The Global Cryosphere Watch

Jeff Key

NOAA/NESDIS, Madison, Wisconsin USA
The cryosphere collectively describes elements of the earth system containing water in its frozen state and includes: solid precipitation, snow cover, sea ice, lake and river ice, glaciers, ice caps, ice sheets, ice shelves, permafrost and seasonally frozen ground. The cryosphere is global, affecting ~100 countries.
Assessment with the goal of integration: *Integrated Global Observing Strategy Partnership*

The IGOS themes were developed primarily to assess current observing systems, including capabilities and requirements.
The IGOS Cryosphere Theme (2007)

Global Cryosphere Watch
The Global Cryosphere Watch (GCW)

The 16th WMO Congress (2011) agreed that “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” and decided to embark on the development of the Global Cryosphere Watch (GCW), as an IPY Legacy, with a view of an operational GCW.
Mission: GCW will 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.

GCW will:

• Implement the IGOS (Integrated Global Observing Strategy) Cryosphere Theme (CryOS);

• Facilitate reliable, comprehensive observations through an integrated observing approach in collaboration with relevant national and international programmes and agencies;

• Provide the scientific community with the means to predict the future state of the cryosphere;

• Facilitate the assessment of changes in the cryosphere and their impact; support decision making and environmental policy development;

• Provide authoritative information on the current state and projected fate of the cryosphere for use by the scientific community, media, public, decision and policy makers – meet user needs.
IGOS Cryosphere Theme Report published

WMO 15th Congress welcomes proposal for GCW

WMO 16th Congress approves GCW development

First GCW Implementation Workshop (Geneva)

First Snow Watch workshop (Toronto)

CryoNet Team meeting (Reykjavik)

First CryoNet workshop (Vienna)

Cg-17 GCW Implement.

Asia CryoNet workshop (Beijing)

Interim Steering Group meeting (Reykjavik)

South America CryoNet workshop

2007
2008
2009
2010
2011
2012
2013
2014
2015
2016

Pre-operational

GCW Development History
The WMO Executive Council expert panel on Polar Observations, Research, and Services (EC-PORS) oversees GCW.
What is GCW doing?

- developing a network of surface observations called "CryoNet", which builds on existing networks;
- developing measurement guidelines and best practices;
- refining observational requirements for the WMO Rolling Review of Requirements;
- engaging in and supporting, intercomparisons of products, e.g., the GCW Snow Watch project;
- contributing to WMO’s space-based capabilities database (with PSTG);
- creating unique products, e.g., the SWE Tracker, in collaboration with partners;
- engaging in historical data rescue (e.g., snow depth);
- building a snow and ice glossary;
- developing international training and outreach materials;
- providing up-to-date information on the state of the cryosphere;
- providing access to data through a portal;
- co-sponsoring workshops.
CryoNet – the core GCW Network

…an immediate priority in GCW development.

- 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.
“IUGG urges snow and ice scientists, practitioners, and scientists from related disciplines to adopt these new schemes as standards.”
Requirements and Capability for observations

- 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”.

Observational Requirements

GCW observational requirements are being formulated. They will draw from various sets of existing user requirements and will be vetted by the scientific community. They will become part of the WMO Rolling Review of Requirements (RRR) and will be accessible through the Observing Systems Capability Analysis and Review Tool (OSCAR), which has a cryosphere theme. OSCAR is the official source for WMO requirements. The IGOS Cryosphere Theme Report (see Documents) contains the most comprehensive set of observational capabilities and requirements for the cryosphere. It is the starting point for GCW. The IGOS and OSCAR cryosphere requirements are given below. Click the filter options button to filter the results. Each entry in the table gives the current measurement capability in green, the threshold requirement (minimum necessary) in blue, and the objective requirement (target) in orange, if available.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Element</th>
<th>Application Area</th>
<th>Special Conditions</th>
<th>Measurement Range, Low</th>
<th>Measurement Range, High</th>
<th>Uncertainty</th>
<th>Spatial</th>
<th>Temporal</th>
<th>Timeliness</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice thickness</td>
<td>Sea ice</td>
<td>CUC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>WCSP (OSCAR)</td>
</tr>
<tr>
<td>Ice thickness</td>
<td>Sea ice</td>
<td>IGOS Climate</td>
<td>0 m</td>
<td>10 m</td>
<td>0.5 m</td>
<td>0.5 km</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>IGOS 2OC</td>
</tr>
<tr>
<td>Ice thickness</td>
<td>Sea ice</td>
<td>IGOS Operational</td>
<td>0 m</td>
<td>10 m</td>
<td>10%</td>
<td>0.5 km</td>
<td>25 km</td>
<td>1 week</td>
<td>1 month</td>
<td>IGOS 2OC</td>
</tr>
<tr>
<td>Ice thickness</td>
<td>Sea ice</td>
<td>Global NWP</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>John Eyn (OSCAR)</td>
</tr>
<tr>
<td>Ice thickness</td>
<td>Sea ice</td>
<td>High Res NWP</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>160 cm</td>
<td>40 km</td>
<td>2 day</td>
<td>12 hour</td>
<td>T Monnet (OSCAR)</td>
</tr>
<tr>
<td>Ice thickness</td>
<td>Sea ice</td>
<td>Climate-OORC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1 cm</td>
<td>500 km</td>
<td>7 day</td>
<td>24 hour</td>
<td>OORC (OSCAR)</td>
</tr>
<tr>
<td>Ice motion</td>
<td>Sea ice</td>
<td>IGOS Climate</td>
<td>0 km day⁻¹</td>
<td>100 km day⁻¹</td>
<td>3 km day⁻¹</td>
<td>5 km day⁻¹</td>
<td>1 km</td>
<td>2 day</td>
<td>1 day</td>
<td>IGOS 2OC</td>
</tr>
<tr>
<td>Ice motion</td>
<td>Sea ice</td>
<td>IGOS Operational</td>
<td>0 km day⁻¹</td>
<td>100 km day⁻¹</td>
<td>3 km day⁻¹</td>
<td>10 km day⁰</td>
<td>1 km</td>
<td>2 day</td>
<td>1 day</td>
<td>IGOS 2OC</td>
</tr>
</tbody>
</table>
Other Products and Services

- Identification and development of initial products
- Development of hemispheric snow "anomaly" trackers for snow cover & SWE
- An inventory of snow datasets
- Product intercomparison:
  - Snow intercomparison project
  - ESA SnowPEX
- Glossary
Portal and Website

Web portal

Web Browser User Interfaces

- Data discovery
- Retrieval of information

- Metadata
- Articles

End users

Data centres contributing to GCW

GCW scientific community

http://gcw.met.no
Portal and Website

- About GCW – impact, framework
- GCW News
- Cryosphere now - products
- CryoNet – site requirements, practices
- Activities – mtgs, projects
- Outreach – forum, video
- References – Glossary, acronyms, GCW documents

http://globalcryospherewatch.org
Why be a part of CryoNet and GCW?

• Being a CryoNet site means being part of an international, operational, global observing system providing observations of known quality for research and knowledge beyond a site’s local region.

• Being part of a global network not only brings better visibility, but also a recognition of the importance of the observations made at your site.

• This in turn can bring better support, either funding or logistical support.

• GCW promotes the exchange of knowledge and data, so CryoNet sites may see broader use of their data and products.