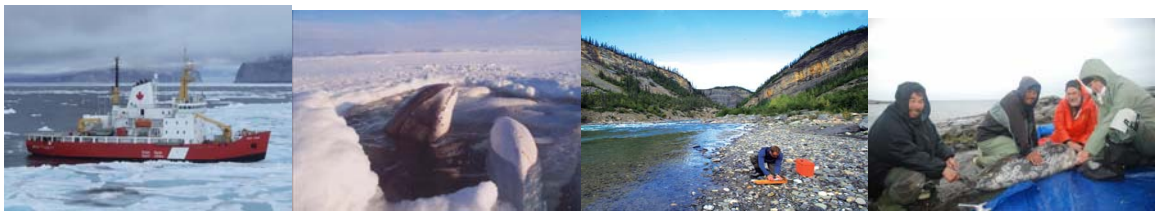


Inventory of Arctic Observing Networks Canada

Version 2: January 22, 2010

Arctic Observing Networks - Canada

Table of Contents

Overview of Approach

The Canadian Arctic has been defined within this Inventory using the same definition as that from International Polar Year; that is "the area north of the southern most limit of discontinuous permafrost". This definition includes areas south of the 60^{o} North latitude, and also includes the northern reaches of some of Canada's southern provinces (e.g. Manitoba, Ontario, Quebec and Newfoundland and Labrador).

The Canadian inventory of Arctic observing networks is presented in a thematic framework. Key components of the Arctic observing were identified to include observations relating to the Atmosphere, Cryosphere, Aquatic Ecosystems, Terrestrial Ecosystems, Human Health as well as multi-disciplinary Networks. Underpinning all of the observation networks is data management responsibilities (Figure 1).

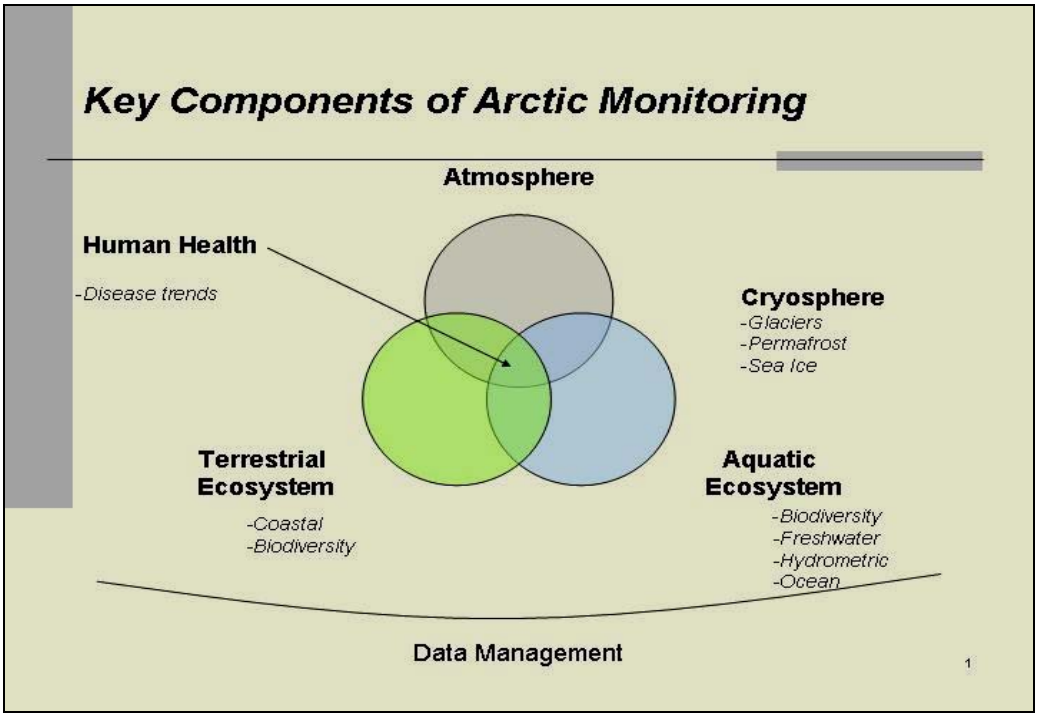


Figure 1

Data management responsibilities should be reinforced as key to all observing networks. Agencies responsible for acquiring observations are equally responsible for managing and disseminating data, integrating and analyzing data so as to increase our understanding and to provide advice and direction on a wide range of management responsibilities.

It was felt that this framework grouping would enable synergies to become evident and enable greater integration across the themed components. Figure 2 presents how the various framework components need to fit together to provide an integrated network. On this figure, the need for Community-based monitoring is included as well.

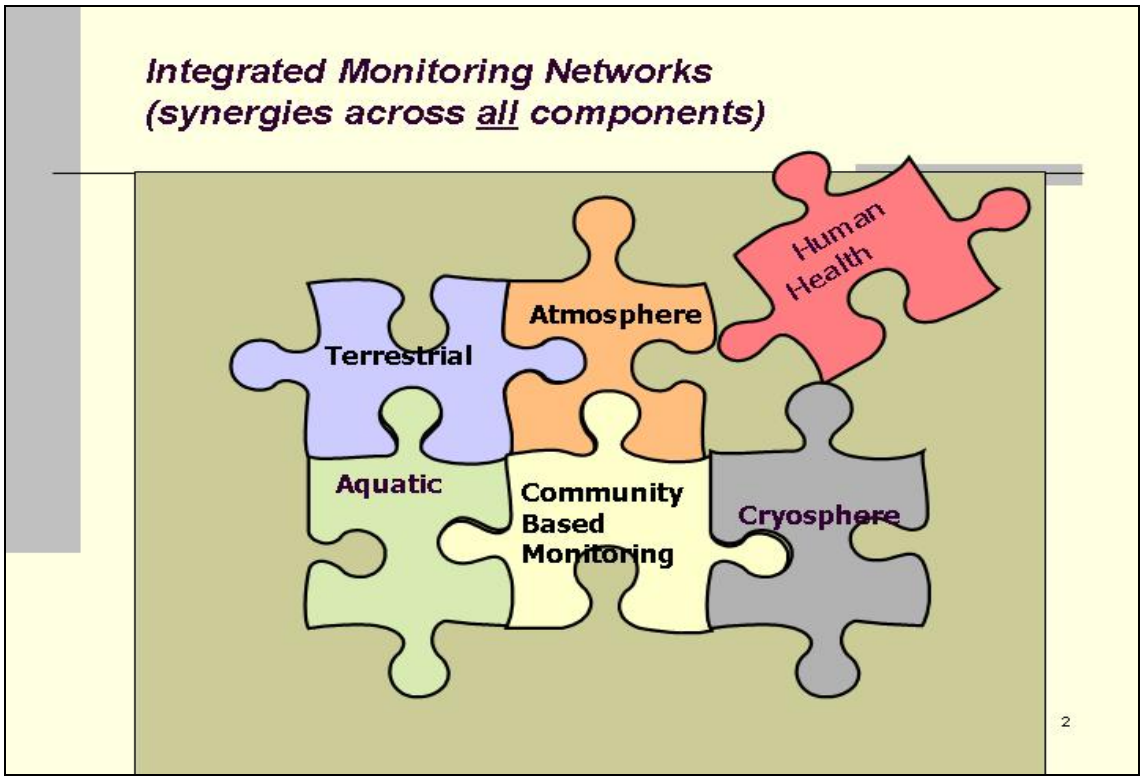


Figure 2

Community-based monitoring (CBM) is an aspect of monitoring that is not yet well articulated within this Canadian inventory. CBM has many elements that can contribute to an integrated monitoring network but efforts are ongoing on how best to integrate this element. Local and traditional knowledge research and community-based monitoring have been, and continue to be, conducted by Arctic communities and can make significant contributions to understanding recent environmental, social and health change.

One CBM network that is emerging is the Exchange for Local Observations and Knowledge of the Arctic (ELOKA). ELOKA is a US National Science Foundation initiative to provide data management services and user support to facilitate the collection, preservation, exchange, and use of local observations and knowledge of the Arctic. ELOKA seeks to help make local and traditional knowledge (LTK) and community

observations discoverable, so more information is available for research and community planning. ELOKA collaborates with communities around the Arctic including several communities in Nunavut. ELOKA currently works with SAON to create a registry of LTK research and organizations across the Arctic. ELOKA is based in Boulder, Colorado with staff in Ottawa; Clyde River, Nunavut; and Eagle River, Alaska.

Section A: Atmospheric Observations

A-1: Atmospheric Observations

Contact person:
Surface Weather and Climate Networks: John MacPhee (john.macphee@ec.gc.ca)
Marine Networks: Chris Marshall (chris.marshall@ec.gc.ca)
Upper Air Networks: Lee Suddick (lee.suddick@ec.gc.ca)

Web site : *http://www.msc-smc.ec.gc.ca/index_e.cfm*

Main objective of the networks:
To acquire atmospheric data in support of both the prediction and detection of severe weather and of climate trend and variability research. This serves a broad range of users including researchers, policy makers, and service providers.

Type of network:
Atmospheric observing stations over land and sea composed of:

- Surface Weather and Climate Network:
  - In-situ land stations comprising both Hourly stations and Daily Climate observations
- Marine Networks:
  - Buoys (moored and drifting)
  - Ships: Automatic Volunteer Observing System
- Upper Air Network:
  - In situ (radiosonde)
  - In situ Commercial Aircraft (AMDAR)

Thematic area:

- Atmosphere: yes
- Terrestrial ecosystems: yes
- Coastal: yes
- Ocean: yes – atmospheric obs over ocean surface
- Freshwater: yes – atmospheric obs over freshwater surface
- Cryosphere: yes - atmospheric obs over ice surface
- Human & socio-economic: yes.
- Space physics: no

Main variables:

- MSC owned Surface Weather and Climate stations:
  - Approximately 65 automatic Reference Climate and Surface Weather Stations of varying quality:
    - hourly; temperature, humidity, 10 m and 2 m wind including peak wind, total precipitation, surface pressure seasonal rate-of-rainfall, and differential snow depth. A few sites report solar radiation.
    - MSC has a high quality but low density Reference Climate Stations (RCS) observing network in the north. Since early 2003, MSC has installed 43 high quality climate observing platforms north of 60^0. These observing sites, operate 24/7

and report hourly through land lines and satellite links. MSC is committed to the ongoing maintenance of these stations well into the future.
    - MSC directly owns and operates approximately 25 Surface Weather stations with essentially the same sensor configuration, but operated in support of prediction services, that is forecasters and numerical weather prediction. These stations are older and less well maintained than the RCS network. They operate 24/7 and report hourly.

  - Daily Climate Stations:
    - Daily Maximum and Minimum Temperature and Total precipitation

- Marine Stations:
  - Drifting buoys:
    - Sea surface temperature and atmospheric pressure and position information (SVP-B). Some buoys provide estimates of wind speed and direction (WOTAN buoys)

  - Ships (AVOS):
    - hourly when in the Arctic, 3-hourlies when in Canadian waters, regularly 6 hourly when away from Canadian waters; wind direction and speed, Pressure, Air Temperature, Sea surface temperature, humidity. Where possible, an observer can complement the observations with additional parameters including present weather, past weather, amount of cloud, type of cloud, height of cloud base, visibility, direction of movement of waves, period of waves, height of waves, sea ice and/or icing of ship superstructure, when appropriate. Note that AVOS network moving towards hourly observations with deployment of Iridium telecommunications.

- Upper Air Stations:
  - In situ (Radiosondes): 00z & 12z; temperature, humidity, atmospheric pressure and wind (speed and direction) from the surface to about 30 km. Some stations also measure atmospheric ozone on a weekly basis.

  - Commercial Aircraft (AMDAR): tropospheric profiles as well as en-route in-situ data: air temperature and pressure, wind speed and direction, aircraft position, time and phase of flight

When operational (year): Although the surface weather network was established in 1950, some climatological records have been systematically collected since 1850. Automatic stations date back to the mid 1990's. Upper Air network (radiosondes) has

been established for about 50 years. The Canadian AMDAR Program has been contributing data on GTS since 2005.

Geographical coverage (countries): Canada

- In-situ lands stations: Higher density in southern areas, over the prairies and near populated centers.

- Drifting buoys:
  - North Eastern Pacific. These buoys drift eastward towards the Canadian West coast with some of them spiraling up towards the Gulf of Alaska.
  - North West Atlantic Buoys are deployed during mooring buoy tender trips, with drift trajectory rapidly ot the NE due to the prevailing gulf stream current.
- UpperAir: In situ radiosonde network is dispersed across Canada. The Canadian AMDAR Program targets observations over Canada in priority – currently the operational AMDAR fleet consists of Air Canada Jazz fleet of CRJ aircraft, thus providing data along the routes of these aircraft (e.g. soundings at 34 Canadian airports located coast-to-coast mostly south of 55N)

Data archive (data center): National Data Archives maintained by Environment Canada. http://www.climate.weatheroffice.ec.gc.ca/Welcome_e.html

Data availability:

- In-situ Land stations:

  - Real time: http://www.weatheroffice.gc.ca/canada_e.html
  - Archived: Data is archived in MSC – NAS (National Archive System http://www.climate.weatheroffice.ec.gc.ca/Welcome_e.html

- Buoys:
  - Data is available as a text bulletin format from the MSC – Data Archive and Anyalysis Division. Data, including meteorological elements as well as complete wave specrum data are archived and available via the ISDM (Integrated Science Data Management) system operated by DFO http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/index-eng.html

- Upper Air:
  - UA data is available in real-time from GTS bulletin formats. Historical data is available on request on a cost-recovered basis from the MSC

- Level of fee to be paid:
Historical climate data is available from MSC – Data Archive and Analysis Division and regional centres. Tailored data is available on a cost-recovered basis. Selected portions are available as CD image files on an MSC web site. Some data that is collected in real-time is available in near-real time at a variety of MSC web sites. Data and metadata will be

increasingly available (in greater volumes and in different formats) on MSC web sites .

Main gaps: Long-term, atmospheric monitoring in the North poses a significant challenge both operationally (e.g. in-situ automated snowfall measurements) and financially (charterd flights for maintenance and calibration).Most monitoring in the North is limited to populated areas. Attempts to develop an AMDAR capacity out of First Air and Canadian North fleets failed due to economical and technical difficulties. As demonstrated through impact studies, benefits of AMDAR in the North would be tremendous, however would require acquisition and deployment of specialized sensing packages such as TAMDAR (which includes measurements of relative humidity), development of datalink capacity through satellite communications (e.g. Iridium), and upgrading some aircraft systems when possible, especially the aircraft navigation systems.

Section B: Aquatic Ecosystem Observations

B-1: Hydrometric Observations

Contact person : Dave Harvey (dave.harvey@ec.gc.ca)

Web site : www.wsc.ec.gc.ca

Main objective of the networks:
To provide for the collection, interpretation, and dissemination of surface water quantity data and information and services that are vital to meet a wide range of water management, engineering and environmental needs across Canada.

Type of network: in-situ.water level and streamflow monitoring stations

Thematic area:
Data collected under the hydrometric program contribute to research and development, and planning and management activities in the following thematic areas.

- Atmosphere: yes
- Terrestrial ecosystems: yes
- Coastal: yes
- Ocean: yes
- Freshwater: yes
- Cryosphere: yes
- Human & socio-economic: yes

Main variables:

- water levels, streamflow, sediment
- Continuous daily data published for most locations;
- over 60% of stations report in near real-time

When operational (year): Water level and discharge data have been systematically collected to national standards by the Water Survey of Canada since 1908. Formal cost-sharing agreements have been in place with the Provinces and Territories since 1975.

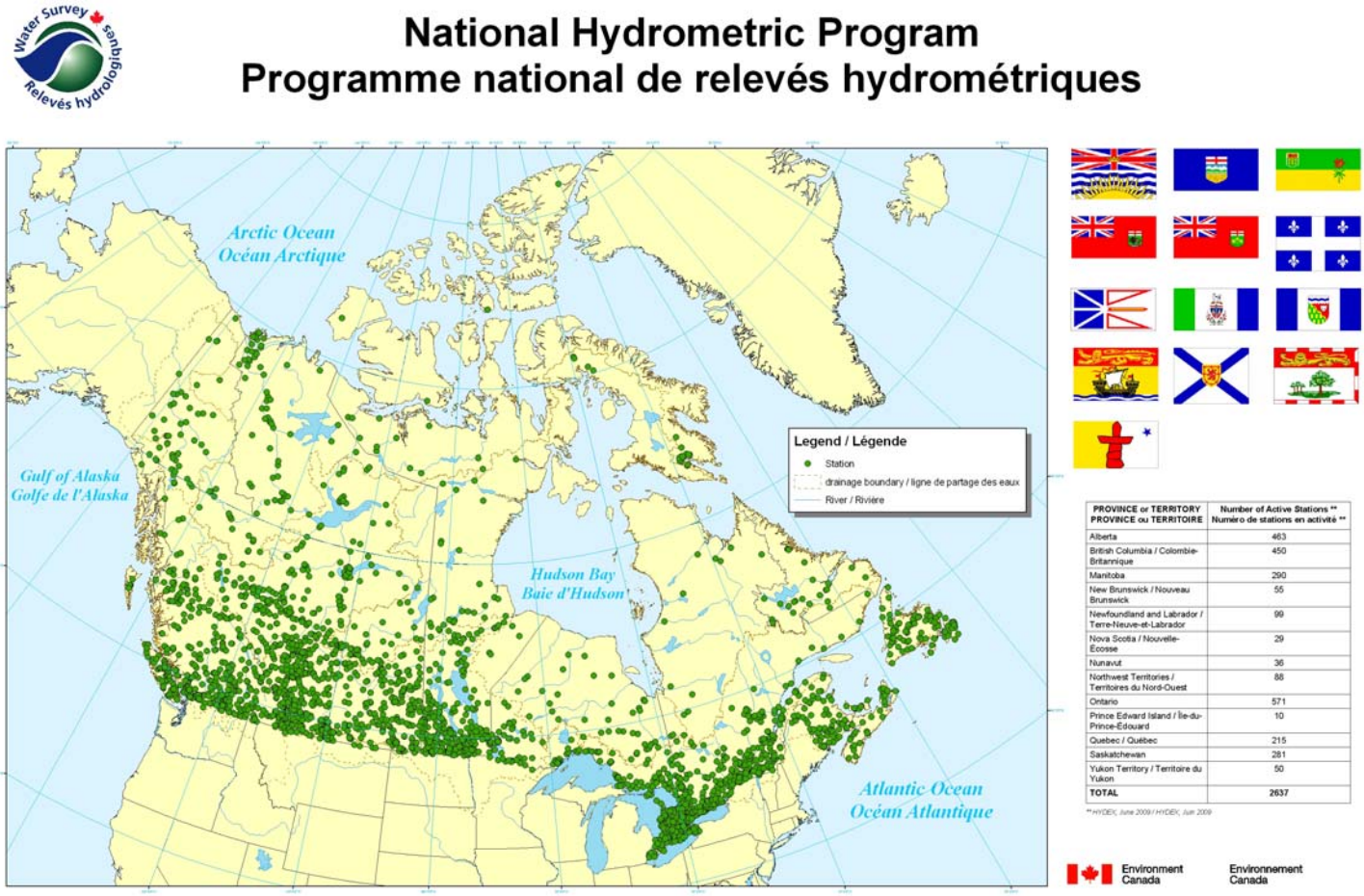
Geographical coverage (countries):

- Canada

2008 Northern Hydrometric Network – Yukon, NT and NU	
	Number of Hydrometric Stations
Federally-funded	**78**
Federal-Territorial cost-shared	**38**
Territorially-funded	**14**

3rd party-funded*	**48**
TOTAL	**178**

*** 30% of network supported by private sector or OGDs outside of F/T cost-sharing agreements**



Data archive (data centre):

- HYDAT is the Canadian hydrometric data archive maintained by Environment Canada.

Data availability:

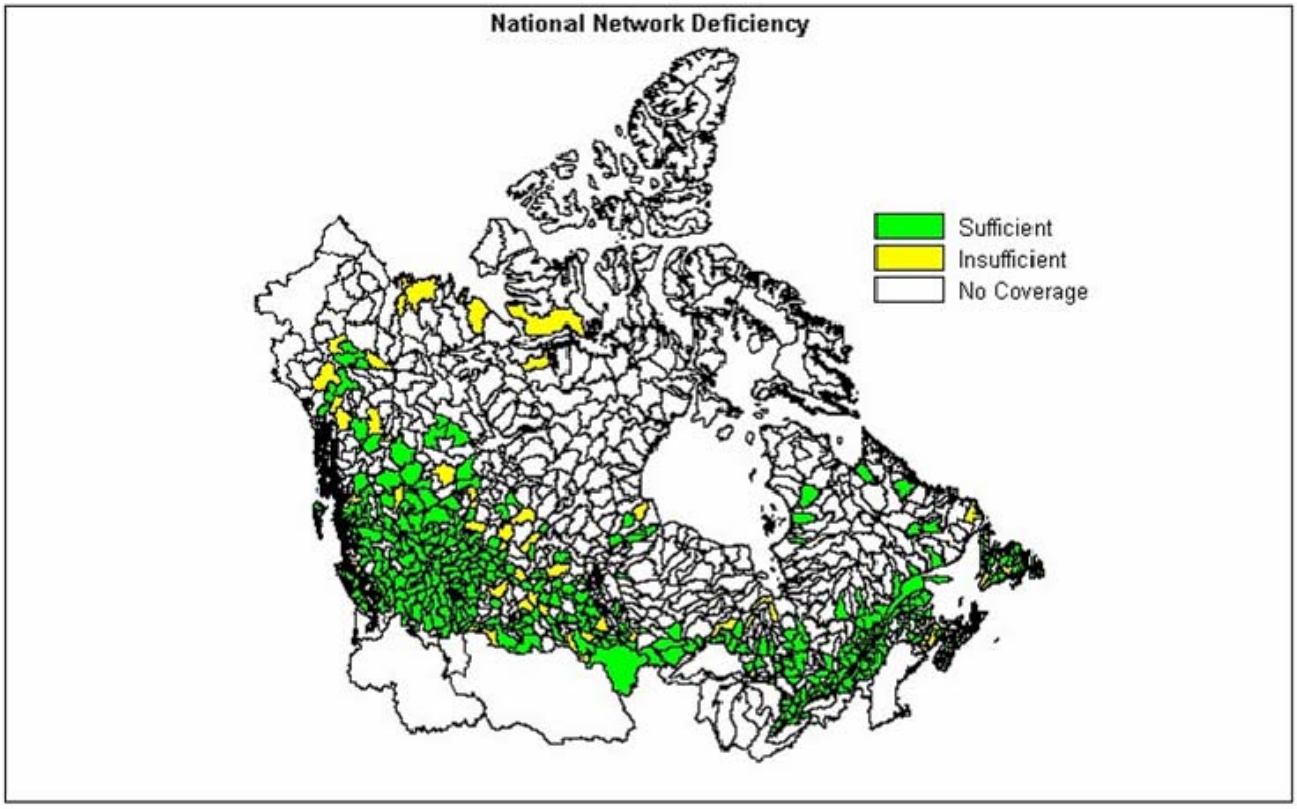
- Both real-time and historical (archived) data are available from Environment Canada's web site: http://www.wsc.ec.gc.ca/).
- near real-time water levels and historical data
- Data from two thirds of the active hydrometric network are reporting in near real-time. Water levels for these stations are presented graphically on the WSC website (http://scitech.pyr.ec.gc.ca/waterweb/formnav.asp?lang=0) within hours of their measurement. Eventually, both water level and stream flow data will be available for most stations in near real-time.
- Some data availability issues are set by the federal and provincial partners in the National Hydrometric Program.

- Specialized or non-standard data are available from individual MSC Regional hydrometric offices on an on-request, cost-recovered basis.

Main gaps:

The current hydrometric network is deficient in terms of understanding the regional hydrology and river regimes across Canada. The map below integrates Environment Canada's two key frameworks: the National Drainage Area Framework with the National Terrestrial Ecological Framework to identify network deficiencies. In order to have sufficient information there needs to be ***at least one active hydrometric station measuring natural flow in each corresponding ecodistrict within a sub-sub drainage area***. This strategy ensures that there will be sufficient information to understand the hydrological processes and the interrelationships with the landscape. This information is essential for research and enhancing our predictive capabilities and data transfer.

As the map shows, areas of sufficiency are concentrated in the southern, more populated regions of the country. Network sufficiency declines to the north and northeast, with great extents of northern Canada having no coverage at all.



B-2: Arctic Oceanographic Observations

Contact person : Helen Joseph (Helen.Joseph@dfo-mpo.gc.ca)

Web site: http://www.meds-sdmm.dfo-mpo.gc.ca/

Main objective of the network:
Observations of the Arctic Ocean have been made since the 1800s at varying levels of intensity. The objective is to gain a better understanding of the physical and chemical composition of Arctic waters, the circulation of the waters within the Arctic Ocean, and flows into and out of the Arctic Ocean. Physical observations are conducted on properties of the water column including ocean temperature, sea surface temperature, salinity, pH, carbon, changes in ice coverage and extent, hydrographic measurements, nutrients, etc. Surface drifters either embedded in the ice, or (lately) able to float and operate in ice infested waters, provide measurements of a limited number of surface ocean and meteorological variables. . Additional observations are obtained on ocean currents, waves and tides. Biological observations are captured within a separate inventory item titled "Arctic Marine Biodiversity Monitoring". Recently, a focus has been on increasing understanding of the impacts of climate change on Arctic waters (e.g., increasing temperature, decreasing pH, decreasing salinity, changing ice conditions, etc.).

Data is gathered by ship with in situ measurements, deployment of moorings and buoys, helicopters (e.g. for ice measurements), and satellites (e.g. sea surface temperature).

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Member/connected to global network, if yes which: International Arctic Science Council's (of the Arctic Council) Arctic Oceans Science Board; Inter-governmental Oceanographic Commission (IOC) and supporting bodies (e.g. Joint Committee on Oceanographic and Marine Meteorology J-COMM)

Type of network:

- Thematical observations: of all oceanographic parameters
- Field stations: Research ships and ice breakers of the Canadian Coast Guard; other ships of opportunity as available; moorings and buoys
- Community based observations:
- Coordination: National coordination of the program provided within Fisheries and Oceans Canada, and the National Centre for Arctic Aquatic Research Excellence (NCAARE)

Thematic area:

- Atmosphere: yes
- Terrestrial ecosystems: no
- Coastal: yes
- Ocean: yes.

- Freshwater: limited
- Cryosphere: yes (sea ice)
- Human & socio-economic: no
- Space physics: no

Main variables: Physical observations are conducted on properties of the water column including ocean temperature, sea surface temperature, salinity, pH, carbon, changes in ice coverage and extent, hydrographic measurements, nutrients, etc. Surface drifters either embedded in the ice, or (lately) able to float and operate in ice infested waters, provide measurements of a limited number of surface ocean and meteorological variables. . Additional observations are obtained on ocean currents, waves and tides. Biological observations are captured within a separate inventory item titled "Arctic Marine Biodiversity Monitoring". Recently, a focus has been on increasing understanding of the impacts of climate change on Arctic waters (e.g., increasing temperature, decreasing pH, decreasing salinity, changing ice conditions, etc.).

When operational (year): Ongoing, at various levels of coverage, since 20th Century

Geographical coverage (countries): Numerous sites throughout the Canadian Arctic.

Data archive (data centre): Fisheries and Oceans Canada Science Sector's Integrated Science Data Management (ISDM) databases.

Data availability:
- Meta-data only: available annually through regular reporting
- All data: Available through the ISDM database
- Level of fee to be paid: None

Main gaps: Large geographic areas of the Arctic are not covered regularly.

B-3: Arctic Marine Biodiversity Monitoring Network

Contact person Dr. Jill Watkins (Jill.Watkins@dfo-mpo.gc.ca)

Main objective of the network:

The main objective of the Arctic Marine Biodiversity Monitoring Network is to develop and implement, for priority marine ecosystems, an integrated, long-term biodiversity monitoring plan to detect changes in biodiversity temporally and spatially, and to establish links between such changes and anthropogenic drivers.

Member/connected to global network, if yes which: Circumpolar Biodiversity Monitoring Program (CBMP) (Arctic Council)

Type of network:

- Thematical observations: ✓ all trophic levels and appropriate proxy variables for biodiversity
- Field stations: ✓ fixed locations on land; research ships and icebreakers of the Canadian Coast Guard; other ships of opportunity as available; moorings
- Community based observations: ✓ connected to scientific projects
- Coordination (e.g. not directly involved in observations, but coordinates data and use (for instance AMAP) : ✓ national coordination of the network, development of plans, data analysis, reporting

Thematic area:

- Atmosphere: no
- Terrestrial ecosystems: no
- Coastal: no
- Ocean: ✓
- Freshwater: no
- Cryosphere: no
- Human & socio-economic: ✓ (humans are part of biodiversity)
- Space physics: no

Main variables: all trophic levels in the Arctic marine ecosystem: ice algae, phytoplankton, zooplankton, pelagic and demersal fish, benthos, seabirds, seals, whales, polar bears, people, sea ice, oceanographic variables

When operational (year): some data collected since the 1950s; some collected during bursts in the 1970s and 1990s; some collected more recently

Geographical coverage (countries): Canada – Beaufort Sea-Amundsen Gulf-Viscount Melville Sound-Queen Maud Gulf; Hudson Bay Complex; Davis Strait-Baffin Bay-Lancaster Sound.

Data archive (data centre): various locations depending on trophic level, proxy, organization

Data availability:

- Meta-data only: ✓
- All data: ✓ (for some, only aggregated data are available, not raw data)
- Level of fee to be paid: generally none

Main gaps: Large gaps both spatially and temporally. Many datasets cover short periods.

Section C: Terrestrial Ecosystem Observations

C-1: Arctic Avian Monitoring Network

Contact person: Garry Donaldson (garry.donaldson@ec.gc.ca)

Main objective of the network:

The main objective of the Arctic Avian Monitoring Network is to characterize the occurrence of birds in the Arctic to support regulatory responsibilities and conservation of birds and the biodiversity on which they depend. Temporal and spatial changes can be used to indicate changes in ecosystems that might otherwise be difficult to detect (e.g. marine areas) and can also be used to model predicted changes due to human activity.

Member/connected to global network, if yes which: Conservation of Arctic Flora and Fauna (CAFF) Seabird Working Group (Arctic Council), African-Eurasian Waterbird Agreement. Program for Regional and International Shorebird Monitoring (PRISM).

Type of network:
Network consists of programs divided into three species themes that combine common aspects of biology and human use:
Waterfowl: e.g. ducks geese and swans

- centered on aerial surveys of high density breeding areas and following non-breeding birds using satellite telemetry

Seabirds: e.g. gulls, terns and auks

- centered on surveys at breeding colonies and of birds at sea (either by direct observation or through the use of data loggers)

Shorebirds: e.g. sandpipers, plovers and phalaropes

- focused on broad-scale, stratified sampling of terrestrial areas and aerial surveys of non-marine habitats

Thematic area:

- Atmosphere: no
- Terrestrial ecosystems: yes
- Coastal: yes
- Ocean: yes
- Freshwater: yes
- Cryosphere: no
- Human & socio-economic: yes
- Space physics: yes

Main variables: avian biodiversity occurrence, demography, and key habitat parameters that may influence bird use of an area.

When operational (year): various depending on sub-survey programs (e.g. for waterfowl, seabirds and shorebirds) some data collected since the 1920s (waterfowl); some collected during bursts in the 1970s and more regularly since the 1980s (seabirds); some collected more recently (this decade – shorebirds).

Geographical coverage (countries): Canada – Mackenzie Delta – Mainland Nunavut – Hudson Straight – Foxe Basin – Lancaster Sound – Queen Elizabeth Islands

- Some level of work sampling all terrestrial areas of North America above tree line.
- Some level of effort sampling all Arctic marine areas

Data archive (data centre): various locations depending on species groups (waterfowl, shorebirds, seabirds)

Data availability:

- Meta-data only: no
- All data: yes
- Level of fee to be paid: generally none

Main gaps: Large gaps both spatially and temporally. Many datasets cover short periods. Some species groups not well covered (e.g. landbirds and shorebirds)

Section D: Cryospheric Observations

D-1: Canadian Permafrost Monitoring Network, Canada's Contribution to Global Terrestrial Network for Permafrost (GTN-P Canada)

Contact person: Sharon Smith , Geological Survey of Canada, Natural Resources Canada (sharon.smith@nrcan-rncan.gc.ca

Web site: www.gtnp.org

Main objective of the network:

- collect field based measurements of permafrost thermal state and active layer thickness (Essential Climate Variables identified by WMO/GCOS)
- disseminate information on permafrost thermal state and active layer thickness (increase public availability
- document current permafrost conditions and changes in these conditions and conduct analysis to explain these changes
- provide essential information on permafrost conditions for decision making in Canada's north to ensure sustainable development and to develop strategies to adapt to climate change

Member/connected to global network, if yes which: Global Terrestrial Network for Permafrost (GTN-P)

Type of network: Thematic observations (permafrost thermal state and active layer thickness), consisting of several field sites (>150) throughout northern Canada (see recent GCOS ECV report for map).
Most sites in remote areas
Limited community based monitoring

Thematic area: - Cryosphere (Terrestrial)

Main variables: Permafrost thermal state (ground temperature) and active layer thickness

When operational (year):
Variable – some monitoring sites in operation since 1970s and 1980s, many new ones established more recently. GTN-P has been officially recognized since 1999.

Geographical coverage (countries)
Canada –throughout the Canadian permafrost regions
GTN-P coverage includes circumpolar north, Antarctic and alpine areas and plateaus of Asia and Europe

Data archive (data center): Summary data through GTN-P website managed by Geological Survey of Canada (International archive through Global Geocryological Database, National Snow and Ice Data Centre Boulder and national organizations)

Data availability:
Metadata available, limited summary data available with updates in progress as part of IPY projects
Free download of Geological Survey of Canada published data products (minimal fee for CDs)

Main gaps: Large regional gaps still exists especially in central region between Mackenzie Valley and Hudson Bay
There is also a lack of long-term funding to maintain network operation and ensure ongoing data collection.

HOW CAN SAON HELP YOU?

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The answer is unclear as SAON appears to only be a process. The GTN-P has been recognized under GCOS and regular reporting is done to the WMO therefore recognition of a coordinated national and international network is not the issue. Funding however, for data collection and management is an issue and it is unclear whether SAON can address these issues.

Which issues are critically important for your network?

Commitments for long-term dedicated funding for network maintenance, field data collection, data management and dissemination and ongoing analysis.
Transition from ad hoc (individual) and largely research based monitoring sites to institutional based long-term reference monitoring network.
Support for equipment upgrade and network enhancements to address key gaps.

D-2: National Glacier-Climate Observing System – State and Evolution of Canada's Glaciers (SECG)

Contact persons (e-mails):
Overall co-ordinator: mike.demuth@nrcan.gc.ca
Western and Northern Cordillera observing cluster: mike.demuth@nrcan.gc.ca
Arctic Archipelago observing cluster: david.burgess@nrcan.gc.ca

Web site:
http://www.pathways.geosemantica.net/WSHome.aspx?ws=NGP_SECG&locale=en-CA

Main objective of the network:

The State and Evolution of Canada's Glaciers initiative provides information and data products produced by the Federal Government's National Glacier-Climate Observing System (monitoring, assessment and data portal) and related freshwater vulnerability research in western and northern Canada.

The Glacier-Climate Observing System is delivered through an integrated monitoring and research collaborative comprised of Natural Resources Canada-Geological Survey of Canada (lead agency), Geomatics Canada-Canada Centre for Remote Sensing, Environment Canada-National Water Research Institute and Water Survey of Canada, Parks Canada Agency, C-CORE Polar View, and academic partners that include the universities of British Columbia, Northern British Columbia, Alberta, Calgary, Lethbridge, Saskatchewan, Regina, Toronto, Brock, Trent and Ottawa, and related academic initiatives such as the Cold Water Collaborative and those supported by the Canadian Foundation for Climate and Atmospheric Science. SECG is a contribution to the NRCan Earth Sciences Sector - Climate Change Geoscience Program**.**

With this data research is conducted on the relationship between climate, glacier fluctuations and their impacts on freshwater systems (e.g., river flow, cold stream ecology, groundwater recharge, flow to oceans).

The development of improved remote sensing tools is also a major research thrust. With the support of the Canadian Space Agency, European Space Agency, the Canadian Consortium for Lidar Environmental Applications Research (C-CLEAR), and the NASA - Wallops Flight Facility, new tools and a systematic approach are increasingly brought to bear to understand more completely and with reduced uncertainty the magnitude, causality and impacts of Canada's changing glaciers.

System outputs are used to a) inform national and international climate change programs and process; b) improve knowledge regarding the nature and locations of historical, current, and potential future impacts of climate change, c) assist

Canadians in understanding and adapting to climate change impacts on natural resources at a regional and national scale.

The System also provides leadership and co-ordination of Canada's contribution to World Meteorological Organization's Global Terrestrial Observing System (GTOS) and its Global Terrestrial Network for Glaciers (GTN-G), the contribution of Essential Climate Variables for GEO/GEOSS, and providing such as Official Communications to the Parties of the Convention UNFCCC.

Member/connected to global network, if yes which: GCOS-GTN-Glacier, WGMS; also the evolving WMO Global Cryosphere Watch

Type of network:
- Thematical observations: yes
- Field stations: yes, 20 reference observing sites
- Community based observations: some in development (Grise Fjord)
- Coordination: SECG guides and co-ordinates observations conducted by partners; SECG co-ordinates reporting for Canada (e.g., GCOS-GTN-G, WGMS)

Thematic area:
- Atmosphere:
- Terrestrial ecosystems: linked to Parks Canada Ecosystem Integrity Monitoring/State of the Park Reporting
- Coastal:
- Ocean:
- Freshwater: Connected to Water Survey of Canada hydrometric network (e.g., Flow to Oceans).
- Cryosphere: Snow cover and glacier fluctuations
- Human & socio-economic:
- Space physics:

Main variables:
- Glacier mass balance (seasonal and annual)
- Ice thickness, form and flow (as required to assess mass balance and calving fluxes)
- Regional area-wise extent (decadal)

When operational (year):
varies:
- Arctic Archipelago:1960;
- Cordillera: 1965

Geographical coverage (countries):
Canada

Data archive (data centre):
http://pathways.geosemantica.net/WSHome.aspx?ws=NGP_SECG&locale=en-CA

Data availability:
- Meta-data: yes
- Annual glacier mass balance data
- Other products and data provided based on collaboration with observing site principal investigator
- Level of fee to be paid: none/collaboration
- Citation/copyright stipulated

Main gaps under-consideration: Regional representativeness has been improving with the re-establishment of former sites or the establishment of new sites. Contributions to thematic needs such as water resources, flow to oceans and sea-level change will require improved co-ordination with hydrometric and other monitoring entities.

Which issues are critically important for your network?

1. The recognition of and discernable action on the need for a long-term outlook when it comes to funding and supporting environmental data collection and assessment – scientific tasks that undeniably contribute to public policy requirements and environmental stewardship on behalf of all host country citizens.

2. There must be changes to our data culture. Many practitioners feel that a data set is a low priority scientific output and so does not feature prominently in our merit-based advancement systems in government and university labs. As Barry Goodison and many others have discussed during the evolution of the SAON effort, WMO Cryosphere Watch etc, if there were more value attached to data sets, there would likely be more AVAILABLE temporally and spatially coherent data with which to conduct modeling, change detection and estimate uncertainty. In absence of a healthy data culture, both personal and institutional data embargos can arise.

A symptom of this is that all too often data sets that do see the light of day go unacknowledged, unreferenced or uncited, even though basic scientific ethic would have us declare that "this work is my own and all other sources have been properly acknowledged and referenced".

Another symptom is the publishing of third party data compilations, in which institutions and principal investigators responsible for and conducting the

measurements and analysis go unacknowledged or cited. Often, these compilations are full of errors and do not benefit from the reprocessing efforts of the originating institution or principal investigator.

This appears to be a problem with glacier mass balance data in particular, where users seem to have determined that because it is publicly available, it can be used without reference. There are ample cases in North America where data sets appear without any sort of permission, acknowledgement or citation.

Like remote sensing data, there is the aspect of reprocessing, and so these data sets are not necessarily static, and there may be addenda (as supported by WGMS reporting). This aspect and all that goes into maintaining efforts and funding for long-term environmental monitoring can be at risk.

The importance of properly referencing / acknowledging data is critical from an ethical perspective and the fact that proper accreditation allows us to demonstrate the value of the work and justify its continuation.

D-3: Sea Ice

Contact Person : Director, Canadian Ice Service (CIS): Doug Bancroft (Doug.Bancroft@ec.gc.ca)

Web site: http://ice-glaces.ec.gc.ca

Main objective of the network:

The Canadian Ice Service (CIS), a branch of the Meteorological Service of Canada, is the leading authority for information about ice in Canada's navigable waters. CIS provides the most timely and accurate information about sea ice, lake ice, river ice and icebergs to:

- Ensure the safety of both mariners and Canadians, their property and their environment through the provision of hazardous ice condition warnings
- Provide present and future generations of Canadians with sufficient knowledge to support sound environmental policies

In summer and fall data collection and analysis is focussed on the Arctic and the Hudson Bay regions with daily satellite acquisitions. In winter and spring, the data collection is focussed on the Great lakes, the St. Lawrence River and the Gulf of the St. Lawrence and the Newfoundland and Labrador coasts

The following products are produced:

- *In situ briefings,* warnings, daily ice charts, image analysis charts, regional charts, observed charts, short- and long-term forecasts and iceberg bulletins and charts; specialised ice information services for Other Government Departments and research communities
- Oil spill monitoring; satellite image analysis for oil spill detection
- Annual Ice Atlas
- Archive of climatic ice information

Member/connected to global network

CIS is a member of:

- the North American Ice Service (NAIS) which also includes the United States National Ice Service (NIC) and the International Ice Patrol (IIP);
- the International Ice Charting Working Group (IICWG)
- the World Meteorological Organisation Expert Team on Sea Ice (ETSI)

Type of network: various: satellite data, observations from ships and aircraft.

CIS acquires and analyses thousands of satellite images, conducts millions of square kilometres of airborne reconnaissance and receives hundreds of ship and shore ice reports annually.

Thematic area:

Atmosphere: no
Terrestrial ecosystems: no
Coastal: yes
Ocean: yes
Freshwater: yes
Cryosphere: yes
Human & socio-economic: limited
Space physics: no

Main variables:

- sea ice concentration, type, thickness, age, drift and extent;
- icebergs, ice islands
- freeze-up and break-up times

When operational: Year round although some products are only provided during peak Arctic shipping.periods from June to November

Geographical coverage (countries): Canadian navigable waters

Data Archive: yes

Data Availability: Through the web site above

Main gaps:

Satellite monitoring of Arctic sea ice is limited to:

- Canadian waters,
- Bi-Weekly acquisitions from January to March
- Weekly acquisitions from April to May
- Daily acquisitions of areas where shipping is active from June to November

Section E: Human Health

E-1: International Circumpolar Surveillance System (ICS)

Contact person: Dr Howard Njoo (Howard_Njoo@phac-aspc.gc.ca)

Web site
Main objective of the network: to establish a network of hospital and public health laboratories throughout the Arctic which would allow collection and sharing of uniform laboratory and epidemiological data between Arctic countries that will describe the prevalence of infectious diseases of concern to Arctic residents and assist in the formulation of prevention and control strategies.

Type of network:
- Community based observations
- Coordination: linked to AMAP

Thematic area:
- Human & socio-economic

Main variables

When operational (year): ongoing

Geographical coverage (countries) US Arctic (Alaska), northern Canada, Greenland, Iceland, Norway, Finland, northern Sweden.

Data archive

Data availability:

Main gaps: Currently the sytem only monitors invasive bacterial diseases and tuberculosis but has the potential to be expanded to other countries and could be adapted to monitor other human health issues of concern to Arctic countries.

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Section E Human Health

E-2 Circumpolar Health Observatory [CircHOB]

Contact Persons:

(1) Kue Young, Dalla Lana School of Public Health, University of Toronto; International Network for Circumpolar Health Research [Kue.young@utoronto.ca]

(2) Susan Chatwood, Institute for Circumpolar Health Research, Yellowknife, NT [susan.chatwood@ichr.ca]

Website:

CircHOB can be accessed at www.circhob.circumpolarhealth.org

Main Objective of Network:

CircHOB is an international collaborative health information system, involved in systematic, standardized, and consistent data collection and analysis. It is population-based, and produces data for all northern regions in all circumpolar countries

CircHOB's purpose is to monitor trends and patterns in health status, health determinants, and health care, provides quantitative evidence for planning and evaluation of health programs and services. It is on-going and sustainable with periodic updates

Type of Network

CircHOB is a flagship project of the Arctic Human Health Expert Group of the Sustainable Development Working Group of the Arctic Council, formed in 2009.

CircHOB is a program within the Institute for Circumpolar Health Research Data Center [www.ichr.ca]

CircHOB extracts relevant data from existing data sources managed by different groups and agencies in different countries, including:

- National population registries, censuses and intercensal estimates
- Vital statistics
- Mortality/morbidity/health care utilization databases
- National/regional health surveys
- Statistical reports

CircHOB does NOT involve access to individual-level health records nor do any such records cross national borders. It involves the preparation of tables of aggregate data only. Most data are available from websites of national statistical agencies, health ministries, etc. Many but not all sites are available in English and language proficiency in all circumpolar languages [eg. Russian, Finnish, Icelandic] is essential. Some data require special tabulations produced by host agencies

Thematic Areas/Main Variables

- Population: Size, age-sex distribution, density, urban areas, indigenous peoples
- Fertility: crud birth rate, total fertility rate, distribution of livebirths by mothers' age
- Mortality: crude death rate, age-sex-specific mortality rates, life expectancy at birth, infant mortality rate, age-standardized mortality rates by cause
- Reproductive Outcomes: perinatal mortality rate, distribution of livebirths by birthweight and gestational age
- Disease Incidence: incidence of cancer by site, incidence of tuberculosis, hepatitis A and B, sexually transmitted diseases (HIV/AIDS, chlamydia, gonorrhea, syphilis)
- Socioeconomic Conditions: Gross Domestic Product, education, employment, income
- Health-Related Behaviours: smoking, physical activity, diet
- Health Care Resources: human resources, health expenditures, facilities
- Health Services Utilization: hospitalization and primary care services

When Operational:

Data capture for 2000-2004, single years and 5-year period, completed; 2005-2009 update underway

Geographical Coverage:

[**US**] *United States*	[**DK**] *Denmark*	[**RU**] *Russian Federation*
[Ak] Alaska	[Gl] Greenland	[Mu] Murmansk Oblast
[**CA**] *Canada*	[Fo] Faroe Islands	[Ka] Kareliya Republic
[Yk] Yukon	[**IS**] *Iceland*	[Ar] Arkhangelsk Oblast
[Nt] Northwest Territories	[**NO**] *Norway*	[Ne] Nenets AO
[Nu] Nunavut	[Nd] Nordland	[Ko] Komi Republic
	[Tr] Troms	[Yn] Yamalo-Nenets AO
	[Fm] Finnmark	[Km] Khanty-Mansi AO
	[**SE**] *Sweden*	[Tm] Taymyr AO
	[Vb] Västerbotten	[Ev] Evenki AO
	[Nb] Norrbotten	[Sk] Sakha Republic
	[**FI**] *Finland*	[Ma] Magadan Oblast
	[Ou] Oulu	[Ky] Koryak AO
	[La] Lappi	[Ck] Chukotka AO

Note: AO = autonomous okrug

Additional breakdown for most data also available for Alaska Natives and Greenland-born Greenlanders; more limited breakdown available for Canadian First Nations and Inuit

Data Archives

Located at the Institute for Circumpolar Health Research Data Centre, Yellowknife, NT

Data Availability:

- Print/electronic publication consisting of tables, charts, maps and interpretive text will be produced periodically as a *Circumpolar Health Supplement* by the International Journal of Circumpolar Health [www.ijch.fi]
- Searchable and interactive databank will be established at [www.circhob.circumpolarhealth.org]

Main Gaps:

Data on health-related behaviours, attitudes, and practices currently available from health surveys done in various circumpolar countries and regions are not directly comparable, due to differences in the construction of variables, sampling techniques, and contextual meanings of underlying concepts. Substantial international comparative research is needed before such data can be presented.

E- 3: International Arctic Human Biomonitoring – Arctic Monitoring and Assessment Program (AMAP)

Contact person (e-mail) Dr Jay Van Oostdam (jay.van.oostdam@hc-sc.gc.ca)

Web site (if any): http://www.amap.no/

Main objective of the network: The network was established to assess the implications and impacts of pollution and contaminants on the health of Arctic residents. The biomonitoring program monitors concentrations of contaminants in human tissues in the eight circumpolar nations and assesses spatial and temporal patterns/trends and potential health effects at present and future levels. Where available, contaminant guidelines are used to evaluate risk to populations/communities. AMAP has been designed to have roots in the national programs of participating countries.

Member/connected to global network, if yes which: AMAP is one of five working groups within the Arctic Council

Type of network:

- **Thematical observations**: Contaminant concentrations and health effects data
- **Field stations**: None, community / population based research.
- **Community based observations**: Participation of community health workers and community residents for data collection through tissue samples
- **Coordination:** Human Health Assessment Group (HHAG) was created bringing together leading researchers and research coordinators from eight circumpolar countries; AMAP Ring Test (QA/QC program) coordinates and standardizes laboratories for analyzing biomonitoring samples.

Thematic area:

- Human & socio-economic

Main variables: Concentrations of contaminants in maternal blood and breast milk across all eight circumpolar regions; concentrations of contaminants in Inuit men and women in Nunavik (Canada), Greenland, and Russia. Not all of the countries monitor the same contaminants. The contaminants measured include:

- Persistent organic pollutants (POPs)
  - oxychlordane
  - trans-nonachlor
  - *p,p'*-DDT
  - *p,p'*-DDE
  - toxaphene (parlars 26, 50)
  - polychlorinated biphenyls (PCBs 99, 118, 138, 153, 180, Aroclor 1260, ∑14 PCBs)
  - hexachlorobenzene (HCB)
  - mirex

- Heavy metals
  - total and organic mercury
  - lead
  - cadmium
  - selenium

- Emerging contaminants, pharmaceutics, personal care products
  - e.g.
  - Polybrominated diphenyl ethers (PBDEs 47, 99, 100, 153, 183, 209)
  - perfluorooctane sulfonate (PFOS)
  - perfluorooctanoic acid (PFOA)
  - Tetrabromobisphenol A (TBBPA)
  - pentachlorophenol (PCP)
  - hydroxylated PCBs (107, 146, 187)
- Broad range of health effects research (see AMAP reports)
  - Immune
  - Neurodevelopmental
  - Cardiovascular
  - Metabolic – obesity/diabetes

When operational (year): Ongoing since early 1990s

Geographical coverage: Eight circumpolar countries (Canada, Denmark/Greenland/Faroe Islands, Finland, Iceland, Norway, Russia, Sweden and the United States [Alaska])

Data archive (data center):

Data availability:

- **Meta-data only:**
- **All data:** Available through AMAP Human Health Assessment Reports released every 5-6 years (AMAP 1998, 2003, 2009). Individual researchers who have contributed data to AMAP reports will need to be contacted.
- **Level of fee to be paid:** None

Main gaps: Trend data of legacy POPs and metals is available, though some communities have only two sampling periods, further monitoing is planned; measurements of tissue concentrations of emerging contaminants and personal care products is just starting and needs to be continued; health effects research needs to be expanded to other regions with high exposure (e.g., arctic Russia).

HOW CAN SAON HELP YOU?

The Arctic Council has agreed to establish a formal body together with IASC and WMO to bring the SAON process forward in a structured form. This body – the SAON Steering

Group (SAON-SG) – has just been formed and consist of national coordinators (Arctic countries), permanent participants in the Arctic countries and the working groups of the Arctic Council. The Arctic Council partners, IASC and WMO, will bring in connections to science and Arctic observations and data from non-Arctic countries, as well as experiemce from global systems.
The SAON-SG may look like a top-down activity. However, we are fully aware that the bottom-up approach is equally important for a successful outcome, and your comments are very welcomed

We will shortly transfer and activate the SAON web site, so please look it up: www.arcticobserving.org.

Which issues are critically important for your network?

Confidentiality requirements for human data precludes direct sharing of raw data. Small populations in arctic communities make the release of this data more problematic. Sharing of the data will only be possible with close connection between northern populations, health authorities and researchers. A process needs to be set up to ensure that data do not lie dormant and/or hidden but available so that the greatest value for local northern populations can be gained from the data.

While you are considering the first question, you could look at this one and ask yourself which 1-3 issues are critical to the success of your network?
Your comments would be very useful for discussing the priorities of the SAON-SG, and in turn how they could help you.

E-4: Northern Human Biomonitoring – Northern Contaminants Program (NCP)

Contact person (e-mail) Dr Jay Van Oostdam (jay.van.oostdam@hc-sc.gc.ca)

Web site (if any) http://www.ainc-inac.gc.ca/nth/ct/ncp/index-eng.asp

Main objective of the network: The NCP aims to reduce and, wherever possible, eliminate contaminants in traditionally harvested foods, while providing information that assists informed decision making by individuals and communities in their food use. The biomonitoring program monitors concentrations of contaminants in human tissues in the North and assesses spatial and temporal patterns/trends. Where available, contaminant guidelines are used to evaluate risk to populations/communities. A multi-disciplinary approach is used to evaluate contaminant concentrations, health effects, dietary research, and risk management/communication to meet the objectives of the NCP.

Member/connected to global network, if yes which: Arctic Monitoring and Assessment Program (AMAP), Stockholm Convention Global Monitoring Plan

Type of network:

- **Thematical observations**: Contaminant concentrations and health effects data
- **Field stations**: None, community / population based research.
- **Community based observations**: Participation of community health workers and community residents is essential for data collection through tissue samples
- **Coordination:** NCP management committee, review teams, and regional contaminant committees all involve members from federal governments, territorial and provincial governments, northern Aboriginal partner organizations throughout all phases of research planning, implementation and reporting.

Thematic area:

- Human & socio-economic

Main variables: Concentrations of contaminants in maternal blood and breast milk across three Arctic regions (NWT, Nunavut, and Nunavik), and in the blood of Inuit men and women in Nunavik

- Persistent organic pollutants (POPs)
  - oxychlordane
  - trans-nonachlor
  - *p,p'*-DDE
  - toxaphene (parlar 50)
  - polychlorinated biphenyls (PCBs 138, 153, 180)
- Heavy metals
  - total and organic mercury
  - lead
  - cadmium

- selenium
- Emerging contaminants (Nunavik only)
  - Polybrominated diphenyl ethers (PBDEs 47, 99, 100, 153)
  - perfluorooctane sulfonate (PFOS)
- Health impacts data (Nunavik only)
  - Immune, neurodevelopmental, and cardiovascular endpoints (see E. Dewailly at U. of Laval, QC)

When operational (year): Ongoing in Nunavik since 1992 and 1995 in NWT and Nunavut

Geographical coverage: Northwest Territories, Nunavut, northern Quebec

Data archive (data center): Databases managed by Health Canada, Territories and Regional health authorities, plus participating researchers (e.g., at university institutions)

Data availability:

- **Meta-data only:** Available through annual reporting
- **All data:** Available through Human Health Assessment Reports released every 6 years (CACAR 1997, 2003, 2009); available through database managers (e.g., Health Canada, Territories, researchers).
- **Level of fee to be paid:** None

Main gaps: Trend data of legacy POPs and metals, particularly for communities having only two sampling periods; measurements of tissue concentrations of emerging contaminants and other contaminants of interest (e.g., food preservation/storage, personal care products); health effects data.

HOW CAN SAON HELP YOU?

The Arctic Council has agreed to establish a formal body together with IASC and WMO to bring the SAON process forward in a structured form. This body – the SAON Steering Group (SAON-SG) – has just been formed and consist of national coordinators (Arctic countries), permanent participants in the Arctic countries and the working groups of the Arctic Council. The Arctic Council partners, IASC and WMO, will bring in connections to science and Arctic observations and data from non-Arctic countries, as well as experiemce from global systems.
The SAON-SG may look like a top-down activity. However, we are fully aware that the bottom-up approach is equally important for a successful outcome, and your comments are very welcomed

We will shortly transfer and activate the SAON web site, so please look it up: www.arcticobserving.org.
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Which issues are critically important for your network?

Confidentiality requirements for human data precludes direct sharing of raw data. Small populations in Arctic communities makes the release of this data more problematic. Sharing of the data will only be possible with close connection between northen populations, health authorities and researchers. A process needs to be set up to ensure that data do not lie dormant and/or hidden but available so that the greatest value for local northern populations can be gained from the data.

While you are considering the first question, you could look at this one and ask yourself which 1-3 issues are critical to the success of your network?
Your comments would be very useful for discussing the priorities of the SAON-SG, and in turn how they could help you.

Section F: Multi-disciplinary Networks

F-1: Northern Contaminants Program (NCP)

Contact person (e-mail): Russel Shearer (Russel.Shearer@ainc.inac.gc.ca)

Web site (if any): http://www.ainc-inac.gc.ca/nth/ct/ncp/index-eng.asp

Main objective of the network:
The Northern Contaminants Program aims to reduce and where possible eliminate long-range contaminants from the Arctic Environment while providing Northerners with the information they need to make informed dietary choices, particularly concerning traditional/country food. To achieve these objectives the NCP conducts research and monitoring related to contaminants in the Arctic environment and people. Monitoring efforts focus on regular (annual) assessment of contaminant levels in a range of media, including air, biota and humans. Environmental research is conducted into the pathways, processes and effects of contaminants on Arctic ecosystems while human health research focuses on assessing contaminant exposure, toxicity research, epidemiological (cohort) studies, and risk-benefit assessment and communications.

Member/connected to global network, if yes which: AMAP, Stockholm Convention Global Monitoring Plan, Global Atmospheric Watch Programme,

Type of network:

- Thematical observations: Contaminants levels and relevant ancilliary parameters
- Field stations: Atmospheric observing stations at Alert, Nunavut and Little Fox Lake, Yukon.
- Community based observations: Numerous communities throughout the Canadian Arctic participate in sample collection
- Coordination: National coordination of the program provided by the NCP secretariat, which also acts as liaison with AMAP.

Thematic area:

- Atmosphere: yes
- Terrestrial ecosystems: yes
- Coastal: yes
- Ocean: yes.
- Freshwater: yes
- Cryosphere: yes
- Human & socio-economic: yes.
- Space physics: no

Main variables: Concentrations of inorganic elements (focus on mercury) and organic pollutants in air, biota (lake trout, burbot, charr, thick billed murres, northern fulmars, caribou, ringed seals, beluga whales, narwhal, walrus), and humans (blood). Numerous other measurements are made in and related to air, including basic meteorological variables and concentrations of particulate and halogen species. Basic morphometric measurements are made on biota along with determination of age, lipid content sampled tissues, and concentrations of stable isotopes of nitrogen and carbon. Numerous human

health endpoints are measured along with the assessment of contaminant concentrations in human blood.

When operational (year): Ongoing since 1991

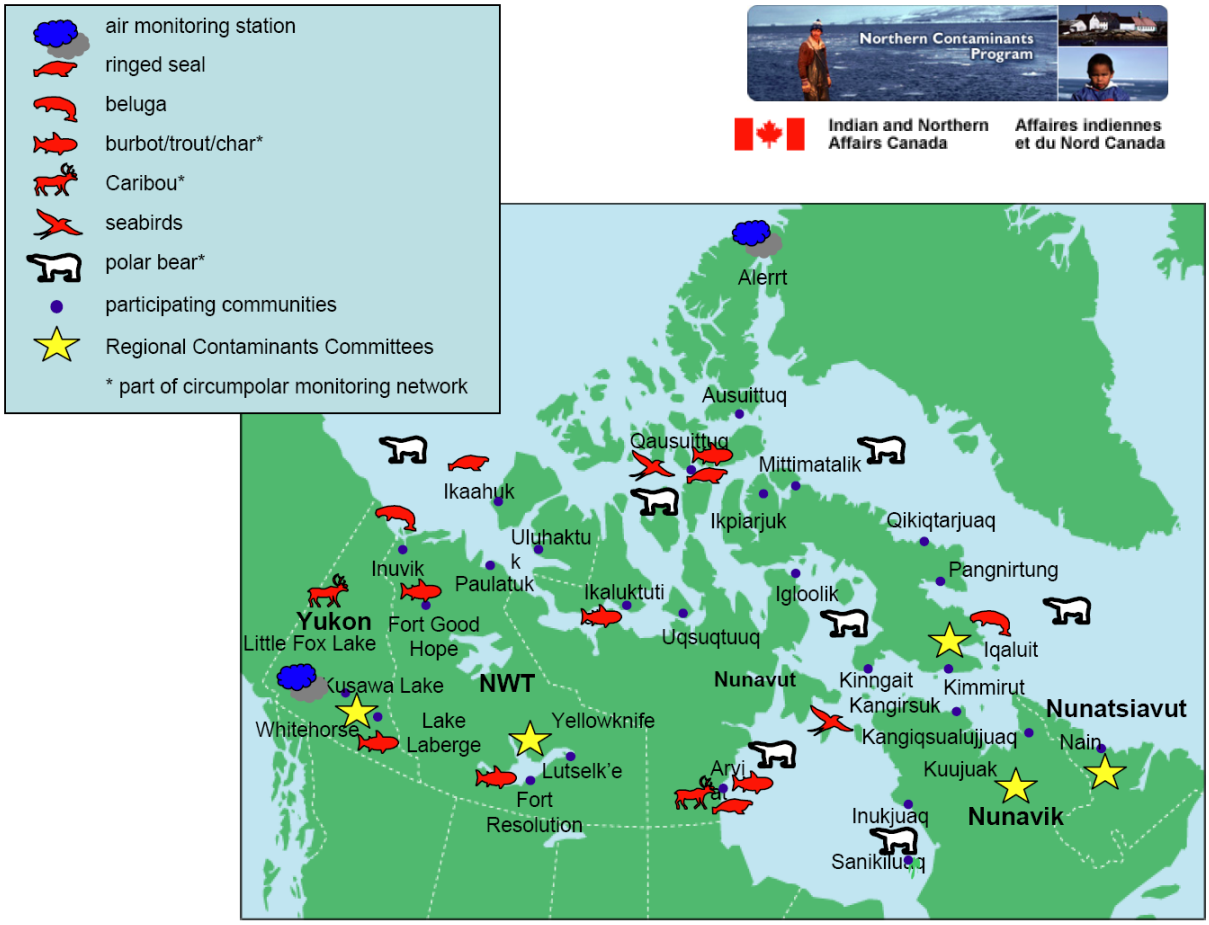
Geographical coverage (countries): Numerous sites throughout the Canadian Arctic. Tied to similar program in other Arctic countries through AMAP.

Data archive (data center): AMAP thematic data centres, institutional databases maintained by government deptartments and individual researchers.

Data availability:

- Meta-data only: available annually through regular reporting
- All data: Available through the NCP secretariat, research institutions and individual researchers.
- Level of fee to be paid: None

Main gaps: Contaminant measurements in Arctic seawater, toxicity data specific to Arctic species.



Long term monitoring of air and biota under the Northern Contaminants Program is conducted by a network of A 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.

F-2 : Centre d'études nordiques (CEN) Observing Program

Contact persons (e-mail):
CEN Director: Warwick F. Vincent (warwick.vincent@bio.ulaval.ca)
CEN Science Coordinator: Christine Barnard (christine.barnard@cen.ulaval.ca)

Web site: http://www.cen.ulaval.ca/

Main objective of the network:
The Centre for Northern Studies (www.cen.ulaval.ca; CEN: Centre d'études nordiques) is an interuniversity centre of excellence for research involving *Université Laval*, *Université du Québec à Rimouski* and the *Centre Eau, Terre et Environnement de l'Institut national de la recherche scientifique* (INRS). Members also come from the following affiliations: *Université de Montréal*, *Université du Québec à Chicoutimi*, *à Montréal* and *à Trois-Rivières*, *Université de Sherbrooke*, and the *College François-Xavier Garneau*. The CEN is multidisciplinary, bringing together over forty researchers including biologists, geographers, geologists, engineers, archaeologists, and landscape management specialists. The CEN community also counts two hundred graduate students, postdoctoral fellows, and employees.

CEN's mission is to contribute to the sustainable development of northern regions by way of an improved understanding of environmental change. CEN researchers analyze the evolution of northern environments in the context of climate warming and accelerated socio-economic change and train highly qualified personnel in the analysis and management of cold region ecosystems and geosystems. In partnership with government, industry and northern communities, CEN plays a pivotal role in environmental stewardship and development of the circumpolar North. CEN research activities are focused on three themes:

1 -Structure and function of northern continental environments.
2 -Evolution of northern environments in the context of global change.
3-Evaluation of the risks associated with environmental change and development of adaptation strategies.

In 2009, CEN organised an international workshop with the European SAON network SCANNET and also partners throughout Canada. The workshop culminated in the formal incorporation of CEN stations within SCANNET (http://www.scannet.nu/).

Type of network:
CEN operates the CEN Network, an extensive network of meteorological and field stations that were established in consultation with northern communities. The CEN Network comprises over 75 climate and soil monitoring stations and eight field stations distributed across a 4000 km North-South gradient from boreal

forest to the High Arctic. The eight field stations are situated at the following sites: Radisson, Whapmagoostui- Kuujjuarapik, Umiujaq, Lac à l'Eau Claire (in the proposed new park Tursujuq), Boniface River, Salluit, and Bylot and Ward Hunt Islands, which are part of two National Parks in Nunavut. The main field station at the heart of the CEN Network is at Whapmagoostui-Kuujjuarapik.

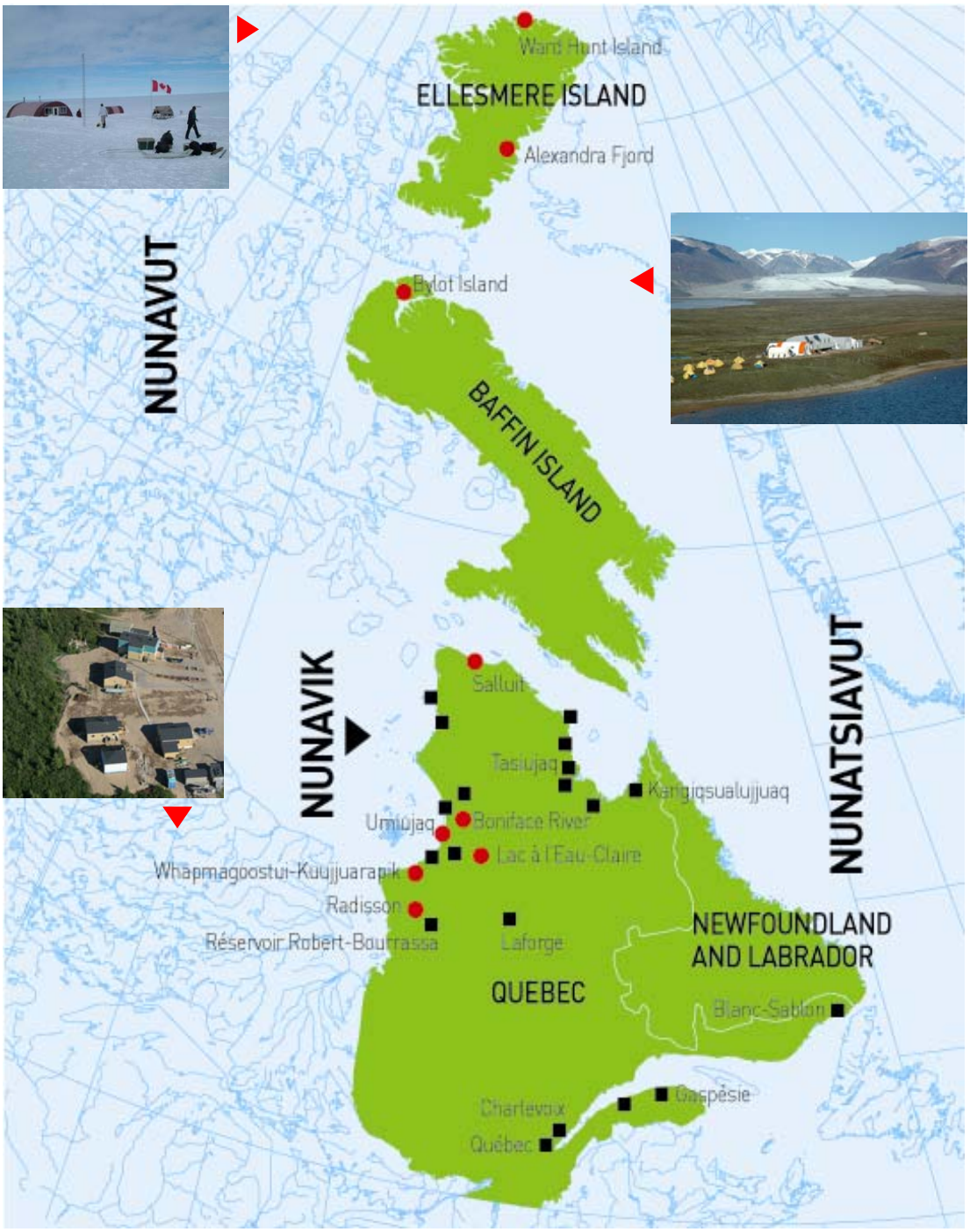
Thematic area:

- Atmosphere: yes
- Terrestrial ecosystems: yes
- Coastal: yes
- Ocean: yes
- Freshwater: yes
- Cryosphere: yes
- Human & socio-economic: no
- Space physics: no

Main variables: climate variables, snow and ice, permafrost soils, vegetation (including treeline variables), lake water and fiord profiles of limnological variables, wildlife (e.g. long- term Snow Goose and small mammal records at Bylot Island), paleoclimate variables.

When operational (year): 1961 (creation of CEN), but most records are more recent.

Geographical coverage (countries): Numerous sites throughout the eastern Canadian Arctic, see following Figure.



N.B. The Alexandra Fjord research station is operated by the University of British Columbia.

Figure CEN Network, an extensive network of climate and field stations across the Eastern Canadian Arctic.

F-3: ArcticNet Network of Excellence Observing Program

Contact person (e-mail): Martin Fortier (martin.fortier@arcticnet.ulaval.ca)

Web site: www.arcticnet.ulaval.ca

Main objective of the network:

ArcticNet brings together scientists and managers in the natural, human health and social sciences with their partners in Inuit organizations, northern communities, government and industry to help Canadians face the impacts and opportunities of climate change and globalization in the Arctic. Over 110 ArcticNet researchers and 400 graduate students, postdoctoral fellows, research associates and technicians from 28 Canadian universities and 8 federal departments collaborate on 28 research projects with over 150 partner organizations from 15 countries.

The major objectives of the Network are:

• Build synergy among existing Centres of Excellence in the natural, human health and social Arctic sciences.

• Involve northerners, government and industry in the steering of the Network and scientific process through bilateral exchange of knowledge, training and technology.

• Increase and update the observational basis needed to address the ecosystem-level questions raised by climate change and globalization in the Arctic.

• Provide academic researchers and their national and international collaborators with stable access to the coastal Canadian Arctic.

• Consolidate national and international collaborations in the study of the Canadian Arctic.

• Contribute to the training of the next generation of experts, from north and south, needed to study, model and ensure the stewardship of the changing Canadian Arctic.

• Translate our growing understanding of the changing Arctic into regional impact assessments, national policies and adaptation strategies.

Type of network:
Thematical observations:Yes
Field stations: Yes on Land (see CEN sheet) and Marine (CCGS *Amundsen*)
Community based observations: Yes
Coordination: Yes

Thematic area:

- Atmosphere: yes (On land and at sea)
- Terrestrial ecosystems: yes
- Coastal: yes

- Ocean: yes.
- Freshwater: yes
- Cryosphere: yes (Sea-ice, glaciers, permafrost)
- Human & socio-economic: yes (Health and Social)
- Space physics: no

Main variables:

When operational (year): ArcticNet started operation in 2003 and is potentially funded until 2018. Numerous observational programs that now form ArcticNet started many years before (NOW 1997-2001; CASES 2002-2007...).

Geographical coverage (countries): Numerous sites throughout the entire Coastal Canadian Arctic from the Yukon to Labrador, including the Archipelago and Hudson Bay. Some oceanographic moorings in Laptev Sea and east Siberian Sea through participation in NABOS network.

Data archive (data center): Polar Data Catalogue (www.polardata.ca)
The Polar Data Catalogue is an online searchable database of metadata that describes, catalogues and identifies access points to the diverse data sets generated by polar researchers. The research is conducted under the auspices of a wide variety of programs, including ArcticNet, the Northern Contaminants Program, NSERC-funded programs and the Government of Canada Program for the International Polar Year (IPY) 2007-2008. The scope of the research covers a range of disciplines, from natural sciences to policy to health and social sciences.

Data availability:
- Meta-data only: Yes
- All data: In development. Data available through collaboration with observing site investigator/organisation
- Level of fee to be paid: Terms of use and Data policy available on Polar Data Catalogue website