Ice-Tethered Platforms: SEARCH Distributed Marine Observatories, History, and NPEO

Presentation at the Ice Tethered Platform Workshop
June, 2004

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SEARCH Motivation

The Arctic has been characterized in recent decades by a complex of significant, interrelated, pan-Arctic changes (Unaami).

DMO: Distributed Marine Observatories

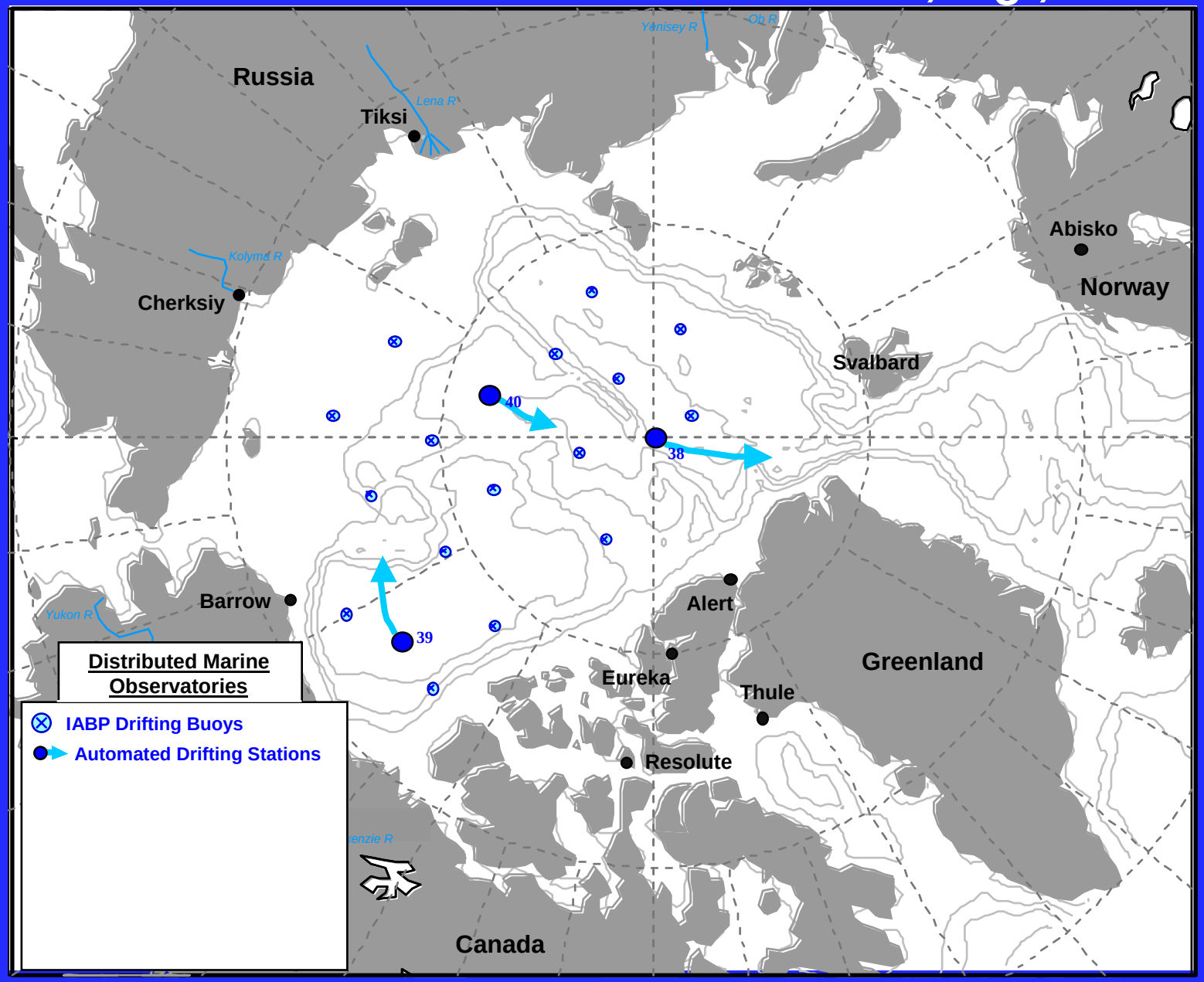
Make large-scale atmospheric, oceanographic, sea ice and ecosystem observations in the marine environment.

SEARCH Implementation Strategy available at
http://psc.apl.washington.edu/search/index.html

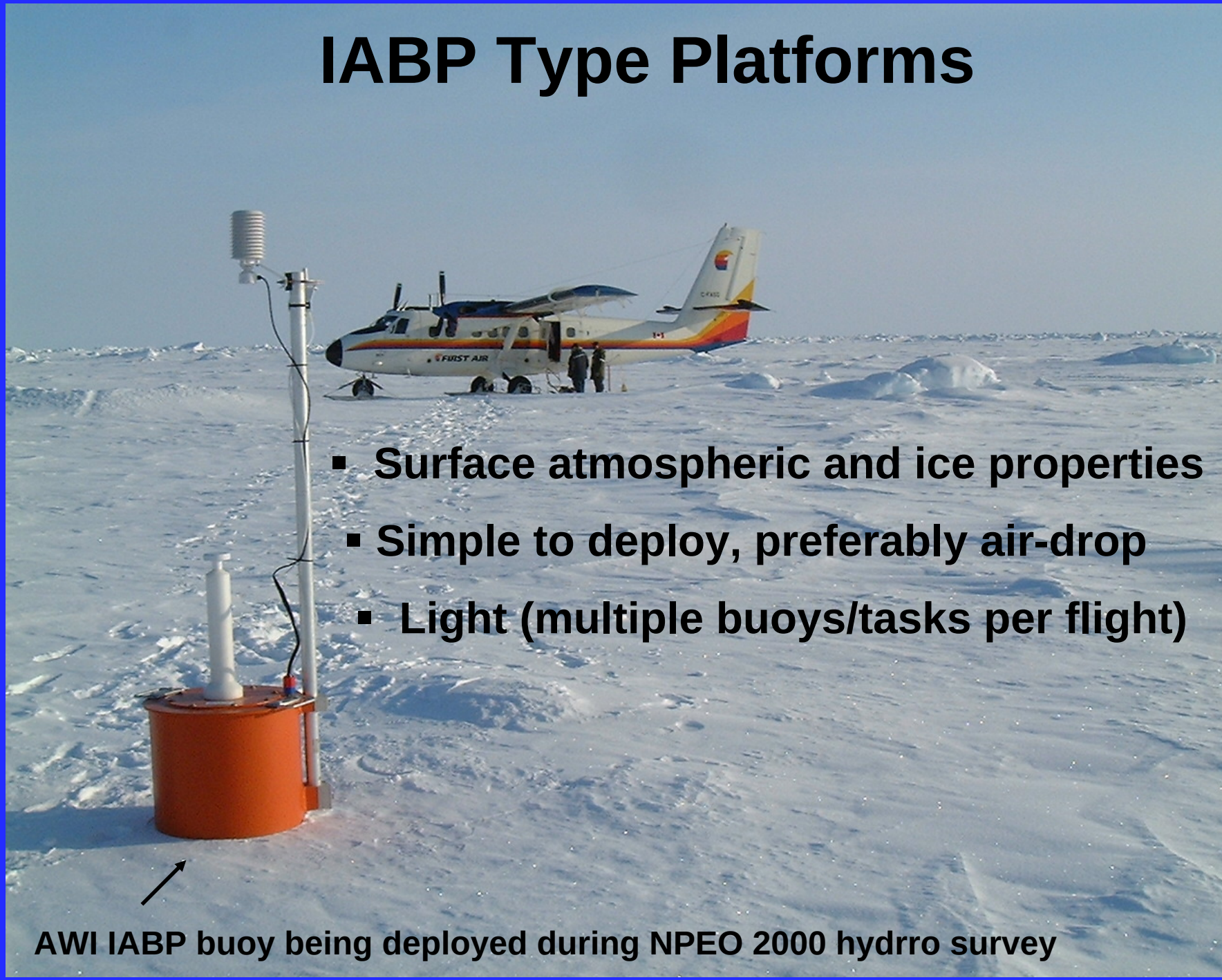
AND: COPIES ON THE TABLE OUTSIDE IN THE HALL

ALSO: See Poster by Takashi Kikuchi: JAMSTEC JCAD

Ice-tethered platforms are important to the SEARCH Distributed Marine Observatories, e.g.,



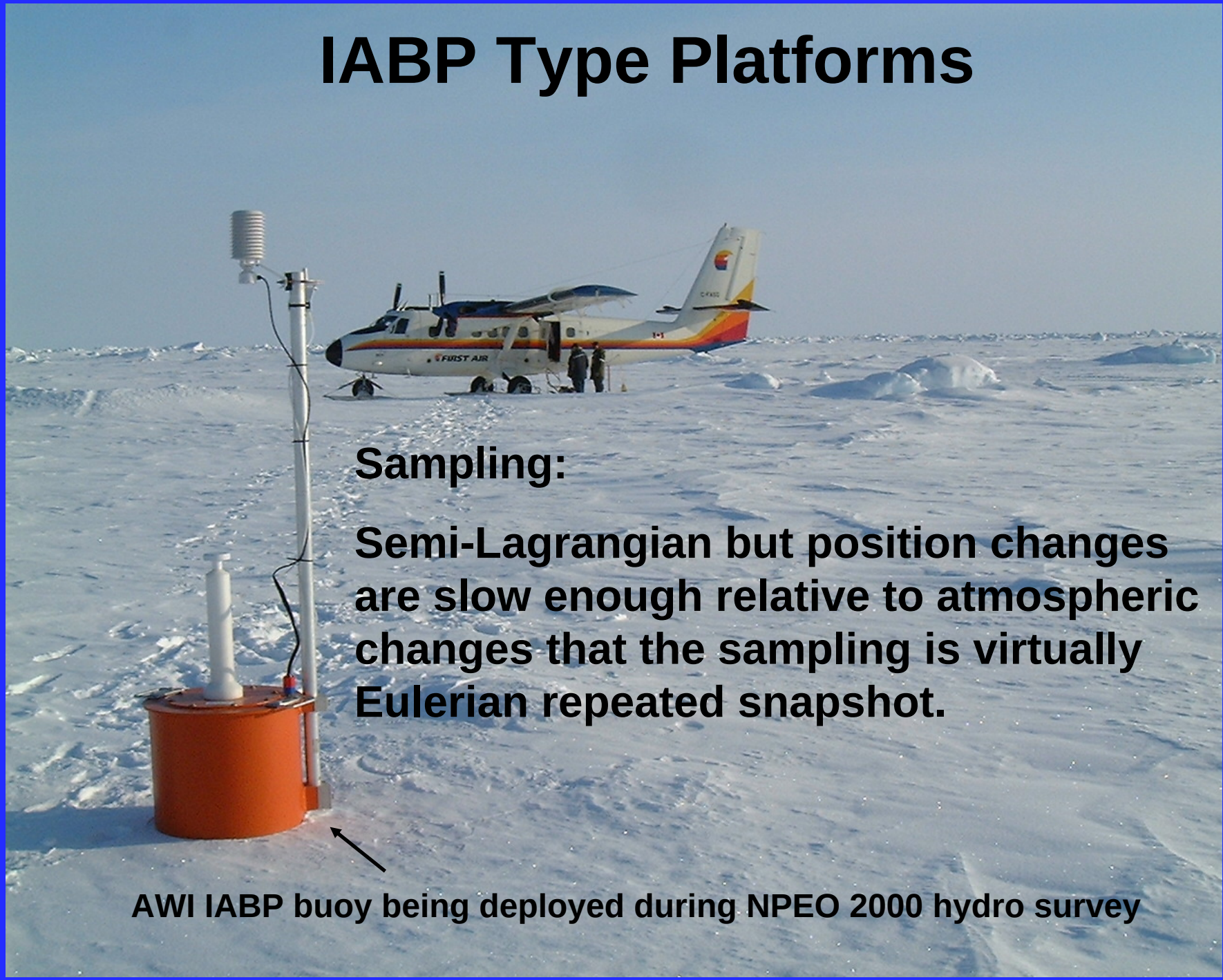
IABP Type Platforms



- Surface atmospheric and ice properties
- Simple to deploy, preferably air-drop
- Light (multiple buoys/tasks per flight)

AWI IABP buoy being deployed during NPEO 2000 hydrro survey

IABP Type Platforms



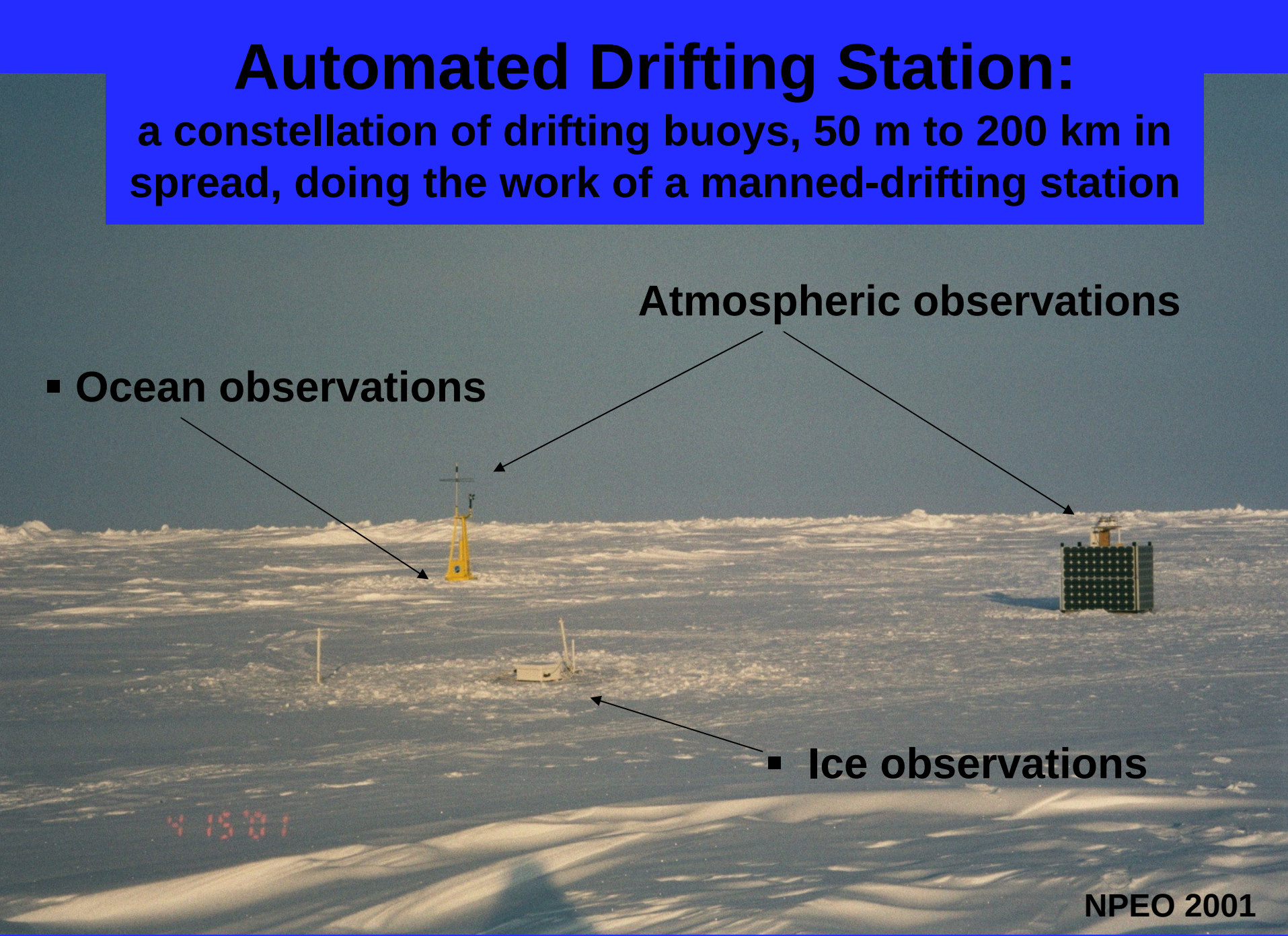
Sampling:

Semi-Lagrangian but position changes are slow enough relative to atmospheric changes that the sampling is virtually Eulerian repeated snapshot.

AWI IABP buoy being deployed during NPEO 2000 hydro survey

Automated Drifting Station:

a constellation of drifting buoys, 50 m to 200 km in spread, doing the work of a manned-drifting station



Automated Drifting Station:

Operations:

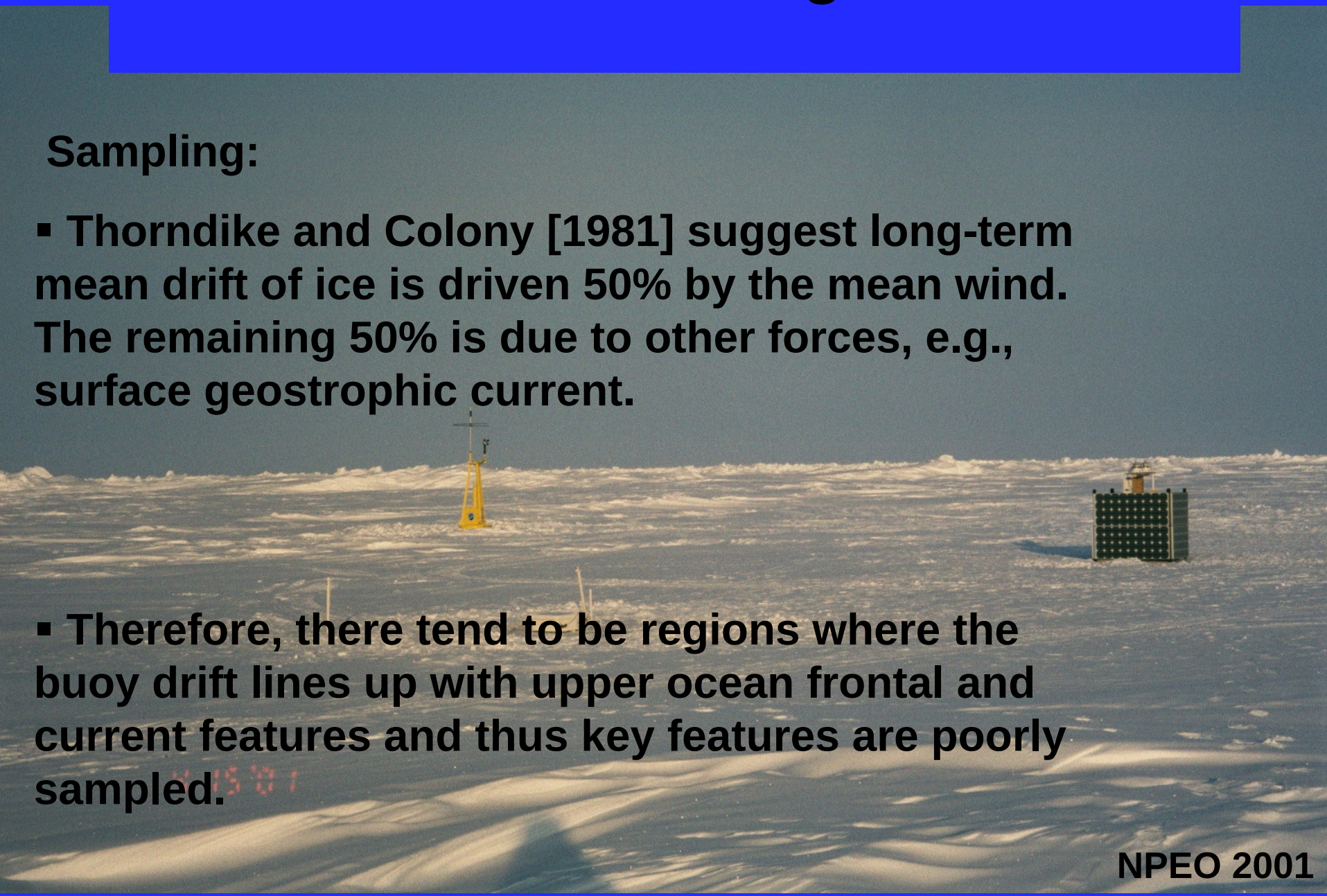
- **Multiple buoys provide flexibility, redundant observations, and economy of scale in deployment.**

Sampling:

- **Lagrangian-ice but position changes are slow enough relative to atmospheric changes that the sampling is virtually Eulerian repeated snapshot..**
- **“1/2 Lagrangian”-near-surface ocean produces time series for local interpretation if spatial variations can be accounted for.**
- **Mean drift comparable to surface current velocities so that ocean sampling is generally not strictly Eulerian or Lagrangian.**

NPEO 2001

Automated Drifting Station:



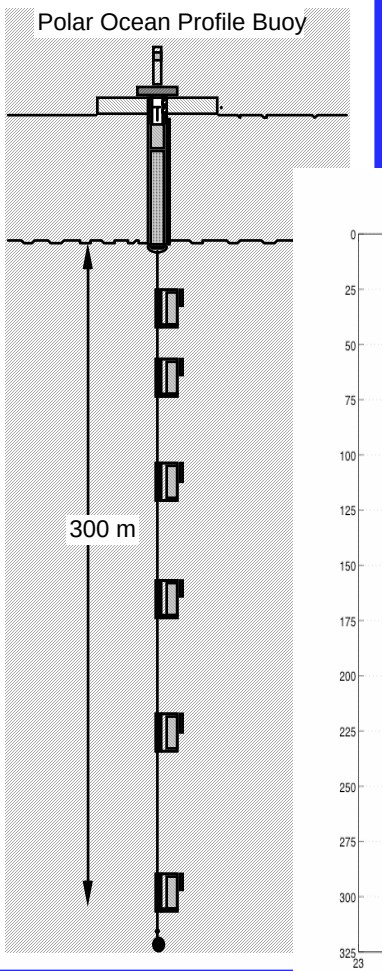
Sampling:

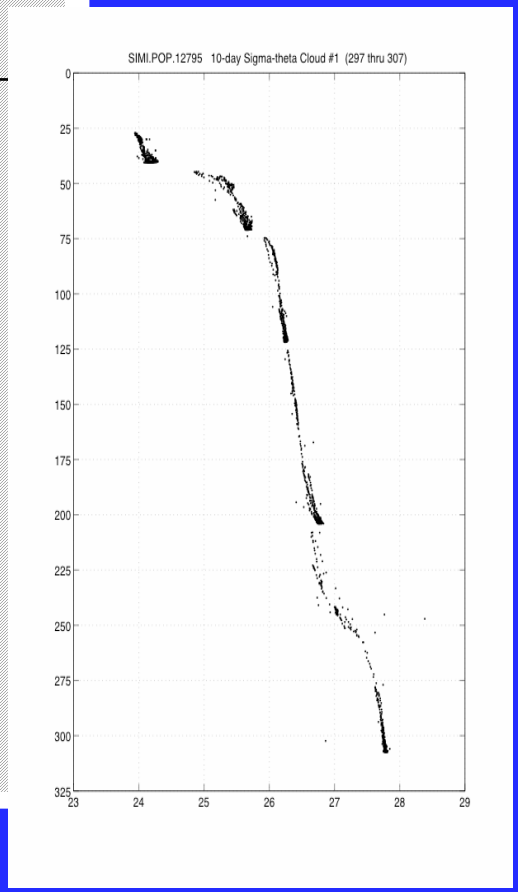
- **Thorndike and Colony [1981] suggest long-term mean drift of ice is driven 50% by the mean wind. The remaining 50% is due to other forces, e.g., surface geostrophic current.**

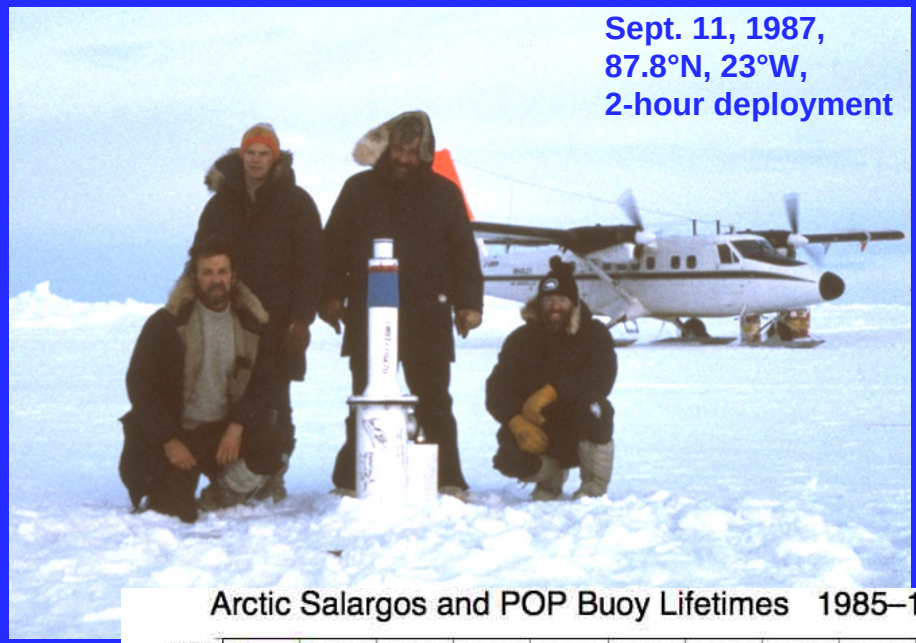
- **Therefore, there tend to be regions where the buoy drift lines up with upper ocean frontal and current features and thus key features are poorly sampled.**

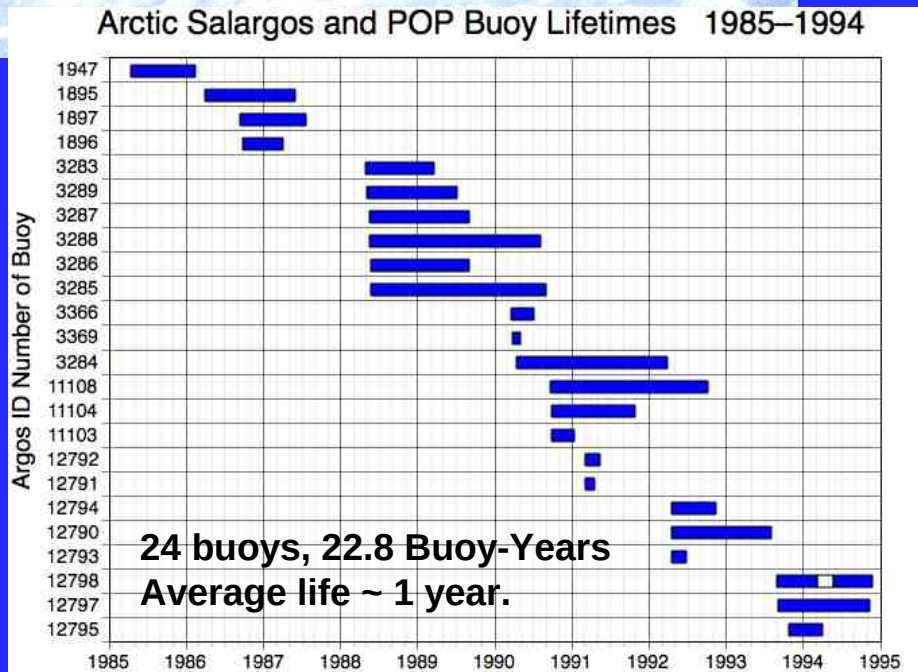
NPEO 2001

Consider the SALARGOS and POP oceanographic buoys deployed by aircraft, ship, and submarine in the 1980s and early 1990s:







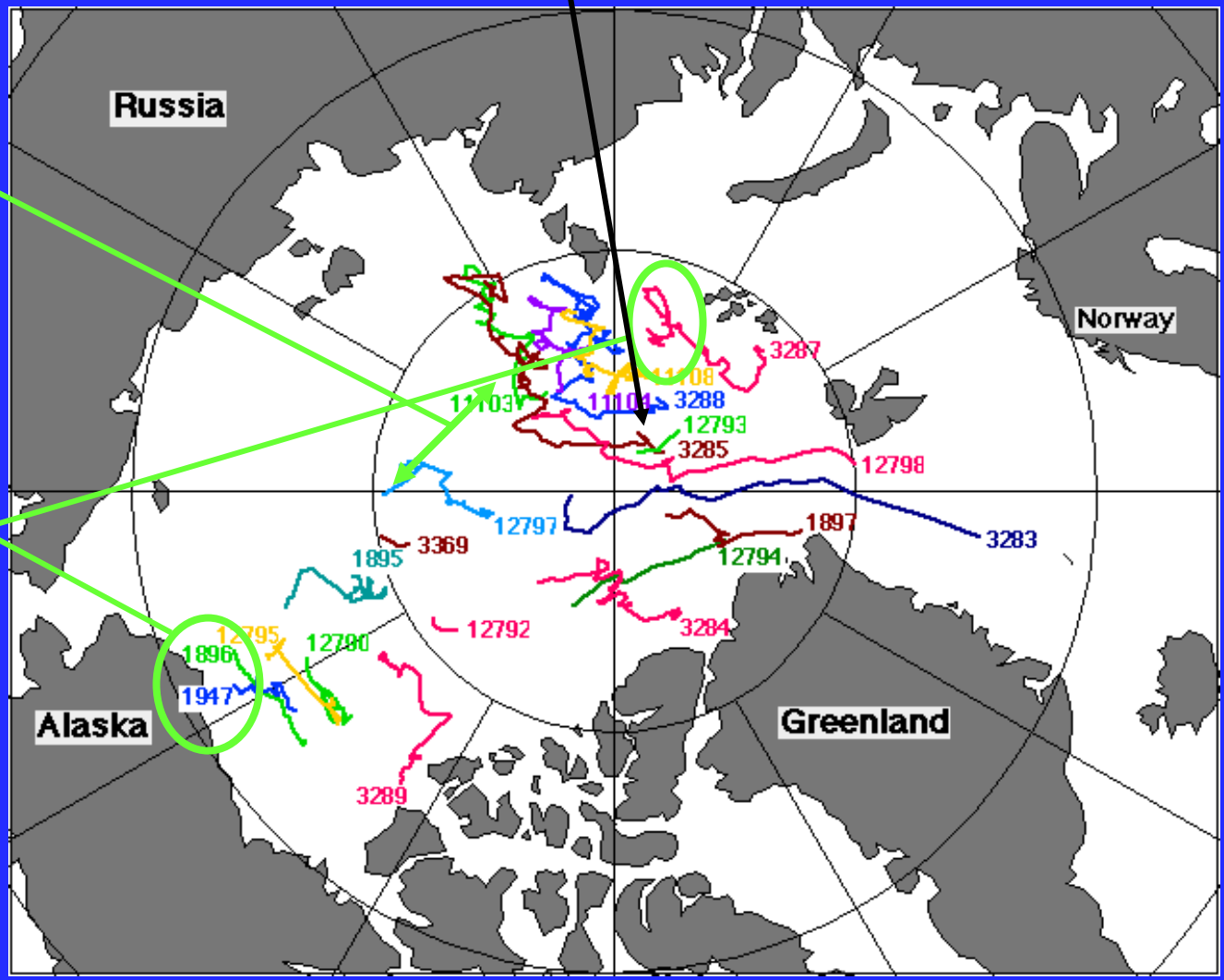


Sampling by the SALARGOS and POP oceanographic buoys was good in many areas,

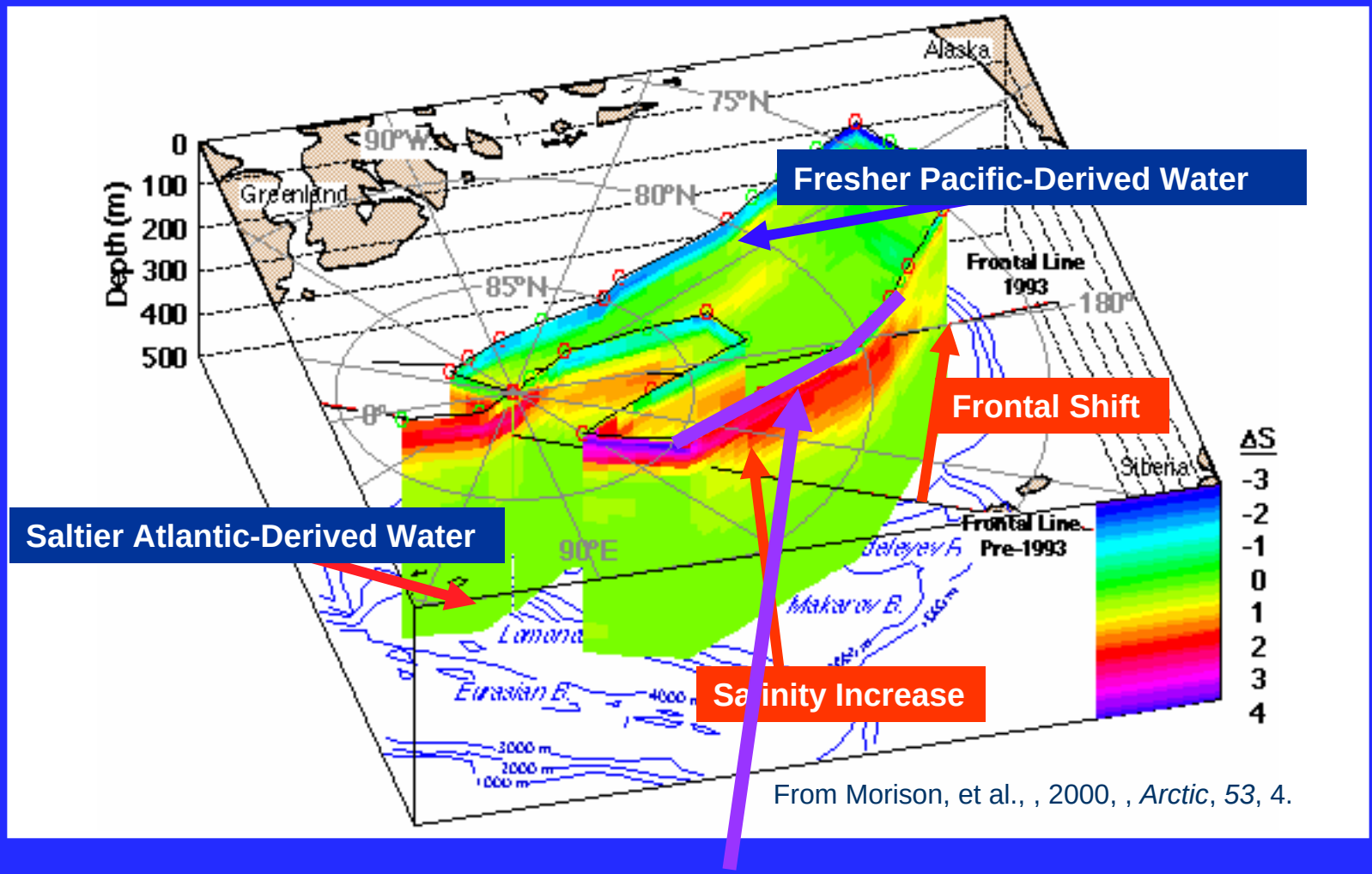
but not all:

No section across the critical Makarov Basin and adjacent Lomonsosv Ridge

Few sections cross continental slope and associated boundary currents
And those that do cross, run aground.



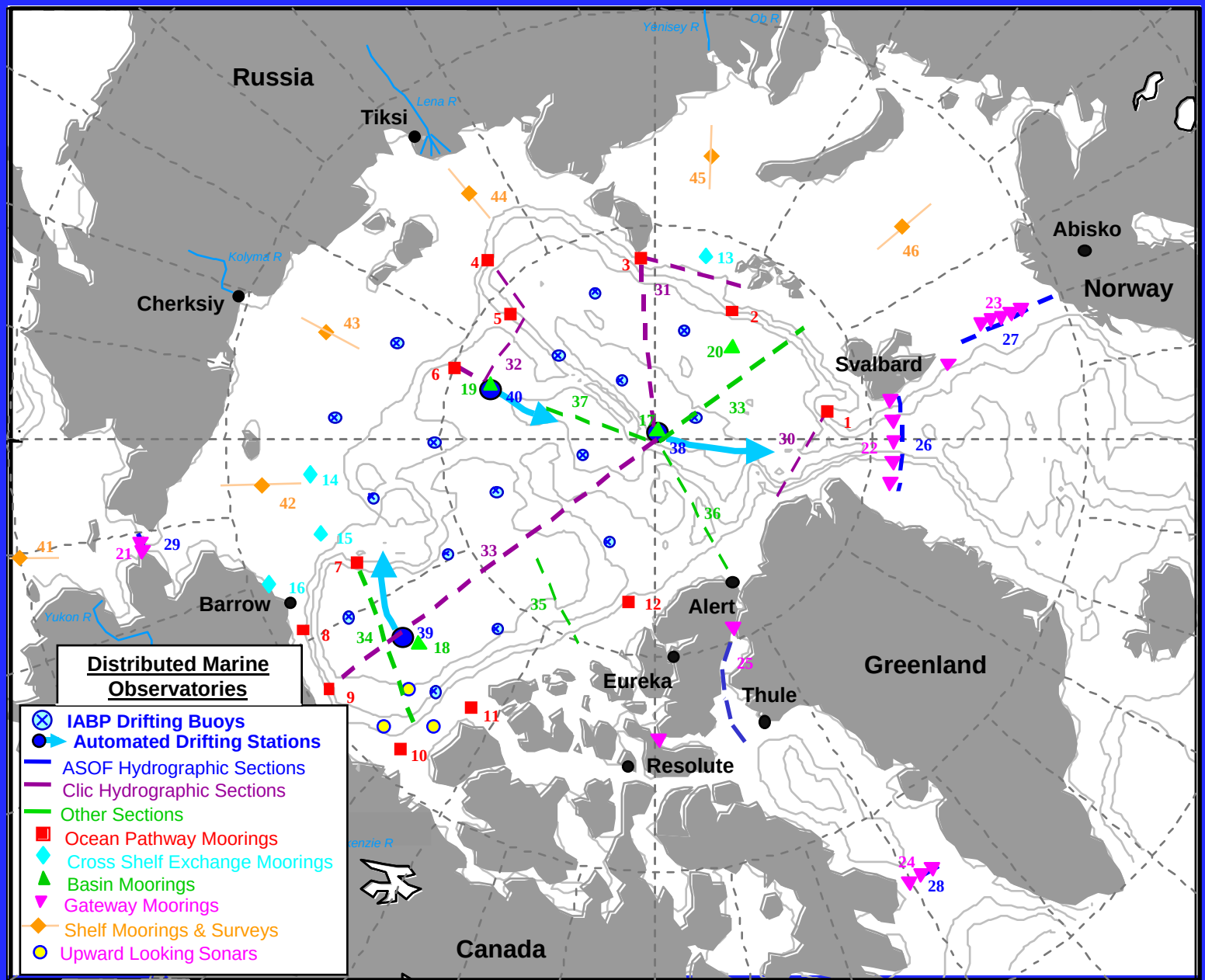
Example: The Makarov Section



From Morison, et al., , 2000, , *Arctic*, *53*, 4.

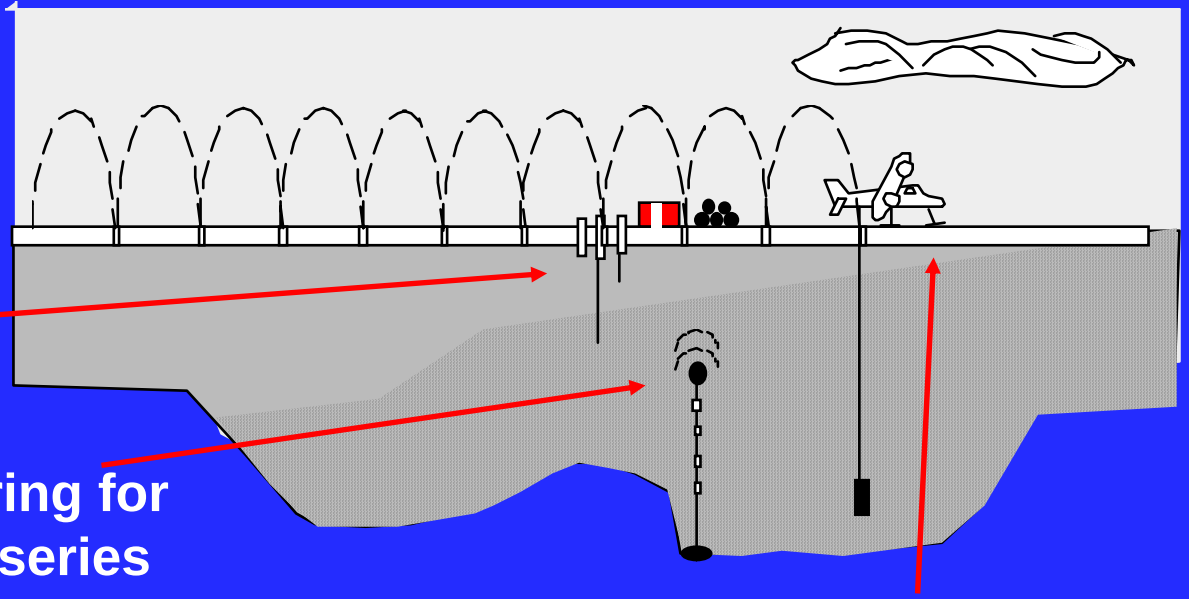
Section across the Makarov Basin gave the most profound indication of ocean change in the early 1990s. It is hard to make, especially with drifting buoys

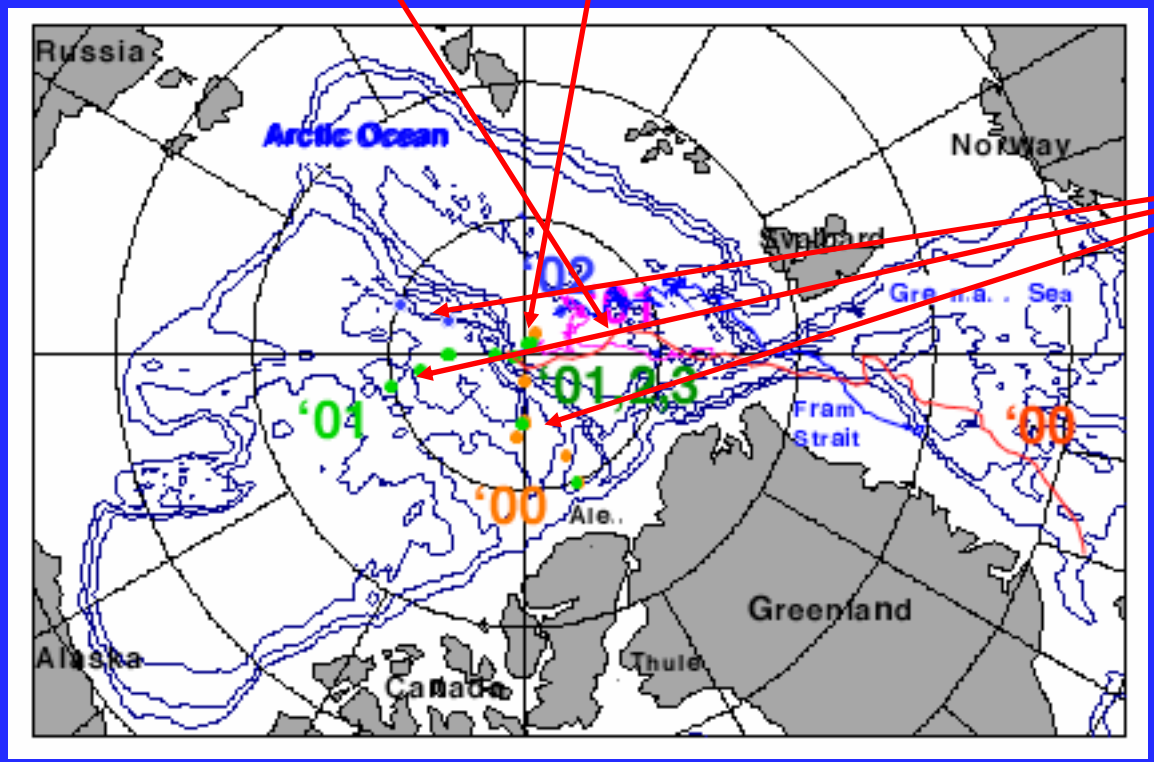
So, while ice-tethered platforms are important to the SEARCH DMO, they aren't everything.



NPEO: A prototype for DMO multi-dimension operations

- Automated Drifting Station (and IABP) semi-Lagrangian
- Mooring for time series
- Airborne Hydro Sections for repeat spatial snapshots





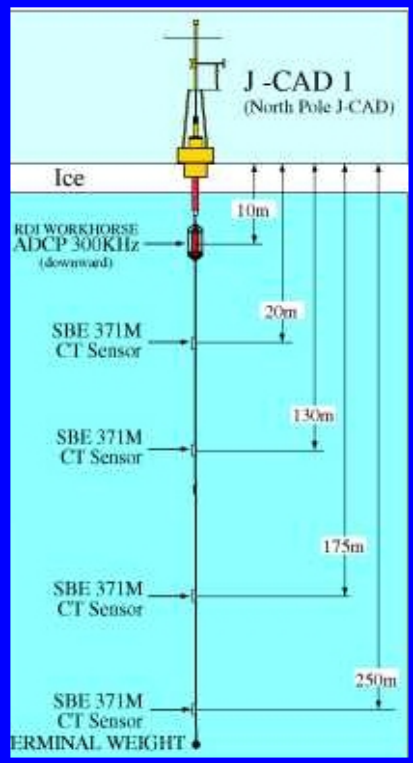
Conclusions:

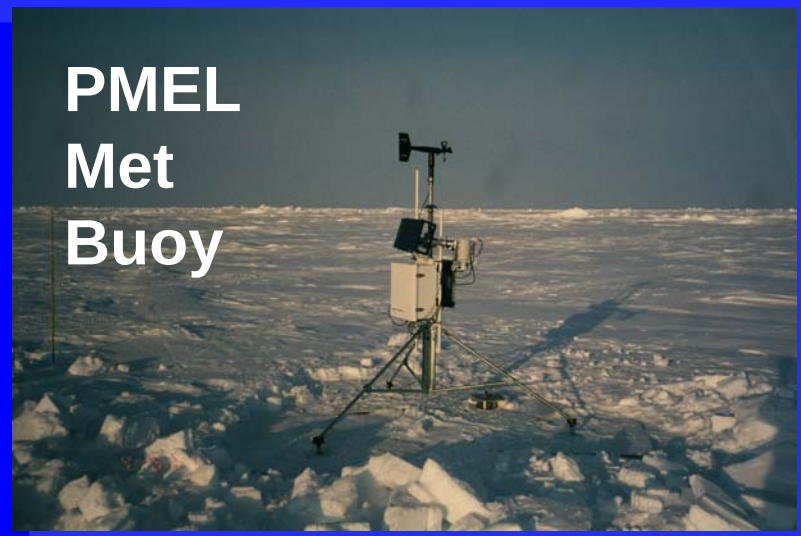
- **Ice-tethered platform are playing an important part in SEARCH.**

- **Their use must be combined in an operationally harmonious way with other observing methods to achieve the required dimensional mix of measurements.**

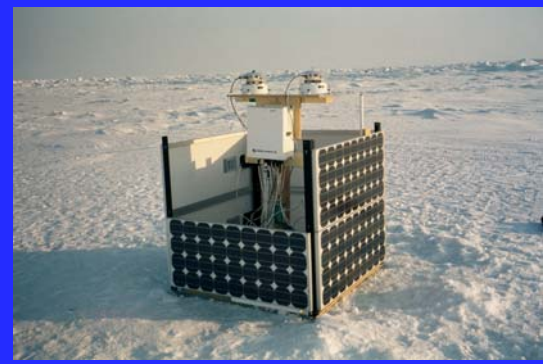
NPEO Automated Drifting Station

J-CAD Ocean/Met Buoy

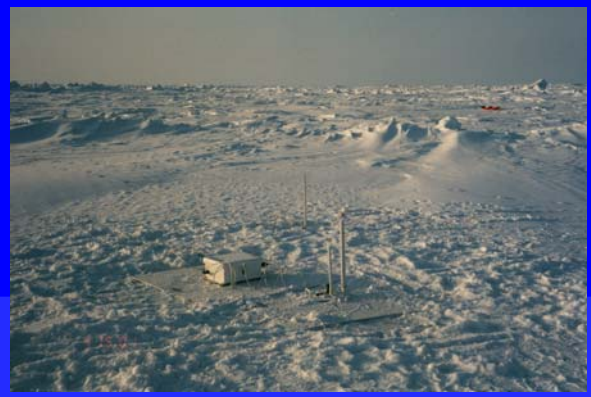




PMEL Radiometer Buoy



CRREL/PMEL Ice Mass Buoy



Takazawa, Shimada, Overland, Perovich, Richter-Menge, McPhee

NPEO 2001- 2003 Ocean Mooring

ULS @ 50 m

CTD

ADCP

Current Meter

CTD

CTD

Current Meter

CTD

Current Meter

CTD

Current Meter

CTD

CTD

Releases @ 2517 m

4120 m depth

NPEO Airborne Hydro Method

Consider the SALARGOS an POP oceanographic buoys of the 1980s and early 1990s: