

Hydrological response to land-use changes in a semi-arid region in China

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Abstract In recent years, the discharge of the Laohahe River, China, has shown a dramatic decrease and discontinuous streamflow in the rainy season as the result of climate change, human activities, or both. The objective of this work is to document significant runoff hydrology changes induced by land-use change and to quantify the impacts of observed changes on regional hydrologic regimes. Based on the analysis of the characteristics of precipitation and streamflow from 1964 to 2008, statistical methods and the Variable Infiltration Capacity (VIC) hydrological model were used to estimate the effect of land-use change on discharge in Laohahe basin. Firstly, the streamflow of study area was divided into two periods according to the analyses of long-term annual runoff records using the Pettitt test method. Then the hydrological process was simulated by the VIC hydrological model using observed monthly discharge. Furthermore, the simulated results were compared based on land-use scenarios in 1989, 1999, and 2007, respectively. This method is used to explore the effect of land-use changes on the spatio-temporal distribution of runoff in Laohahe basin. The result shows that land-use change has a direct effect on the spatio-temporal distribution of runoff in the study area, while the human activities including water intake and land-use changes appeared to be the most likely factor contributing to the significant reduction in discharge from 1999 to 2008 in the Laohahe basin.

Key words hydrological response; land-use change; climate change; human activities