



全球水循环模拟与预报团队

Hydrological Simulation and Prediction Lab

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[108] Wang, T., Yang, D., Fang, B., Yang, W.,
03 Sep 2018

[107] Wang, Y., Yang, H., Gao, B., Wang, T.,
03 Sep 2018

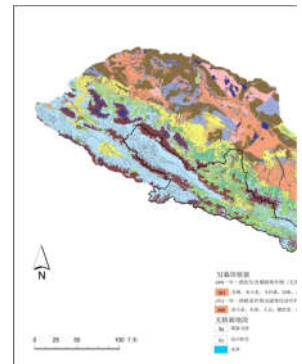
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Research papers

[10] Quantifying the streamflow response to frozen ground degradation in the source region of the Yellow River within the Budyko framework
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ABSTRACT

The source region of the Yellow River (SR) is greatly important for water resources throughout the entire Yellow River Basin. Streamflow in the SR has experienced great changes over the past few decades, which is closely related to the frozen ground degradation; however, the extent of this influence is still unclear. In this study, the air freezing index (AFI) is selected as an indicator for the degree of frozen ground degradation. A water-energy balance equation within the Budyko framework is employed to quantify the streamflow response to the direct impact of climate change, which manifests as changes in the precipitation and potential evapotranspiration, as well as the impact of frozen ground degradation, which can be regarded as part of the indirect impact of climate change. The results show that the direct impact of climate change and the impact of frozen ground degradation can explain 55% and 33%, respectively, of the streamflow decrease for the entire SR from Period 1 (1965–1989) to Period 2 (1990–2003). In the permafrost-dominated region upstream of the Jinai hydrological station, the impact of frozen ground degradation can explain 71% of the streamflow decrease. From Period 2 (1990–2003) to Period 3 (2004–2015), the observed streamflow did not increase as much as the precipitation; this could be attributed to the combined effect of increasing potential evapotranspiration and more importantly, frozen ground degradation. Frozen ground degradation could influence streamflow by increasing the groundwater storage when the active layer thickness increases in permafrost-dominated regions. These findings will help develop a better understanding of the impact of frozen ground degradation on water resources in the Tibetan Plateau.

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