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Changes in low flow regime of the Yarlung Zangbo River Basin during the past two-third century

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Abstract:Steady rising global temperature has already altered regional water cycles in many places around the world and has posed great challenges to local water resources managements. This issue is especially alarming for snow-fed catchments in the southwest drainage divisions and the Qinghai-Tibetan Plateau region in China, where are the headwater regions of most large rivers of China and Southeast Asian. However, quantifying the impacts of long-term changes in climate forcing on local hydrological cycle are still difficult because noise and variability in observed streamflow are relatively much larger than the long-term trends. In this study, long-term streamflow records of two hydrological stations of a pristine river in southwest of China, i.e. Yarlung Zangbo River Basin (YZRB), are collected to detect the changes in regional water cycle during the past 2/3 century (viz. 1955-2015). Analysis of the trend shows that there is no statistically significant trend in either precipitation or total streamflow in the study region. However, significant trends are detected in the timing and amount of annual minimum 7-day flow and in annual groundwater storage-discharge dynamics in at both two stations. Results indicate that low flow and groundwater storage of the YZRB has decreased significantly and timing of annual minimum 7-day flow has advanced about 40 days during the past two-third century, which are not accompanied by significant changes in precipitation and total runoff. Detected changes in long-term low flow regimes are generally consistent with long-term freeze-thaw and annual snow-fraction data over the same area. It suggests that changes in low flow regime of the YZRB may be explained by the global warming. Here we proposed a new method to detect the changes in regional water cycles in the southwest of China and highlights that increase in temperature in the past six decades has caused significant changes in regional hydrological cycle in the YZRB.
Key words: global warming, low flow regime, flow recession, storage-discharge dynamics, Yarlung Zangbo River Basin, snow-fed rivers