



Environment
Canada

Environnement
Canada

Canada



Establishing the Canadian Arctic Buoy Array and Impact of Buoy Observations on Forecast Models

Data Buoy Cooperation Panel S&T Workshop

Paris, France – September 23rd 2013

**Chris Marshall – Manager of Marine and
Lighting Networks**

**Environment Canada – Meteorological Service
of Canada**

Overview

- Establishing the Canadian Arctic Buoy Array
- Buoy types and deployment logistics
- Plans for 2013
- Assessing the impact on numerical weather prediction
- Future plan direction

Drivers and funding for Arctic Buoys

- Canada has taken on responsibility to manage the communication of SOLAS information for newly formed METAREAS XVII and XVIII
- Project has funded investments in enhanced services to the marine transportation sector, along expanded in-situ observations from coastal automatic weather stations and on-ice buoys.
- The **Canadian Arctic Buoy Array (CABA)** has the goal of sustained deployment of buoys to make meteorological, oceanographic, and ice measurements in the Arctic Basin.
 - Canadian contribution to the International Arctic Buoy Panel Network



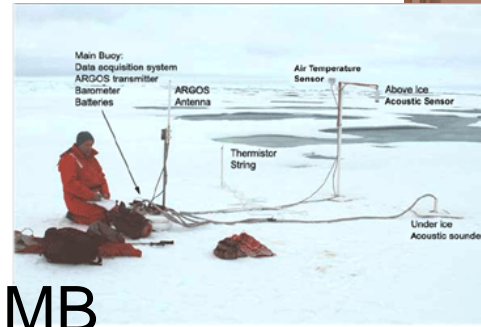
Various types of buoys



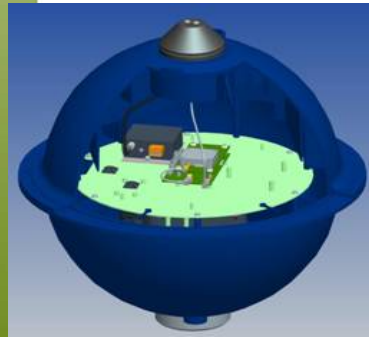
ICEX-Air



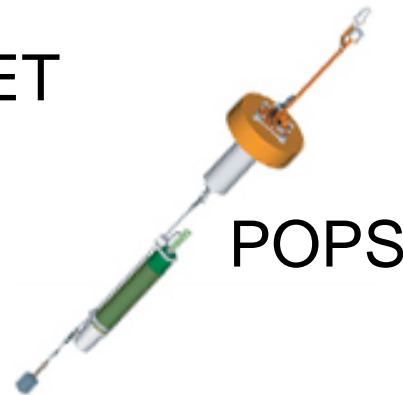
CALIB



IMB



MINIMET



POPS



Polar SVP_B

Observations for different users

- CABA buoys are making measurement to serve a range of different users including:
 - Numerical weather prediction (weather and ice models)
 - Marine and Ice operational forecast programs at MSC
 - Scientists interested in range of new measurements (ice thickness, ice growth/decay, ocean profile measurements below the ice).
- Key measurements from buoys:
 - Barometric pressure
 - Buoy position (via GPS)
 - Air and Sea temperature
 - Some buoys providing ocean profile data, ice thickness, and wind measurements.



Data acquisition and management

- Buoys deployed utilize Iridium and ARGOS communications system.
- Data received and delivered to GTS in real-time, archived by ISDM as well as IABP
- Environment Canada has worked with Jou Beh and Scotia Weather to route observations from third party buoy operators to the GTS – Includes over 50 buoys in Arctic basin in the past 2 years
- Buoys in CABA array contribute to IABP network
 - In 2013, 80 buoys deployed in the Arctic
 - 59 of these included barometers – EC buoys approx 30% of these
 - BUT...many buoys in clusters at north pole and in Chukchi Sea
 - Array is not meeting goal one buoy per 250 Km grid



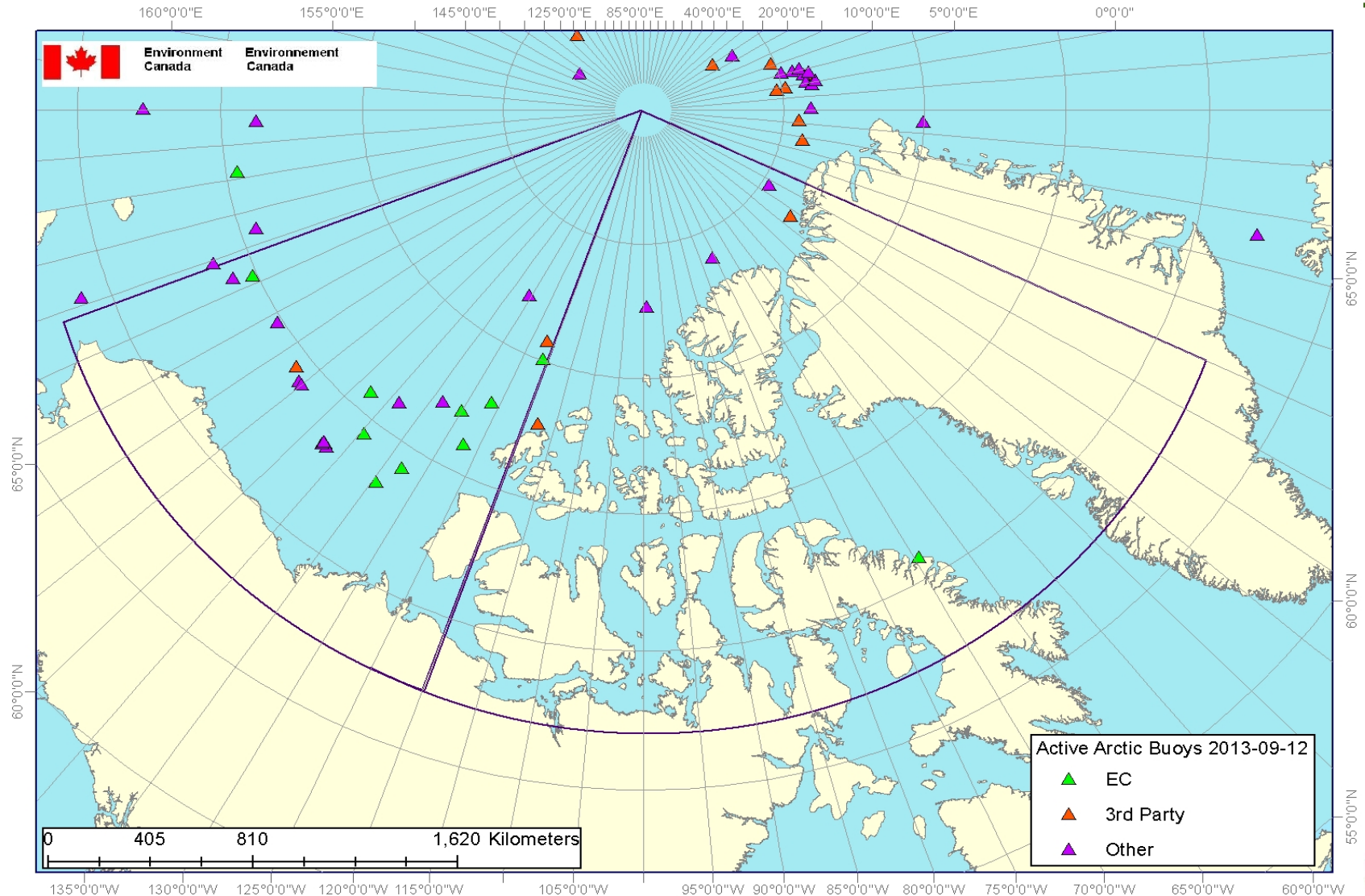
Deployment Logistics

- Deployment of buoys in the Arctic Basin is extremely expensive and complex.
- CABA buoys have been deployed via cooperation and collaboration with range of different organizations including:
 - Canadian Coast Guard
 - United States Coast Guard
 - Department of Fisheries and Oceans
 - Royal Canadian Air Force
 - Royal Canadian Navy
 - Arctic Net (University of Manitoba, Laval University, McGill University)
 - University of Washington
- Air deployment via Air Force C-130 very costly
~\$40K/buoy



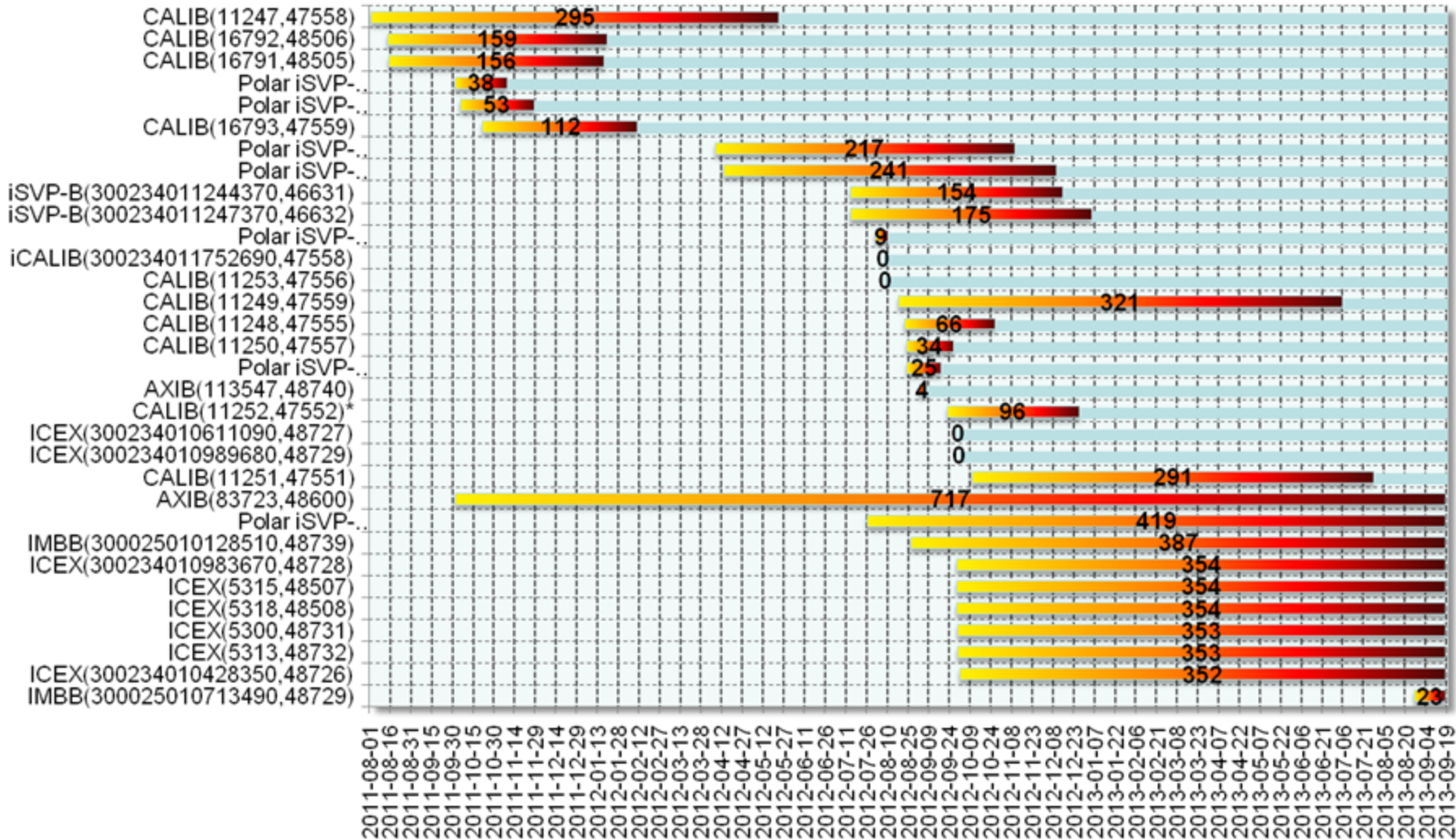
Arctic Marine Network

Active Buoys in Canadian High Arctic - 2013 Sept 12



Data as of Sept 16, 2013

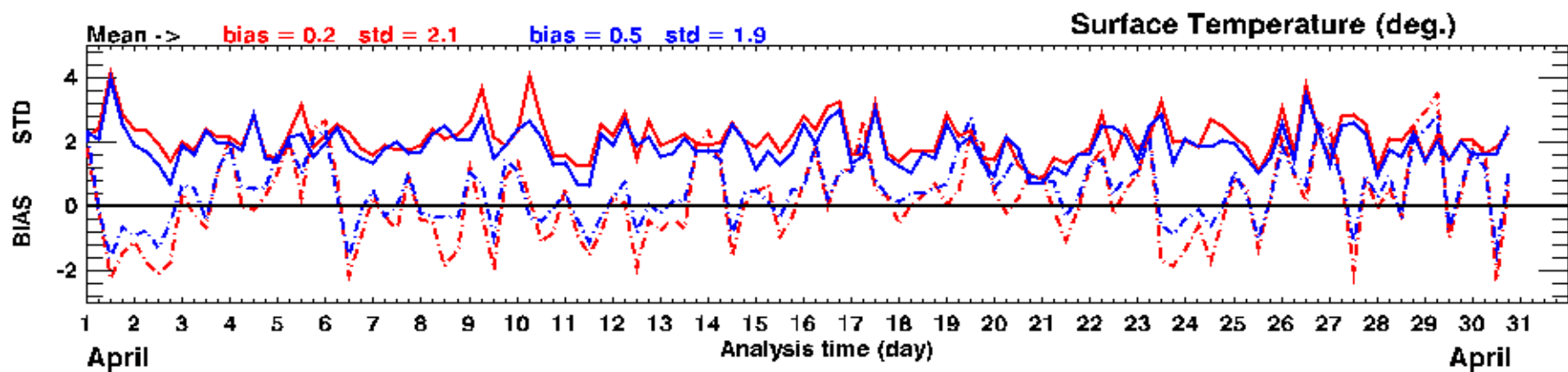
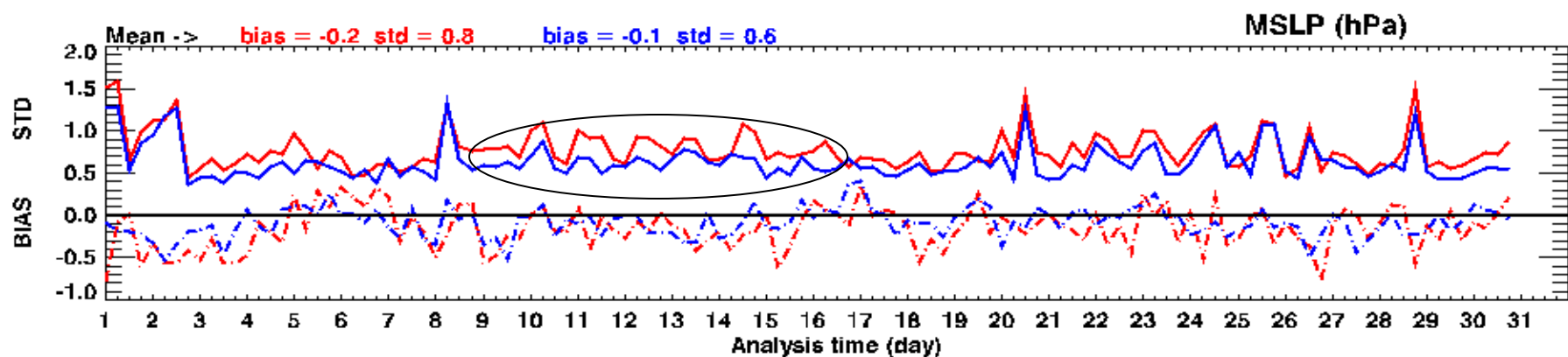
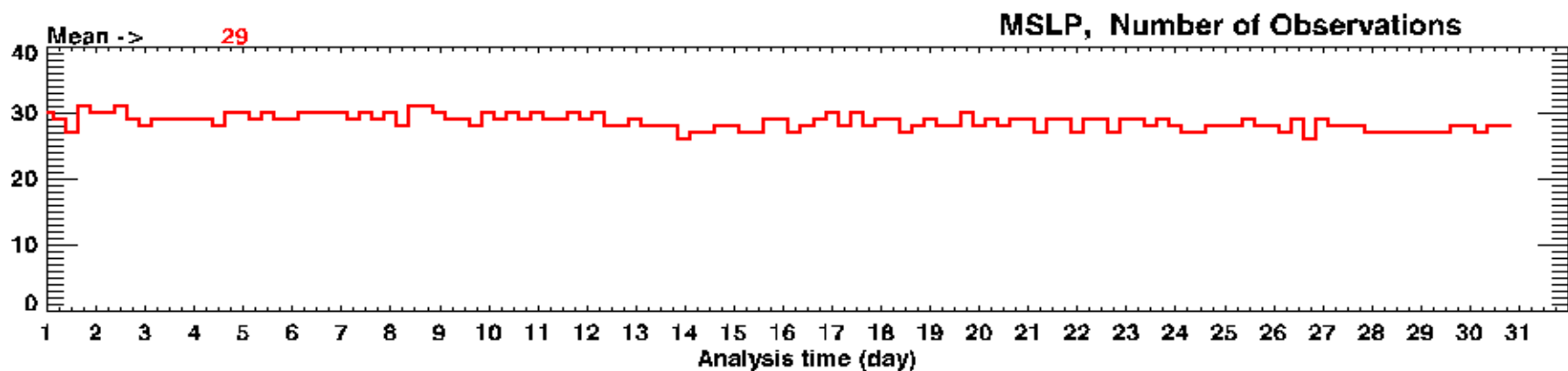
Lifespan of Buoys



Date = 2013043018

DRIFTER Observations Arctic

O-A O-P

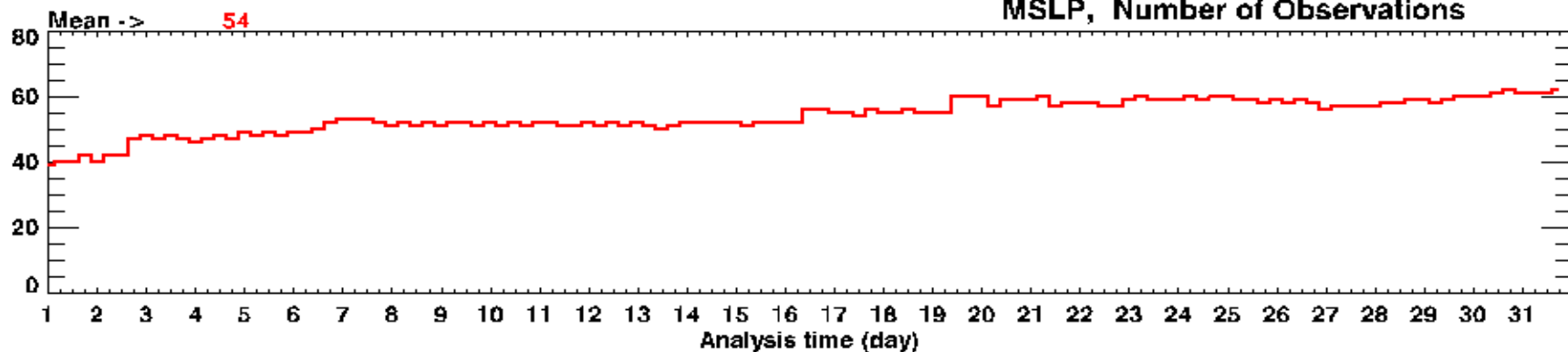


Date = 2013083118

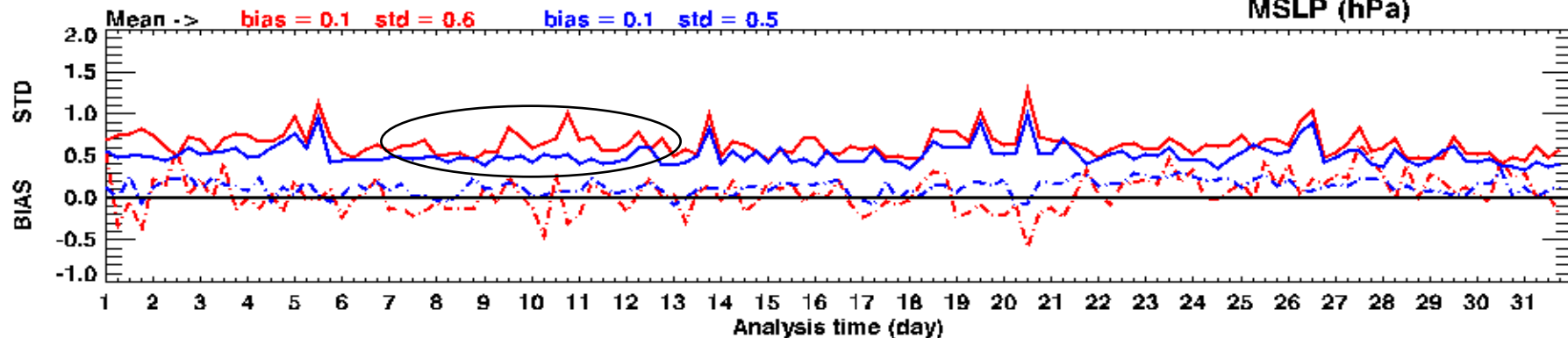
DRIFTER Observations Arctic

O-A O-P

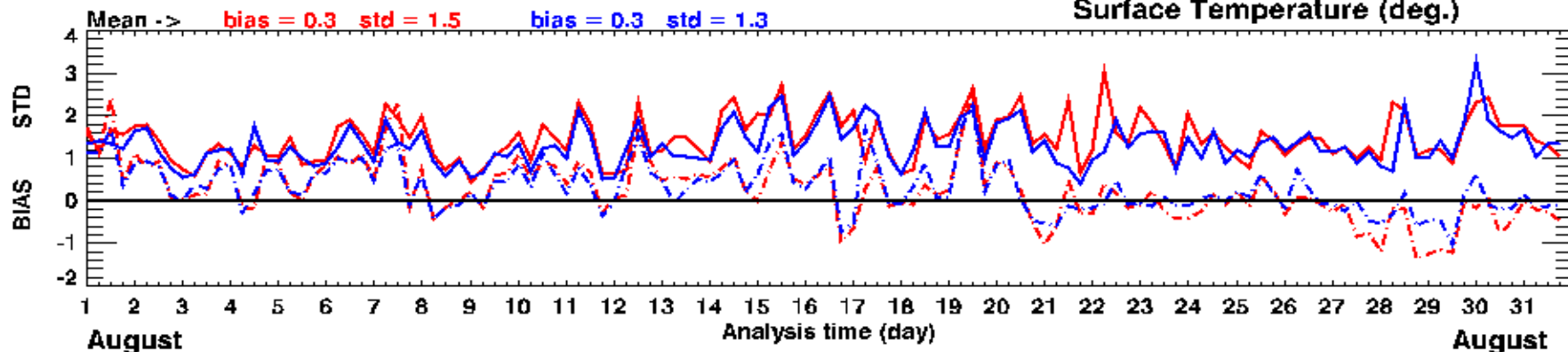
MSLP, Number of Observations



MSLP (hPa)



Surface Temperature (deg.)



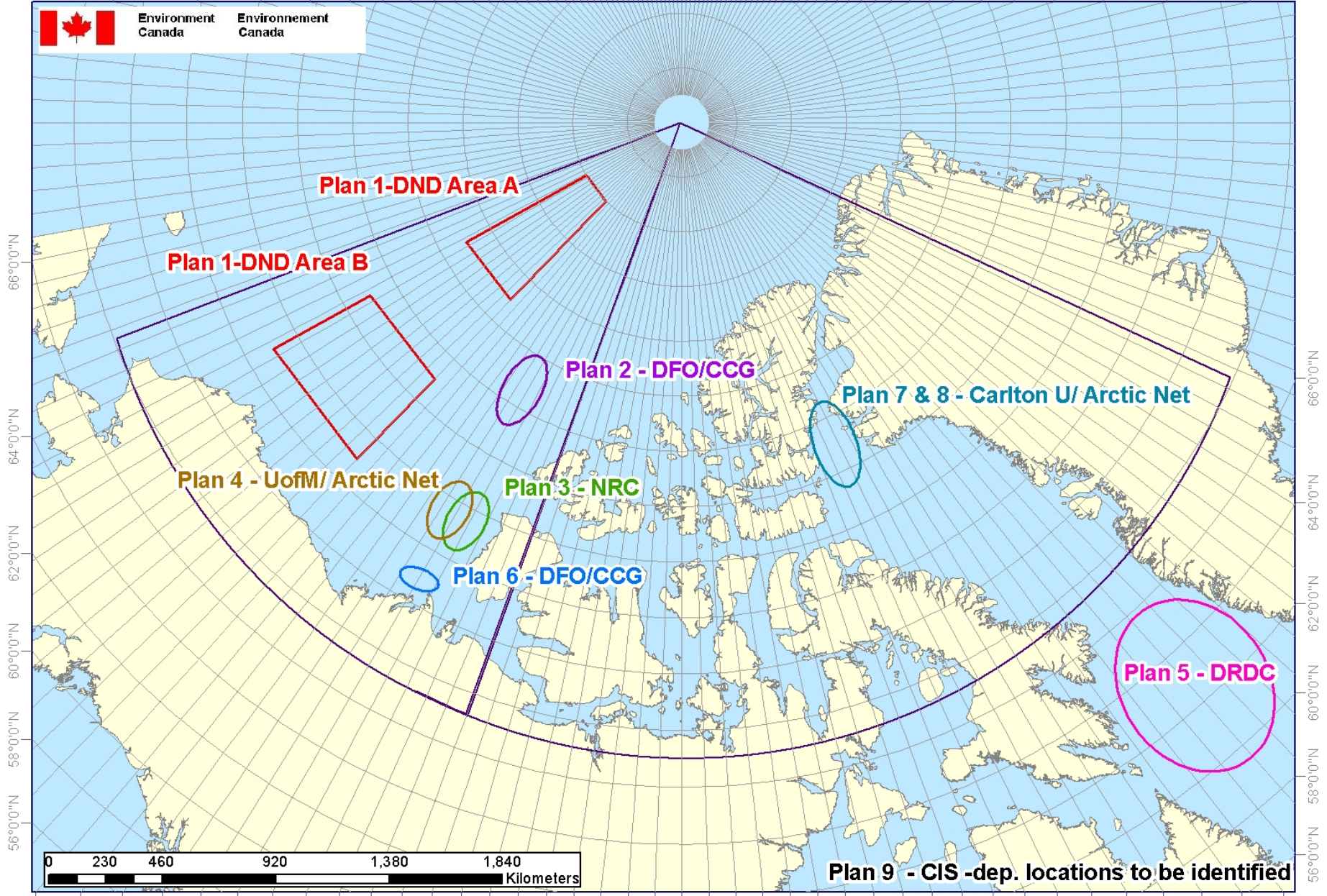
Impact of buoy obs on NWP

- Initial assessment of impacts spring and summer of 2013
 - Increase of obs from 29 to 54, 2 steps in May and August
- For **MSLP**, analyses are always better compared to the trial fields.
- Month after month the trial field improves; this could be in part the effect of these new drifters seen by the complete cycle of analyses (memory effect).
- More months (year) are needed to confirm these positive impacts. It is difficult to remove the seasonal effects which could be associated with these improvements. But there are improvements month after month over the arctic.
- For TT, exactly the same conclusions
- Buoy observations also critical to initialize and validate ice drift models.



Arctic Buoy Deployment Plan - 2013

158°0'0"E 156°0'0"E 152°0'0"E 148°0'0"E 142°0'0"E 132°0'0"E 112°0'0"E 84°0'0"E 56°0'0"E 36°0'0"E 24°0'0"E 16°0'0"E 10°0'0"E 6°0'0"E 4°0'0"E 2°0'0"E



Plan 1-DND Area A

Plan 1-DND Area B

Plan 2 - DFO/CCG

Plan 7 & 8 - Carlton U/ Arctic Net

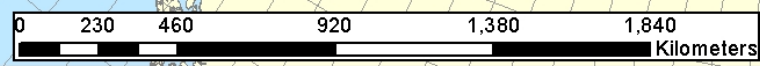
Plan 4 - UofM/ Arctic Net

Plan 3 - NRC

Plan 6 - DFO/CCG

Plan 5 - DRDC

Plan 9 - CIS -dep. locations to be identified



140°0'0"W 136°0'0"W 132°0'0"W 126°0'0"W 120°0'0"W 114°0'0"W 108°0'0"W 98°0'0"W 92°0'0"W 86°0'0"W 80°0'0"W 74°0'0"W 70°0'0"W 66°0'0"W 62°0'0"W

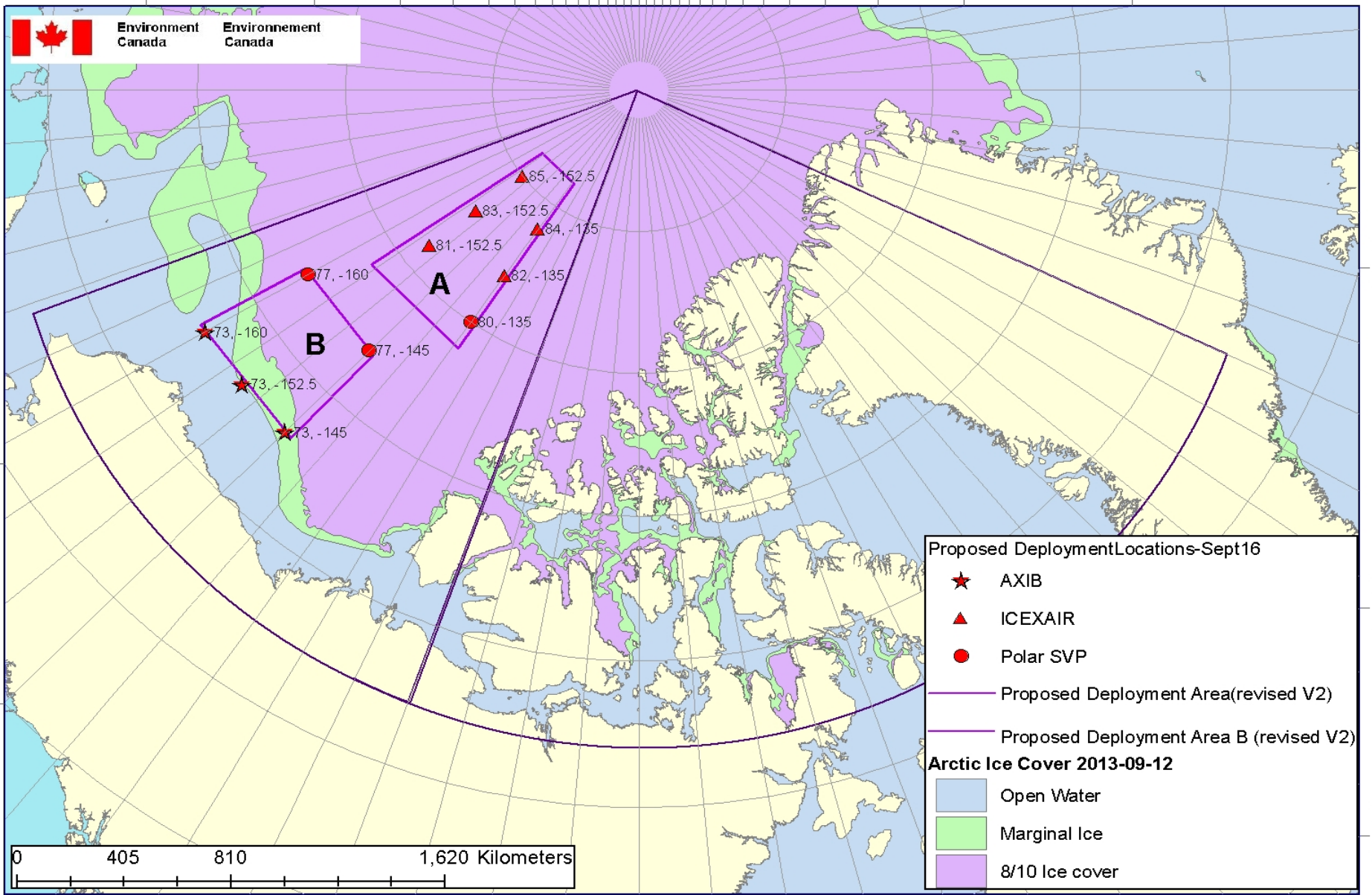
RCAF Buoy Deployment Plan 2013

- 11 buoys will be deployed in Beaufort Sea
- Three types of buoys (AXIB, ICEX-Air, Polar SVP) will be deployed
- Deployments are schedule for October 5th-10th
- Estimated cost of deployment ~\$420K



Air Deployment Of Drifting Buoys in the Canadian High Arctic - 2013

160°0'0"E 155°0'0"E 145°0'0"E 125°0'0"E 85°0'0"E 40°0'0"E 20°0'0"E 10°0'0"E 5°0'0"E 0°0'0"



Data as of Sept 16, 2013

Future plans and direction

- Continued evaluation of impact of buoy observations on NWP weather and ice forecasts.
- Continue to solicit feedback from marine and ice operational forecast programs.
- Feedback will validate requirements, and also optimize deployment locations and buoy measurements.
- Consideration for seasonal moored buoys (wave and wind measurements)
- Develop business case to seek funding support to sustain Canadian Arctic Buoy Array.



Thank You

Questions / Comments



Chris Marshall

Chris.marshall@ec.gc.ca

416-739-4468