Some preliminary studies on hydrological process and response in cold regions--basinal scale

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How glacier and snow impact on river runoff and baseflow?

The roles of permafrost active layer on surface runoff?
Permafrost covered 80% of 11,000km².
Field observation in experimental watershed

Variable Infiltration Curve

Permafrost vs. non-permafrost

Vegetation parameters

Soil thermal and moisture
Runoff observation vs. simulation in different section

1.4B
0.6B
0.37B
0.1B

B=billion cubic metre
Runoff capacity of different land surface in Shule River basin

G-glacier; C-alpine desert; Ag-alpine steppe; Am-alpine meadow; Sm-swamp meadow; S-shrub
Distributions of river runoff recharged by different water sources

- **Shiyang river**
  - Rainfall

- **Ulungur river**
  - Snowmelt

- **Kashi river**
  - Rainfall-Snowmelt

- **Aksu river**
  - Glacier and snow melt
Impacts of water consumption patterns

Agriculture

Shiyang river

Runoff (m³/s)

Month

1 2 3 4 5 6 7 8 9 10 11 12

Ulungur river

Runoff (m³/s)

Month

1 2 3 4 5 6 7 8 9 10 11 12

Kashi river

Runoff (m³/s)

Month

1 2 3 4 5 6 7 8 9 10 11 12

Aksu river

Runoff (m³/s)

Month

1 2 3 4 5 6 7 8 9 10 11 12

Ecology

Agriculture & Ecology
Response of river runoff to landscape change

Snowmelt recharged river basin

Rainfall recharged river basin
Impact of cryospheric factors on river discharge

(a) Observed runoff depth
- Non-glacier
- Including glacier

(b) Observed runoff depth
- Full energy open
- Full energy closed

(c) Observed runoff depth
- Frozen soil open
- Frozen soil closed

(d) Observed runoff depth
- Simulated runoff depth

Permafrost vs. non-permafrost

flood

recession
Differences of hydrological characters and water balance in middle latitudes and Circum-Arctic regions. What dominated the surface runoff change in permafrost regions?

a) Annual runoff trend (1951-1985) (mm/a)

b) Annual runoff trend (1986-2015) (mm/a)

c) Winter baseflow trend (1951-1985) (mm/a)

d) Winter baseflow trend (1986-2015) (mm/a)

e) Summer flood trend (1951-1985) (mm/a)

f) Summer flood trend (1986-2015) (mm/a)
Differences of hydrological characters and water balance in middle latitudes and Circum-Arctic regions. What dominated the surface runoff change in permafrost regions?
The similarity of Alaska and high-latitude Continent in climate, permafrost conditions and landscape makes the Alaska a ideal study region to detect the hydrological mechanism differences in middle latitudes and Arctic regions.