Status of cryospheric observations and gaps in China

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(SKLCS, CAREERI, CAS; also CAMS, CMA)

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Potential impacted area

Most direct impacted area

High Asia Cryosphere

- ~45% world population
- 3 oceans
- arid/semi-arid
Outline

• Glacier (Chinese Acad. Sci--CAS)
• Snow cover (China Meteor. Adm.)
• Frozen ground/permafrost (CAS, CMA)
• Sea ice (National Oceanography Adm.)
• River ice (Ministry of Water Resources)
• Gaps
Glaciers monitored in long-term and summer season

Legend

- **Black**: Long-term stations (3)
- **Blue**: Monitor sites (6)
- **Red**: New sites (8)
Permafrost observation network in this region
Surface soil temperature, therefore **seasonal frozen ground** are monitored country-wide.

- more than 2400 stations
- 8 layers: 5cm, 10cm, 15cm, 20cm, 40cm, 80cm, 160cm, 320cm
Snow cover observations at meteorological stations

- **daily**
  - Snow depth
  - Snow pressure
- **monthly**
  - Max. snow depth
  - Max. snow pressure
  - Snow cover days
- **Number of stations** is almost steady since 1960s.
Problems for daily snow cover data

- Around 756 stations, but with some data problems:
  - Stations with both SD and SP in the same day at least 1 day in a year (filled circle)
  - No data at all ("+") in figure
  - Missing either SD or SP in each day (open circle)
Anomaly of sea ice changes in Bohai Sea

(Blue bars: sea ice; Red curve: solar activity; Red bars: ENSO)
In average, 3 day earlier for break-up, 5 days later for freeze-up, 8 days shorter of frost duration in north China rivers
Observation: GAPS

Annual Global Monitoring  1-15/10/2008

SYNOP reports made at 06, 12 and 18 UTC at RBSN stations

Percentage of reports received:
- 90 to 100 per cent (2912 stations)
- 45 to 90 per cent (697 stations)
- Less than 45 per cent (325 stations)
- Silent stations (350 stations)

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Area above 4000 m a.s.l.
Area above 5000 m a.s.l.
Area above 6000 m a.s.l.
<table>
<thead>
<tr>
<th>Applications</th>
<th>Essential Cryospheric Variables (ECV) *</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMIP3-5, CLM, Snow-melt floods forecast, degree-day model, energy-balance model</td>
<td>Area ( (S) ), depth ( (h) ), SWE, snow cover duration ( (SCD) ), albedo, density, water content, accumulation, submilation, snow temperature, rainfall ratio, surface energy exchange</td>
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* Green: operated ECV
## Gaps ___ glacier

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<tr>
<td>• Dynamic models,</td>
<td>Mass balance (MB), ELA, terminal position, ice temperature, ice flow, geometric shape (length, width, area, thickness, volume), surface energy balance</td>
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<tr>
<td>• Meltwater runoff,</td>
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<td>• Basin-scale degree-day model (DDF),</td>
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<td>• Energy-balance model</td>
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Gaps ___ frozen ground

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<tr>
<td>• Permafrost models,</td>
<td>Soil temperature, ice content, ACL, zero curtain, soil types, humus, vegetation types, talik, surface energy balance, low limit, geomorphology</td>
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<tr>
<td>• CLM,</td>
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<tr>
<td>• FG-Atmospheric coupled models</td>
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<tr>
<td>Sea ice models</td>
<td>concentration, thickness, area, open water, snow cover on ice, roughness (ridging), frozen date, melt off date, salinity, ice temperature, transparency, flow vector, surface energy balance</td>
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<tr>
<td>Fishing</td>
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<td>Gas station</td>
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<td>harbour</td>
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<tr>
<td>River ice</td>
<td>Length of frozen river, thickness, frozen date, break-up date, snow cover on ice, concentration, types, roughness, ice volume, width, flow velocity</td>
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<tr>
<td>Lake ice</td>
<td>Frozen date, break-up date, thickness, snow cover on ice, concentration, temperature, salinity, surface energy balance</td>
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Summary

- Existing nice network on High Asia
- Harsh condition of HA not enable observe all ECVs, IGOS-C
- GCW may need define ECVs in every specific region, i.e., regional standards
- Which ECVs should be international homogeneous standards, which should be regional ones?
- Define baseline reference sites and integrated (supersite)