Inconsistent hydrological frequency calculation and attribution analysis of annual runoff of Lancang river basin based on LWHM-LUCC model

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In the context of global climate change and intensive human activities, the runoff process in the Lancang River Basin has been greatly changed. This study proposed a lumped watershed hydrological model considering land use/cover change (LWHM-LUCC) for the frequency calculation and attribution analysis of annual runoff of Lancang River Basin from physical causes aspect. We first detected the variability of precipitation, evaporation, and runoff time series at annual time scale of the Lancang River Basin during 1961–2014 through the hydrological variation diagnosis system. Then, the inconsistent runoff frequency calculation method based on LWHM-LUCC model were applied to analyze the annual runoff frequency distribution in past, current and future period, respectively. Besides, the contribution rates of climate change and human activities on runoff variation were quantitatively determined based on LWHM-LUCC model and scenarios simulation. The result showed that there was an abrupt increase of evaporation in 2002, and an abrupt decrease of runoff in 2004. From the distant past period, near past period, to the current period, the design runoff in the Lancang River Basin showed a declined trend, whereas the runoff in the current and future periods remained basically unchanged, and the difference between current and distant past period was much larger than that between current and near past period. The contribution rates of precipitation, evaporation, land use and other human activities to runoff variation were around 38%, 31%, 0% and 31%, respectively. This indicated climate change has greater impact on runoff variation than human activity in the Lancang River Basin.
