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Spatial-Temporal Evaluation of Human Impacts on Hydrological Cycle and Natural Vegetation in an Arid Area of Northwestern China

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We focus on changes in hydrological cycle and natural vegetation caused by the agricultural development during past 50 years in the Heihe river basin, Gansu Province and Inner Mongolia, China. The river is typically an inland river in an arid area, which originates from glaciers in the upper mountain area, goes through the middle oases area and finally disappears in the lower desert area. The increase of water demand for agricultural development in the middle oases area caused decrease of the discharge in the lower desert area. It caused depletion of terminal lakes.

In the lower desert area, we analyzed 1) groundwater recharge mechanism using stable isotopes, 2) change in water balance using following models and 3) its relation to vegetation using remotely sensed data. We made meteorological and hydrological observations from 2003 to 2005. Based on the observation, we developed both a groundwater model and a new surface energy balance model which uses remotely sensed data.

We illustrated the groundwater recharge mechanism is different in between the desert area with a source of high intensity precipitation and the riverside area with a source of the river water. The contribution of the river water is significant in the terminal area. Based on the water balance analysis, we found that decrease of the discharge in 1990's caused rapid decline of the groundwater level mainly in the terminal area. We detected degradation of natural vegetation in response to the decline of the groundwater level in the terminal area.