Fluctuation of discharge from July 1st Glacier in northwest China since 1930s

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[Introduction]

There are glaciers in the Qilian mountains in northwestern China. Precipitation has stored in the glacier once as snow or ice, and the meltwater from the snow and ice flow down as river water or ground water from glaciers depending on the climate conditions. Those meltwater has been used for agriculture or livestock in the downstream. In this way, the water from mountains has been affected on the living people in the Oasis cities located at the foot of the mountains. The purpose of this study is to estimate fluctuation of discharge from the glacier during recent 70 years.

[Observation]

There is a glacier, the name is the July 1st glacier at the northern slope of the Tuolai mountain, which is one of the Qilian mountains. Chinese researchers have carried out observation occasionally for the mass balance and equilibrium lines since 1950s. And Chinese-Japanese co-operated team have carried out observation from June 2002 to August 2005.

[Concept of model improvement and verification]

Past available meteorological data are only temperature and precipitation data On the other hand, Fujita and Ageta, (1999) established a glacier mass balance model required all meteorological data (wind speed, humidity, solar radiation, and so on). Then we improved the model which require only temperature and precipitation.

Calculated discharge using above improved model has been verified comparing to the observed discharge in 2002. Heat balance method using all meteorological parameter has good correspondence with the discharge calculated from only temperature and precipitation.

[Calculation since 1934]

Discharge from the glacier has been calculated using temperature and precipitation data(NCDC) at Jiuquan since 1934. Jiuquan locates from July 1st Glacier the north 70 km. There is only monthly data. Then, we set three data sets of daily temperature fluctuation to monthly average basing on the data from 2002-2003, 2003-2004, 2004-2005. Then, we calculated discharge and mass balance using 3 patterns of daily data.

[Result and discussion]

All calculated discharges and mass balances have similar fluctuations. From 1990s shrinkage of glacier has accelerated and the discharge from glacier has been increased since temperature increase.

However, calculated mass balances and discharges slightly differ depending on the pattern of daily temperature and precipitation. The reason was combination of temperature and precipitation, since accumulation of snow strongly depending in the combination of temperature and precipitation.

[Summary]

1)Discharge can be estimated with high accuracy by only daily temperature and precipitation data by improved model.

2)Shrinkage of glacier has been accelerated and discharge from glacier has increased in 1990s.

3)Combination of daily temperature and precipitation affect on the calculated mass balance and discharge.