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Analysis and prediction of hydrological extreme conditions for a small headwater catchment in a German lower mountain range

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Headwater catchments with wetlands represent important buffer areas by decreasing peak discharges and providing water in meteorological droughts. Wetlands act also as key feature of the riverine carbon cycle and are able to store significant amounts of carbon. Therefore, understanding and predicting discharge generating processes in the context of climate change is essential for such catchments. We use a Regional Climate Model (RCM) Ensemble to study possible changes in discharge patterns due to climate change at the Lehstenbach catchment, located in the Fichtelgebirge Mountains. Our aim is to quantitatively estimate periods of hydrological droughts and floods, their temporal length and intensity, their recurrence intervals as well as possible connections to snow melt. In order to achieve this goal, we use the process-based model HydroGeoSphere to simulate discharge until 2100 based on the RCM Ensemble. Statistical Analysis, including Trend and Wavelet Analysis aids us in detecting changing discharge conditions. Discharge seems to follow an increasingly variable pattern making droughts and floods more likely in the future. Since the overall length of drought conditions increases although precipitation amounts remain fairly stable, we identified evapotranspiration and altered precipitation patterns as main driving forces of droughts in this headwater. Snow conditions and subsequent spring floods seem to decrease in likelihood until 2100.