



The Way Forward for the Cryosphere Theme

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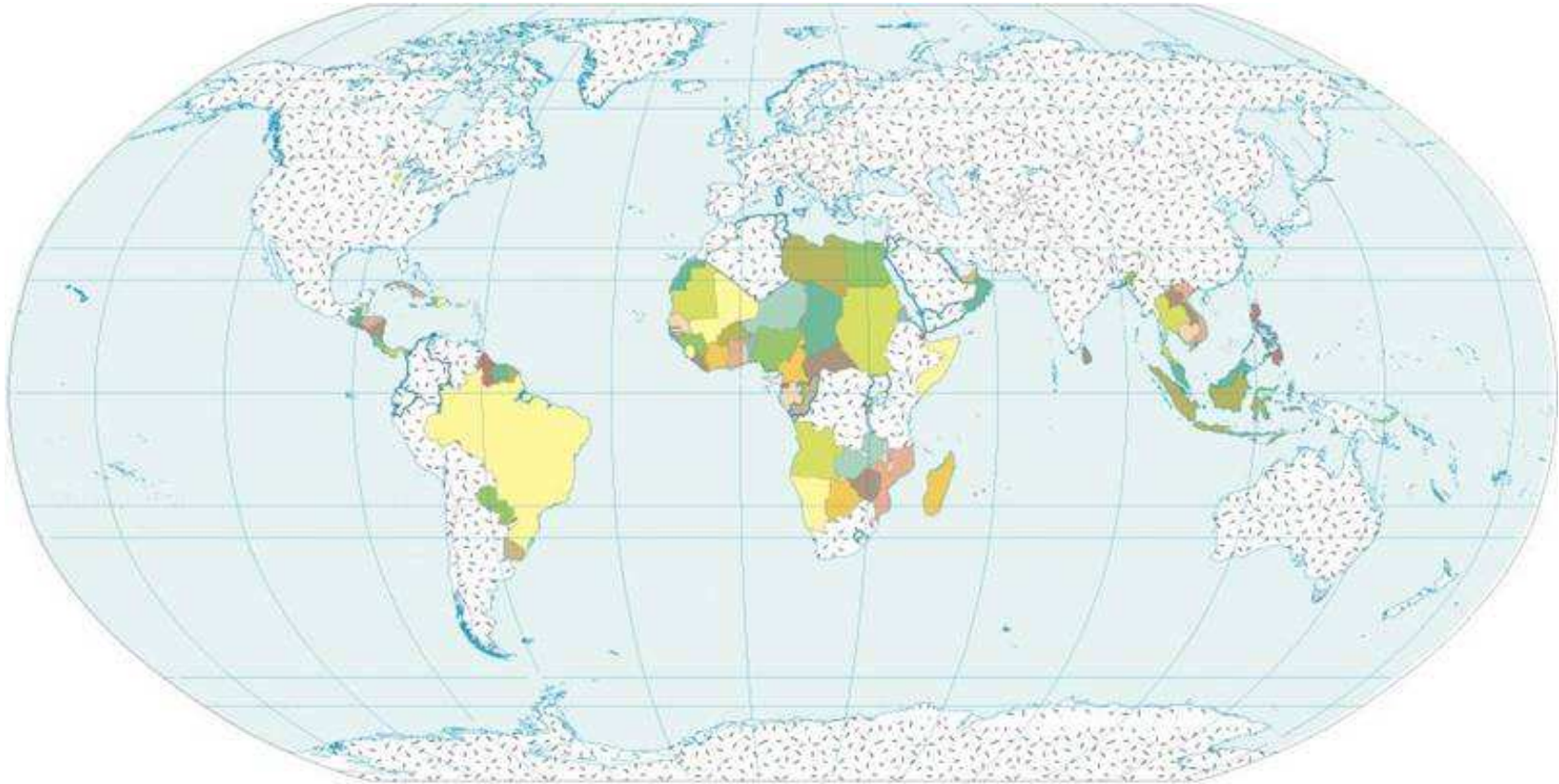
World Climate Research Programme

GEO UIC Meeting

March 3, 2010

The cryosphere is global

~100 countries have cryospheric components



It includes snow, sea ice, lake and river ice, glaciers, ice caps, ice sheets, permafrost and seasonally frozen ground, and solid precipitation



Socio-economic Impacts

Inuit say spring in the Arctic is becoming more dangerous



Thawing permafrost, GHG emission and **coastal erosion**



Polar bears could face **extinction** as global climate change warms the Arctic

Melting Ice sheets, glaciers and global **sea level rise**



Tourism at risk



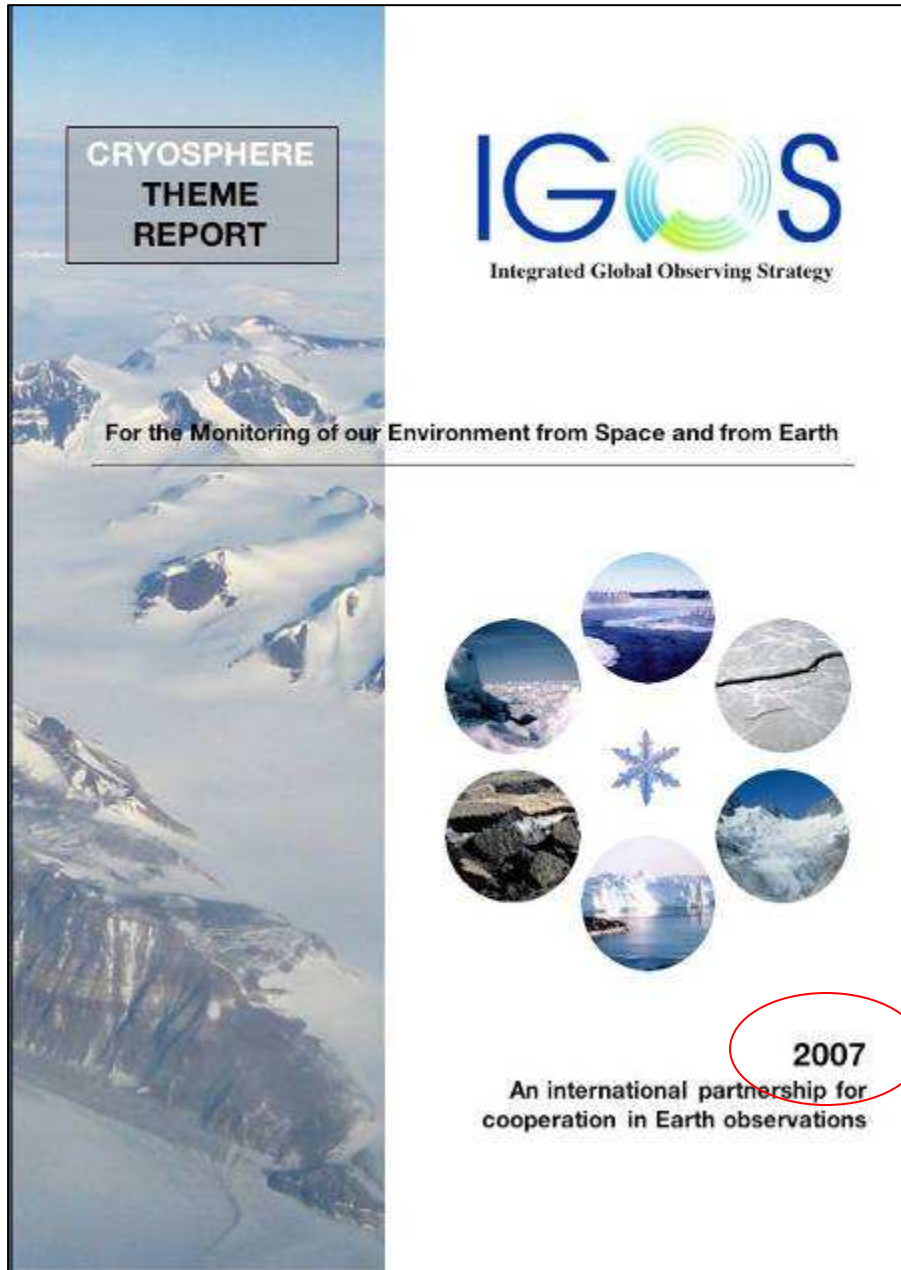
Floods feared as glaciers melt

Disappearing glaciers menace **water supplies**

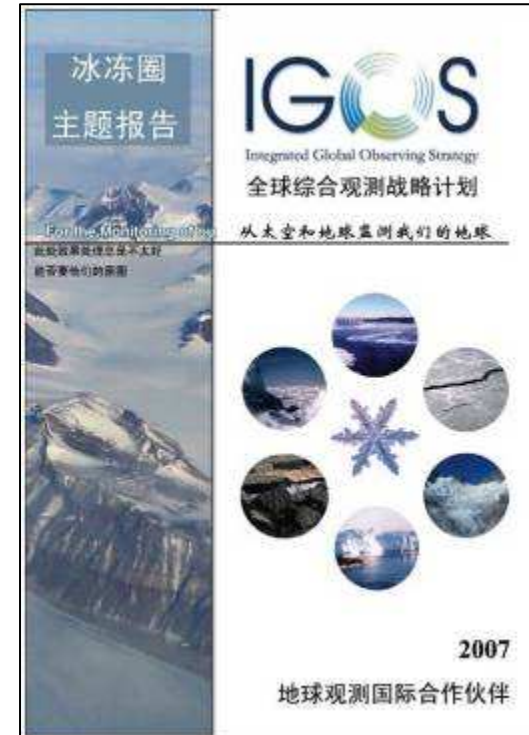


Relevance to GEO SBAs:

Disasters	★ ★
Health	★ ★
Energy	★ ★ ★
Climate	★ ★ ★ ★
Water	★ ★ ★ ★
Weather	★ ★ ★
Ecosystems	★ ★ ★
Agriculture	★ ★
Biodiversity	★ ★
+ Transport	★ ★ ★ ★



Workshops were held in Canada, Japan, and the Netherlands, 2005-2006. Contributions from ~80 people in 17 countries, **the basis of an evolving cryosphere community of practice that started with WCRP CliC and SCAR.**



Chinese translation soon!

Proposed Implementation in Three Timeframes

Observing System Type	Implementation Action Timeline		
	Near Term IPY: 2007-2008	Mid Term Post-IPY: 2009-2015	Long Term
Space Infrastructure Near Surface AUV/UAVs In Situ Infrastructure Data and Data Management Integrative Actions	Ensure coordinated interagency planning of the IPY Polar Snapshot (plan for SAR/InSAR; high-resolution Vis/IR; and optimization of coverage in respect to IceSat laser cycles) and continuity in higher-level polar data products for an IPY legacy dataset.	Implement a virtual SAR constellation for polar applications – based on uniform, standard, routine data acquisition. Develop integrated data processing capabilities for cryospheric products from SAR virtual	Establish an operational, international SAR satellite constellation for all-weather cryospheric remote sensing, retaining essential modes for large-scale mapping/charting, InSAR terrain mapping, and sea-ice dynamics.

Space Infrastructure
Near Surface AUV/UAVs
In Situ Infrastructure
Data and Data Management
Integrative Actions

2007-2009, IPY. CliC IPY project “**The State and Fate of the Cryosphere**”. *GEO Task CL-06-05*; various IPY projects, particularly *GIIPSY* and *WMO Space Task Group*.

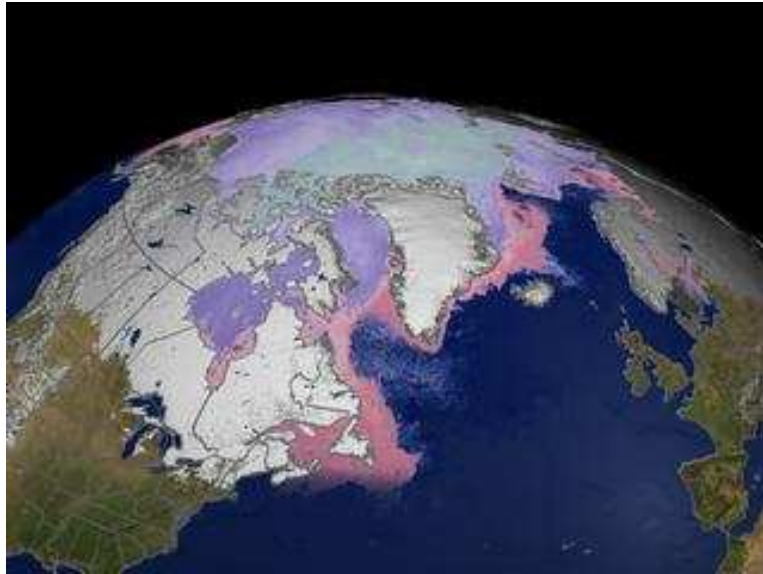
2010-2015. **Preserve the legacy** of the IPY observing and information systems; **expand** to the global cryosphere; realize concepts for space observing systems. *WMO Global Cryosphere Watch*; *SAON*.

After 2015. Implement previously recommended **space missions** that fill key observational gaps, as well as **routine in situ observations** of such essential parameters.

- The IGOS Cryosphere Theme assessment resulted in **improved coverage of cryospheric elements** in the GCOS Implementation Plan and contributed to the GCOS-CEOS plan for satellite-based products.
- **Began efforts to ensure an IPY legacy** through the GEO Work Plan.
- **Influenced the satellite mission planning process** resulting in:
 - Approval of three orbital cycles of coordinated, experimental inter-satellite (ERS-SAR and Envisat ASAR) SAR interferometry.
 - Approval of the Global Monitoring for Environment and Security (GMES) Sentinel-1A C-band SAR mission.
 - Approval of the GMES Sentinel-3A SAR altimeter mission that will provide sea-ice thickness measurements.
 - Approval of RADARSAT MiniMAMM (Modified Antarctic Mapping Mission) SAR mapping of Antarctica.
 - Approval of CryoSat-2 with a re-launch in 2009.
- **Developed new satellite products** for real-time applications, e.g., sea ice concentration, thickness, and motion from MODIS. New acquisitions through GIIPSY.
- **Contributed to the planning of ongoing SCAR scientific research projects** (ISMASS, ASPeCT, PPE, and AGCS).
- ❖ Fed directly into **SAON** (Sustaining Arctic Observing Networks) and the Arctic Council's **SWIPA** project (Snow, Water, Ice, and Permafrost in the Arctic).
- ❖ Inspired the **WMO Global Cryosphere Watch**.

The community involvement in CryOS gave it the credibility needed for these accomplishments...the first time this has been done internationally for the cryosphere. The community that started with CliC and SCAR expanded through CryOS.

Where are we now? The Global Cryosphere Watch



A legacy of IPY

A component of WIGOS

A legacy of WCRP/CliC in the area of observations

A contribution to GEOSS

*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.*

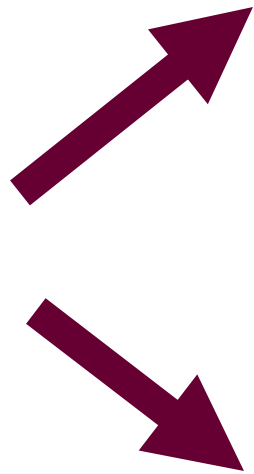


GLOBAL CRYOSPHERE WATCH:

*observation, monitoring, assessment, product development,
research through to prediction*

Mission:

- implement the IGOS Cryosphere Theme (CryOS);
- support reliable, comprehensive **observations** through an integrated observing approach;
- 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.



(Note: These are not official logos!)

The Cryosphere Community of Practice

NSIDC, NCDC, WIS, ...

Public

Public

The cryosphere community was established through WCRP CliC and ICSU SCAR. It was expanded through the IGOS Cryosphere Theme, one of the last themes to be established. It is being expanded further through GCW and (potentially) GEO with increased emphasis on societal benefits.

Weather
(NO
Weather
Nationa
NAI
River fo
Climate

GCOS, IASC, IPA, WMO, etc.

Space agencies (NOAA, ESA, JAXA, ...)

National surface station operators

Research scientists

What the UIC can do

- Suggest ways to better integrate the existing cryosphere community into the GEO/GEOSS framework.
- Help connect us with GEO activities that have cryosphere components or interests.
- Help fill the CoP “circle” by identifying gaps and suggesting ways to fill them.