

Numerical evaluation of human impacts on hydrological cycle of Ili-Balkhash basin

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The Ili River Basin is stretching over the China and Kazakhstan. It is an internal river that flows into the Balkhash Lake, which is the largest lake in the Central Asia. Its significant discharge comes from the Tian Shan ridge. Thus, elevation and precipitation difference in the basin is very large. Especially, from the middle part of the river to the lower part of the river, precipitation amount is drastically decreased, and there are classified as semi-arid and arid zone. While traditional living form of this region was combination of nomadic grazing and agriculture, there were large-scale developments such as electric power development by a dam construction and agricultural development during the period of the Soviet Union. In addition, under the condition of global warming, the amount of water supplied by glacier melting in the Tian Shan Mountain might decrease. Thus, to evaluate these anthropogenic impacts on hydrological cycle of the basin, we constructed a hydrological model.

The model consists of several modules to simulate hydrological processes. While spatial resolution of river routing is 0.5 degree, runoff calculation is executed with 1km spatial resolution. Time resolution is 1day. Number of tuning parameters is designed to be minimum as possible as we can. Without considering any anthropogenic impacts, simulated results could not follow the actual water level change of the Balkhash Lake after 1980. Thus, to clarify what kind of human impacts is the most significant one, we attempted to consider irrigation to agricultural lands, evaporation from the Kapchagai reservoir and outflow from melted glacier. As a result, we found that irrigation and evaporation from the Kapchagai reservoir are the two important factors which have a significant impact on water level changes of the Balkhash Lake.

Keywords: Ili River, irrigation, Kapchagai reservoir, Balkhash Lake