Looking Ahead: Integrated Observing Networks/Sites

1st IPY Workshop on Sustaining Arctic Observing Networks

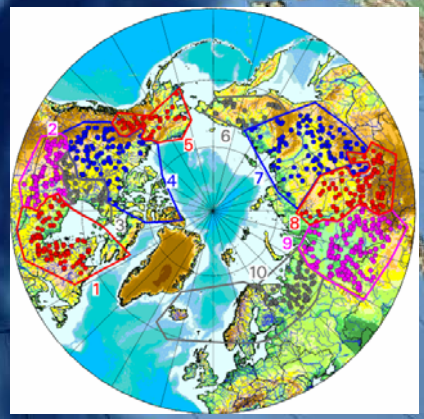
November 12-14 2007
Stockholm, Sweden

Dr. Barry Goodison, Chair, CliC SSG
And Environment Canada

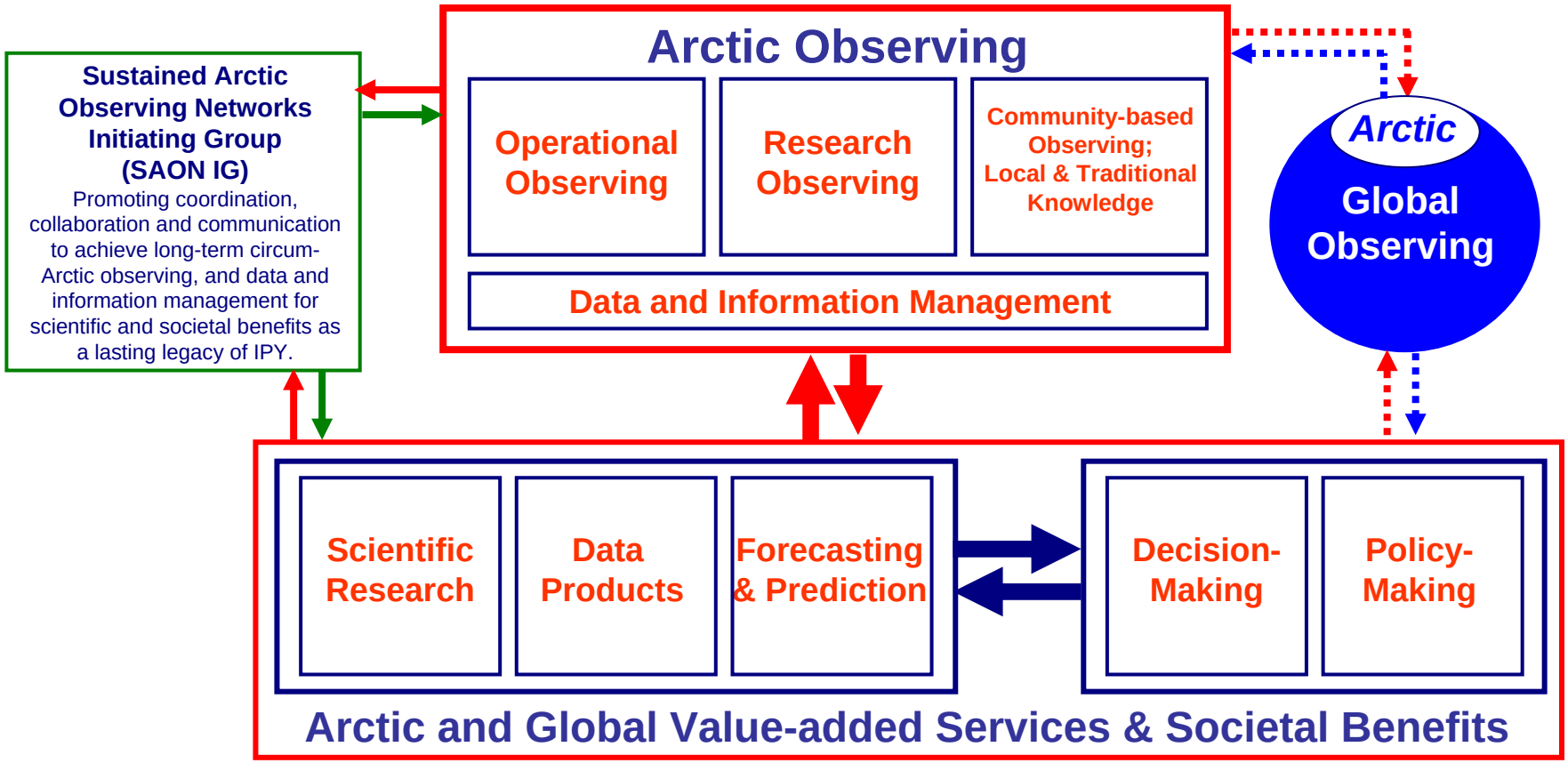
ICARP II

2nd International Conference on Arctic Research Planning

The Arctic System in a Changing World



www.icarp.dk


Sustained Arctic Observing Networks Initiating Group (SAON IG)
Promoting coordination, collaboration and communication to achieve long-term circum-Arctic observing, and data and information management for scientific and societal benefits as a lasting legacy of IPY.
Arctic Observing
Operational Observing
Research Observing
Community-based Observing; Local & Traditional Knowledge
Data and Information Management
Arctic
Global Observing
Scientific Research
Data Products
Forecasting & Prediction
Decision-Making
Policy-Making
Arctic and Global Value-added Services & Societal Benefits

Integrated Monitoring – what might this be?

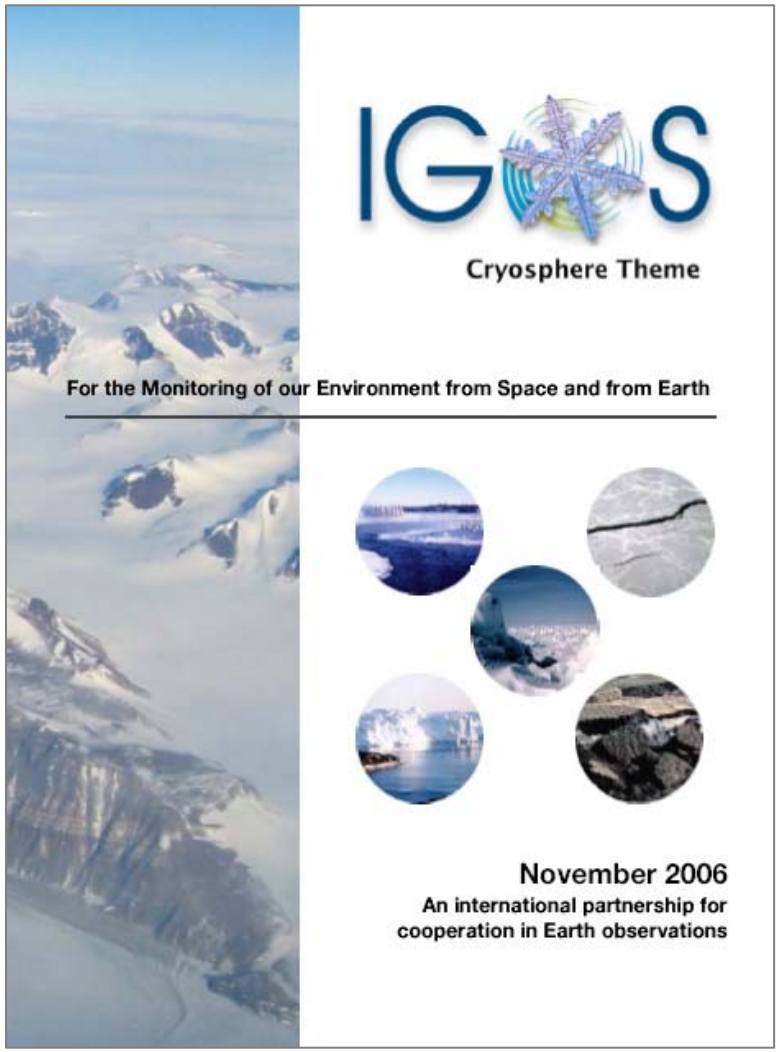
- Integrated Circumpolar network –disciplinary
- Integration of in-situ, remote sensing, modelling to produce product or information for users
- Multi-disciplinary and circumpolar – “supersites” or environmental observatories to look at the Arctic system
- Integration of research sites into operational networks
- Integrated data sets and systems – a portal to information

- “State of the Arctic System” – past, present and future

What should be monitored?

- The list could be “endless”
- Measurement to a desired level of accuracy
- Time and space scale considerations
- Current networks biased to coastal regions and low elevations
- **Many of these issues developed for GCOS and GEOSS – don’t reinvent the wheel**
- Natural and disturbed systems
- **What is missing, where are the gaps by element and by geographic distribution?**
- Define core observations that contribute to explaining changes across the earth system

- **Inventory of current networks and available data and information of the Earth System in high latitude regions**



- Final document approval
  IGOS-P-14 May 2007
- IGOS being transferred to GEO
- Report being published by WMO

http://igos-cryosphere.org/

Report

Preface
Foreword
Executive Summary – to be amended
1. The Cryosphere Theme
2. Applications of Cryospheric Data
3. Terrestrial Snow
4. Sea Ice
5. Lake and River Ice
6. Ice Sheets
7. Glaciers and Ice Caps
8. Surface Temperature and Albedo of Snow and Ice
9. Permafrost and Seasonally Frozen Ground
10. Solid Precipitation
11. An Integrated and Coordinated Observing System
12. Implementation

App. A. References
App. B. Observational Capabilities and Requirements
App. C. Satellite Missions in Support of the Cryosphere Theme
App. D. Acronyms
App. E. Contributors

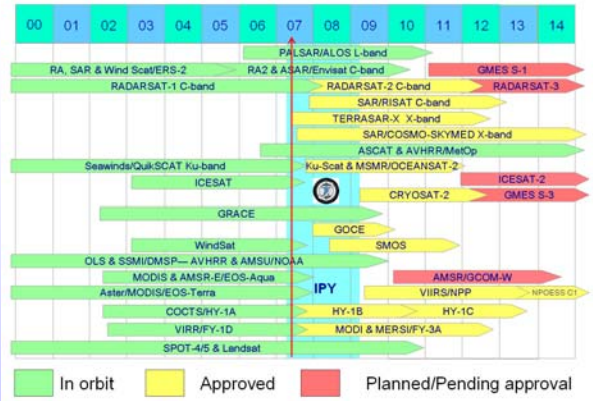
Team:

Jeff Key (Chair)
Mark Drinkwater (Vice-Chair)
Don Hinsman (link to IGOSP)
Ken Jezek and ~ 50 contributors from 14 countries

Ch 11: An Integrated and Coordinated System (1)

Satellite remote sensing

1. SAR
2. InSAR
3. PM
4. Altimetry



5. Radar Scatterometry
6. VIS to Thermal IR
7. Gravity
8. Ground control
9. Major Gaps (mostly NPOESS)

Ground based observations

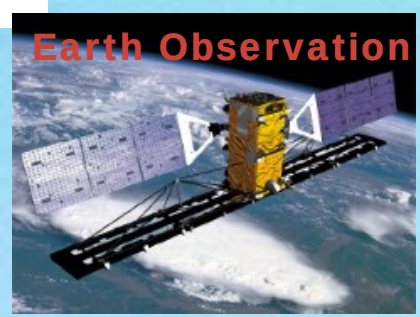
Airborne observations

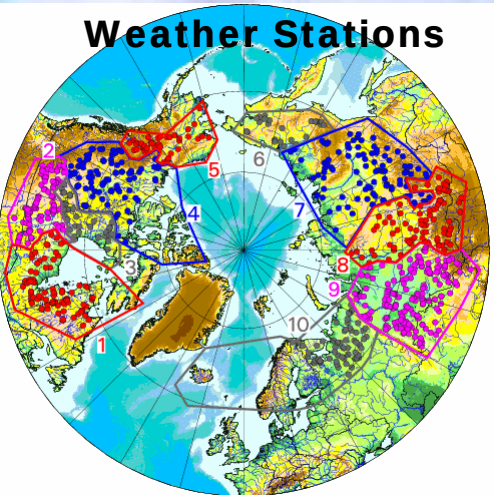
Modelling, Data Assimilation, Reanalysis

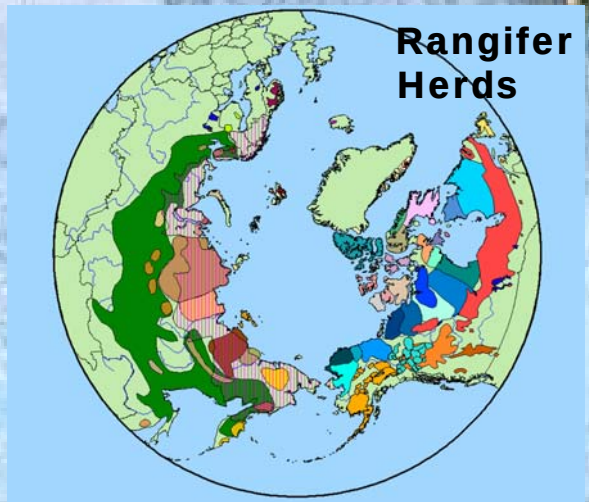
Data and Information Management Vision

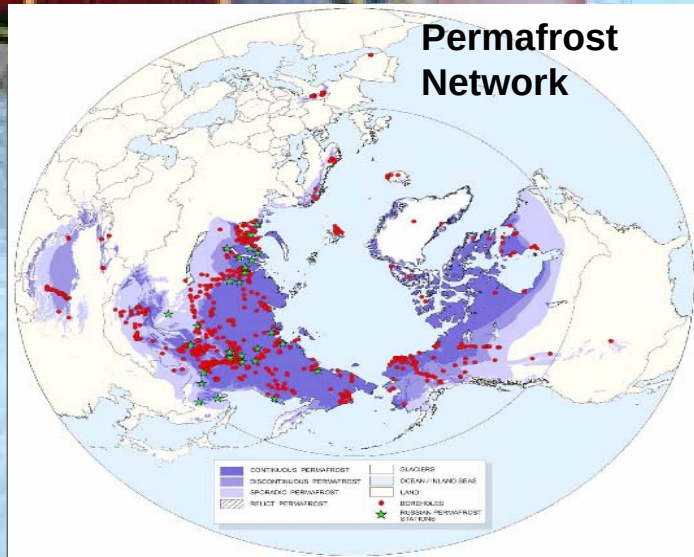
Related Systems

Observation Networks

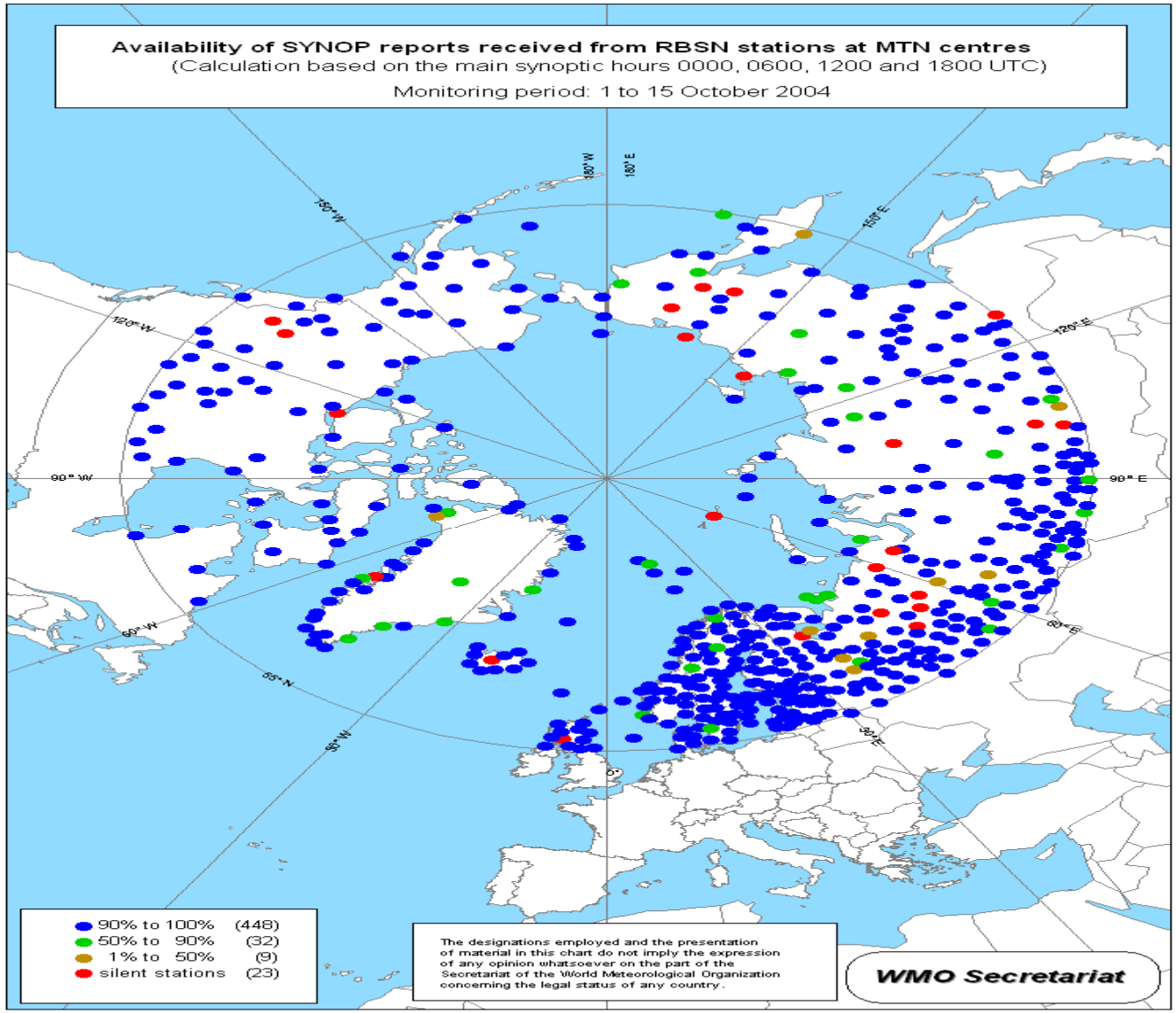






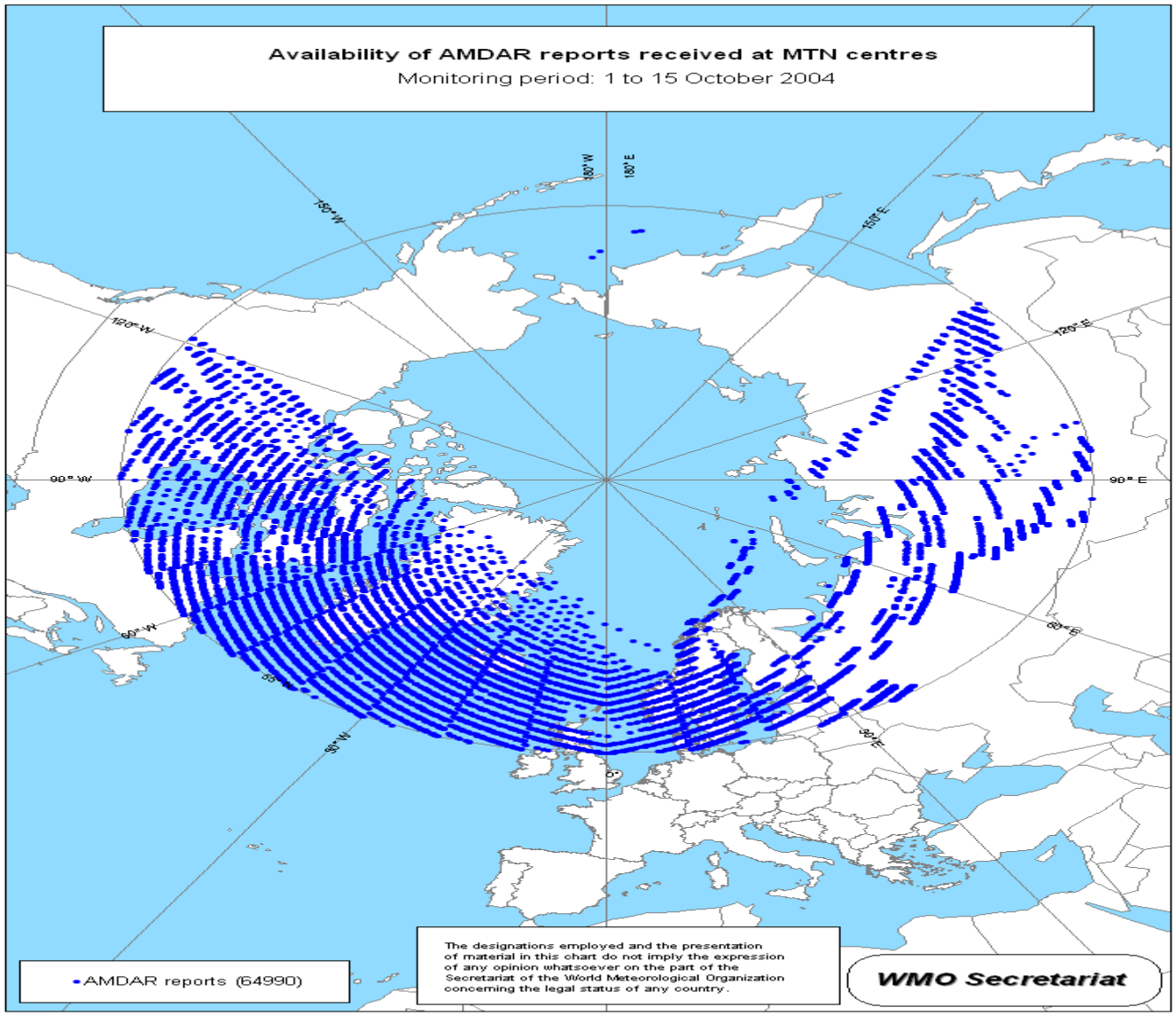


IPY
2007
2008



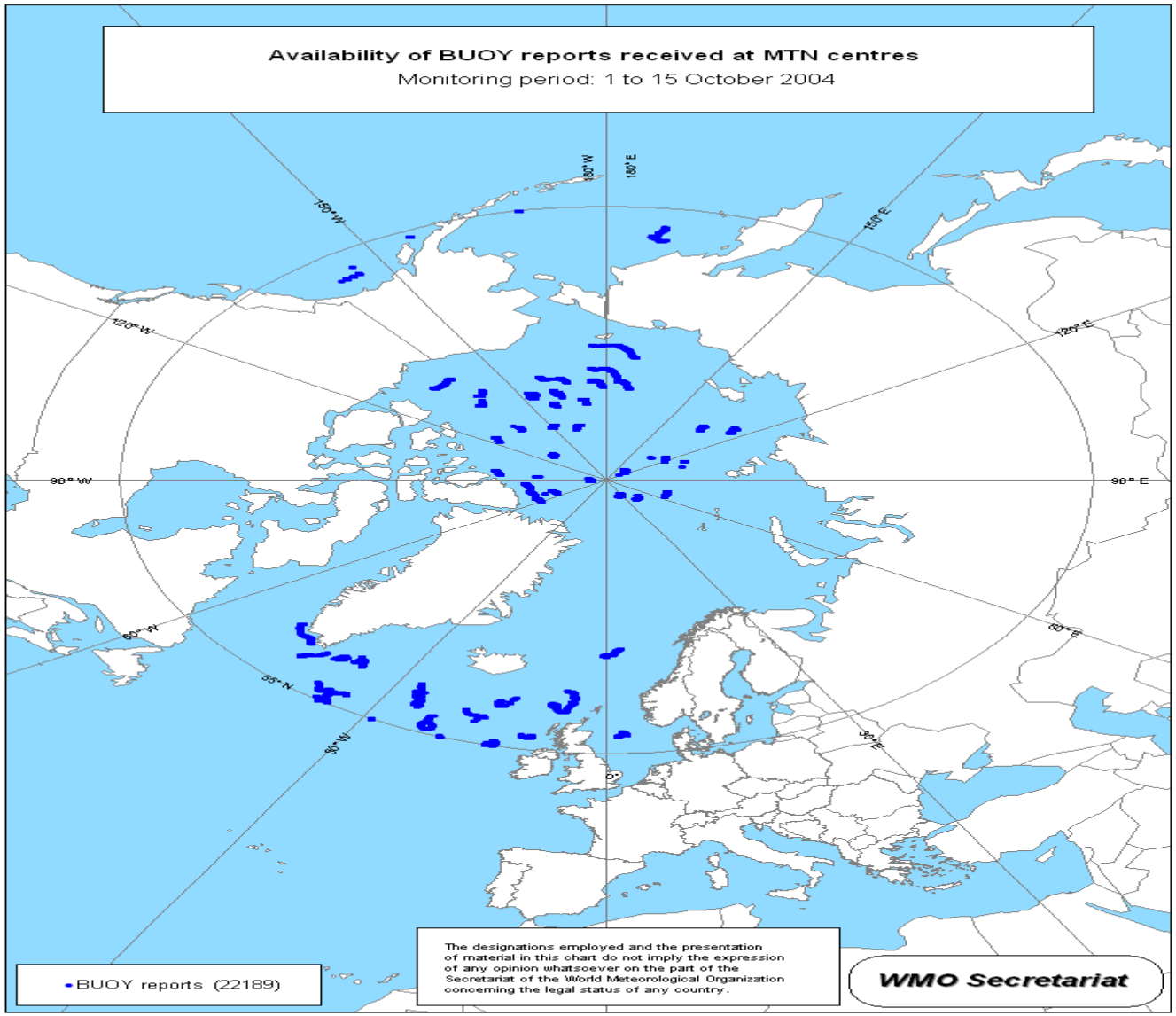
WMO
OMM

IPY
2007
2008



WMO
OMM

IPY
2007
2008

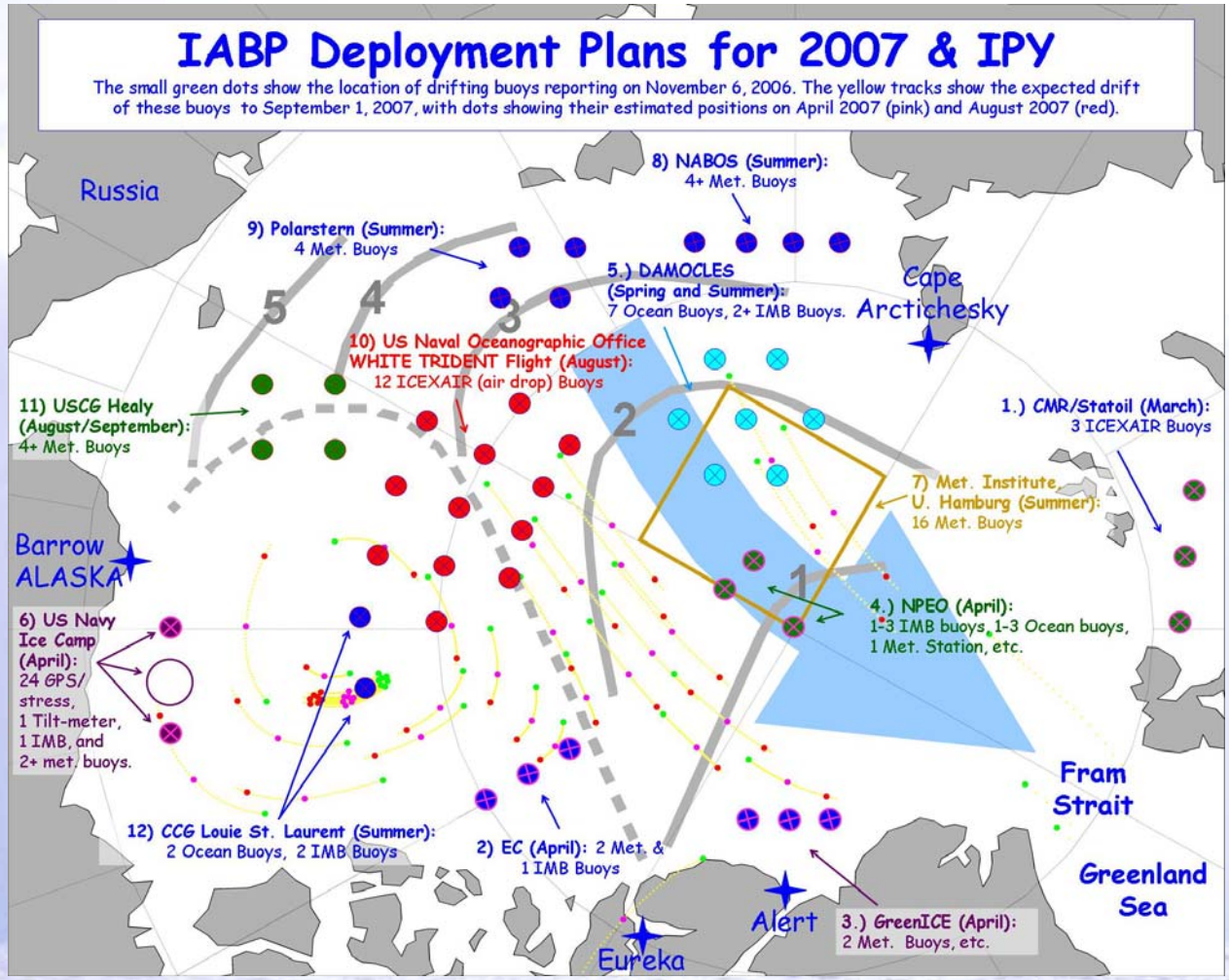


WMO
OMM

International Arctic Buoy Program

Coordinator: Ignatius Rigor

Chairman: Tim Goos



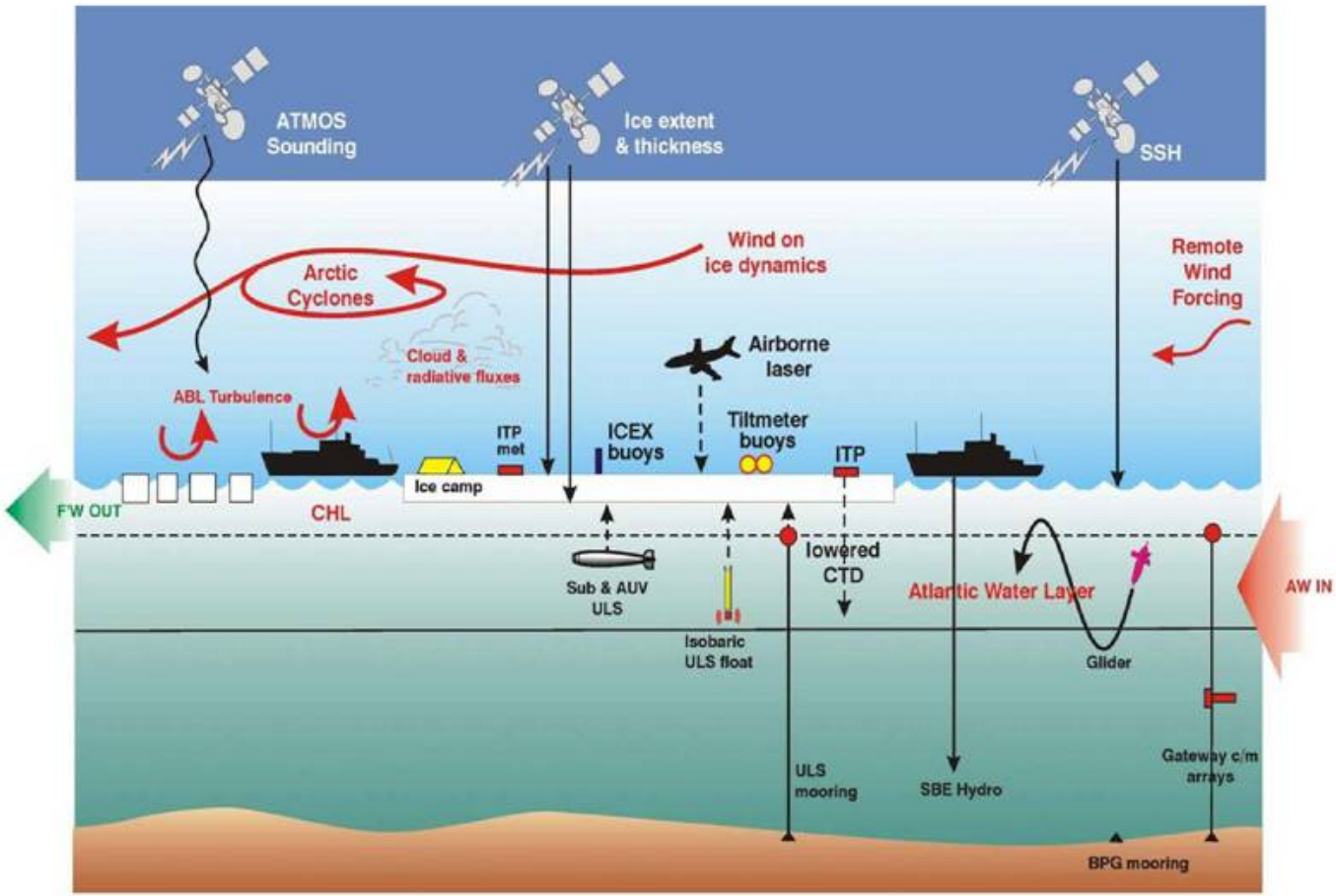
While the IAPB program typically deploys 25 buoys per year, interest in the Arctic driven by the International Polar Year has increased this number to 135 for the current year. Many of these will be deployed on the ice in 'clusters' to support particular scientific studies involving meteorology, oceanography and, in particular, ice (melting, growth, movement etc.)

WCRP
World Climate Research Programme

Integrated Arctic Ocean Observing System (iAOOS)

8 nations: 54 EoIs

Observing the Arctic Ocean from satellites to sea bed



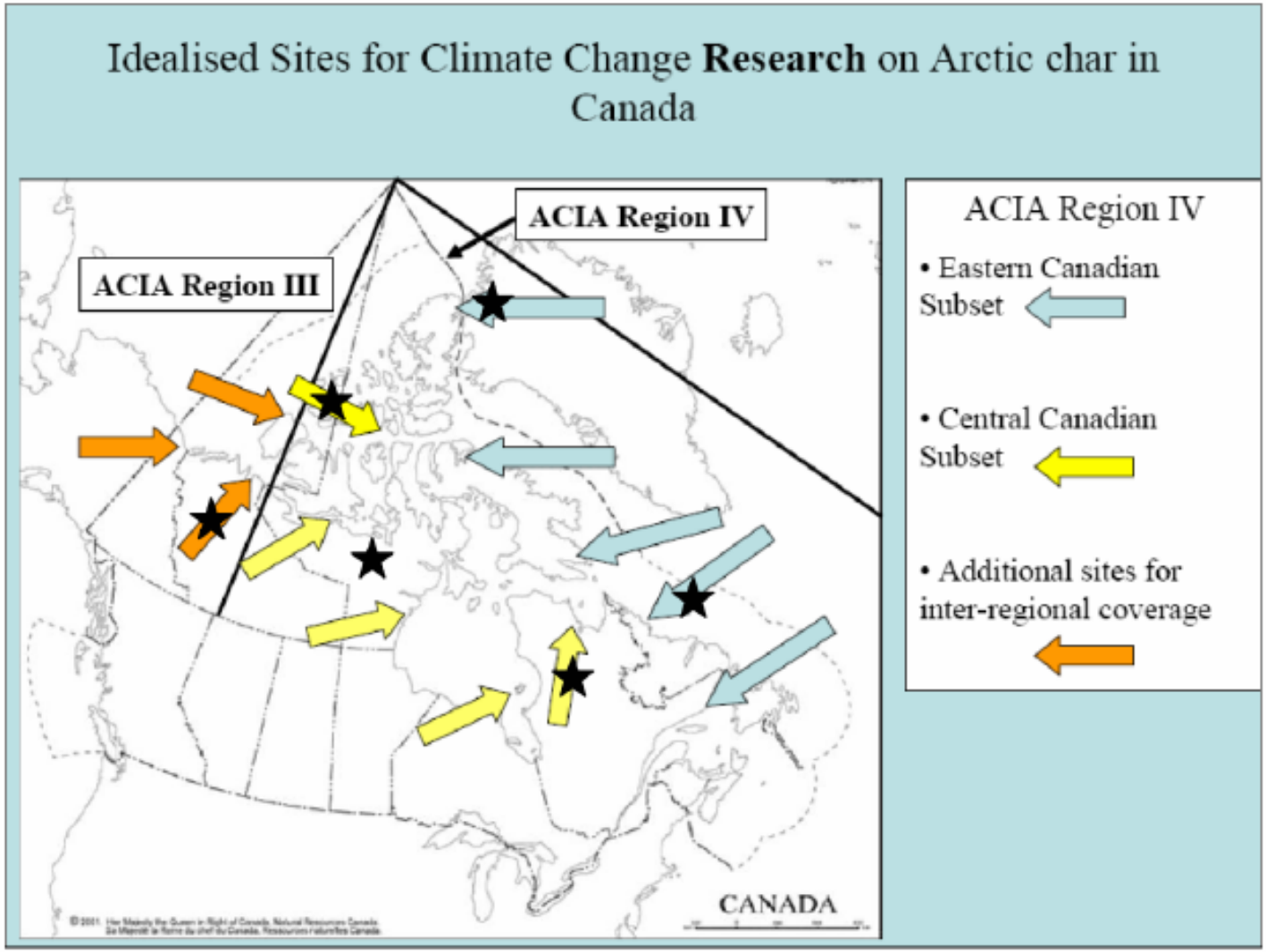
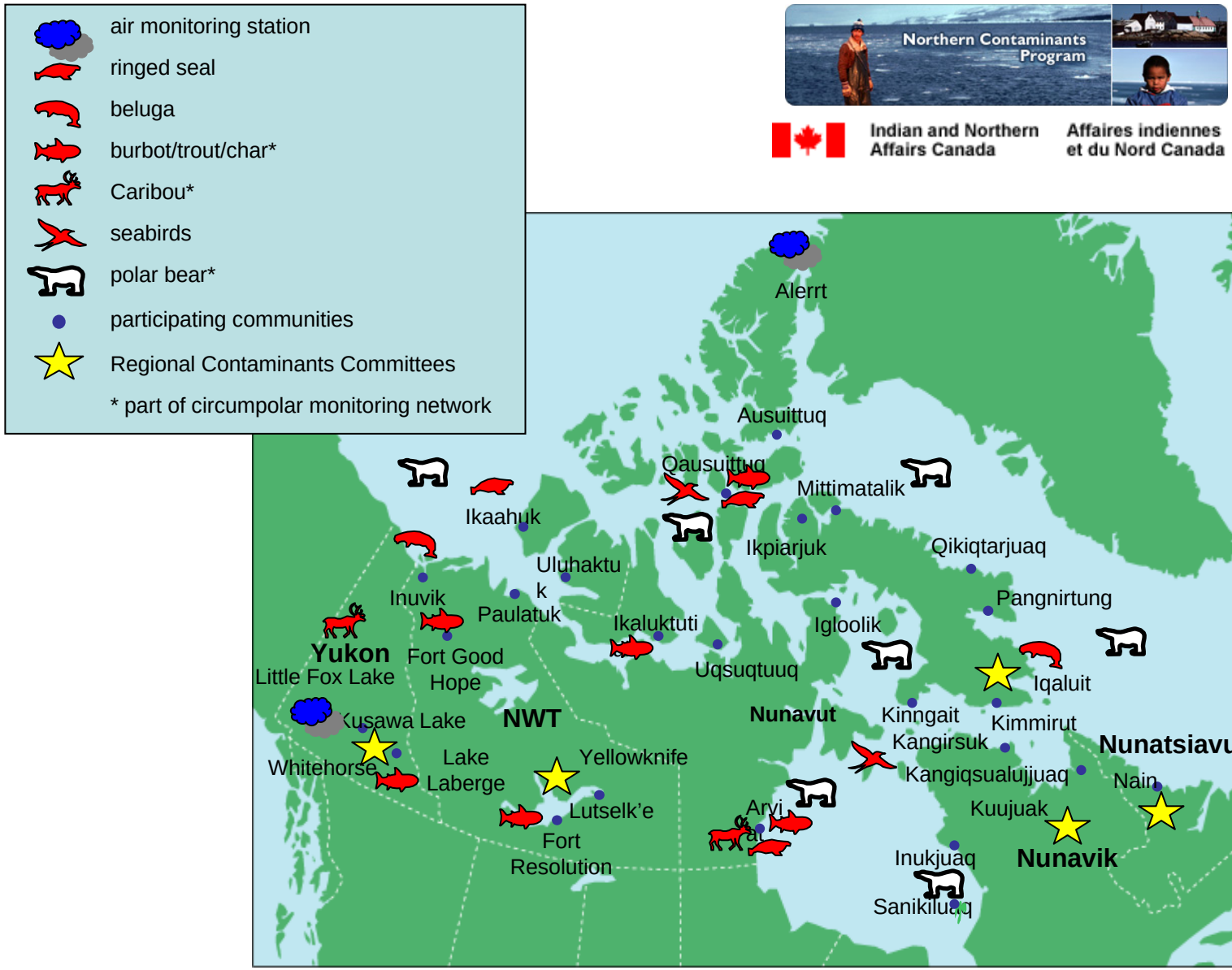
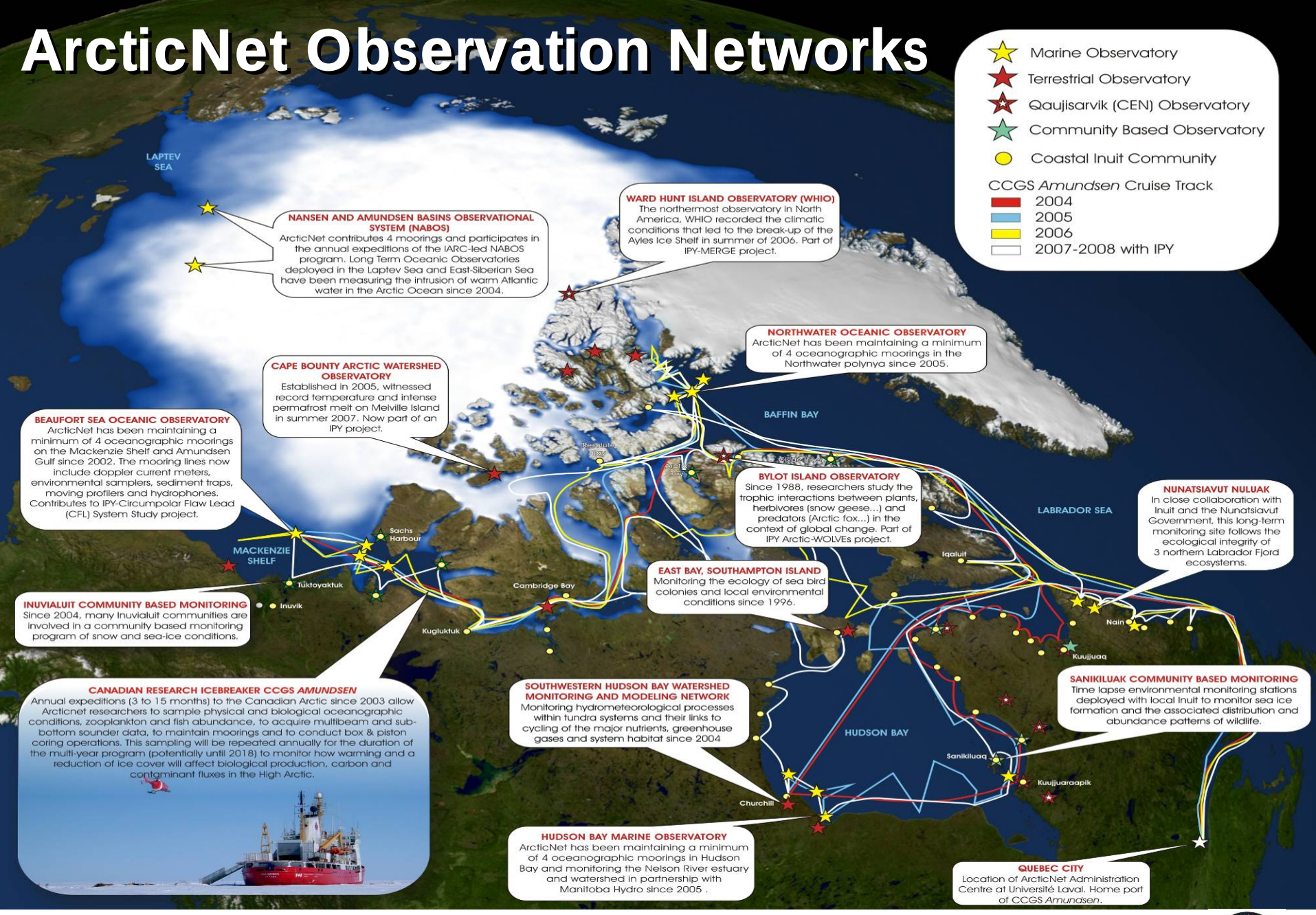


Figure F7. Sites proposed as part of an idealised suite for Research-based Monitoring of the Biodiversity of Arctic char populations in the Canadian North. This coverage ensures latitudinally and longitudinally regional differences in various forcing factors of environmental change are captured. Although shown here for Arctic char, these sites can be integrated with other sites where other char species occur to provide full Northern coverage. Stars indicate sites of char populations to be studied during the International Polar Year project investigating char and climate change.



Long term monitoring of air and biota under the Northern Contaminants Program is conducted by a network of Arctic communities, Regional Contaminant Committees and research scientists. Red symbols on the map indicate the location of annual monitoring sites for fish, caribou, ringed seal, beluga whale and seabird eggs. Polar bear are sampled on a five year rotational cycle.

ArcticNet Observation Networks



Canada

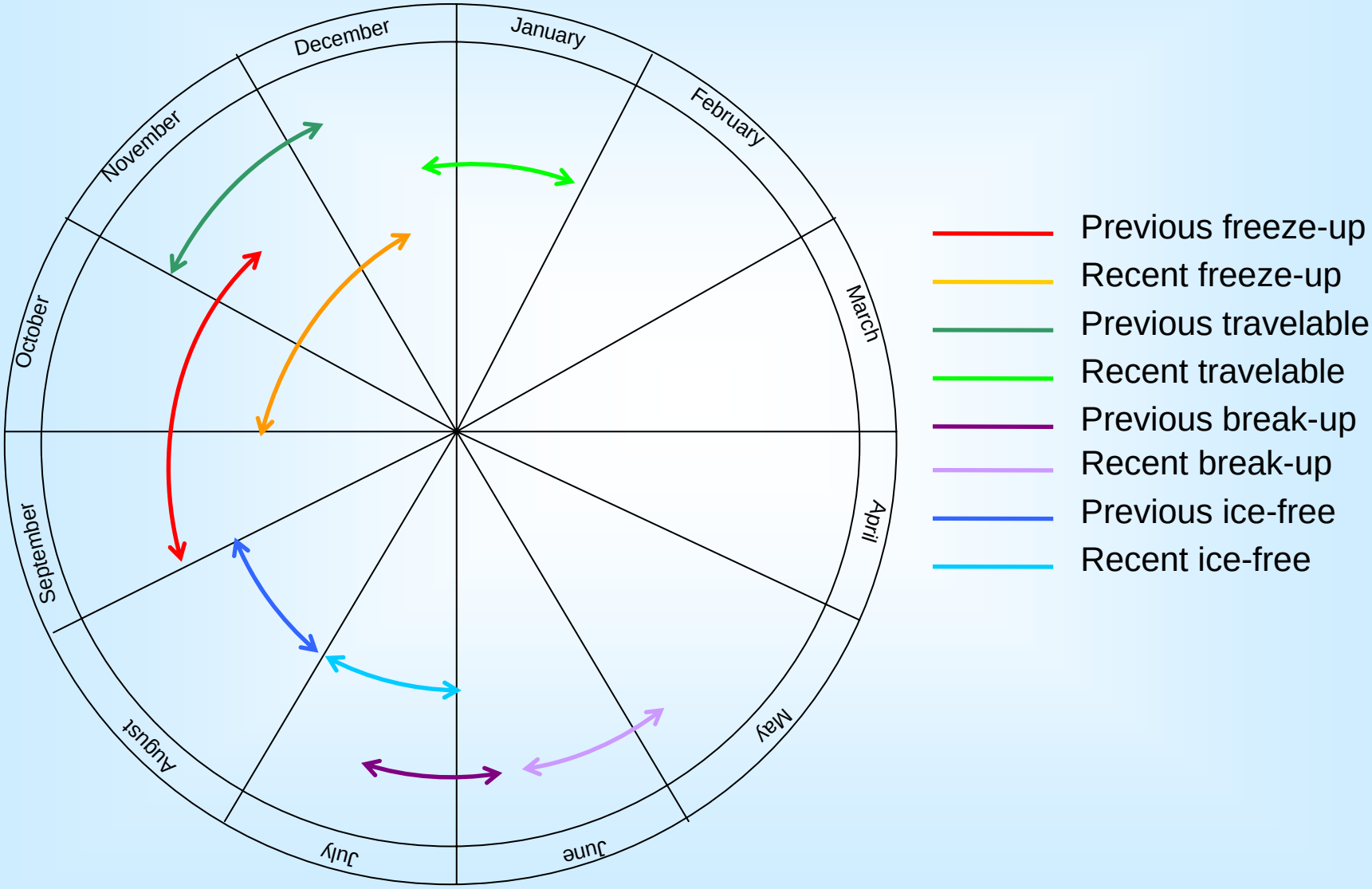
ArcticNet

Networks of Centres of Excellence
Réseaux de centres d'excellence

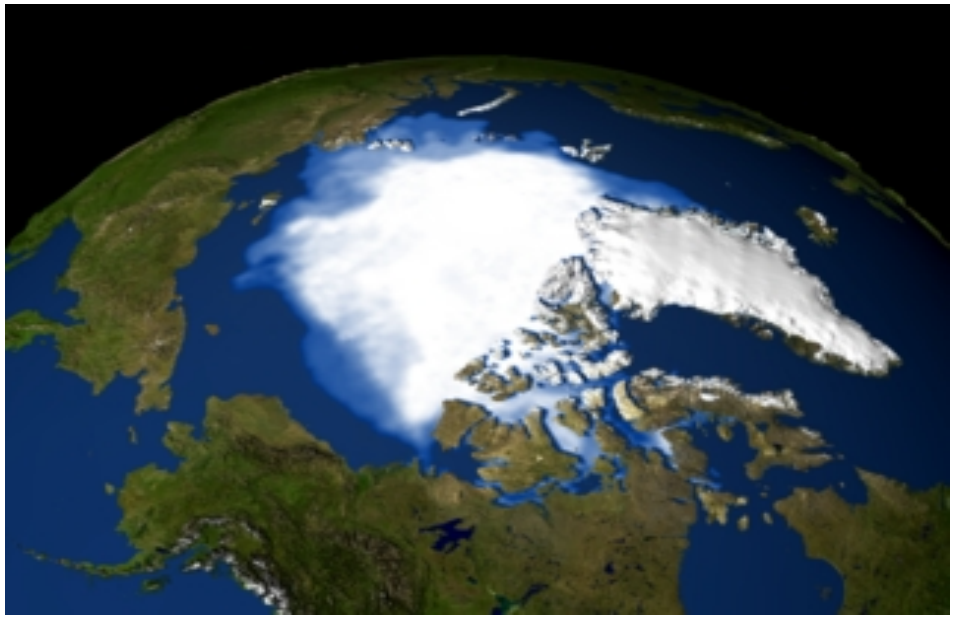
Host Institution: Université Laval

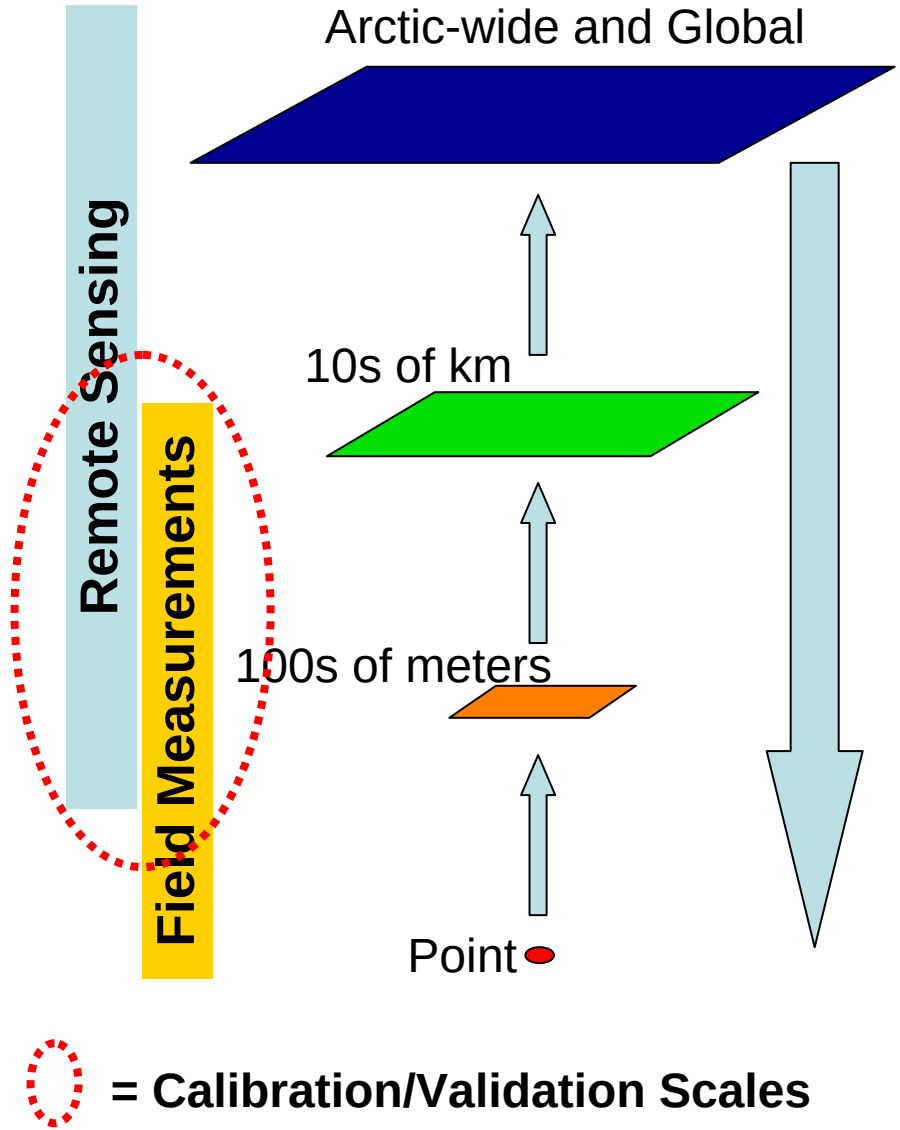
IPY-API International Polar Year 2007-2008
Année polaire internationale

Local Knowledge: Freeze-up/Break-up timing

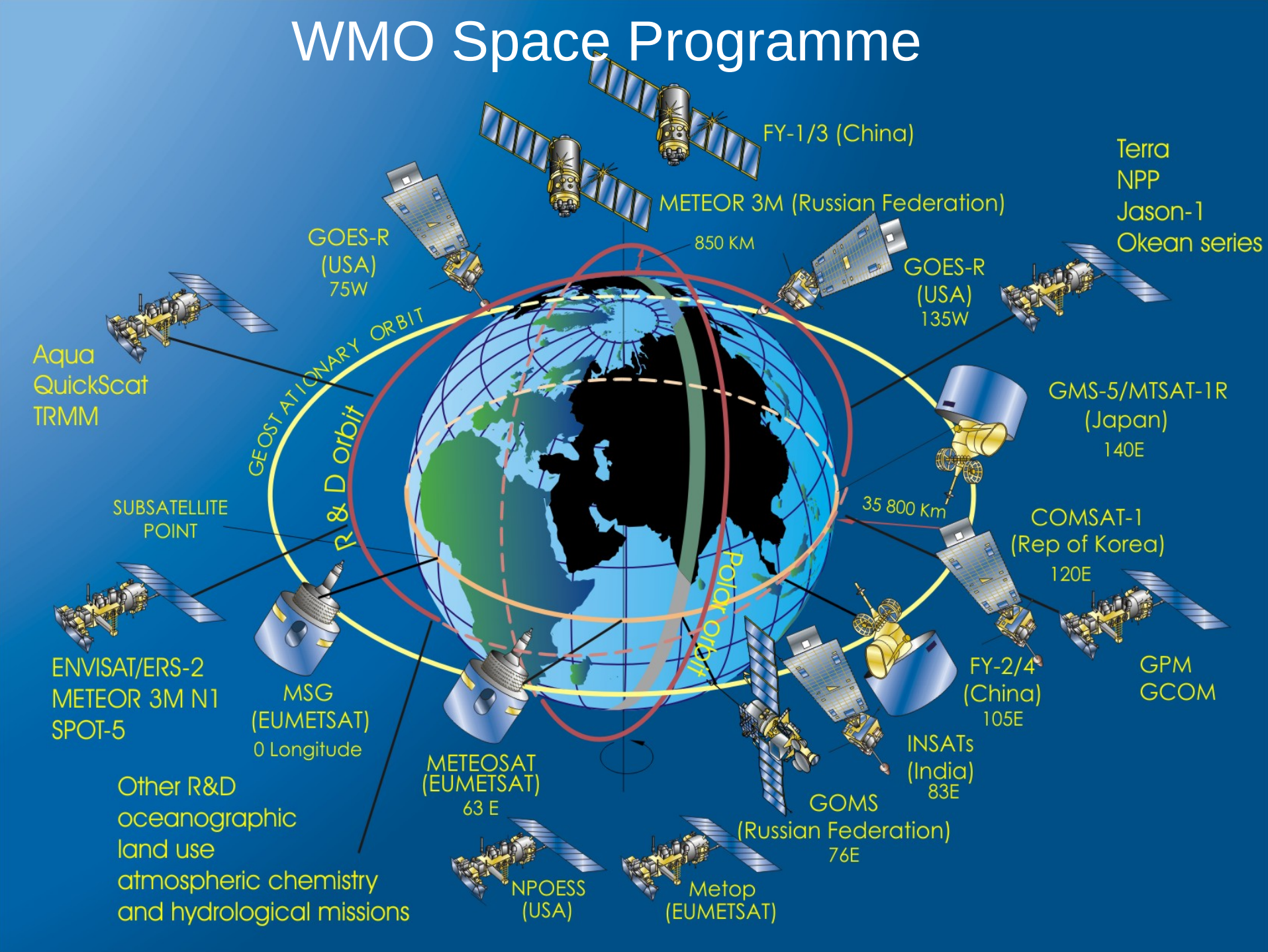


Perspective and Scale





WMO Space Programme




CEOS agencies are operating or planning approximately 170 missions with over 340 instruments in the next 15 years
CEOS Earth Observation Handbook
Jason-1
Landsat 7
QuikSCAT
ERBS
ACRIMSAT
Aqua
Terra
TOPEX/Poseidon
TRMM
SAGE III/METEOR-3M
UARS
SORCE
GRACE
SeaWiFS
EP-TOMS
NMP/EO-1
ICESat
Aura
www.eohandbook.com

IPY
2007
2008

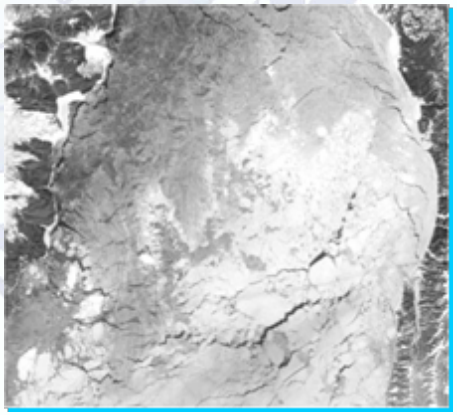
WWW Global Observing System

Meteorological ice drifting buoy
using for IABP and IPAB

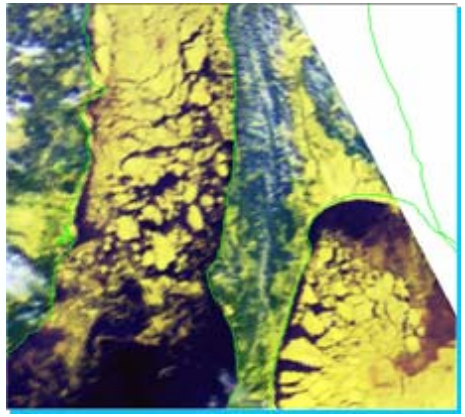
Airborne measurements

Automatic
weather station

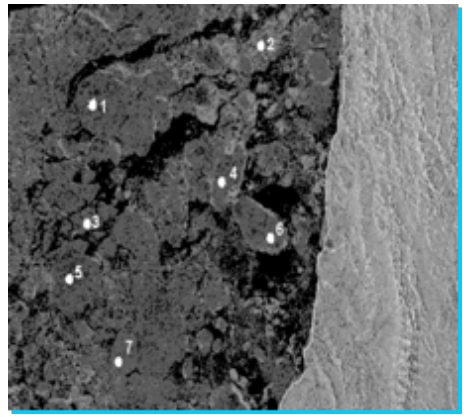
Satellite images



MODIS (TERRA)



AVHRR (NOAA)

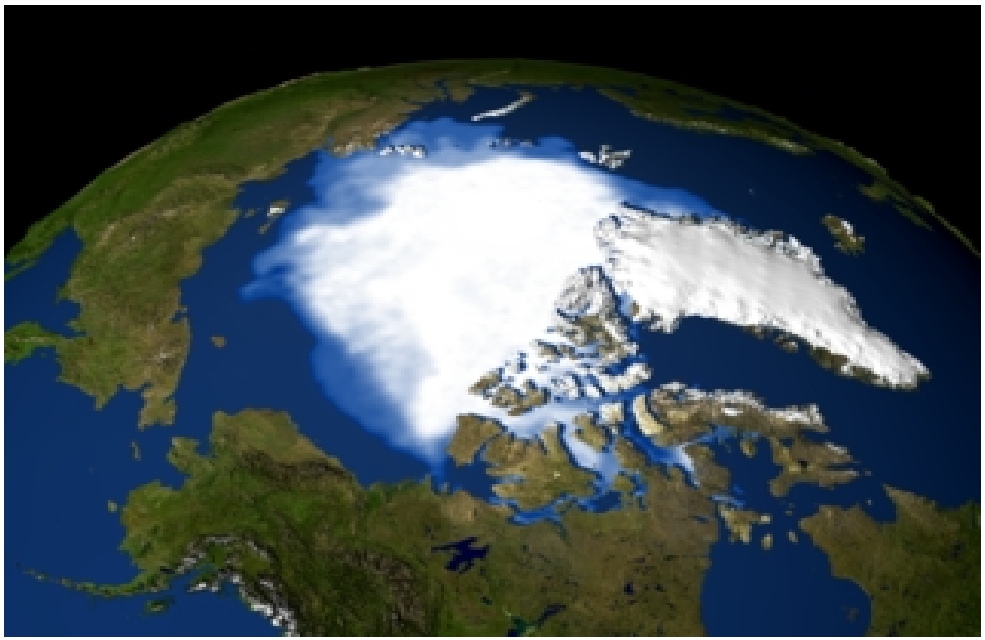


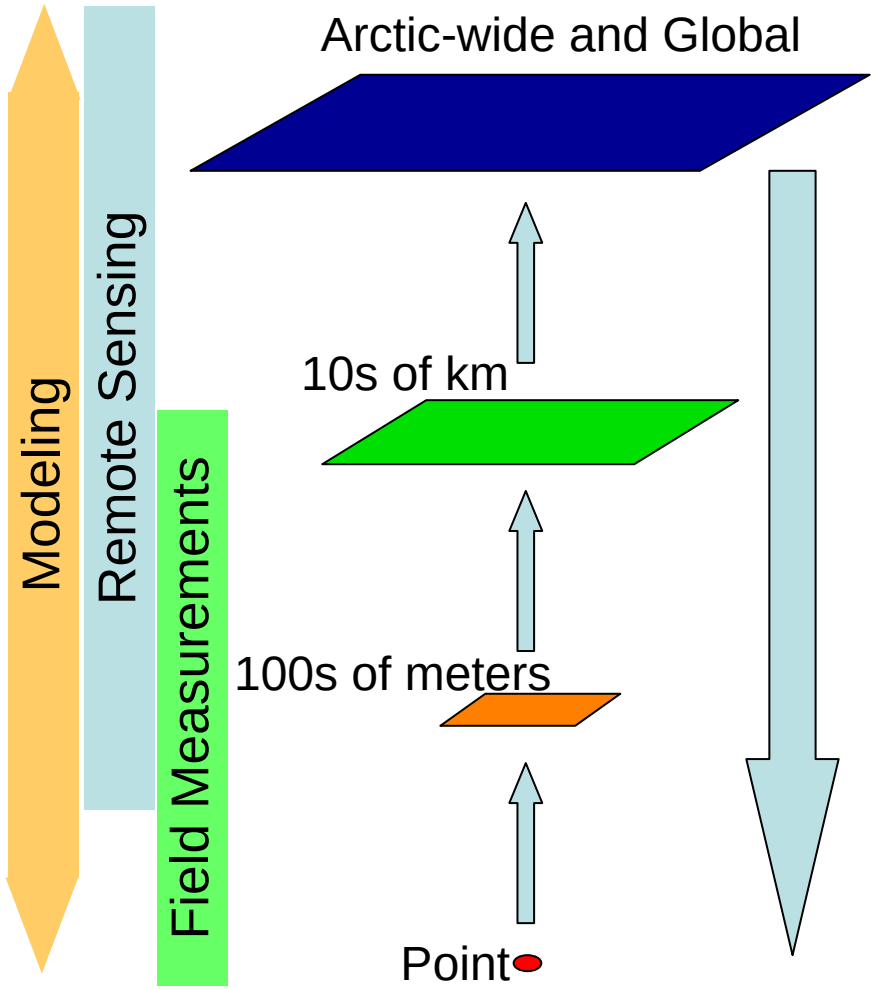
SAR (RADARSAT)

WMO
OMM

The Overarching Challenge

Integrating strengths of remote sensing with complementary observations and models to describe the How the Arctic system works, how it is changing, and what those changes mean for the future





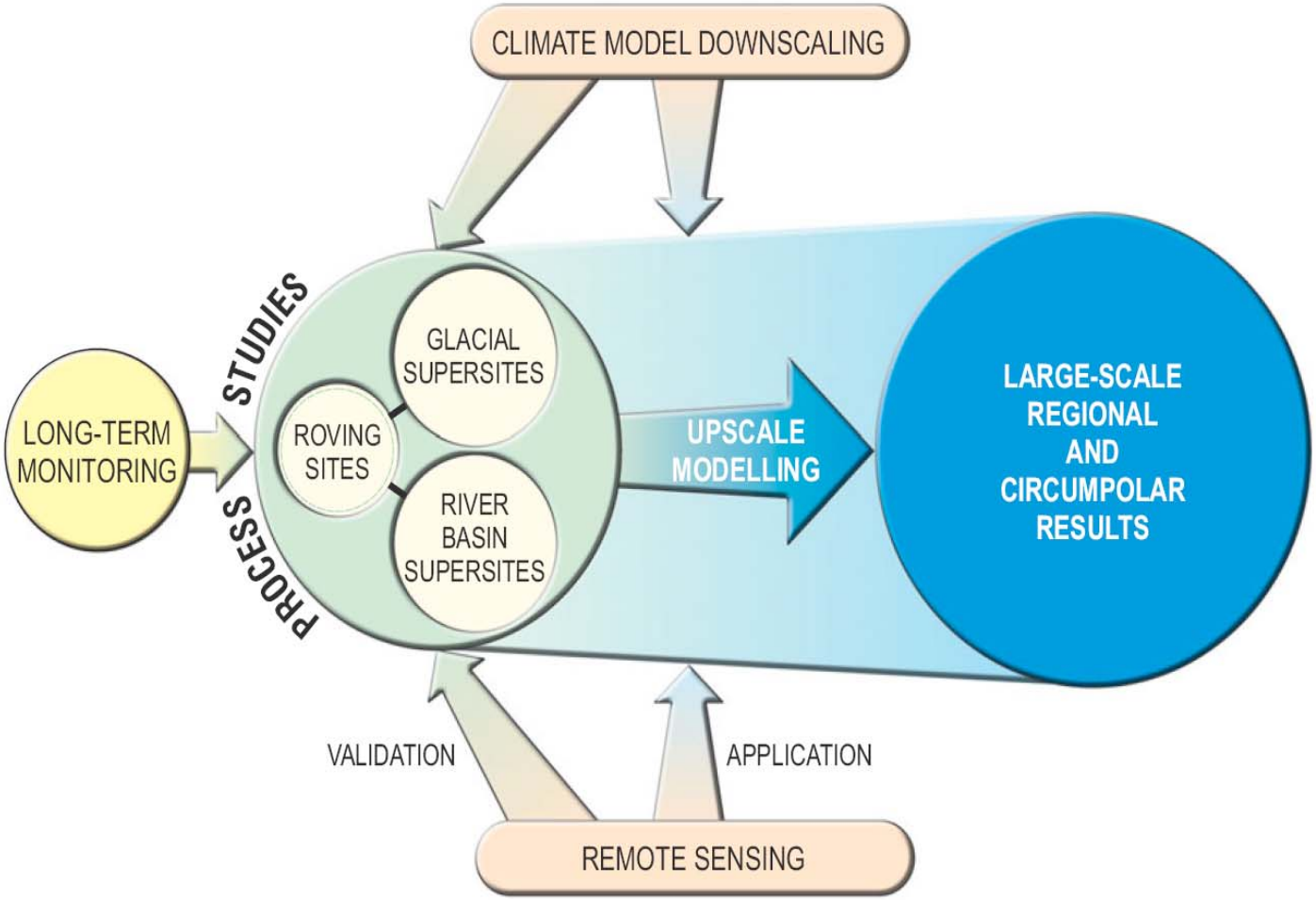
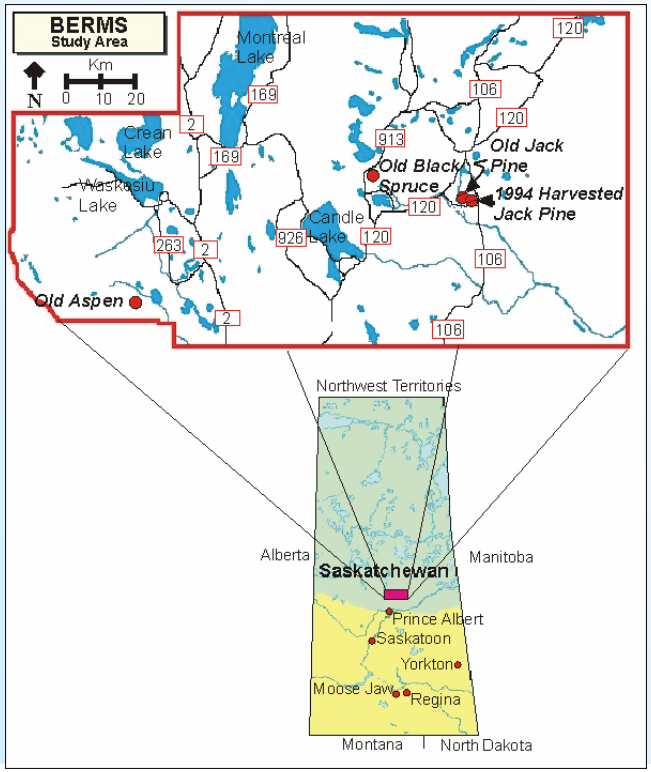


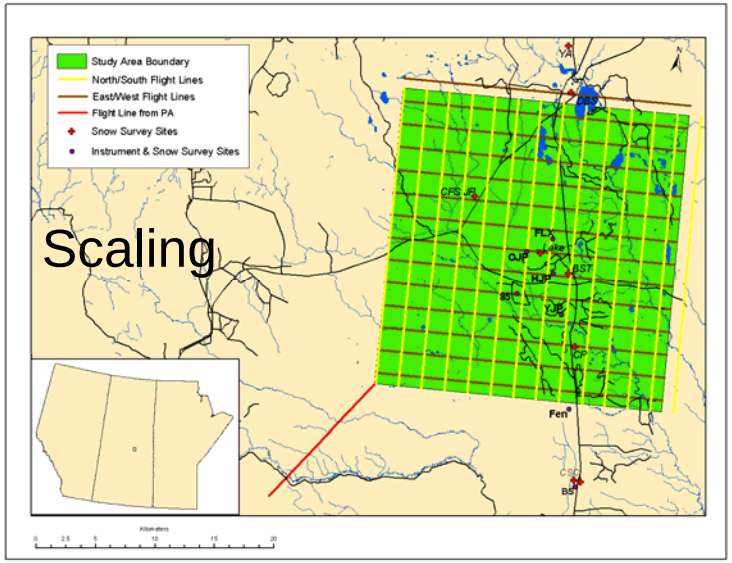
Figure 4: Major components of ICARPII study approach.

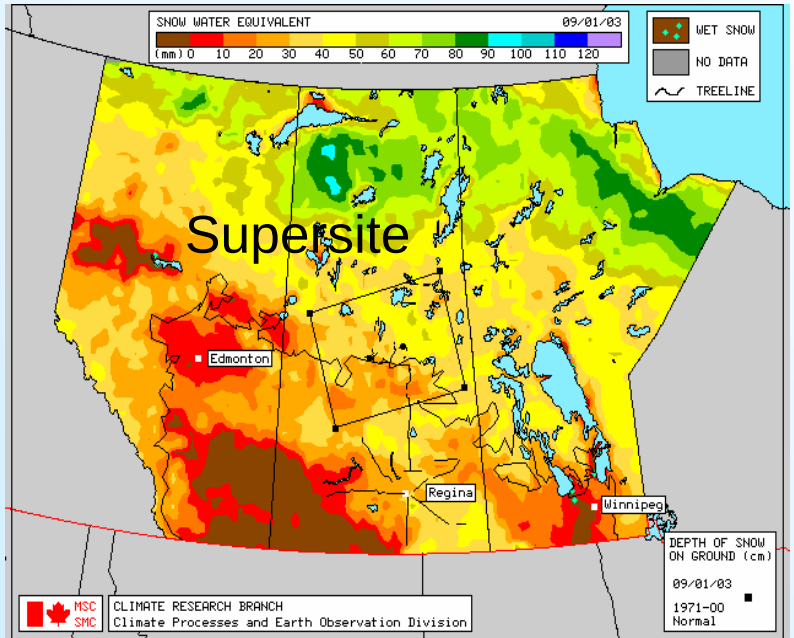
Integrated Studies, Joint Projects

Supersites



- *Produce baseline terrestrial data and information for model validation and climatological assessment*





BERMS Overview

- **Joint initiative of Meteorological Service of Canada, Canadian Forest Service, Parks Canada and Canadian university partners**
- **<u>Objective</u>: to study the carbon, water and energy cycles of the southern boreal forest in relation to inter-annual climate variability, stand age and type, disturbance regime (fire vs. harvest)**
- **“Super-site” with ten flux towers and associated array of climatological, ecological and hydrometeorological measurements**

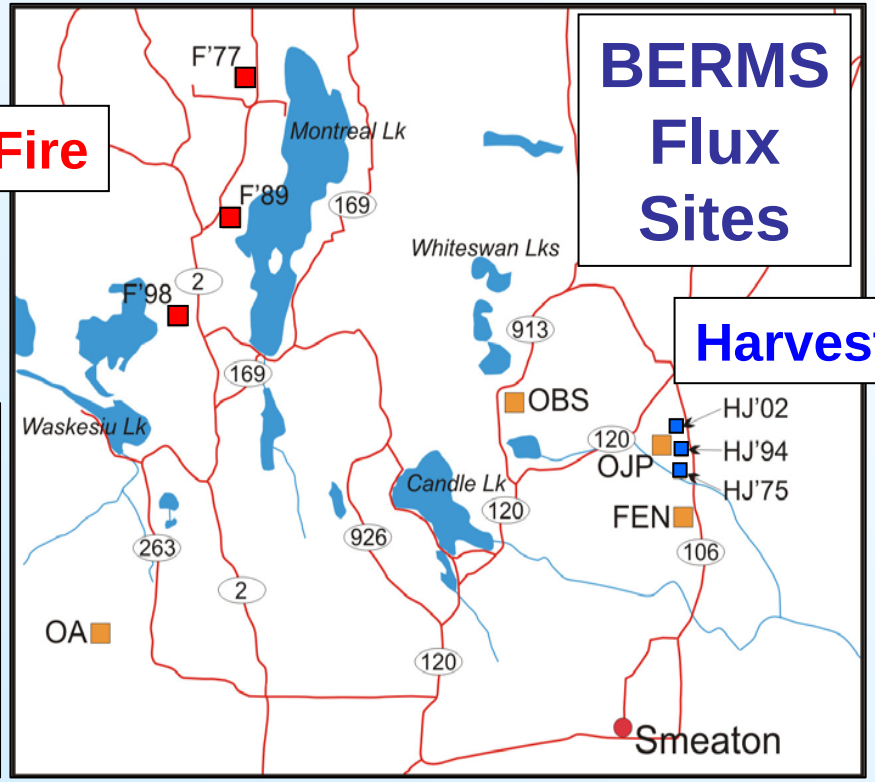

F89

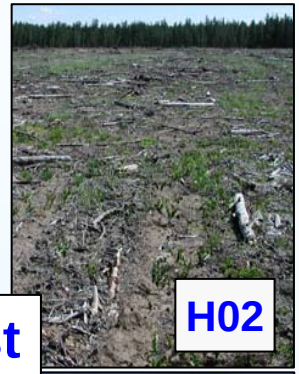

OBS

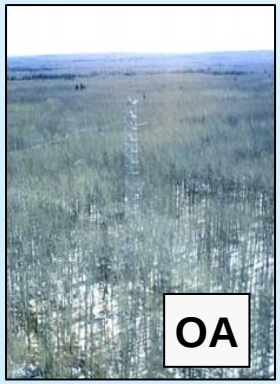

OBS


H94


Fire
F98

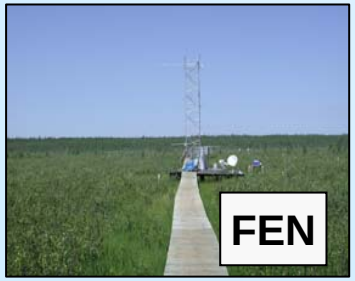

BERMS
Flux
Sites
Harvest
F'77
Montreal Lk
F'89
169
Whiteswan Lks
F'98
2
913
169
OBS
HJ'02
Waskesiu Lk
120
HJ'94
OJP
HJ'75
Candle Lk
120
FEN
926
106
263
2
OA
120
Smeaton


H02


OA


H94


OA


FEN


OJP

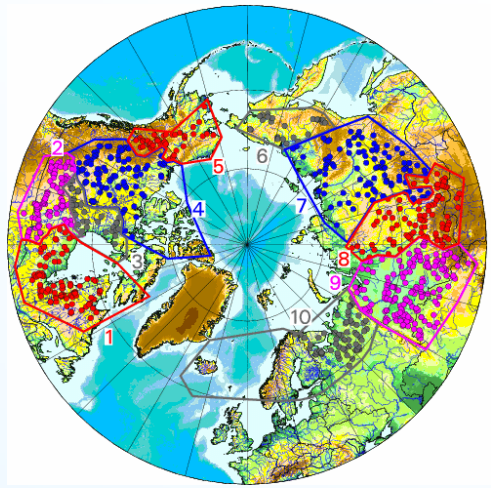

H75

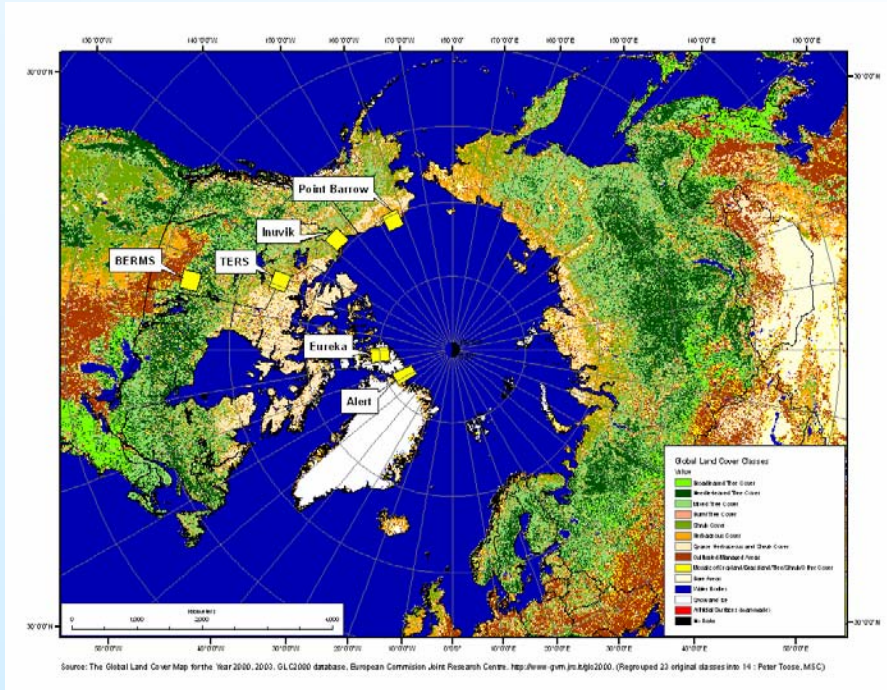
High Latitude Super Sites

Enhanced observing systems

- Reference climate stations (GCOS)
- Hydrometric
- Cryosphere - in-situ and remote sensing
- Ship-board upper-air
- Ozonesondes
- Alert/Eureka – SEARCH, PEARL
- Multi-disciplinary observatories
  - atmosphere, cryosphere, ecosystem, flux
- COMAAR, CEON
- Arctic coastal dynamics
- Data access and management

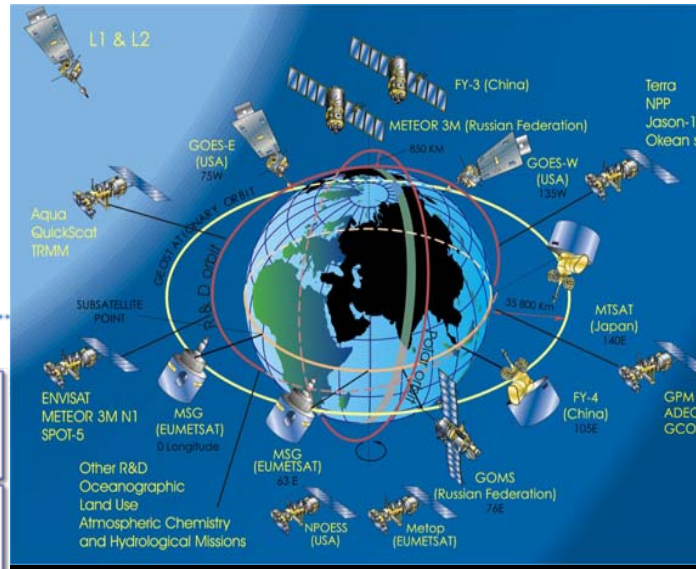
Ability to apply global and regional climate model to Arctic issues

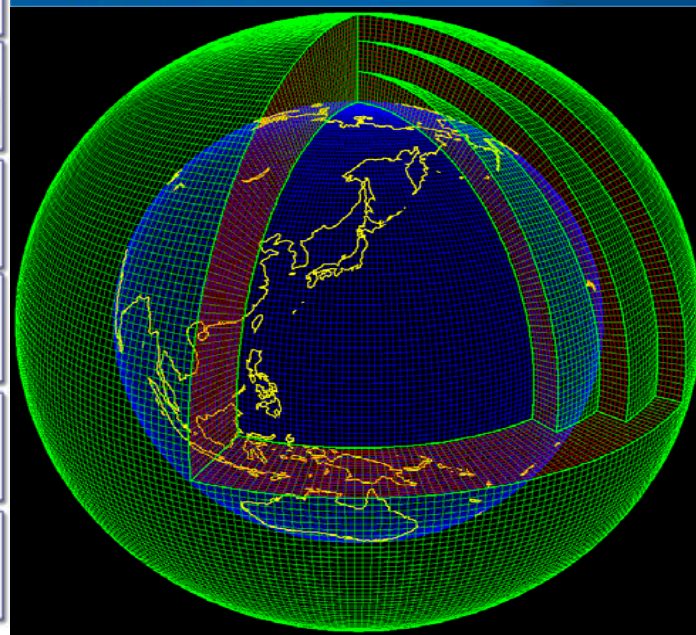




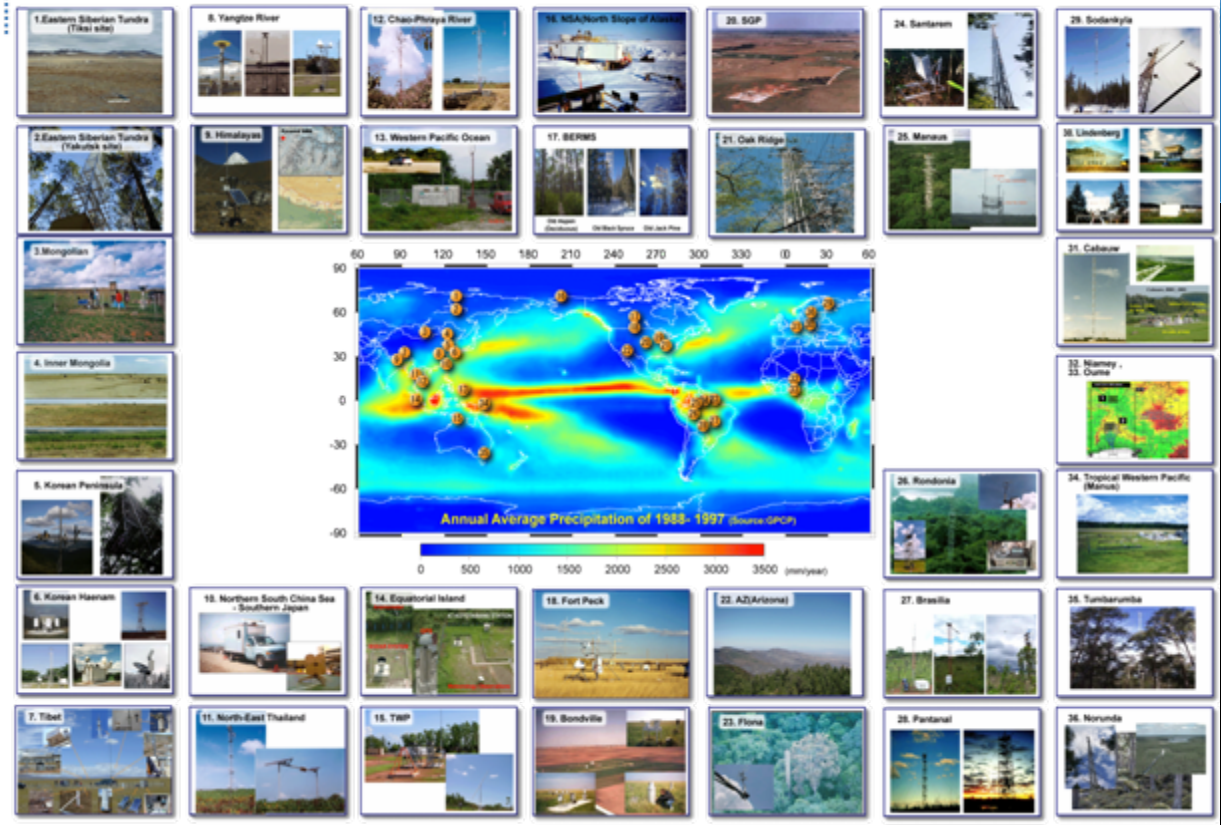
Coordinated Enhanced Observing Period
Three Unique Capabilities

A Prototype of the Global Water Cycle Observation System of Systems



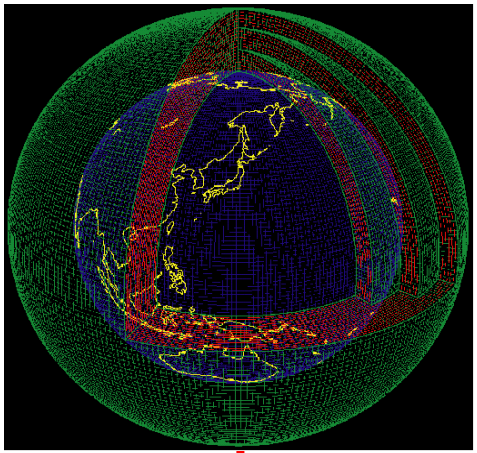


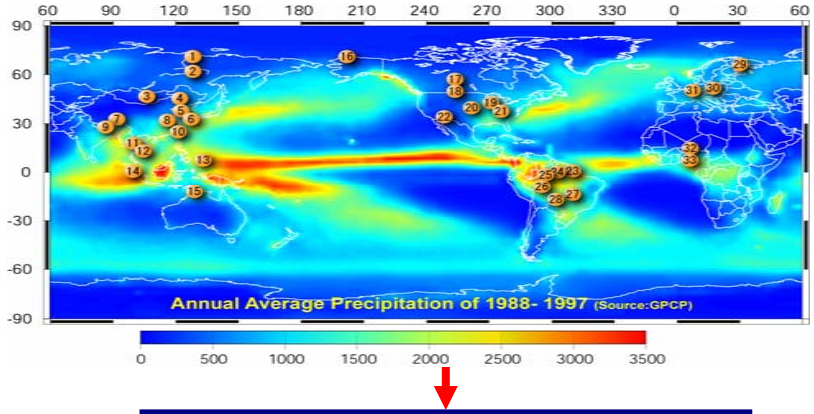
International Cooperation for the Global Coverage

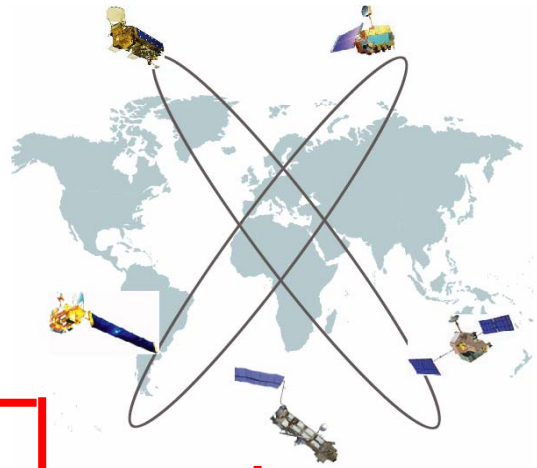


Coordinated Enhanced Observing Period
Three Unique Capabilities

A Well Organized Data Archive System







In-Situ Data Archiving Center at UCAR (University Corporation for Atmospheric Research) of USA

Model Output Data Archiving Center at the World Data Center for Climate, Max-Planck Institute for Meteorology of Germany

Data Integrating/Archiving Center at University of Tokyo and JAXA of Japan

The Role of Data Management in IPY

- IPY 1 1882: much of the data has been lost.
- IPY 2 1932-33, almost nothing remains http://www.arctic.noaa.gov/aro/ipy-1/index.htm.
- "Building an integrated data set from the broad range of IPY research activities represents one of IPY's most daunting challenges. An enduring data set, accessible to scientists and the public during IPY and for many decades into the future, will represent one of IPY's strongest legacies " (The Scope of Science for the International Polar Year, 2007-2008, http://www.icsu.org/gestion/img/icsu_doc_download/).

Information products - considerations

- **Data and information** – not just products
- **Reliable, freely accessible data** -- a strong data management framework built on standards with consistent methods for access across various datasets.
- Query tools that enable one to **build one's own 'information product**' -- query tools that enable some analysis etc. of the data as desired
- **Rapid, near-real-time access** to as much data as possible -- the initial, minimally non-qc'd data for those things requiring quick response and then the qc'd data later for research
- **Metadata tools** -- the existing database of all Arctic information is already large -- need reliable/complete tools to interrogate metadata first – use established guidelines and develop a virtual data center
- Develop **data collection strategies to meet scientific goals and real-time requirements**
- Implement consistent **quality control** and processing procedures
- **Collaboration** among networks, programs and data centers – sharing, acknowledgement, trust
- Develop a data policy
- **Virtual data centre with entry portals**
- don't underestimate the **resources needed to maintain an effective national data archive**
- **unless data and information are easy to obtain (e.g. online "free" access) and have well-documented meta-data, the huge investment in observing systems is being wasted**

What is GEOSS?

Comprehensive

Coordinated

Sustained

An end-to-end system of existing systems linking with new and expanding systems

GEOSS is : Collaboration

Here to promote data accessibility and interoperability for earth observations

Here to promote interagency, intergovernmental, and interdisciplinary collaboration

Here to encourage shared infrastructure

Here to inform the decision makers what needs to be done to realize the vision, and to build the political will to make it happen

Data Sharing Principles

There will be **full and open exchange of data**, **metadata, and products** shared within GEOSS, while recognizing relevant international instruments and national policies and legislation

All shared data, metadata, and products will be made available with **minimum time delay and at minimum cost**.

All shared data, metadata, and products for use in **education and research** will be encouraged to be made available **free of charge or at no more than the cost of reproduction**.

Key Operational Principles

Driven by user needs

Able to incorporate new technology and methods

Addresses planned and existing observation systems

Include observing, processing, and dissemination capabilities interfaced through interoperability specifications adhered to by all contributing systems

Observations and products are to be observed, recorded and stored in clearly defined formats, with metadata and quality indications to enable search and retrieval, and archived as accessible data sets

In the Arctic alone…

There are

54 active networks

11 planned networks

31 observatories

25 Arctic data centers, archives, portals

17 Coordinating bodies