

Impacts of Human Activities on the Hydrological Cycle in the Heihe River Basin, Western China

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This paper focuses the effects of changes in the hydrological cycle during the past fifty years caused by the water resource development on the environment in the Heihe River basin, an inland river of the arid region in the western China. The Heihe River basin consists of three parts, namely the upper mountainous area which is the source of the Heihe River by rather big amount of precipitation and glaciers, the middle oasis area like Zhangye and Jiuquan, and the lower terminal arid area like Ejina. Each area has independent hydrological condition and ecosystem. Surface runoff from the upper mountain area by rain and melt water of snow and glaciers is the only source of water available in the middle oases area and the lower arid area. The increase of water demand in the middle oases area mainly by irrigation for agricultural land has resulted in the decrease of surface water supply for the lower arid area.

The degradation of vegetations and the difficulties of the usage of shallow groundwater in terms of not only quantity, but quality have become serious problems. Even in the middle oasis area, over 80% of the total discharge has been diverted from main river courses to many irrigation canals, resulting in not only the rise of groundwater level inside the cultivated oases, but also the increase of soil salinization area. At the same time, the decrease of discharges in the main river courses have formed deserted area. Developing a distributed hydrological model with the grid based information of land use and irrigation systems, the spatial distribution water budget in the Heihe River basin has been evaluated. The relationship between the water status and the degradation of vegetations and water quality were investigated. Based on this analysis, we found that the strategies of farm production in each area are closely related to hydrological status. Also, using several future scenarios including possible climate change and expansion of the economy of this area, the proper way to use the limited water resources minimize the degradation of the environment will be discussed.