satellite products or from interpolated (EDK) meteorological data. The hydrologic model uses regionalized parameters whose nonlinear transfer function parameters are calibrated with adaptive simulated annealing. A transfer function links a model parameter with spatially distributed observables such as time-dependent land cover and other time-independent basin descriptors such as soil properties, mean slope, aspect, geological formations among others.

This study is carried out in the Upper Neckar River basin covering an area of ap-

proximately 4000 km^2. The model is calibrated in the period from 1981 to 1988 and subsequently validated during the period from 1962 to 2002. The spatial and temporal resolutions used are a grid size of (1000 $\times$ 1000) m and 12 h intervals respectively. The result of the study indicates that the model with regionalized parameters calibrated at daily timescale is able to catch reasonably well the various long-term semi-annual runoff characteristics (e.g. Nash-Sutcliffe efficiency $\approx$ 0.50-0.80) associated with high- and low-flows as well as their long-term trends.