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Response of streamflow to climate change in a sub-basin of the source region of the Yellow River based on a tank model

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Though extensive researches were conducted in the source region of the Yellow River (SRYR) to analysis climate change influence to streamflow, however, few researches concentrate on streamflow of the sub-basin above the Huangheyan station in the SRYR (HSRYR) where a water retaining dam was built in the outlet in 1999. To improve the reservoir regulation strategies, this study try analyzing streamflow change of the HSRYR in a mesoscale. A tank model (TM) considering snowmelt was proposed and calibrated with monthly observation streamflow from 1991 to 1999. In the validation period, though there is a simulation deviation during the water storage and power generation period but a strong predictive power was found by validating with observation data from 2008 to 2013. The model was further validated by the two inside lakes area obtained from Landsat 5, 7, 8 dataset from 2000 to 2014, and significant correlations were found between the simulated streamflow and the two lakes area. Then the Global Climate Model (GCM) HADCM3 data of three emission scenarios (SRA1B, SRB1 and SRA2) were downscaled and used as input to the TM to simulate the streamflow change of three benchmark periods 2011-2030(2020s), 2046-2065(2050s), 2080-2099(2090s), respectively. The results similarly indicated that streamflow has a temporary increase in the 2020s and shown a decrease trend in the long term. Results obtained from SRA1B and SRB1 shown an up-low-up periodic change pattern. However, results obtained from SRA2 shown a gradually decline change pattern. This research is helpful for water resources management and a better understand of streamflow change caused by climate change in the future.