International Arctic Buoy Programme

http://iabp.apl.washington.edu

Chairman's and Coordinator's Report for DBCP 26th Session

Christine Best - Chairman IABP
Environment Canada

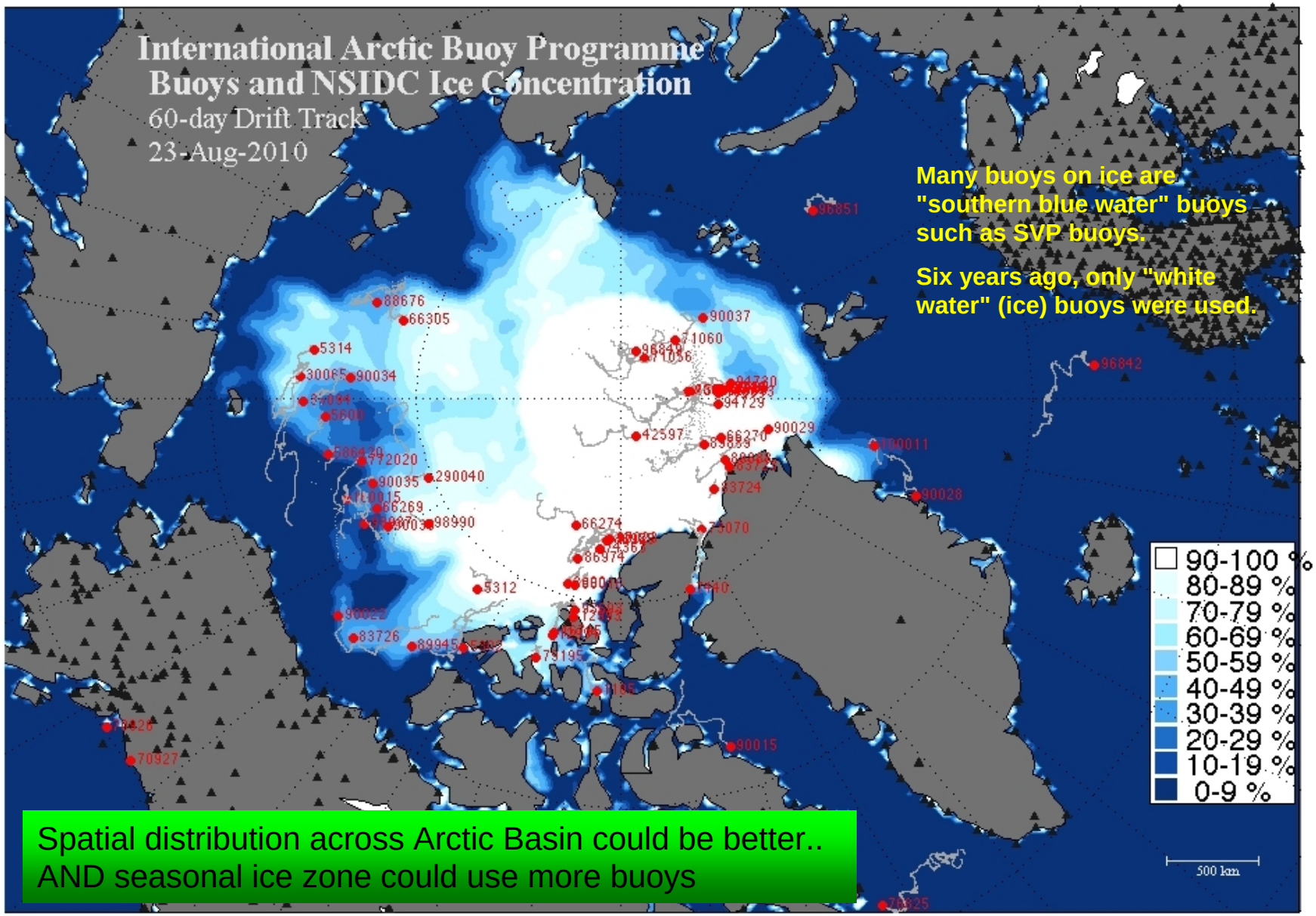
Ignatius Rigor - Coordinator IABP
Polar Science Center, University of Washington

Prepared by Edward Hudson, Christine Best and Ignatius Rigor

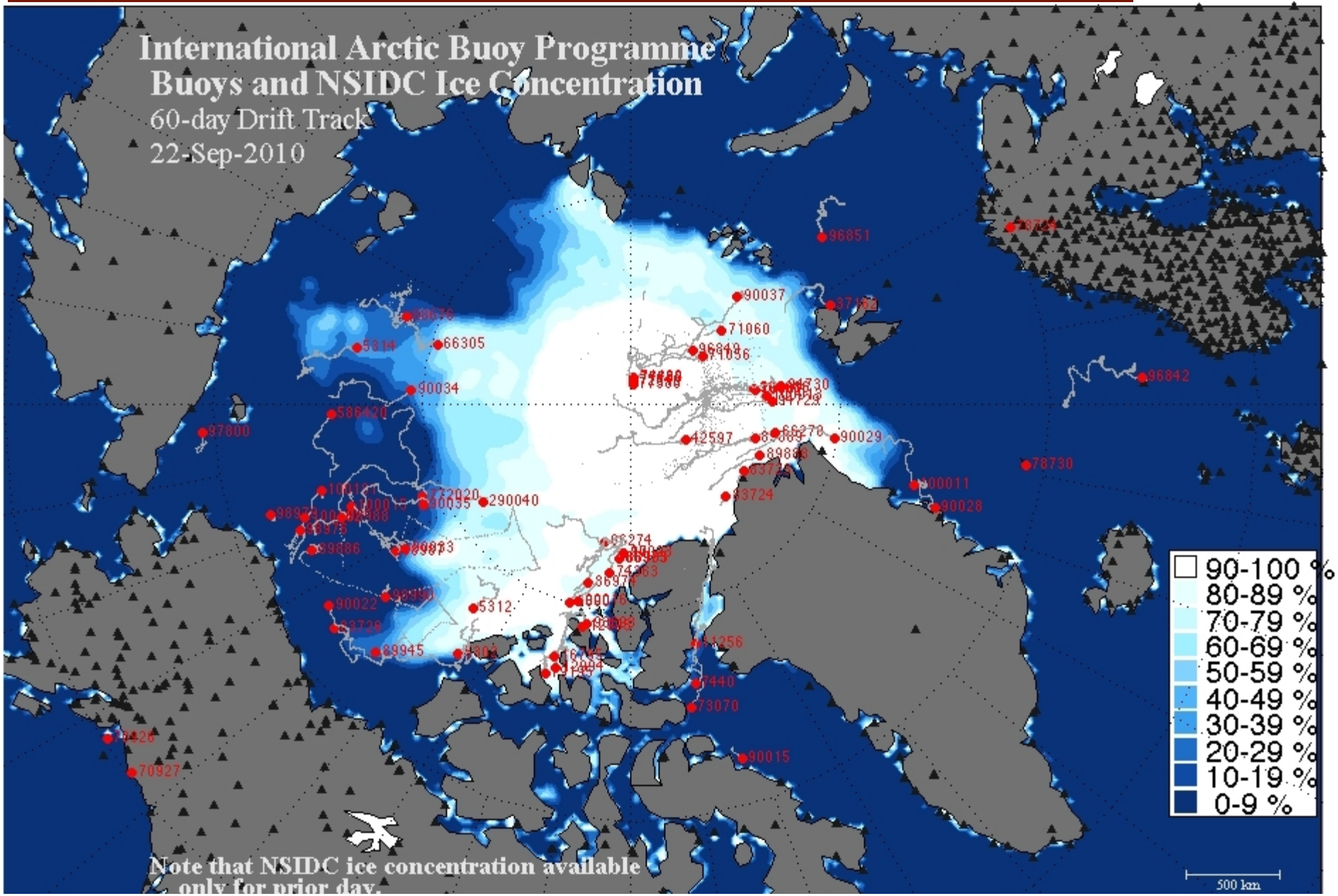
24 August 2010 edition updated 26 September

23 August 2010 - Area off Canadian Archipelago and area north of Greenland well served by buoys

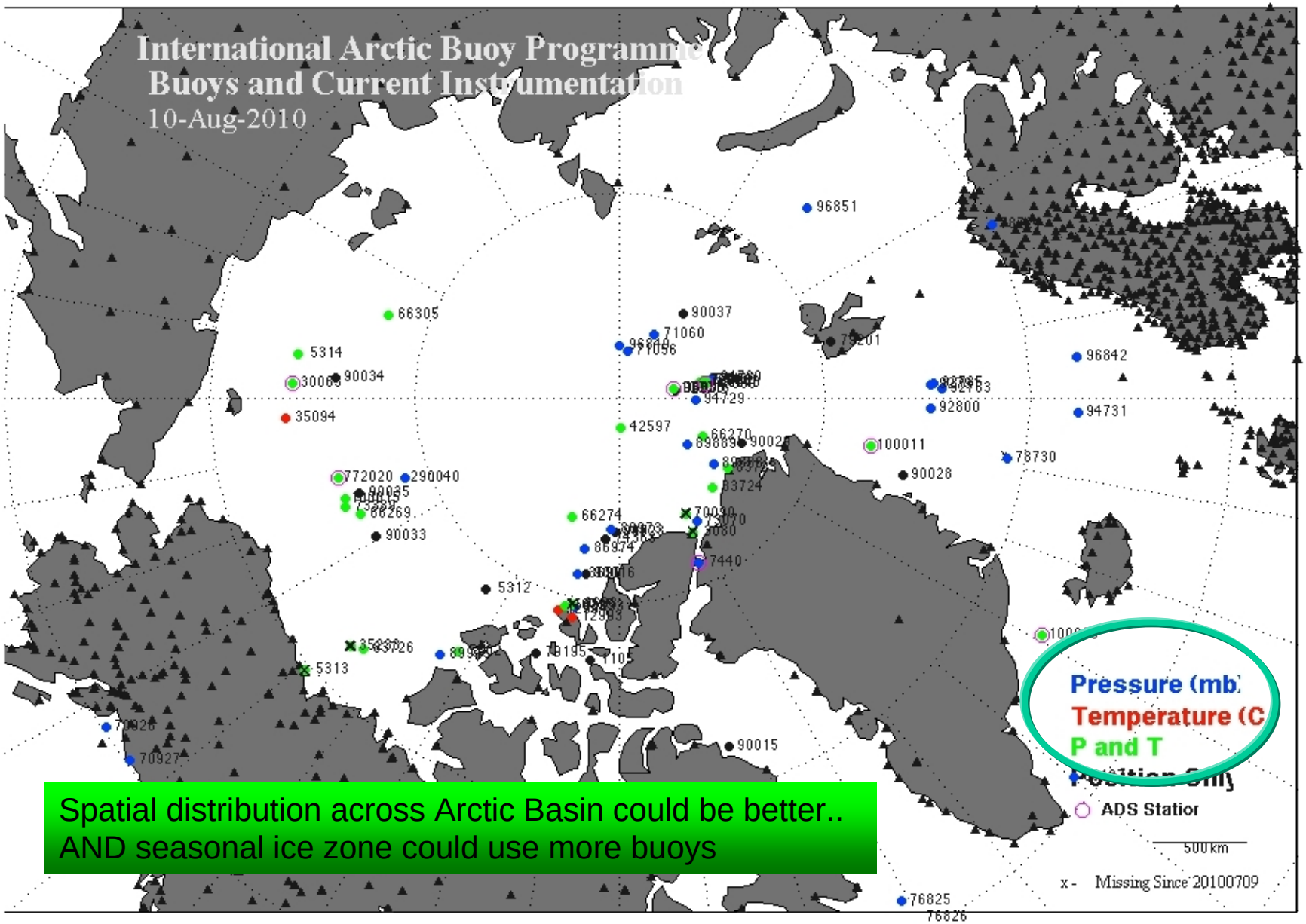
http://iabp.apl.washington.edu



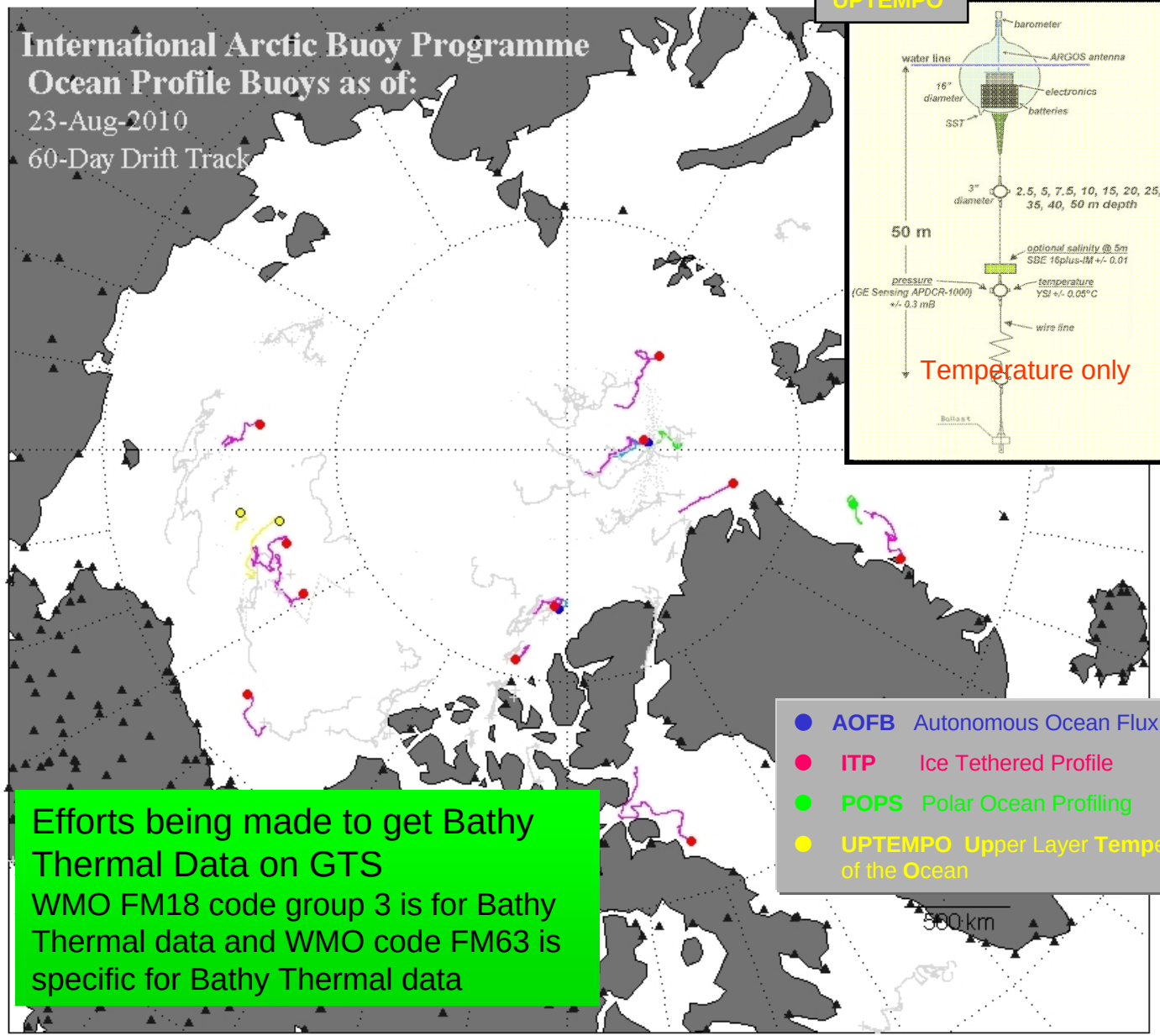
22 September 2010 - Area off North Coast of Alaska, northern Canadian Archipelago and area north of Greenland well served by buoys



Buoy array with respect to basic surface meteorology of air pressure and air temperature



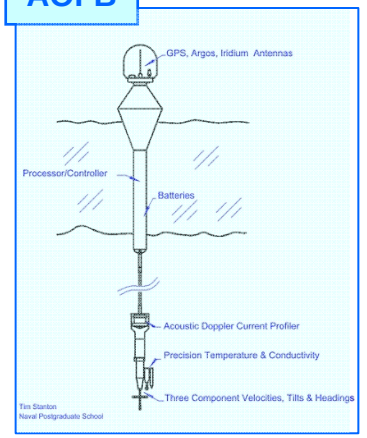
Several oceanographic buoys in array. **Most also have the basic air temperature and air pressure sensors and that data is getting on the GTS**



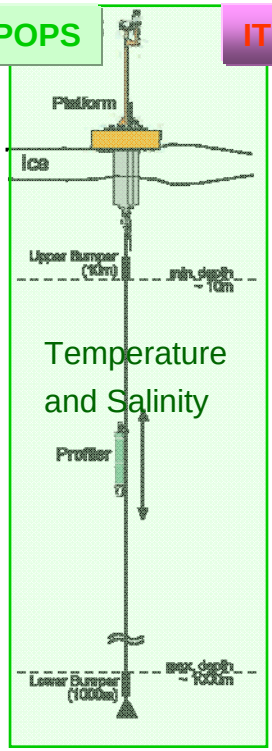
UPTEMPO

Temperature only

AOFB



POPS ITP



- **AOFB** Autonomous Ocean Flux Buoy
- **ITP** Ice Tethered Profile
- **POPS** Polar Ocean Profiling
- **UPTEMPO** **Up**per Layer **Temp**erature of the **O**cean

Efforts being made to get Bathy Thermal Data on GTS

WMO FM18 code group 3 is for Bathy Thermal data and WMO code FM63 is specific for Bathy Thermal data

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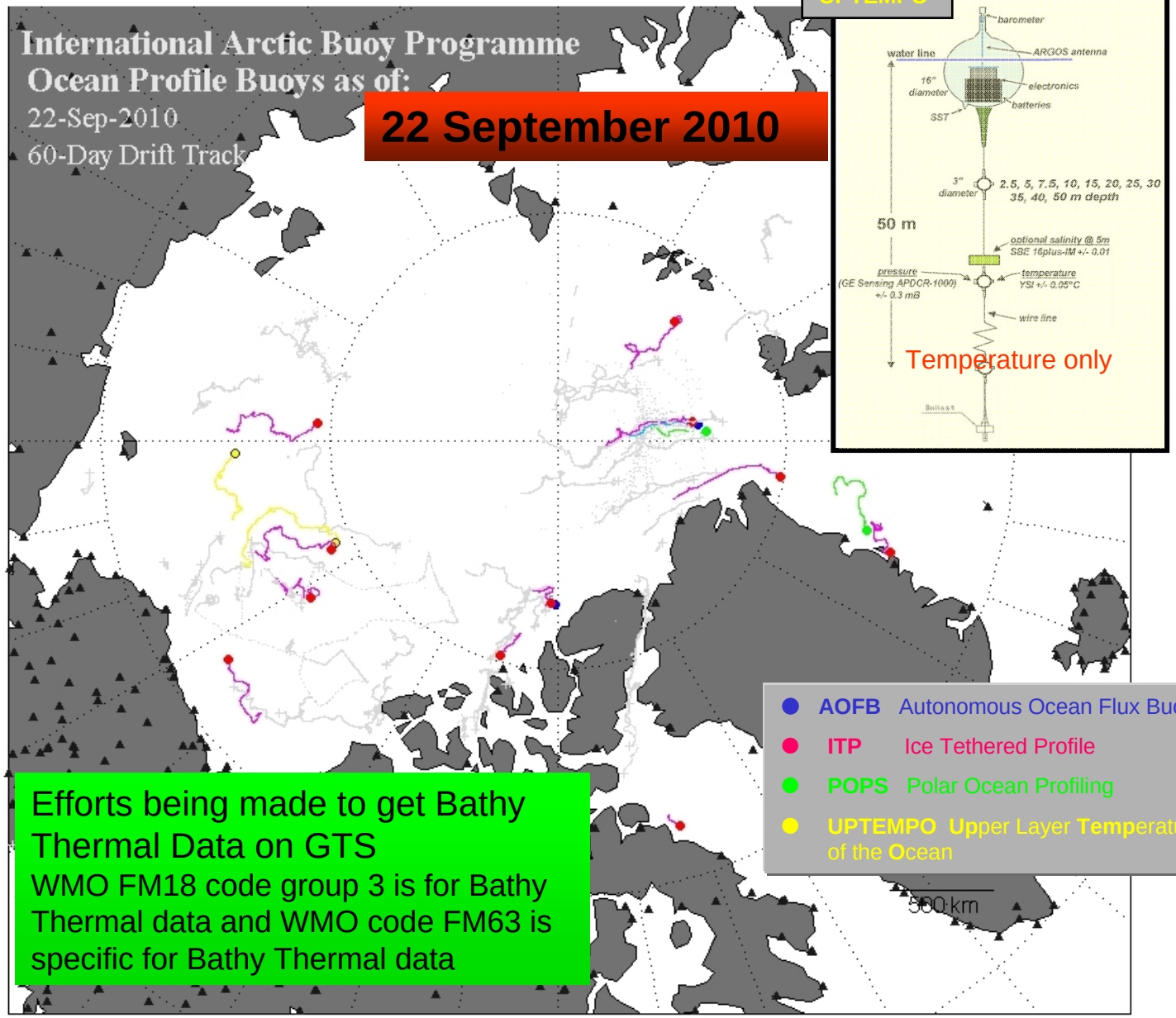

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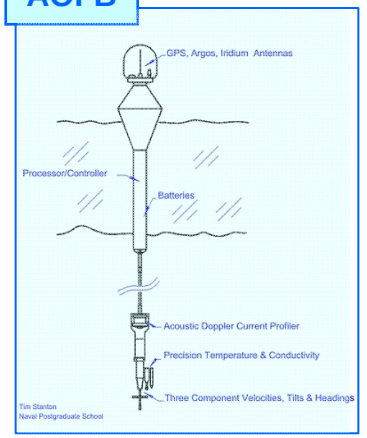

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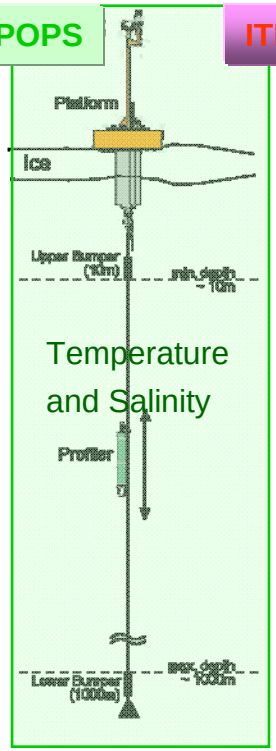

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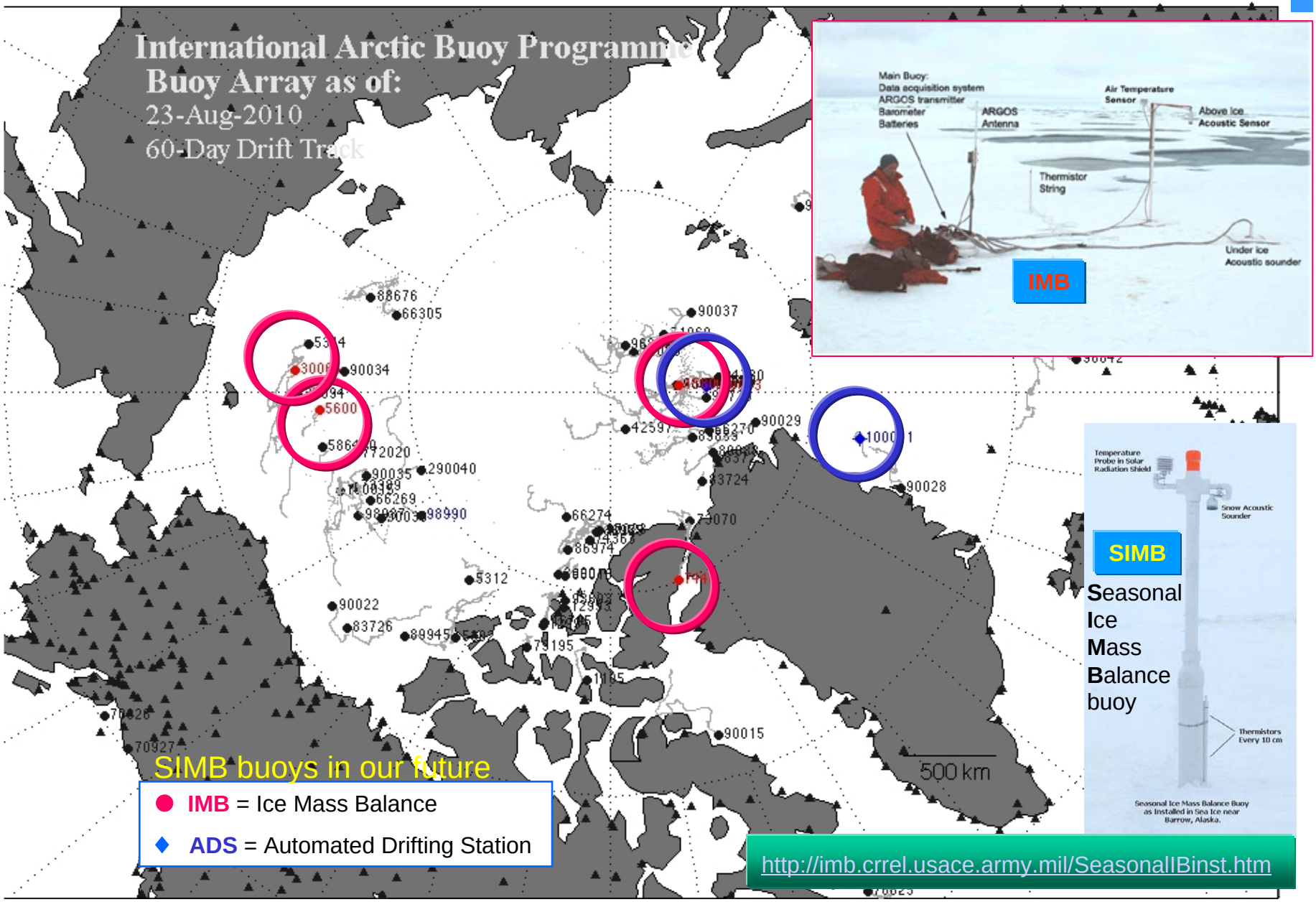
A few IMB Ice Mass Balance buoys in the array



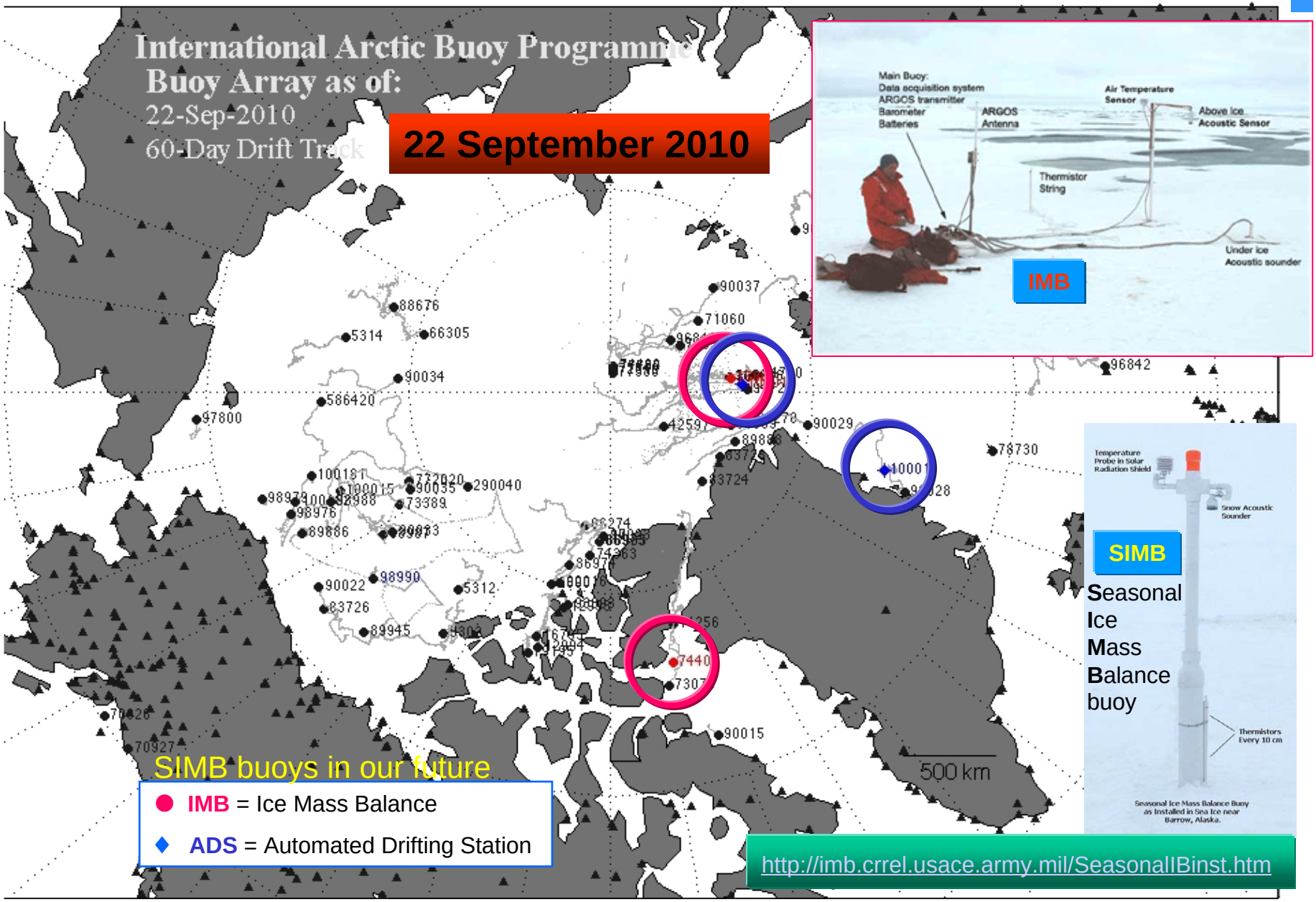
Seasonal
Ice
Mass
Balance
buoy

SIMB buoys in our future

- **IMB** = Ice Mass Balance
- **ADS** = Automated Drifting Station

http://imb.crrel.usace.army.mil/SeasonalIBinst.htm

A few IMB Ice Mass Balance buoys in the array



Presently one atmospheric components "O" buoy in the array. It went on ice September 2009.

O-Buoys use Iridium for communication.
Efforts being made to get some data on GTS.
http://transport.sri.com/obuoy/monitor

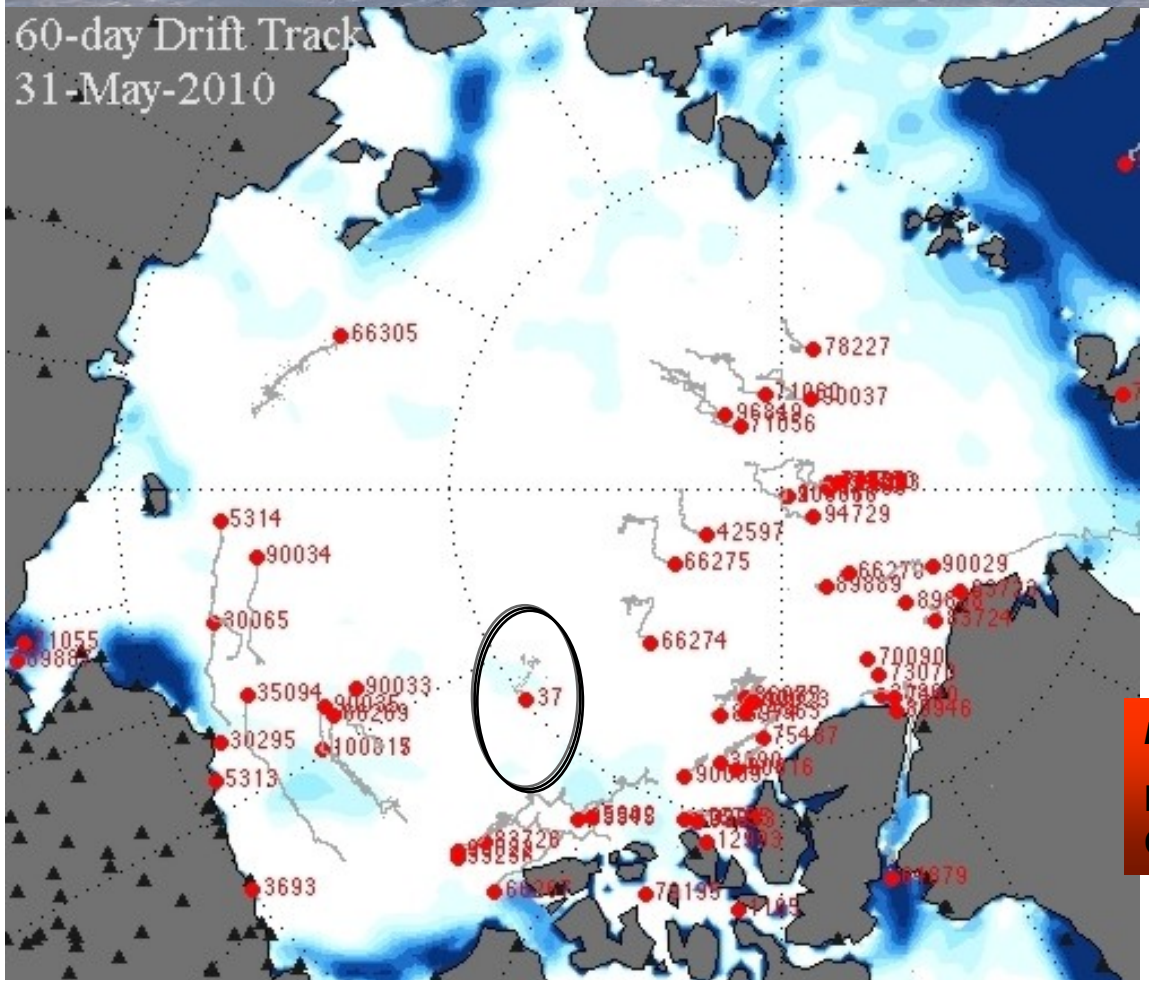
O-Buoy

An O-Buoy was on ice vicinity Borden Island 2–27 April 2010.

Another O-Buoy was on ice Hudson Bay 20 February to 27 March 2010.

Manned Russian Station NP37 provided real-time meteorological information late summer 2009 to spring 2010

NP37 http://www.aari.ru/resources/d0014/np37/default.asp?lang=0



Surface observations on GTS
Header - SMVB15 RUNW
Identifier – UFTA

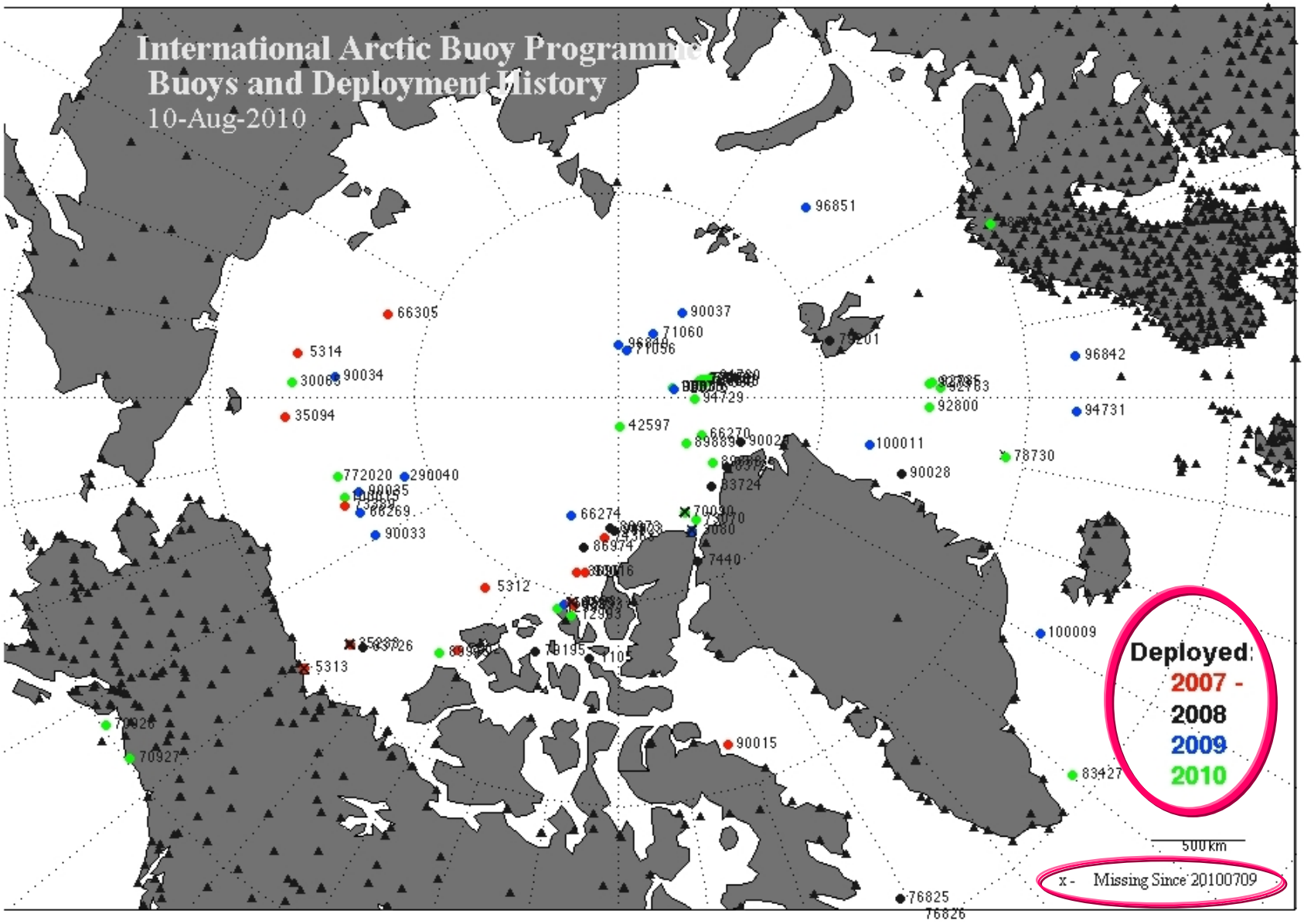
Sample - from 12Z 19 January 2010

SMVB15 RUNW 191200
BBXX
UFTA 19121 99816 71426 41997
51205 11389 21429 49966 53023
77073 85010 333 11380=

From The Voice of Russia, 21 September 2010

North Pole 38 will be established early October using the icebreaker Russia

Annual deployments remain a must



Comparison of IABP buoy array in August 2006 to 2010

	2006 7 August	2007 17 August	2008 15 August	2009 9 August	2010 23 August[1]
Ocean Profiling POPS or ITP	2	9	7	11	13
Ocean Profiling UpTempo					3
Arctic Ocean Flux Buoy			1[2]	1[2]	2
Ice Mass Balance	6	8	9	5	4
Atmospheric Components O buoy					1
Only Surface air temperature and **surface air pressure**	27	33	30	25	11[4]
Only Surface air temperature	2	1	1	1	1
Only Surface air pressure	2	8	20	40	22
Position only[3]	4	30	23	6	15
Russian manned station			NP 35	NP 36	Nil - NP37 which was established September 2009 was removed May 2010
Total Numbers of buoys	**43**	**89**	**91**	**89**	**72**

[1] The annual White Trident aerial deployment historically occurs early August and accounts for 7 to 12 buoys once it has occurred. The 2010 mid August buoy count is low as the annual WT exercise has not yet occurred. WT 2010 is scheduled for October and is expected to add up to 10 buoys to the array.

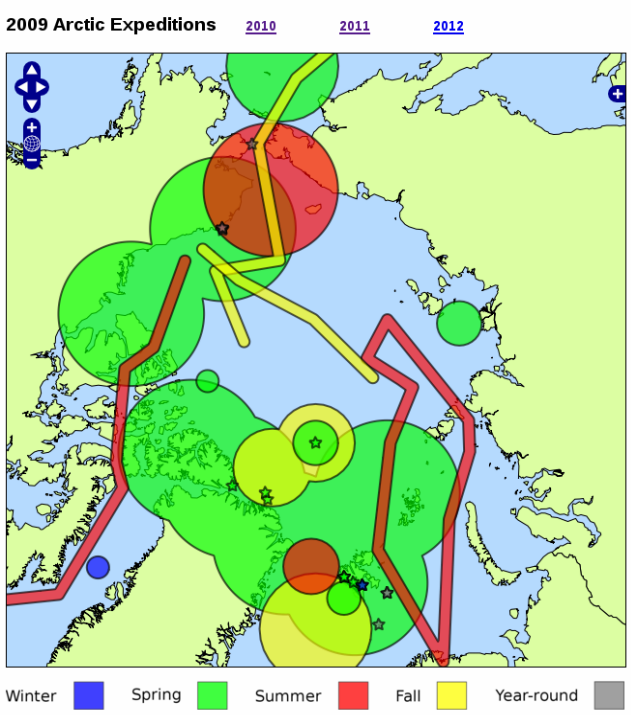
[2] Not reflected in 2008 or 2009 editions of table

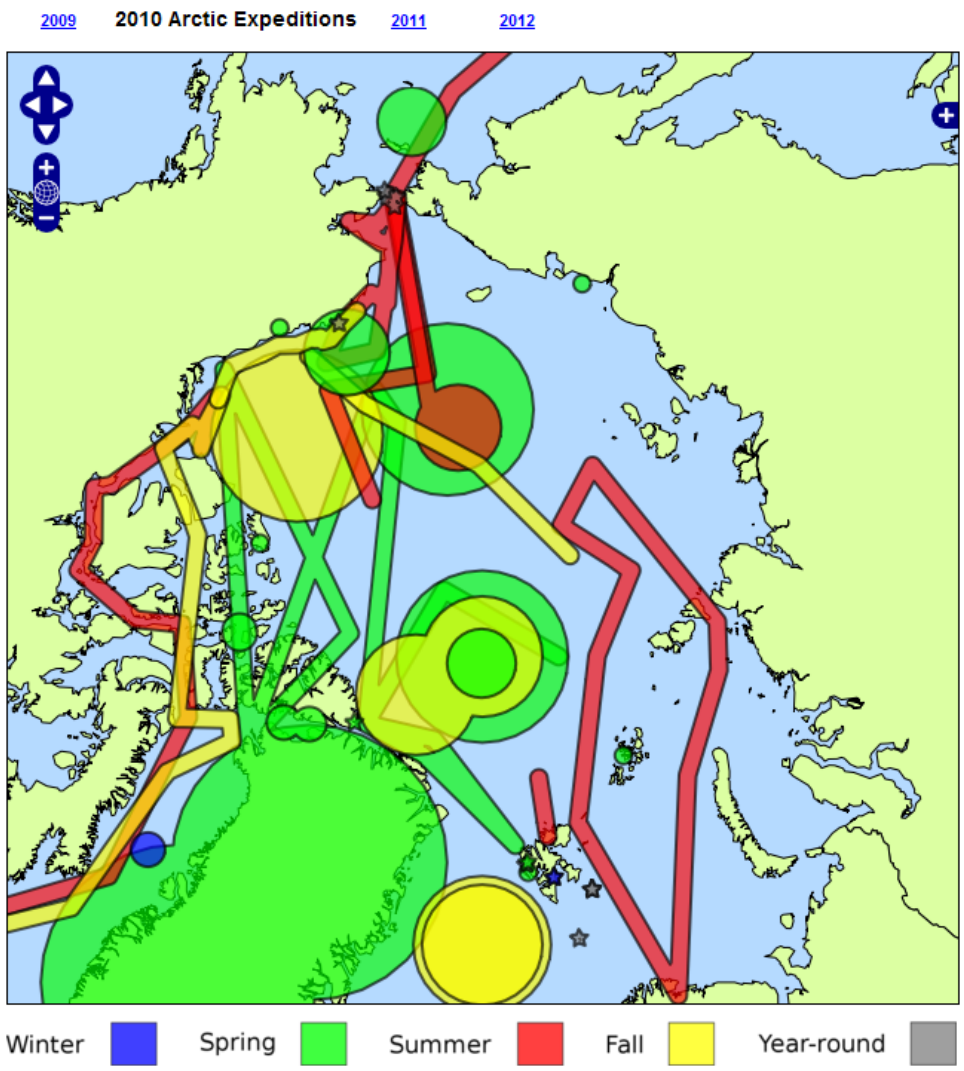
[3] By design or because the surface12 air temperature and surface air temperature data has failed or become unreliable

[4] Five buoys shown elsewhere in the table also provide both surface air temperature and surface air pressure.

www.iceplan.org Field planning website in year two

Site is courtesy CliC / CliC sea ice working group
and IARC, Jenny Hutchings, website coordinator





- One-stop shop for Arctic sea ice field planning coordination
- They seek to include all expeditions where buoys are to be deployed
- They hope to encourage collaborations and pave way for coordinated sea ice data collection

IABP Participants Annual Meeting

Annual International Arctic Buoy Programme Meeting held 6-7 June 2010 in Oslo, Norway

- hosted by Norwegian Meteorological Institute
- 19 attendees representing 12 of the 28 Participants
- meeting dates facilitated IABP participants participating in either or both the International Symposium on Sea Ice in Tromso and the IPY Science meeting in Olso which occurred respectively before and after the IABP meeting

IABP Executive

Chairman	Christine Best	Canada
Vice-Chairman	Christian Haas	Canada
Member	Pablo Clemente-Colón	United States
Member	Takashi Kikuchi	Japan
Member	Jean-Claude Gascard	France

IABP Coordinator

Ignatius Rigor — United States

Discussion / Issues

Challenges to sustain IABP network

- Increasing areas of First-Year Ice and Open Water during summer
- Deploying buoys in the Eurasian Arctic

Buoy data not getting onto GTS

- **Argos Buoys** - Yann Bernard, Service Argos, provided the IABP Coordinator a list of active Argos platforms in the IABP area north of 66N not yet being processed by Service Argos for the GTS. The IABP Coordinator will be contacting those on the list to see if they are wiling to share via having data posted to the GTS.

Iridium Buoys - Many researchers are using Iridium rather than Argos to get their data and that data is being posted to ftp sites and no further. Efforts are being made to have data flipped to the GTS. For example, Joubeh, Scotia Weather, and Environment Canada have collaborated for posting Iridium data on the GTS.

Obtaining data that did not get onto the GTS

During the IPY in particular, there were buoys on ice whose data has yet to make it to GTS or IABP archives. Efforts are being made to have that data entered into the GTS and IABP archives.

Kalman filter per IABP Coordinator Ignatius Rigor

Concerns

- Can a single Kalman Filter that can accurately tracks the motion of a bird, bear, whale, ocean currents and sea ice be developed? *Difficult?*

- For climate research, a consistently analyzed data set is a must. If our new data is only available as Kalman filtered positions (essentially modeled data), then the same procedures must be applied to earlier data going back to 1979. A detailed report should be provided so that researchers can properly evaluate and reproduce these procedures to make their data consistent. Not only do we want accurate positions, but accurate derivatives of position (velocity, stress/strain rates), and any interpolation or filtering affects these derivatives.

- The possibility for future re-analyses should be maintained. As we learn more about our observations, and as computers get faster, we may want to reanalyze our data. For example, Kalman Filters have long been used in numerical weather analysis. We should note that both of the NCEP/NCAR and ERA-40 Reanalysis projects would not have been possible if all they had to reanalyze was the Kalman

Possible solutions

- Allow time to properly assess quality of Argos Kalman Filtered positions.

- Let user decide whether they want Kalman filtered data or not.

- Low level positions as currently provided by Argos should continue to be made available to users and archived in as "raw" a form as possible to allow future re-analyses.

2011

Expect trends to continue:

- more buoys that can survive freeze-thaw cycle
- more oceanographic buoys
- more ice mass balance buoys
- buoys that are using Iridium communication to set up procedures to have, at minimum, position and basic meteorological data posted to the GTS in real time.

Resolution of Kalman filter concerns

Slides and notes per email from IABP Coordinator Ignatius Rigor

Sent: September 24, 2010 10:01 PM

To: Malarde Jean-Pierre; Hudson,Edward [Edm]

Cc: Woodward, Bill; Debbie Stakem; David Meldrum; David C Douglas; Etienne Charpentier; Viola Hester (JCOMMOPS); Guigue Michel; Mark Ortmeyer

Subject: Re: TR: Argos and Kalman Filter

looking at the positions and drift of buoy 42509 in 2009

Methods:

I applied the following procedures to all positions records for this buoy as consistently as possible:

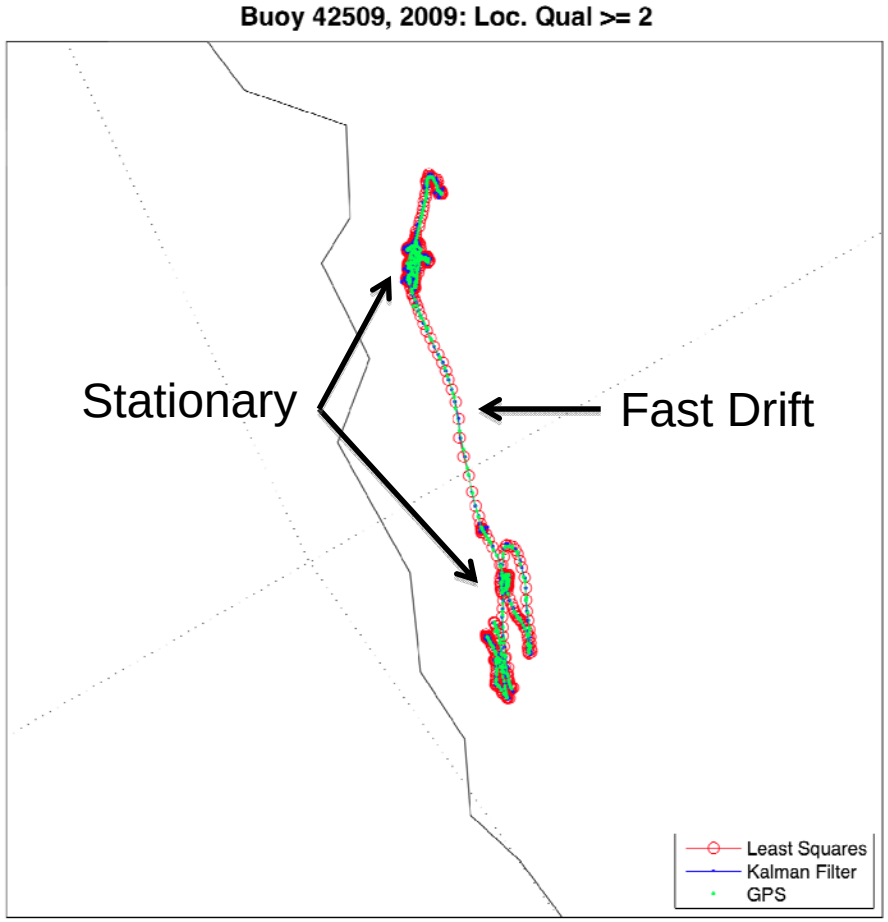
I took only LS and KF locations that you (Jean-Pierre Malarde) sent me with a quality >= 2.

For quick comparison, I assume there is no "error" in the position estimated by the onboard GPS.

Lat/long coordinates were converted to X/Y Cartesian coordinates using the EASE equal area projection.

To calculate velocities, I linearly interpolated these X/Y values to 3-hourly synoptic times. The velocities are thus based on 3-hourly displacements.

Argos Kalman Filter
Buoy 42509



Map shows Least Squares (LS), Kalman Filtered (KF) and GPS positions.

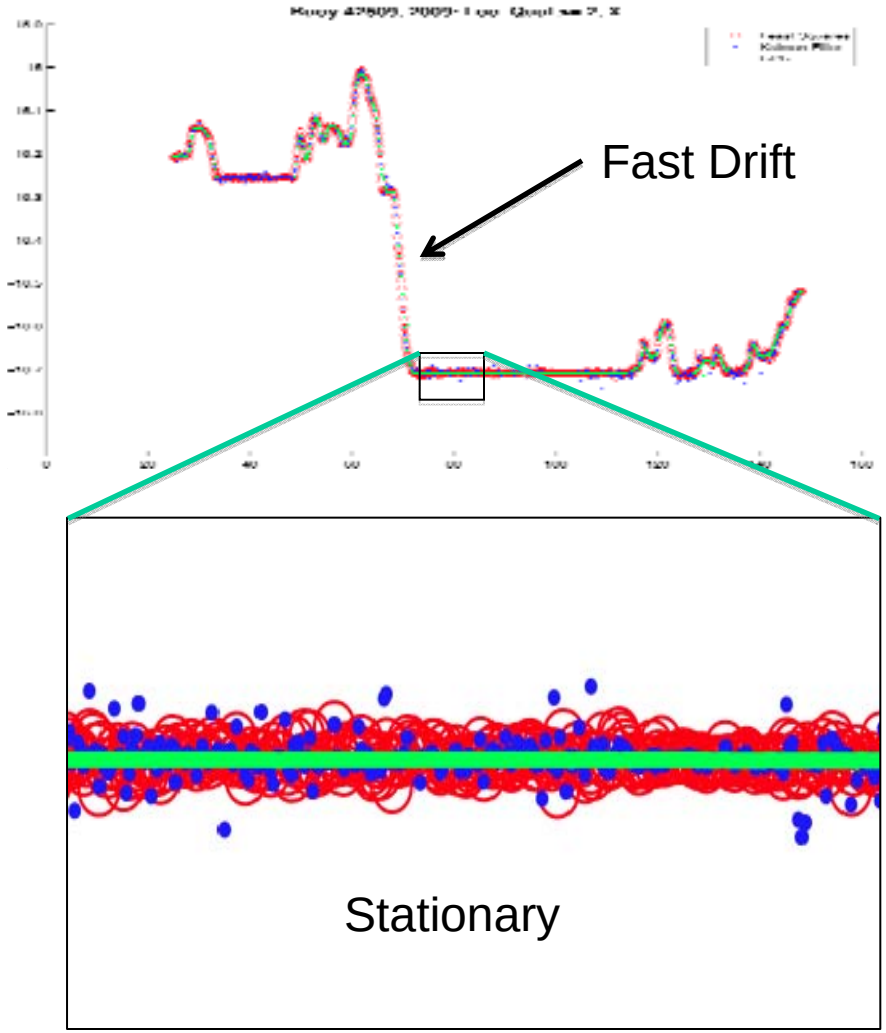
Deployed on Landfast sea ice north of Alaska in winter 2009.

Note:

- KF positions generally overlap LS positions.
- Non-linear drift behavior, with periods locked in ice interspersed with storm driven accelerations.

Showing only Argos positions with location qualities of at least 2, interpolated to synoptic times.

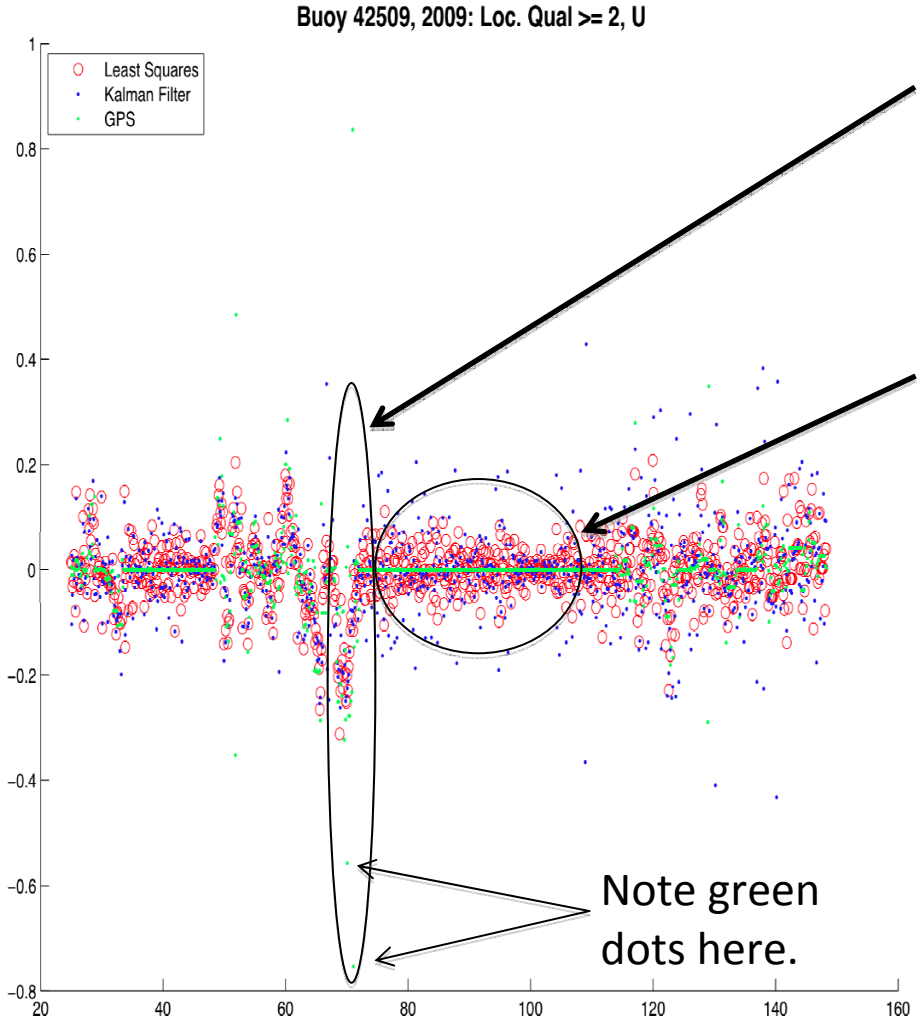
Argos Kalman Filter
Buoy 42509



LS and KF positions with location qualities >= 2 appear to match GPS positions.

However, during periods of zero drift velocities noted by GPS, we see that the KF positions are noisier than LS positions.

Argos Kalman Filter Buoy 42509



- LS and KF positions **underestimate velocities (m/s)** during periods of fast drift.
- Standard Deviation (SD) of Velocity during periods of zero drift (i.e. velocity error):
  - SD(LS) = 3.7 cm/s
  - SD(KF) = 7.2 cm/s
- LS velocities may actually be better?

Argos Kalman Filter
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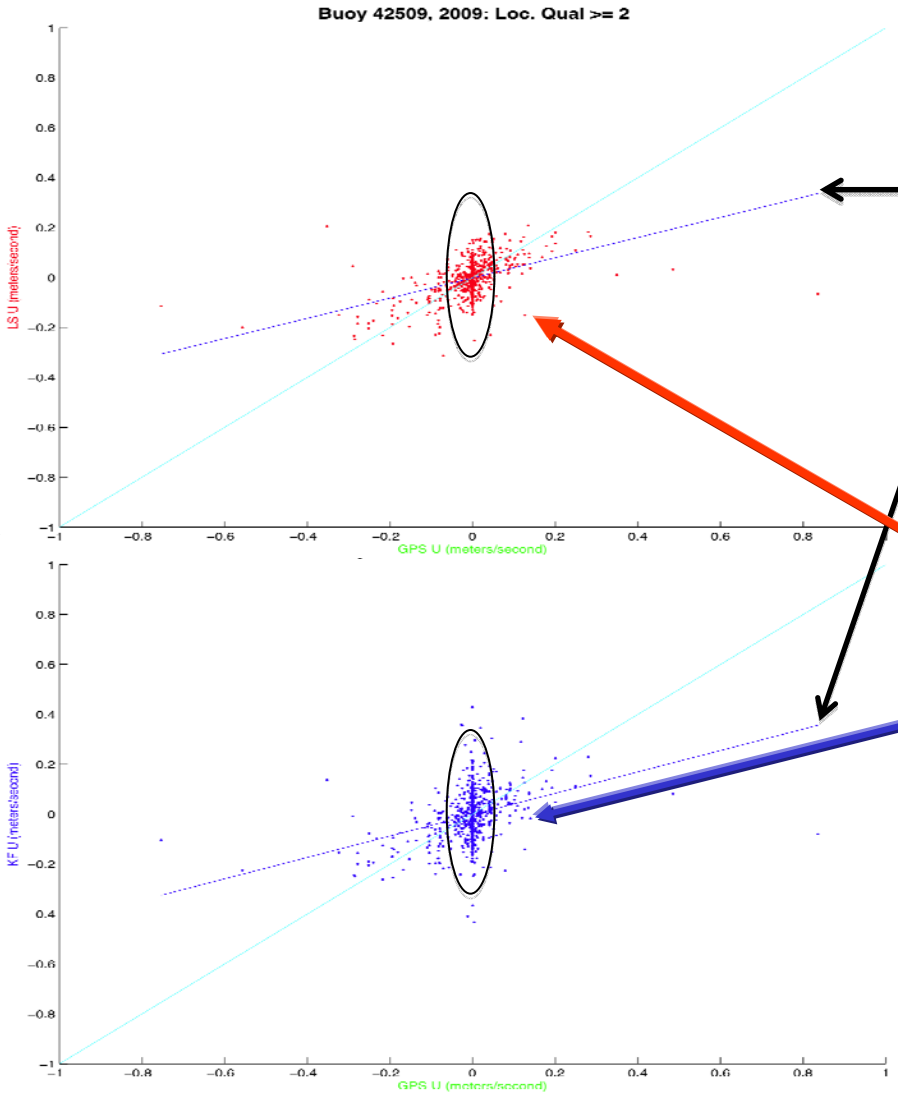

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Observations, Preferences, and Recommendations:

1) The KF positions are less noisy than LS for instances when the location quality is low.

2) I prefer LS to KF positions since the derivatives of position are important for my research. For this test case, the LS velocities match the GPS velocities better than KF.

3) For climate research, the LS positions should continue to be provided since I think these are based more on the Doppler estimates than the KF, and thus closer to the positions that Argos has provided since 1979. One example of how this is important in my research is that we know the sea ice is retreating in thickness and extent. We would expect that the thinner ice may thus be more responsive to wind forcing. Hypothetically, if the LS estimates represented Argos positions taken in say 1979, while the KF estimates represented ice conditions now, I may mistakenly attribute this increase in variance to a thinner ice pack that is more responsive to wind forcing when really it is just a change in the algorithms that we use to estimate the positions of the buoy (or bird, bear, whale). Consistency is critical for the interpretation of long-term records.