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Overview of MSC Marine Monitoring Networks

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Weather and Environmental Monitoring

Topics for Today

- **Overview of MSC Networks – 3 networks in one**
  - **47** Moored Buoys
  - **54** AVOS (Automated Volunteer Observing Ships)
  - **30 - 40** Drifting buoys deployed in Oceans and on Arctic Ice
- **Challenges**
- **Future developments**

MSC Moored Buoy Network

- Comprised of **46** moored buoys installed on Canada's west and east coast, Great Lakes and other interior lakes. Ocean buoys operate year round, while buoys in Central Canada are removed for winter months.

- The MSC operates the 2nd largest network of weather buoys in the world.

- Buoys are equipped with meteorological and oceanographic sensors that provide real-time in-situ measurements of:
  - **Atmospheric pressure**
  - **Wind speed, direction and gust**
  - **Air and sea surface temperature**
  - **Wave height and period (MSC network does not currently measure wave direction)**

- Observations are relayed via GOES satellite on hourly basis for public distribution to GTS (Global Telecommunications System), as well as weatheroffice web-site, Weather Radio etc.

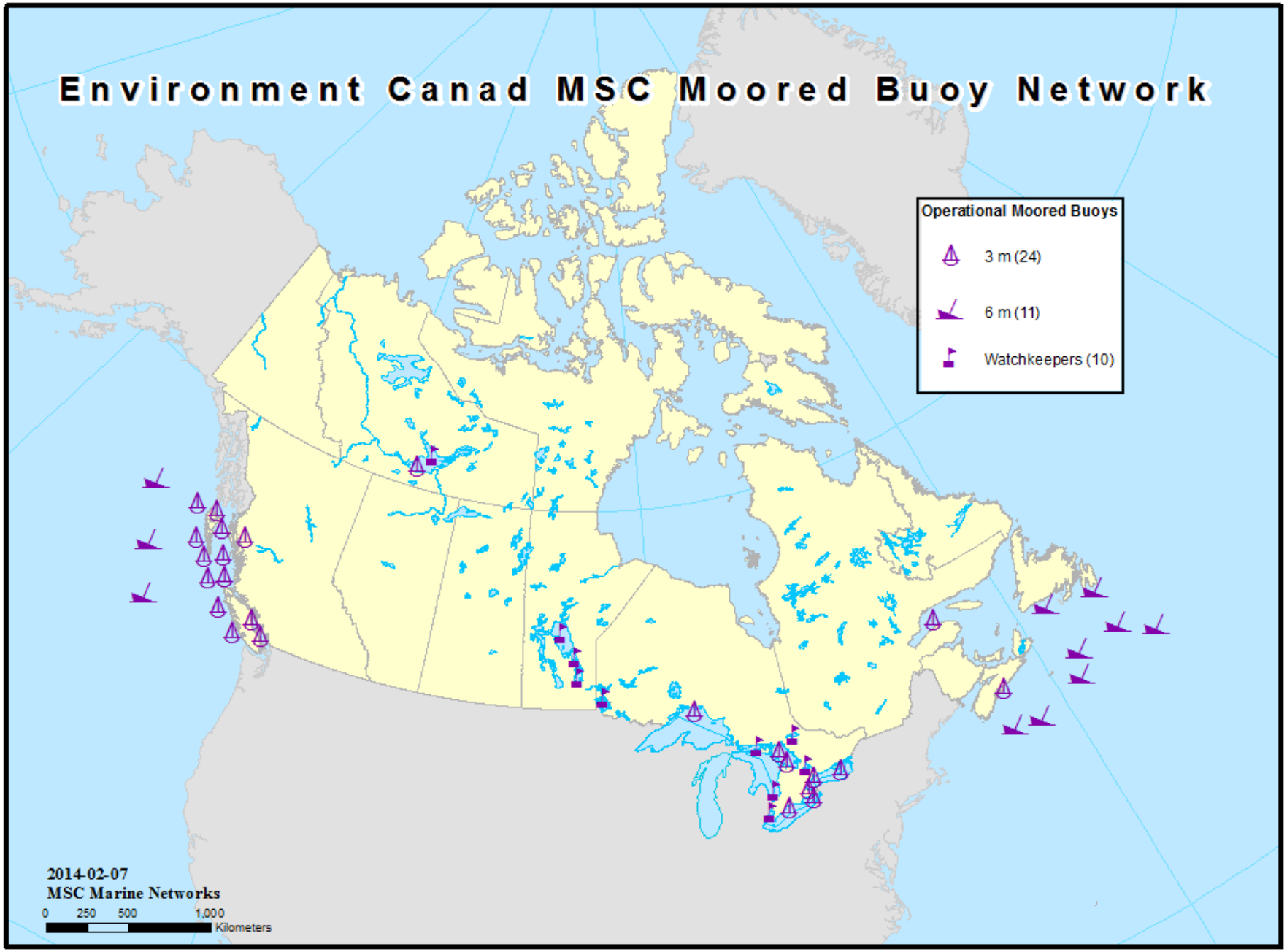
Network Composition

6 M “NOMAD”

1.7 M WatchKeeper

3 M Discus

MSC moored buoys all utilize WM100 “payload” provided by AXYS Technologies.


Environment Canad MSC Moored Buoy Network
Operational Moored Buoys
3 m (24)
6 m (11)
Watchkeepers (10)
2014-02-07
MSC Marine Networks
0 250 500 1,000
Kilometers

Geographical Distribution of Network

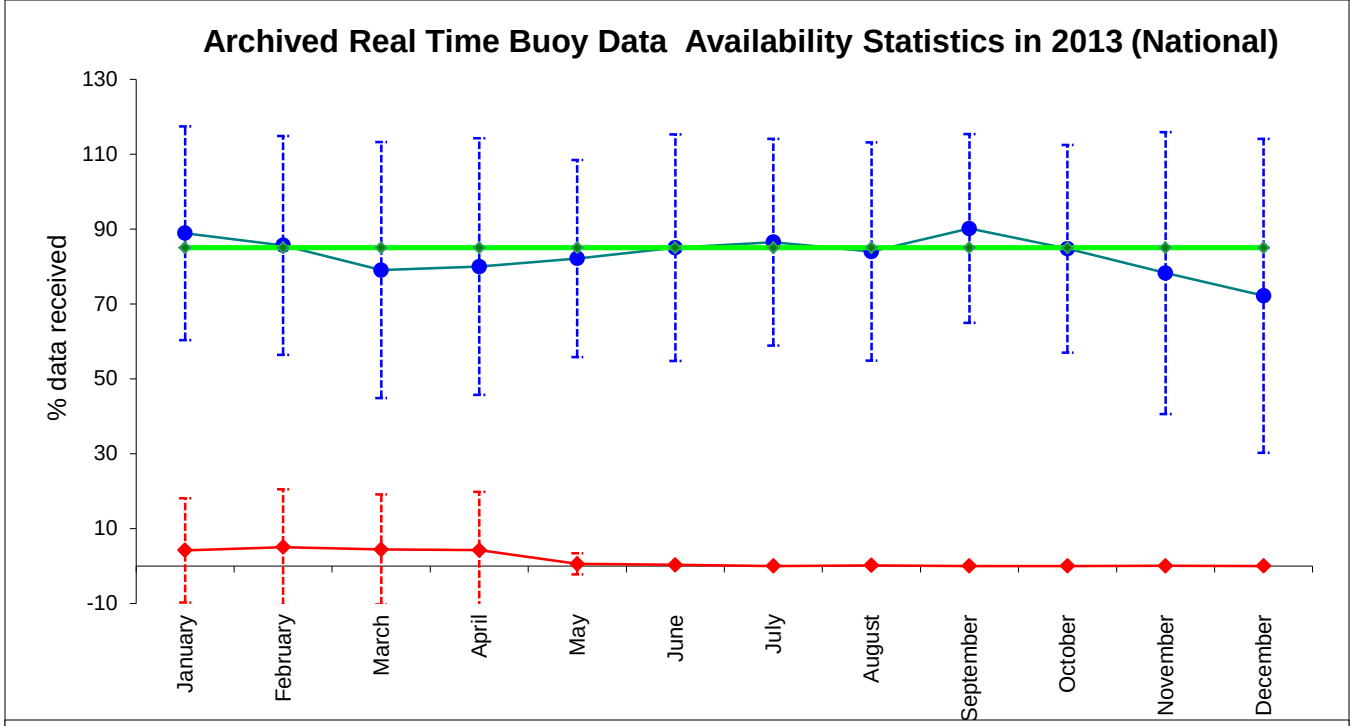
Region	Number and type of buoys deployed
Pacific	• **3** 6M NOMADS • **13** 3 M Discus • **1** Test buoy (3 M Discus)
Central (Prairies, Ontario and Quebec)	• **10** 1.7M WatchKeepers • **10** 3M Discus
Atlantic	• **8** 6M NOMADS • **1** 3M Discus

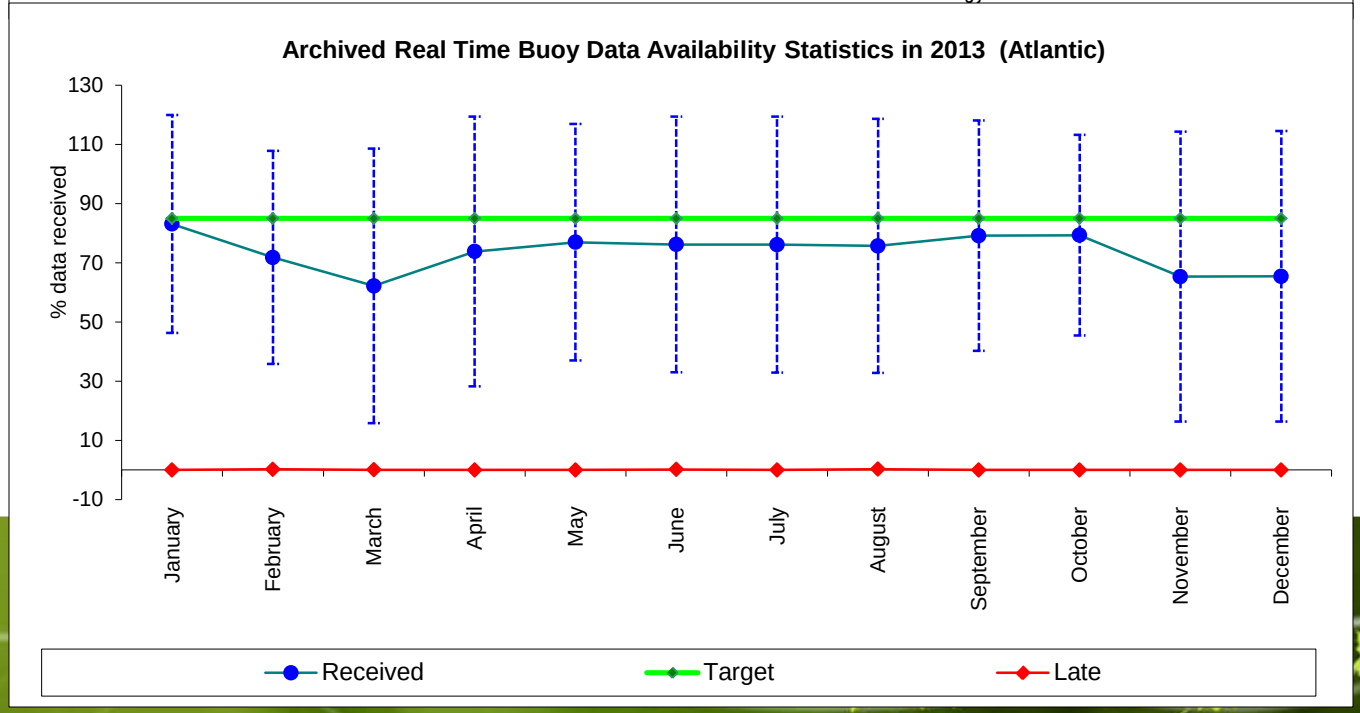
Sensor Configuration

Sensor	Primary/Secondary	Type	Sensor height		
			Nomad	3M	Watchkeeper
Air Temp	Primary	YSI 703	4.48m	4.17m	2.92m
Air Pressure	Primary	Vaisalla PTB 210	0m	0m	0m
	Secondary	Vaisalla PTB 210	0m	0m	N/A
SST	Primary	HATS/ YSI 44203	-0.91m	-0.67m	-0.36m
Winds	Primary	RM Young (5106 or 5103)	5.4m	4.75m	3.38m
	Secondary	Visala UltraSonic WS425	4.9m	4.54m	N/A
Waves	Primary	Jewell Acc LCA100/ Columbia 107B	N/A	N/A	N/A

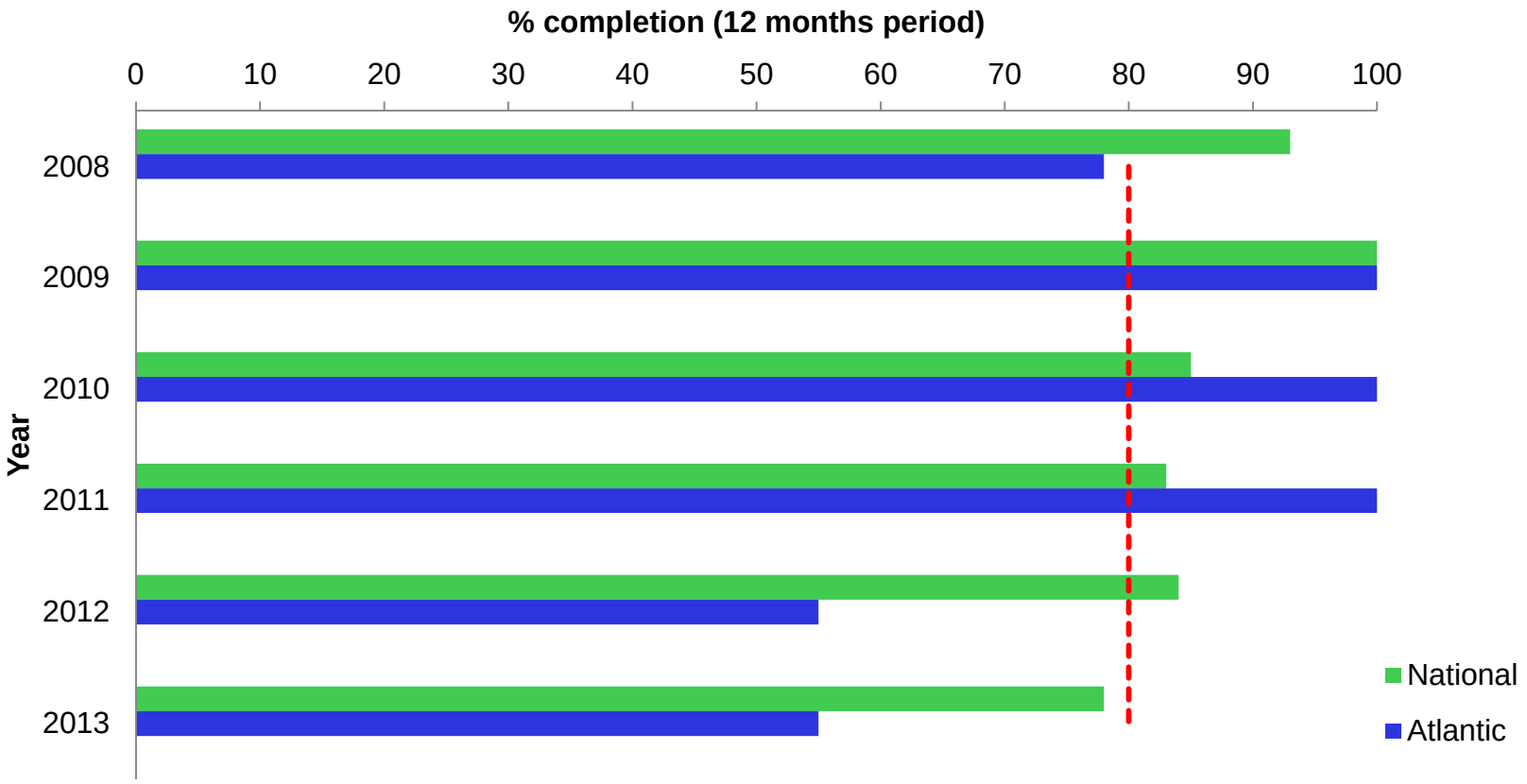
Sensor Configuration –Sampling time

Sensor	Duration	Remarks
Air Temp	10 min averaging	
Air Pressure	10 min averaging	
SST	10 min averaging	
Wind Speed	10 min scalar averaging	No correction for buoy tilt and/ or height
Wind Direction	10 min averaging	
Wind Gust	Length 5 sec	
Wave Height	37 min sampling period	
Wave Period	37 min sampling period	


Archived Real Time Buoy Data Availability Statistics in 2013 (National)
% data received
130
110
90
70
50
30
10
-10
January
February
March
April
May
June
July
August
September
October
November
December


Archived Real Time Buoy Data Availability Statistics in 2013 (Atlantic)
% data received
130
110
90
70
50
30
10
-10
January
February
March
April
May
June
July
August
September
October
November
December
Received
Target
Late

Maintenance History – Atlantic Buoy Network



AVOS Network

- AVOS is comprised of automated weather station installed onboard a ship which is coupled with a “Bridge PC”. FM13 generated and transmitted by the vessel.

- Bridge PC is the interface that provides the following functionality:
  - *Read-out of latest automated weather observations*
  - *System status*
  - *GUI for input of manual observations (i.e. sky condition, visibility and sea state)*
  - *Quality control of automated and manual observations*

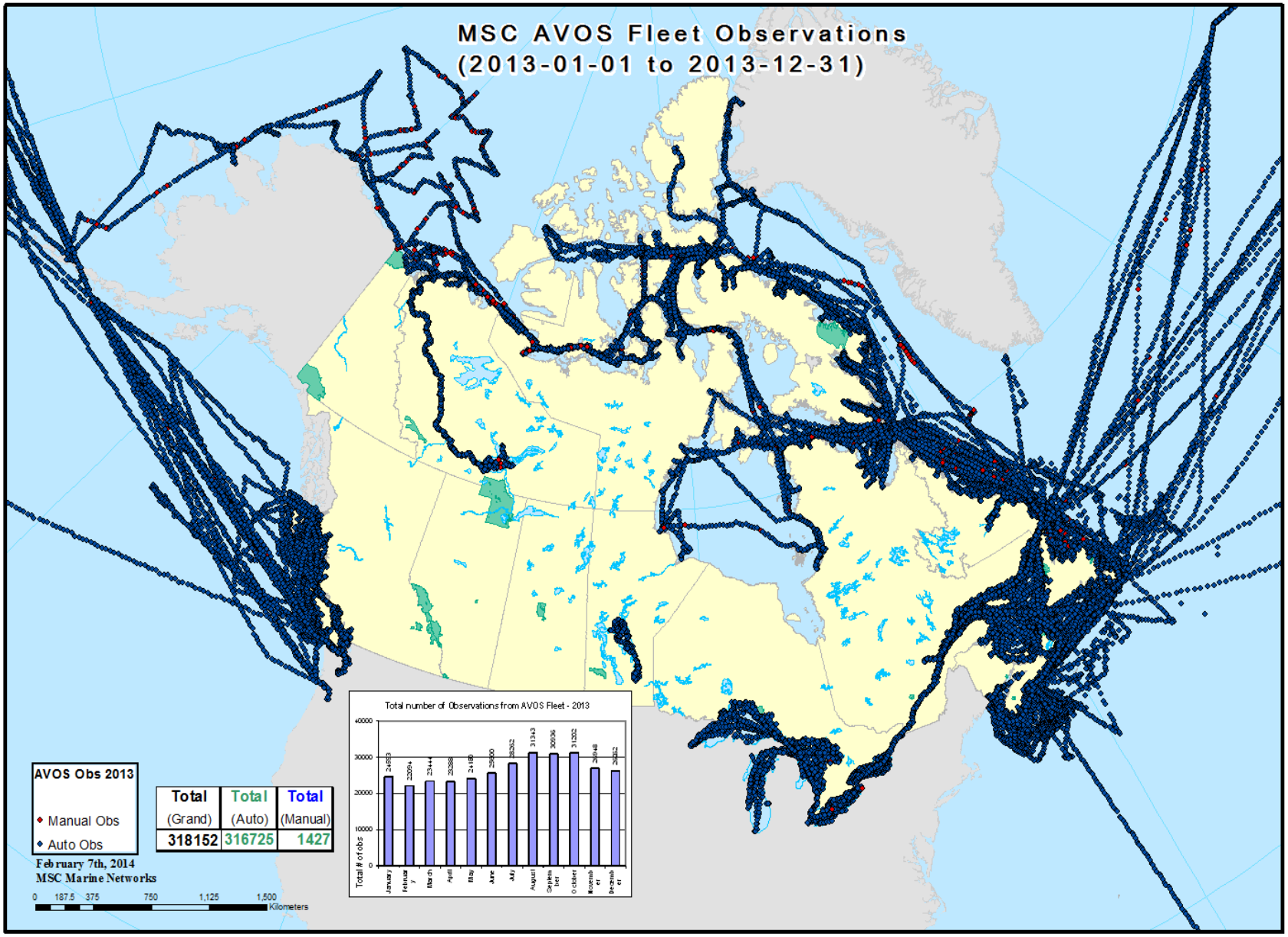
- Presently installed on 54 vessels, and 2 test/training sites. Plan to expand the network to ~75 with focus on observations in the north.

- All AVOS now report on <u>hourly</u> basis with data transmitted via Iridium short burst data (SBD)

- Number of observations continues to grow year-over-year, with sig. number of observations from Arctic waters.

5405279
HUDSON

MSC AVOS Fleet Observations
(2013-01-01 to 2013-12-31)



Total (Grand)	Total (Auto)	Total (Manual)
318152	316725	1427

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Drifting Buoys

- Drifting buoys are deployed by the MSC in the NE Pacific, NW Atlantic, and in the Arctic (in-water and on-ice).

- Buoys are “consumable” assets that operated for 18-36 months before batteries expire, or buoy runs aground. Provide observations of:
  - *Surface currents or ice movement*
  - *Atmospheric pressure*
  - *Air temperature (some ice buoys)*
  - *Sea surface temperature*

- MSC maintains a network of approx. 30-35 drifting buoys, which are Canada’s contribution to the **Data Buoy Cooperation Panel** (DBCP) target of 1250 buoys operating in the world’s oceans at all times.

- Buoys relay data via ARGOS and Iridium satellite, with various data flow and quality control paths.

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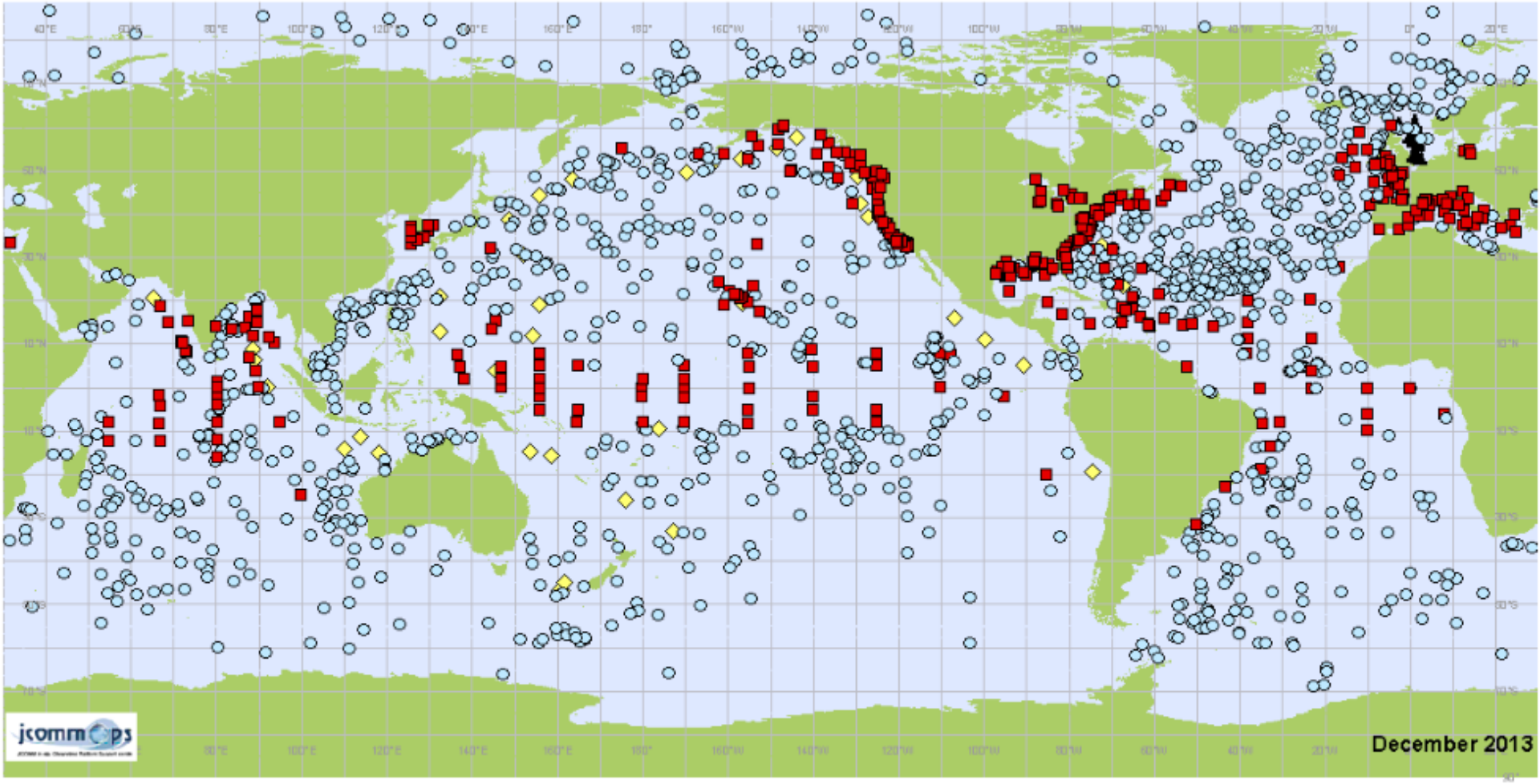
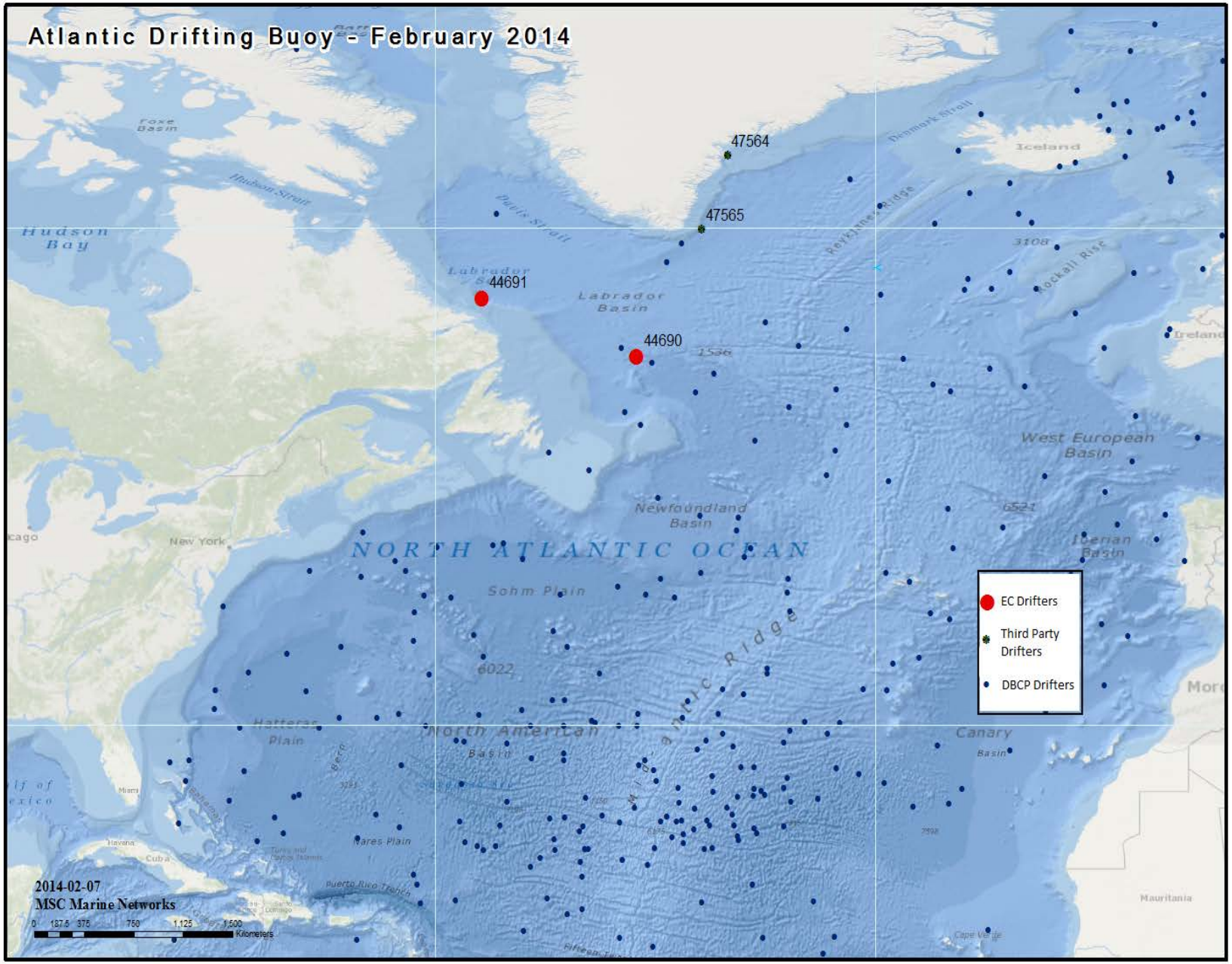
DBCP Buoys by Platform Type December 2013



Moored Buoys (386) Drifting Buoys (1250) Tsunameter Buoys (41) Fixed Platform (63)



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METAREA Project

- Canadian Government has provided funding to Environment Canada and Department of Fisheries and Oceans programs in the Arctic.

- High level goal of the project is to enhance **safety of marine transportation** in Arctic waters through improvements in weather and ice predictions. This will be achieved by the following initiatives:
  - Canada has taken on responsibility to manage the communication of SOLAS information for newly formed areas XVII and XVIII
  - Enhancements in in-situ and space based weather, ocean and ice monitoring
  - Expansion of operational marine and ice forecast and warning services in Arctic waters.
  - Funding for science to improve knowledge of numerical weather prediction in Arctic.

- METAREA project will provide funding for the procurement and sustained deployments of buoys as part of the **Canadian Arctic Buoy Array (CABA).**

METAREA Project con't

- CABA will see the procurement and deployment of between **~50** *on-ice* and *in-water* drifting buoys during the 5-year duration of the project. Plan to build foundation of sustained array of buoys.

- The buoys will be a mix of existing and new technology, to meet the needs of both marine and ice prediction programs, as well as science.

- Planned deployments will include:
  - **ICEX-Air** (air deployable on-ice or in-water buoy) – very rugged with 2-3 year operating life)
  - **CALIB** ice beacons
  - **I-SVP-B** (air or ship deployable SVP) – more cost effective that ICEX, with lithium batteries to extend life in Arctic (~18 month operation)
  - **IMB** – Ice Mass Balance buoys that can track changes in ice growth/decay
  - **AXIB** – New type of buoy which may offer superior performance in marginal ice conditions (able to survive freeze/thaw) and deployable by air or ship.

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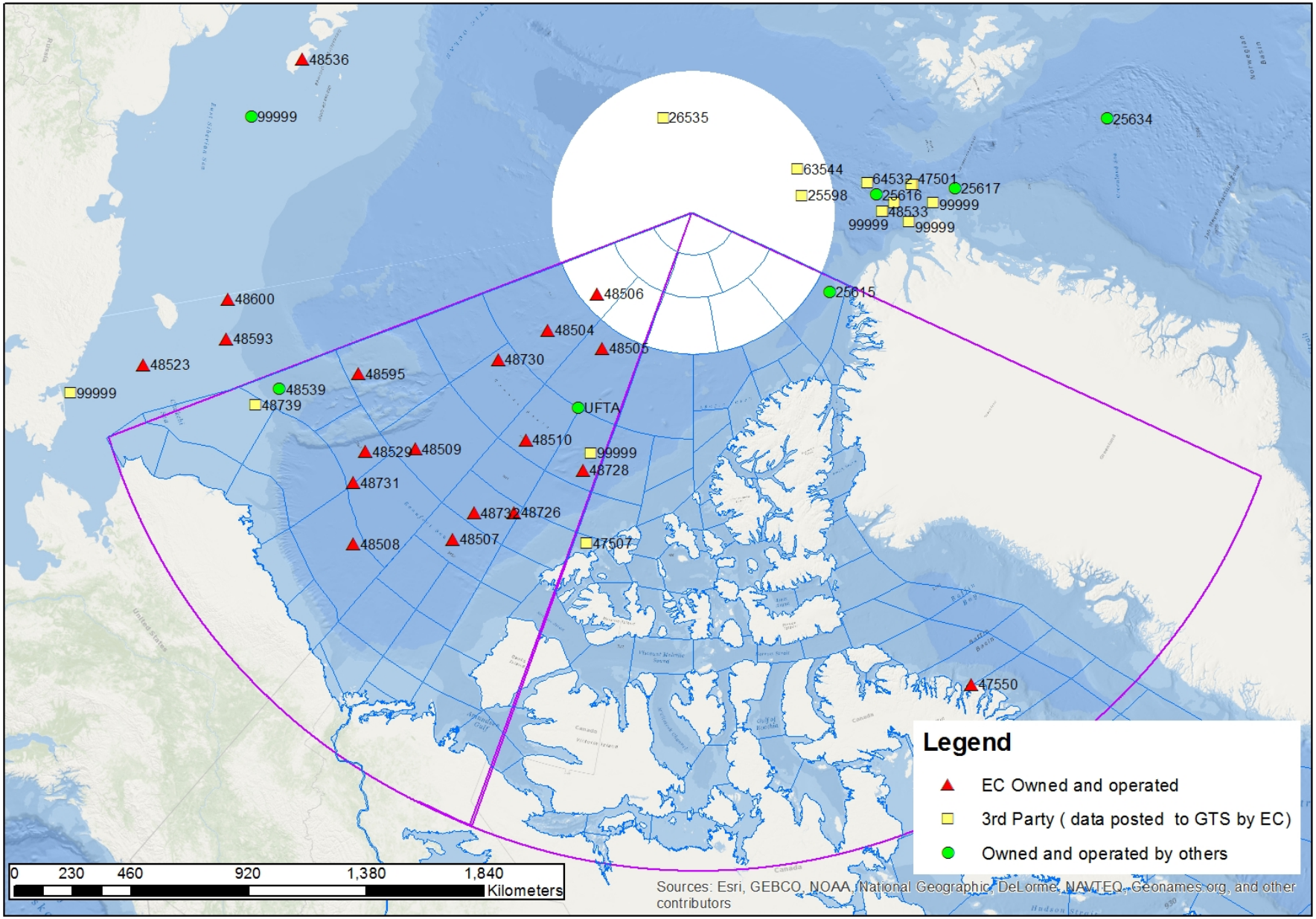
Canadian Arctic Buoy Array (CABA) - 2013 Oct. 23

(Buoys with Air Pressure measurements)



Challenges

- Dependency on Canadian Coast Guard for buoy tendering

  - Over the years the ship time provided for buoy services has been in decline due to Organizational changes/pressures. Atlantic is the mostly affected region by these reductions.

- Aging network

  - Buoy network established ~20 years before.

- Mooring loses in the Atlantic Region

  - 05 mooring were lost during last 02 years

Other future developments…

- Bi-directional communications
  - Moored buoy network is now in transition to have Iridium Communication as the backup telecommunications system. 4 buoys in Atlantic will be retrofitted with Iridium in the summer 2014.
- Next generation payloads will be installed on moored buoy and AVOS in coming years.
  - Will allow for higher improved data availability, more frequent observations, redundant communications, remote diagnosis, as well as onboard archive of raw data
- Expect growing requirement for more ocean measurements, including directional waves, visibility, present weather, ocean current, temperature and salinity profiles.
- Additional requirement for marine observations in the Arctic, potential expansion of networks to support marine transportation and oil spill response/mitigation.
- Expect increasing linkage of marine weather observations to modernized E-Navigation systems.
- In the longer-term, MSC may deploy UAVs such as wave gliders to obtain in-situ observations at lower cost (i.e. no requirement for expensive ship time ~$30K/day, or moorings).

Questions?

South Hecate Buoy off BC Coast – Fall 2009

Thank-you