

Reconstruction of glacier runoff using ice core data since the 1600s, northwest China

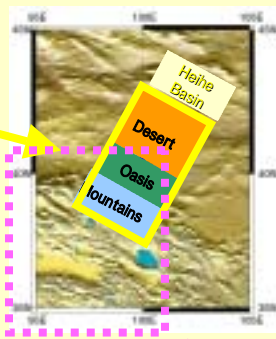
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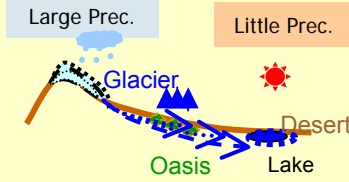
Study area



Northwest China Heihe river basin
Qilian mountains



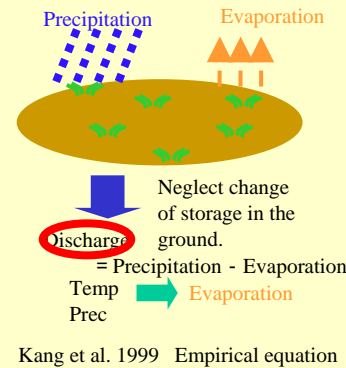
Back ground & Purpose



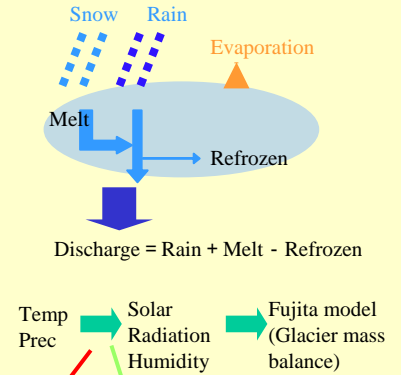
Melt water from mountain area has been significant for human activity.

Estimation of historical glacier runoff

Discharge from Glacier-free area



Discharge from Glacier



Meteorological data

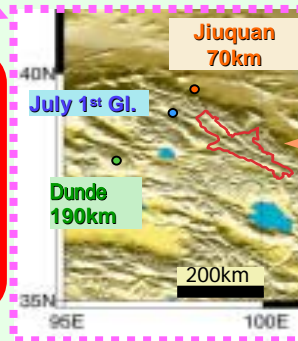


July 1st Glacier(2002-2004)
 (4300m)
 Temperature, Precipitation
 Solar radiation, Humidity, Wind speed,...

Proxy data

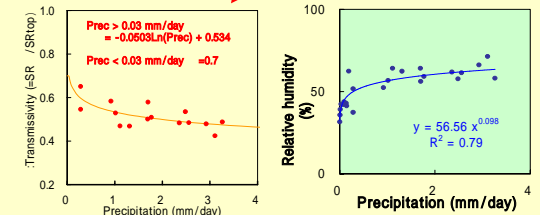
Jiuquan (NCDC)(1935-2003)
 (1400m)
 Temperature, Precipitation

Dunde (ice core)(1606-1989)
 (5300m)
 $\delta^{18}O$ (Temperature)
 Accumulation(Precipitation)
 Thompson et al.(1989)

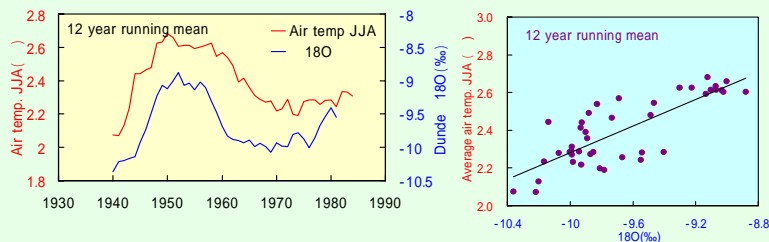


Yinlaoxia Basin
 Calculated area

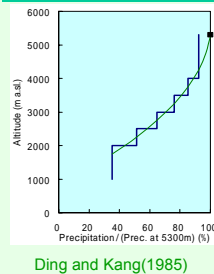
Glacier area was assumed to be constant.



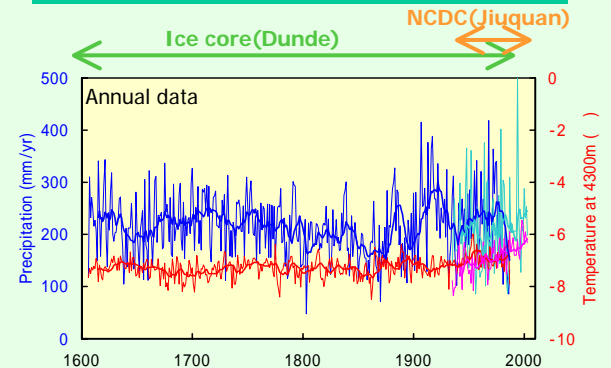
Temperature estimated from ice core data



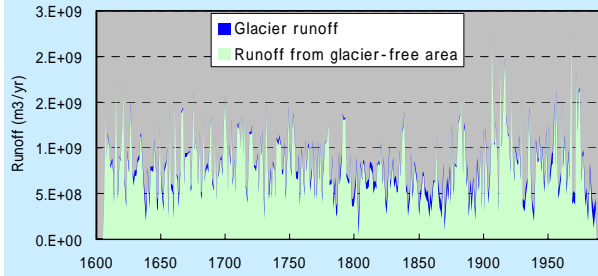
Altitudinal distribution of precipitation



Precipitation & temperature

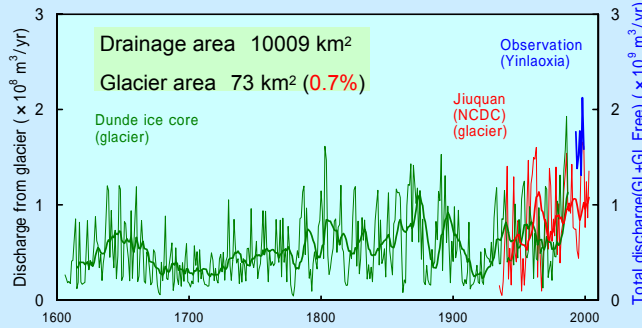


Runoff from glacier and glacier-free area



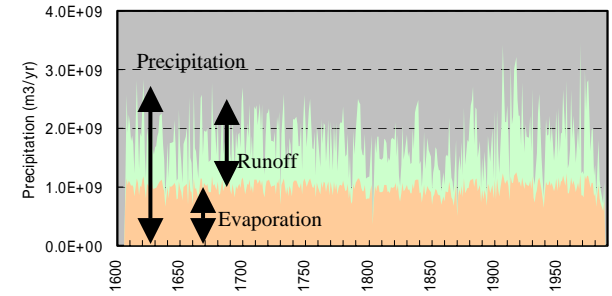
Calculated runoff at Yinglaoxia basin from ice core data.

Glacier runoff compared to observation



Glacier runoff attained about 10% of total runoff.

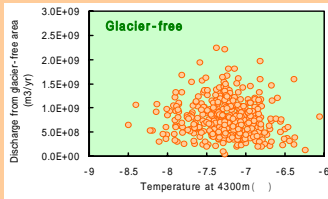
Runoff from glacier free area



Runoff from glacier free area depends on precipitation.

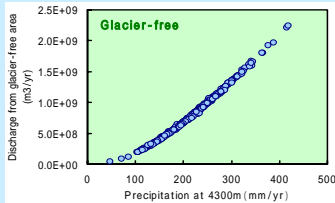
Characteristic of runoff from glacier-free area

Temperature

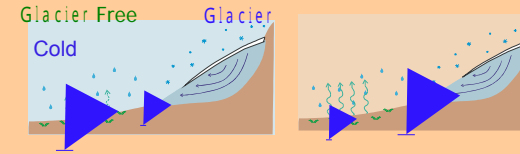
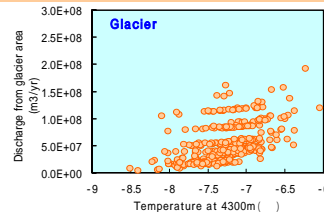


Precipitation

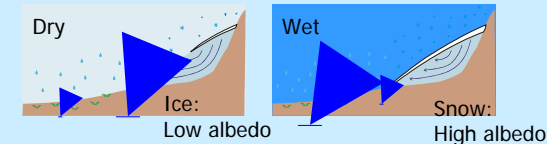
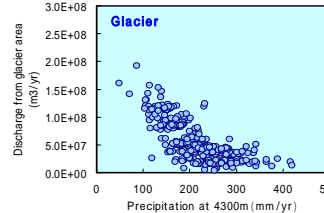
Runoff from glacier-free area depends on precipitation.



Characteristic of Glacier runoff

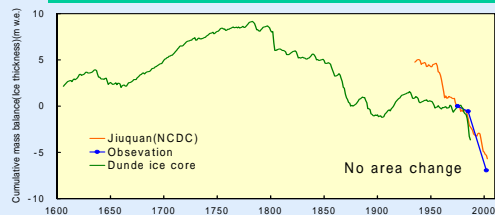


Temperature increase
Increase of glacier melt
discharge Increase



Precipitation increase
Glacier is covered with snow.
Glacier surface albedo become high.
Glacier melt decrease.
discharge decrease

Fluctuation of July 1st Glacier

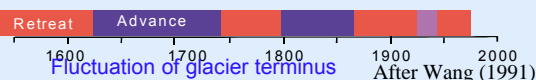


Further study

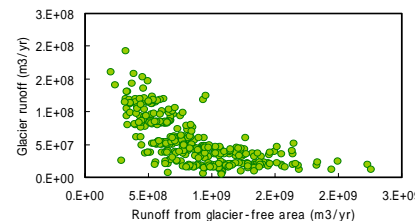
Model
Fluctuation of
glacier terminus

Verification

Measurement
Moraine dating



Role of Glacier



Glacier runoff has made up a shortage of discharge from glacier free area.

Summary

Reconstruction the runoff fluctuation at Yinlaoxia basin using ice core data.

Less annual precipitation

Glacier free area : Small runoff

Glacier area : Large runoff

Glacier runoff stable water supply