Hydrological Research in China: Process Studies, Modelling Approaches and Applications (Proceedings of Chinese PUB International Symposium, Beijing, September 2006). IAHS Publ. 322, 2008, 161-170.

Impacts of climate change on hydrological processes and water resources in the headwater area of the Yellow River

HUI GAO, YANGWEN JIA, CUNWEN NIU, YAQIN QIU & HAO WANG

Department of Water resources, Institute of Water resources & Hydropower Research (IWHR), 20 Che-Gong-Zhuang West Road, Beijing 100044, China

jiayw@iwhr.com

Abstract The headwater area upstream of the Tang-Nai-Hai hydrological gauge station is one of the main runoff generation areas of the Yellow River Basin. Climate change is one of the main reasons for water resources decrease and ecological deterioration in the headwater area in recent years, and analysing of future further change impact is important for water resources planning and management in the basin. In this article, we simulated the changes of both annual and monthly runoffs in the headstream of the Yellow River under air temperature and precipitation change by using the WEP model. WEP is a physically-based distributed model and can reflect the impact of air temperature change on water resources through evapotranspiration change, snow storage and melting change and infiltration capability change in the frozen soil layer. The model was validated using the observed daily discharge data from 1956 to 2000 at the Tang-Nai-Hai station. After validating the model, we assumed eight different schemes with temperature change of ±1, ±2°C and precipitation change by ±10%, ±20% on the basis of historical observed meteorological data. The results indicated that air temperature change had different impacts on annual and monthly runoffs. The temperature increase causes an annual runoff decrease, with an obvious decrease of monthly runoff from May to October because of the evapotranspiration increase, and an increase from November to the following April because of snow storage and melting, and frozen soil infiltration capability changes. The maximum increase is 63.7% in March, 1989, when assuming the air temperature increase of 2°C. Precipitation increase or decrease causes runoff increase or decrease to different extents, and the runoff has a larger change rate than precipitation.

Key words headwater area of the Yellow River; climate change; distributed model; Tang-Nai-Hai