A Global Cryosphere Watch

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The IGOS Cryosphere Theme was developed primarily to:

• create a framework for improved coordination of cryospheric observations

• assess current capabilities and requirements for cryospheric observations

Over 100 recommendations provide the basis for subsequent actions. But who will take action?
The 15th WMO Congress (May 2007) welcomed the proposal of Canada that WMO will create a Global Cryosphere Watch which would be an important component of the IPY legacy. Congress requested the WMO Inter-commission Task Group on IPY to establish an ad-hoc expert group to explore the possibility of creation of such global system and prepare recommendations for its development.

The 16th WMO Congress approved GCW in May 2011.

A legacy of IPY

A component of WIGOS

A contribution to GEOSS
GCW MISSION

GCW will provide authoritative, clear, 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.
KEY TASKS

- Implement recommendations of the IGOS Cryosphere Theme ("CryOS")
- Initiate pilot and demonstration projects
- Establish a network of surface sites, called "CryoNet". Reference, supersites – a consortium of sustained, ground-based international observatories
- Establish best practices for surface measurements
- Select candidate products for GCW
- Develop a web portal and interoperability for cryosphere users and providers
- Assess user needs and requirements
- Capacity development
- Communication and outreach
# Feature Comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>NSIDC</th>
<th>GCOS</th>
<th>GCW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data archival and distribution</td>
<td>■</td>
<td>■</td>
<td>○</td>
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<tr>
<td>Web data portal</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Analysis</td>
<td>■</td>
<td>■</td>
<td>■</td>
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<tr>
<td>Monitoring</td>
<td>○</td>
<td>○</td>
<td>■</td>
</tr>
<tr>
<td>Product intercomparisons</td>
<td>○</td>
<td>○</td>
<td>■</td>
</tr>
<tr>
<td>Integrated products</td>
<td>○</td>
<td>■</td>
<td>○</td>
</tr>
<tr>
<td>Assess observational requirements</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Assess user needs</td>
<td>○</td>
<td>○</td>
<td>■</td>
</tr>
<tr>
<td>Measurement standards and best practices</td>
<td>○</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Observational network</td>
<td>■</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observing system coordination and development</td>
<td>■</td>
<td>■</td>
<td>■</td>
</tr>
<tr>
<td>Compilation of Terminology/Vocabulary</td>
<td>■</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity development</td>
<td>■</td>
<td>■</td>
<td></td>
</tr>
</tbody>
</table>

- ■ Definitely
- ○ Partially
Challenge: Sustaining Networks

Sustaining and funding networks in remote harsh, cold environments and new networks established during IPY

Joint Programmes
- GAW
- WCRP
- Arctic HYCOS
- GCOS (GOOS, GTN-P, GTN-G)
Challenge: Develop CryoNet
Challenge: Product Selection

- Routine evaluation of products
- Robust algorithms for climate use
- Product intercomparisons
- Products meet user needs
- Sustainable product development and production
- Transfer from research to operations

SWE derived from SSM/I for Western Canada

Envisat ASAR mosaic sea ice for September 2007

Ice surface temperature from NPP VIIRS
Challenge: Product Selection, cont.

Product intercomparisons and error assessments are important.
Product Inventory

Product inventory characteristics (from WOAP ECV workshop, Frascati, 2011).

1. Date of this inventory entry
2. Dataset name
3. Lead investigator
4. Geophysical parameter and related ECV
5. Intended uses and users (existing or potential)
6. History and outlook; sustainability
7. Availability (web/ftp, restrictions, is it registered with DOI system)
8. Maturity (Bates & Barkstrom maturity index)
9. Description of how the effort adheres to the 12 GCOS guidelines
10. Strengths and weaknesses or limitations
11. Uncertainty estimates, possibly as a function of time
12. Long-term homogeneity and stability
13. Have there been self and independent assessments? Identify other datasets used in the assessment
14. Have the algorithm theory, FCDR characteristics, self assessment and independent assessments been published? If so, give reference(s).
15. Dataset details:
   - Product version number
   - Time period covered
   - Spatial coverage (global, Arctic, etc.)
   - Spatial and temporal sampling intervals
   - Based on what fundamental climate data records (FCDR)
   - Ancillary inputs used to derive product
   - Other datasets used in the development of this product:
   - Output data product contents
   - Output product format(s)
Product Inventory

Example of possible product summary information.

**Data products: Glaciers**

<table>
<thead>
<tr>
<th>Data set</th>
<th>Source</th>
<th>rs/in-situ</th>
<th>Type</th>
<th>free?</th>
<th>Coverage</th>
<th>Temporal</th>
<th>comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glacier outlines</td>
<td>GLIMS</td>
<td>RS + maps</td>
<td>vector (shape file)</td>
<td>yes</td>
<td>global (not complete)</td>
<td>1960s - maps</td>
<td>part of GTN-G web portal avail.</td>
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<tr>
<td>Glacier fluctuation data</td>
<td>WGMS</td>
<td>in-situ (most)</td>
<td>point (glacier-ID) with value</td>
<td>yes</td>
<td>global (selected sites)</td>
<td>16th. cent. (ΔL)</td>
<td>order via email</td>
</tr>
<tr>
<td>(mass, length)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1947 (mb)</td>
<td></td>
</tr>
<tr>
<td>World Glacier Inventory (WGI)</td>
<td>NSIDC / WGMS</td>
<td>maps, aerial, satellite</td>
<td>point (location w. attrib.)</td>
<td>yes</td>
<td>global (not complete)</td>
<td>1955-1985</td>
<td>ftp link</td>
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<tr>
<td>GGHydro Glacier layer</td>
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<td>yes</td>
<td>global (complete)</td>
<td>1950s-1990s</td>
<td>ftp link</td>
</tr>
</tbody>
</table>
Challenges: Perspective, Scale, and Integration

Point

100s of meters

10s of km

Arctic-wide and Global

Field Measurements

Modeling

Remote Sensing

100s of meters

Point

= Calibration/Validation Scales

From Waleed Abdalati ICARPII
It is essential to understand that:

**GCW is not assuming the mandate of any of the Partners/Collaborators.**

Instead,

**GCW enables Partners/Collaborators to exercise their mandate effectively.**
Challenge: Standardization

Cooperation Agreement with ISO (2008):
1. Development of joint ISO/WMO tech standards
2. WMO existing standards can become ISO standards
3. WMO retains primary control of its own standards
4. Underlines authority of WMO standards and enhances international recognition WMO standards
   - Need for GCW standards to be promoted to ISO standards?

Working Arrangements with CIPM (2002):
- Ensuring traceability of measurements to SI
- Part of MRA: mutual recognition of standards & calibration & measurement certificates
- Need for GCW measurements to be traceable to SI?
**Organization: GCW Conceptual Framework**

- **WMO**
- **Advisory Group**
- **Management Board**
- **Project Office**
- **Working Groups**

**Users and Applications**
- research, operational centres, security, impacts, adaptation

**Outreach, Education, Capacity Building**

**GCW Portal**
- integrating data and information

**GCW Information and Analysis**
- anomaly tracking, hot-spots, variability and change, global and regional products

**Observations**
- reference stations, contributing networks, satellites

**Cryosphere Products**
- operational products, reanalyses, research datasets

**Partners**
- met centres
- satellite agencies
- data centres

**Data and Information**
• Observing Systems Working Group
  – *Will address capabilities and needs for surface-based and satellite obs*
  • CryoNet Team
  • Requirements and Capabilities Team
  • Infrastructure and Practices Team

• Products and Services Working Group
  – *Will decide which products and services GCW will provide, develop the “clearinghouse” for products and services, develop data policies for GCW.*
  • Products Team
  • Portal Team
  • Outreach Team
The GCW web portal will make GCW data and information available to WMO Members, their partners, and users while providing the ability to exchange data and information among a distributed network of providers of data and products. The portal, as a part of WIS, will allow for rapid exchange of data, metadata, information, and analyses.
BRINGING USERS AND PROVIDERS TOGETHER

ROLE of GCW WEB PORTAL

The GCW web portal will provide the ability to exchange cryosphere data, metadata, information and analyses among a distributed network of providers and users in support of informed decision-making.

Data quality, sharing and access are fundamental principles
• improve access to, and utilization of observations and products from WMO and other observing systems and from national and international data centres
• built using the principles developed for IPY2007-2008.
• facilitates the interaction between users and providers of the products
Schematic of GCW Web Site

The web site differs from the METNO GCW data portal in that it will contain more background, higher-level information on the state of the cryosphere, news and “hot topics”, meeting information, GCW documents, and outreach material. It will link to the METNO data portal.
Definition and Organization

- **GCW was approved as a WMO initiative** in May 2011. It has a small budget. We are now in the implementation phase.

- The **First GCW Implementation Meeting** was held November 2011. Participants were from 17 countries and at least 18 agencies, institutions, and international bodies.

- The GCW **organizational structure has been defined**. Membership in an Advisory Group and a Management Board is now being considered.

- GCW is overseen by the WMO Executive Council expert panel on Polar Observations, Research, and Services (**EC-PORS**).

- GCW is a component of the WMO Integrated Global Observing System (**WIGOS**).
**Task Progress**

- CryoNet: Surface measurement **sites are being identified**. Many have been “offered”, e.g., Sodankylä, China, Sonnblick, IASOA(S)
- **Site types are being defined** (supersites, reference sites, observation sites)
- **Inventories of satellite and surface products** for GCW are being developed.
- A **Snow Watch Workshop** is being planned
- Many **partnerships** have been confirmed.
- A **web portal** prototype has been developed. An information web site is under construction.
PSTG Involvement

Product Selection
PSTG-1, Item 2: PST Members to identify a list of data sets and routinely generated products for preparation of an inventory of satellite products for the cryosphere.

Requirements Review
PSTG-1, Item 4: PSTG Members to review the cryosphere application area in the WMO online Database of Observing Requirements, particularly in regard to the threshold, breakthrough and goal values.

Surface Site Selection
Surface sites will be used for validation of some satellite products. Are there particular needs that should influence the locations and types of measurements?