SAON Board meeting
(Fairbanks, 16-17 March 2016)

Global Cryosphere Watch (GCW)

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Chief, Observing Systems Division, WMO
GCW Mission

To provide authoritative, understandable, and useable data, information, and analyses on the past, current and future state of the cryosphere to meet the needs of WMO Members and partners in delivering services to users, the media, public, decision and policy makers.
WMO needs to have a focus on global cryosphere issues to be able to provide authoritative information to meet Members’ responsibilities on regional and global weather, climate, water and related environmental matters....Cg-16

Changes in the cryosphere can have significant impacts on....

The Global Earth System:
• Sea level rise
• Climate
• Ocean circulation
• Atmospheric circulation

Regional and local impacts:
• Natural resources and hazards
• Ecosystems
• Food production and fisheries
• Infrastructure
• Transportation
• Recreation
• GHG emissions
GCW activities and added value

Observations
  o **CryoNet**: Core network of surface observations
  o Best practices & guidelines, intercomparisons
  o Contributing to WMO’s space-based capabilities database **OSCAR**

Data sharing & exchange
  o Developing **GCW Data Portal** with up-to-date information on the state of the cryosphere
  o Producing unique hemispheric products, e.g., “snow anomaly trackers” for SCE and SWE in collaboration with partners
  o Engaging in historical data rescue (e.g., snow depth)
  o Building a glossary of cryospheric terms

Developing international training, outreach materials; co-sponsoring workshops
Organizational structure of GCW
Establish the core network of GCW surface measurement sites – CryoNet.

CryoNet is one part of the whole GCW observing system, which is a component observing system of the WMO Integrated Global Observing System (WIGOS).

CryoNet covers all components of the cryosphere (glaciers, ice shelves, ice sheets, snow, permafrost, sea ice, river/lake ice) through an extensive approach of in-situ observations.

CryoNet is initially comprised of existing stations/sites, rather than creating new sites.

…an immediate priority in GCW development.
CryoNet concept

See: [http://globalcryospherewatch.org/cryonet/site_types.html](http://globalcryospherewatch.org/cryonet/site_types.html)

CryoNet STATIONS

- measures at least one variable of a cryosphere component (e.g. snow, permafrost, sea ice...)
  - has to fulfill CryoNet minimum requirements
  - must have ancillary meteorological measurements
  - has the target of long-term operation (primary) or long-term operational commitment with 10+ years record (reference)

_Potential attributes: primary, reference, cal/val, research_

CryoNet SITES

- contain two or more coordinated stations (at least one is a CryoNet station) with varying capabilities that are coordinated as a local cluster
- must have a concept describing the research approach and the site management

_Potential attributes: basic, integrated_
CryoNet Station Minimum Requirements

1. **Meeting Core CryoNet Measurement Requirements**: The station shall measure at least one of the variables of one of the cryosphere components (i.e. snow, solid precipitation, lake and river ice, sea ice, glaciers, frozen ground and permafrost). The station location is chosen such that cryospheric measurements are representative of the surrounding region, and such representativeness needs to be clearly described.

2. **Commitment of Operational Continuity**: The station must be active. The responsible agencies are committed, to the extent reasonable, to sustaining long-term observations of at least one cryosphere component. There must be a commitment to continue measurements for a minimum of four (4) years.

3. **Metadata Up to Date and Availability**: The station metadata, including all metadata describing the station characteristics and observational programme, are kept up-to-date and available in the GCW Portal as the interface to the WIGOS Information Resource (WIR).

4. **Compliance with Agreed Regulatory Practice**: The station observational procedures, the instruments and method of observations, quality control practices, etc., should follow GCW endorsed regulations, manuals, guides and, to the extent possible, the recommended best practices.

5. **Data and Ancillary Data Freely Available**: Data are made freely available, and whenever possible in near real-time. In situ ancillary meteorological observations, as required by CryoNet best practices, should also be available with documented quality.

6. **Competency of Staff**: Personnel must be trained in the operation and maintenance of the station.
CryoNet Site Minimum Requirements

1. A site comprises at least one CryoNet station.
2. Integrated sites have technical supporting staff.
3. Integrated sites have training capability.
4. There is a long-term financial commitment.
5. Data are made freely available, and whenever possible in (near) real-time.
CryoNet Sites (pre-operational)

Approved for pre-operational testing by Cg-17

7 new Sites proposed in Feb. 2016 at the Salekhard workshop for the Arctic and sub-Arctic
## Proposed new Sites (Feb. 2016)

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Country</th>
<th>Type</th>
<th>Slce</th>
<th>R,Lice</th>
<th>Snow</th>
<th>Glacier</th>
<th>Permafrost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beliy</td>
<td>Russia</td>
<td>Arctic</td>
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<td>2</td>
<td>Svalbard</td>
<td>NO/RU</td>
<td>Arctic</td>
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<tr>
<td>3</td>
<td>Tavan Bogd</td>
<td>Mongolia</td>
<td>HiM/Altai</td>
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<tr>
<td>4</td>
<td>Chersky</td>
<td>Int’l/Ru</td>
<td>SubA</td>
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<td>5</td>
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<td>6</td>
<td>INTERACT</td>
<td>Int’l/</td>
<td>SubA</td>
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<tr>
<td>7</td>
<td>IMB</td>
<td>USA</td>
<td>Arctic</td>
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</table>
Submission of proposals for CryoNet

Welcome to the GCW Station/Site Questionnaire

This questionnaire system is for providing detailed information on potential GCW surface network stations or CryoNet sites and for updating information on current sites. The questionnaire is typically used in preparation for a CryoNet workshop, later serving as an application for a station to be part of the GCW network. Presentation at a workshop is recommended but not required. The questionnaire must be completed online. Questions? Contact the CryoNet Team. Additional information:

- The application process
- A preview (PDF) of the questionnaire

Please login:

Email Address: Enter Email
Password: 

Login

or:

Create a new account
The GCW Website does not contain any raw data. Instead, data can be accessed through the GCW Data Portal. The Portal is a web interface that contains information about datasets (metadata), but not the data itself. Instead, it links to datasets that are stored at partner data centres. It is compatible with the WMO Information Service (WIS). The GCW Portal was developed by the Norwegian Meteorological Institute ("Metno"). It is in a pre-operational phase at this time.*

*The GCW Data Portal is currently considered as a pre-operational service. It is populated with metadata harvested from a number of contributing data centres, but data remains in the original location and are served through the interfaces supported by the originating data centre. The process of harvesting, filtering and translating metadata is still under development and will be modified through dialogue with contributing data centres and WMO activities organised through WIS and WIGOS.
The website differs from the METNO GCW data portal in that it contains more dynamic information (news, state of the cryosphere plots, highlights, calendar), as well as background, higher-level information, GCW documents, and outreach material. It links to the METNO data portal.

http://globalcryospherewatch.org
New Trackers (coming soon)

**APP-x Surface Temperature Tracker**
- Surface Temp

**APP-x Broadband Albedo Tracker**
- Broadband Albedo

**APP-x Ice Thickness Tracker**
- Ice Thickness
## Snow Dataset Inventory
(satellite-derived, *in situ*, and analysis/reanalysis)

<table>
<thead>
<tr>
<th>Product(s)</th>
<th>Type</th>
<th>Organization</th>
<th>Description</th>
<th>Period</th>
<th>Areal Coverage</th>
<th>Resolution</th>
<th>Variables</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>GlobSnow SWE</td>
<td>Satellite</td>
<td>ESA, Finnish Meteorological Institute (FMI)</td>
<td>Combination of climate station snow depth observations and forward microwave emission model simulations with SMMR and SSM/I satellite passive microwave data</td>
<td>1979-</td>
<td>Non-alpine Northern Hemisphere</td>
<td>25 km</td>
<td>SWE</td>
<td>Daily; week monthly</td>
</tr>
<tr>
<td>GlobSnow Snow Extent</td>
<td>Satellite</td>
<td>ESA, Finnish Meteorological Institute (FMI)</td>
<td>Estimation of fractional snow covered area from SCAmod algorithm</td>
<td>1995-</td>
<td>Northern Hemisphere</td>
<td>0.01 deg</td>
<td>Fractional Snow Cover</td>
<td>Daily; week monthly</td>
</tr>
<tr>
<td>NASA Standard AMSR-E</td>
<td>Satellite</td>
<td>NASA</td>
<td>19 and 37 GHz Tb difference; enhancements for vegetation and grain size evolution; distinction between shallow and deep snow</td>
<td>2002-2011</td>
<td>Northern Hemisphere</td>
<td>25 km</td>
<td>SWE</td>
<td>Daily; pent-monthly</td>
</tr>
<tr>
<td>NASA Prototype AMSR-E</td>
<td>Satellite</td>
<td>NASA</td>
<td>Combination of numerical techniques, snow emission modeling and climatology</td>
<td>2002-2011</td>
<td>Northern Hemisphere</td>
<td>25 km</td>
<td>SWE</td>
<td>Daily; monthly</td>
</tr>
<tr>
<td>NOAA AMSR2 Snow Products</td>
<td>Satellite</td>
<td>NOAA</td>
<td>Variation of NASA AMSR-E methodology</td>
<td>2014</td>
<td>Global</td>
<td>25 km</td>
<td>Snow Cover, Depth, SWE</td>
<td>Daily</td>
</tr>
</tbody>
</table>
Measurement Standards and Best Practices

Step 1: Inventory of existing guidelines:

<table>
<thead>
<tr>
<th>Cryosphere Element</th>
<th>Existing Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permafrost</td>
<td>Smith and Brown (2009), GTN-P (2012)</td>
</tr>
</tbody>
</table>

Step 2: GCW works through these documents, engages the community, and reaches a consensus on best practices for each variable.
Requirements and Capability for observations (in progress)

- GCW Requirements are being formulated and documented on the GCW website;

- They will draw from various sets of existing user requirements and will be vetted by the scientific community;

- Those requirements will become part of the WMO Rolling Review of Requirements (RRR);

- Will be accessible through the Observing Systems Capability Analysis and Review Tool (OSCAR), the official source for WMO requirements, which has a cryosphere theme;

- Need for a new application area “GCW or Polar Obs”.

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**Global Cryosphere Watch**

**Observational Requirements**

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<td>Ice thickness</td>
<td>Sea ice</td>
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<td>-</td>
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<td>WCRP (OSCAR)</td>
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<tr>
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<td>Sea ice</td>
<td>IGOS Climate</td>
<td>0 m</td>
<td>10 m</td>
<td>10 m</td>
<td>0.5 m</td>
<td>-</td>
<td>500 km</td>
<td>1 day</td>
<td>IGOS 20C</td>
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<td>Sea ice</td>
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<td>Ice thickness</td>
<td>Sea ice</td>
<td>High Res NWP</td>
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<td>Ice motion</td>
<td>Sea ice</td>
<td>IGOS Climate</td>
<td>0 km day</td>
<td>100 km day</td>
<td>100 km day</td>
<td>0.5 km day</td>
<td>-</td>
<td>25 km</td>
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Questions?
Thank you