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Climate Change: Future Water Resources of the Yellow River

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ABSTRACT

In the drought stressed Yellow River basin a further decrease in water supply or increase in water demand will have a serious impact on the Yellow River and all who depend on it.

This paper focuses on the water supply and provides an overview of past trends of Yellow River discharge after which the impact of future climate change on the Yellow River water resources are analyzed. We focus on the source regions of the Yellow River, the region most sensitive to climate change. A decrease in the flow rate from this region will severely affect the social-economic development of the middle and lower reaches.

The increased frequency and duration of no-flow events of the middle and lower reaches of the Yellow River severely disrupted the supply of irrigation water in the lower reaches of the Yellow River. Anthropogenic factors are among the most important factors causing the frequent drying-up of the Yellow River. However, natural runoff, precipitation and temperature trends reveal that climate change is a major additional factor contributing to the water crisis. Even in the source region of the Yellow River, with limited human interventions, the Yellow River discharge shows a steadily decreasing trend. The glacier and snow covered areas in this region are highly sensitive to temperature change. Projections show an increase in temperature for this region. Several model studies showed a clear declining trend for the future Yellow River discharge from the source region.

In this study we used a snow and ice melt runoff model that is forced with remotely sensed precipitation and snow cover to estimate the total runoff and the relative contribution of rainfall and melt water to the water supply of the Yellow River. Our analysis showed that the annual basin precipitation equals 419 km^3 of which 32% falls in areas higher than 2000 meter. Preliminary climate change simulations indicated a dramatic increase in rainfall runoff whereas snow and glacial runoff remains fairly constant. The total runoff in the upper Yellow River will increase by about 81% due to climate change. The projected runoff increase in upper Yellow River might alleviate the water stress in the middle and lower reaches of the Yellow River and partly compensate for the expected increase in future water demands. This research clearly demonstrates the importance of incorporating climate change into water resource planning.

KEYWORDS:
Yellow River, Water resources, Climate change, Remote sensing, Runoff modeling