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Analysis of impacts of climate variability and human activity on streamflow in the Yanqi Basin, northeast China

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Abstract: Hydrological processes in river systems have been changing under the impacts of both climate variability and human activities. Based on the hydrologic and meteorological data in the Yanqi basin from 1956 to 2011, the trend, characteristics and spatial variation of streamflow change was examined in the study. The long-term trend of climate change and hydrological variations were determined by using both Mann-Kendall and Mann-Whitney nonparametric tests and the complex Morlet continuous wavelet function will be applied to analyzing the annual runoff time series in the study area. The deriving forces of changes in runoff trend of the main stream of the Yanqi basin were explained by anthropogenic activities and climatic changes. By comparing the variation of runoff, precipitation and temperature on the base of runoff periods partition, it is found that climate variation in summer was the main reason for runoff change in summer, autumn and winter, precipitation directly influences the runoff but temperature does it through glacier wastage, precipitation has more weight than temperature in influencing runoff change. A quantitative assessment reveals that local human activities since the 1970s led to a decrease of the water volume diverted into the main stream of the Yanqi Basin. Irrigation and domestic water use were the main reasons for runoff change of rivers in northern part of study area in summer and autumn. Results of the study will provide scientific basis for sustainable use of water resource and for delineate suitable plan for future water resources management in the Yanqi Basin.

Keywords: Stream flow trends; climate change; human activity; change-point analysis