Cryospheric and related observations in Qilian Mountains

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Where we are

Northeast of Tibet Plateau
Where we are

- Upper stream of Shule River
- Qiyi
- Hulu Valley
- Ningchan
- Long-term observation
- Short-term scientific expedition
- Dunde
- Bayi
- Yanglong
- Gangri
- Shuiguan
What we observe

1. Upper stream of Shule River
2. Qiyi Glacier
3. Hulu Valley
4. Ningchan River
1. Upper stream of Shule River
Meteorology

10m Tower, 3900m

10m Tower, 3900m

2008.7~
River runoff, 4200m, 3900m, 3400m, 2500m
Permafrost: 20 boreholes

2008 年（ZK1-ZK10）
2009 年（ZK11-ZK20）
Spatial distribution of different permafrost types
13 Ecological sites
### Observational parameters for each plot

<table>
<thead>
<tr>
<th>Plot number</th>
<th>Meteorology</th>
<th>Vegetation</th>
<th>Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLP1</td>
<td>AT, RH, WVP</td>
<td>C, B, SD</td>
<td>ST, SW, SS, SHF, SOC, TN, SEA, SMBA, SCM, SGHGs</td>
</tr>
<tr>
<td>SLP2</td>
<td>AT, RH, WVP, TR, WS, WD, SD</td>
<td>C, B, SD, P</td>
<td>ST, SW, SS, SHF, SOC, TN, SEA, SMBA, SCM, SGHGs</td>
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<tr>
<td>SLP3</td>
<td>AT, RH, WVP, P, WS, WD</td>
<td>C, B, SD</td>
<td>SOC, TN, SEA, SMBA, SCM, SGHGs</td>
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<td>AT, RH, WVP, TR, WS, WD, SD</td>
<td>C, B, SD</td>
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<tr>
<td>SLP6</td>
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<td>SOC, TN, SEA, SMBA, SCM</td>
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<td>AT, RH, WVP, P, WS, WD</td>
<td>C, B, SD</td>
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</table>

AT, air temperature; RH, relative humidity; WVP, water vapor pressure; TR, total radiation; WS, wind speed; WD, wind direction; SD, Snow depth; P, precipitation; C, coverage; B, biomass; SD, species diversity; P, phenology; ST, soil temperature; SW, soil water content; SS, soil salinity; SHF, soil heat flux; SOC, soil organic carbon; TN, total nitrogen; SEA, soil enzyme activities; SMBA, soil microbial biomass activities; SCM, soil culturable microbes (bacteria, fungi, actinomycetes); SGHGs, concentrations and fluxes of soil greenhouse gases (CO2, CH4 and N2O).
Laohu Valley 1958-1962, 1970s', 1980s', since 2005-
Map showing the detailed allocations of the observation fields and the lining poles
Laohu Valley

Glacier No. 12, 9.8 km long, 21.03 km²; the largest Valley glacier in Qilian Mt.
Meteorology

(10m tower, 2009.06)

(4m, 2009.08—)

(4m, 2008.09—)
Mass balance
Surface movement

图 例

- 花杆点
- 流速矢量示意
- 等高线
- 冰川边界
Surface movement
Terminus and area Variation based on Map, RS and In situ
Surface elevation Variation

1957-1993

1993-2009

Legend:
- Green: < -50
- Blue: -50 to -40
- Blueish-green: -40 to -30
- Greenish-blue: -30 to -20
- Green: -20 to -10
- Yellow: -10 to 0
- Orange: 0 to 10
- Brownish-orange: 10 to 20
- Red: 20 to 30
- Dark red: > 30

- Yellow: < -50
- Blue: -50 to -40
- Blueish-green: -40 to -30
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- Red: 20 to 30
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Scale:
- 0 500 1,000 2,000 meters
• Ice core temperature (5070m, 4900m, 4550m)
Runoff component

Precipitation (every time)  Melt water (1/7 day)  Groundwater (1/7 day)

Flow area: 1150 km²
Ice area: 52.5 km²
Inclination: 10.2°
River length: 65 km
Snow ice, Melting water, 71.8 ± 2.7%
Precipitation, 13.8 ± 2.3%
Groundwater 14.4 ± 2.4%

14
Ice cores

Ice cores, depths 172.6 m, 166 m
Greenhouse gases (CO2 and CH4)

Since 2008.7- , once per week.
Black Carbon
aerosol particles
GPR monitoring permafrost

Glacier No.12

Probe position

Probe 1
Freeze: 1.25m

Freeze limit

Probe 3
Depth 0.86m

No frost encountered
What we observe

1. Upper stream of Shule River
2. Qiyi Glacier
3. Hulu Valley
4. Ningchan River
Qiyi Glacier

Mass balance movement

3.66km long, 2.7km²
## Terninus and area Variation

<table>
<thead>
<tr>
<th>Year</th>
<th>Area/km²</th>
<th>Length/km</th>
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<tbody>
<tr>
<td>1958</td>
<td>2.895</td>
<td>3.8</td>
</tr>
<tr>
<td>1975</td>
<td>2.871</td>
<td>3.76</td>
</tr>
<tr>
<td>1985</td>
<td>2.866</td>
<td>3.75</td>
</tr>
<tr>
<td>2005</td>
<td>2.698</td>
<td>3.66</td>
</tr>
</tbody>
</table>
1984年和2007年两次测厚点位置

1984年和2007年

七一冰川雷达测厚结果以及近23年来的厚度变化
Meteorology and hydrology
What we observe

1. Upper stream of Shule River
2. Qiyi Glacier
3. Hulu Valley
4. Ningchan River
Field experiment: Meteorology

5 AWS
Field experiment: **Meteorology**

8 weighted rainfall recorders (2980~4640m)
Field experiment: Meteorology

precipitation calibration

Gauge measured

Alter shelter

Pit gauge

DFIR
Field experiment: Meteorology

Evapotranspiration

Manually

Auto
Area of Shiyi Glacier: 0.48 km², larger than average area of glaciers in Heihe River Watershed (0.33 km²)
Observational Network Dataset

3-half years Continuously observation

- Glacier mass balance
- Surface velocity
- Glacial-meteorology
- Ice temperature (12 m depth)
- RTK-GPS topography survey
- GRP Ice thickness
Field experiment: Glacier

Shiyi glacier

GPS, Lidar

Stakes
Field experiment: Snow

Fixed point: 7 snow depth recorders

Snow pillow and flow capt sensor

SnowFork
Field experiment: Snow

Watershed

Terrestrial photographic methods
Field experiment: Frozen soil

- Content: soil temperature and water content
- Goal: SVATs

Grassland  Meadow

Wetland  Cold desert

2980m
Field experiment: Runoff

1. Measured 3tims/day manually
2. 2 hobos (1times/half hour)
3. Terrestrial photographic methods
What we observe

1. Upper stream of Shule River
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4. Ningchan River
Meteorology and hydrology

- AWS
- Stake
- Elevation
- Glacier
- Runoff
Ningchan No.3

length: 1.8 km
Area: 1.39 km²

Mass balance
Movement
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Chen Rensheng
Ye Baisheng
Li Zhongqin
Wang Ninglian

....
Welcome to Qilian Mountain Station!

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Thanks for your attention