Observations for Climate: International Arctic Buoy Programme (IABP)
A Cornerstone of the Arctic Observing Network

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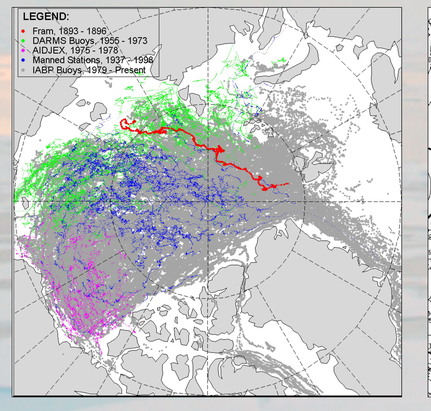
ABSTRACT

The Arctic has undergone dramatic changes in weather, climate and environment. It should be noted that many of these changes were first observed and studied using data from the International Arctic Buoy Programme **(IABP, http://iabp.apl.washington.edu).**

For example, IABP data were fundamental to Walsh et al. (1996) showing that atmospheric pressure has decreased, Rigor et al. (2000) showing that air temperatures have increased, and to Proshutinsky and Johnson (1997); Steele and Boyd, (1998); Kwok, (2000); and Rigor et al. (2002) showing that the clockwise circulation of sea ice and the ocean has weakened. All these results relied heavily on IABP data

In addition to supporting these studies of climate change, the IABP observations are also used to validate satellite retrievals of environmental variables, to force, validate and initialize numerical models, and to forecast weather and ice conditions (Fig. 1). Over 600 papers have been written using data from the IABP.

The observations and datasets of the IABP are one of the cornerstones for environmental forecasting and research in the Arctic.



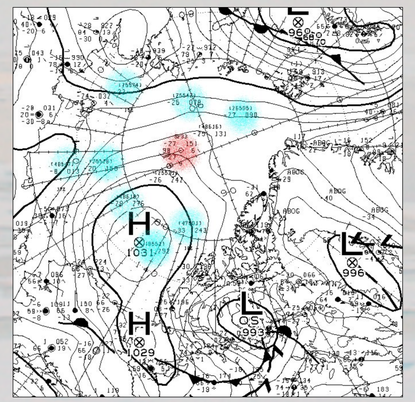


Figure 1. Historical map of drift tracks from buoys, manned stations and ships (left). Observations from the IABP are used for both weather and ice forecasting as well as research. On the right, we show the surface air temperature and pressure analysis by the Meteorological Service of Canada for 12 November 1200 UTC 2004.

- IABP observations. Note all buoys are shown for clarity.
- Manned Russian Station SP-33

Status of IABP Arctic Observing Network

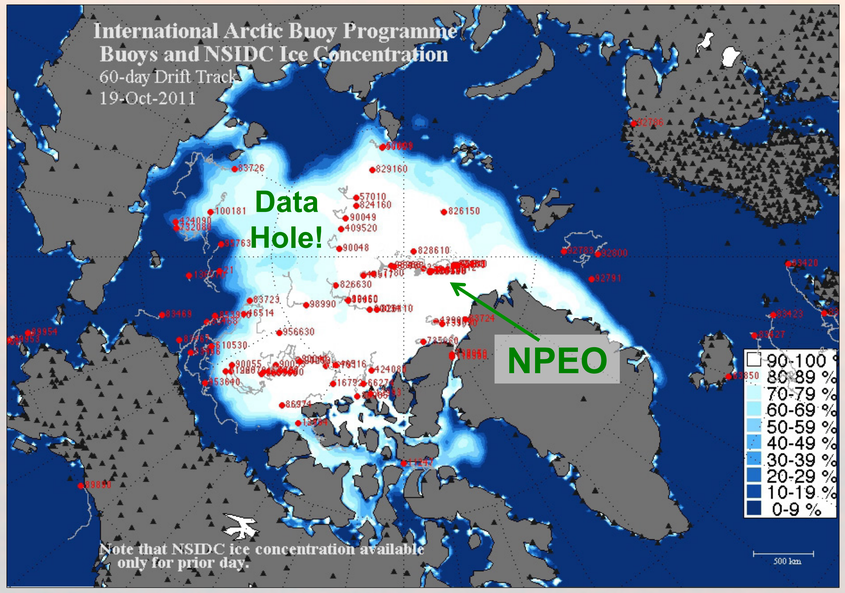


Figure 2. This map shows the positions of buoys reporting on Oct. 19, 2011. The grey tails show how these buoys drifted during the last 60 days. There were 96 buoys reporting: 79 measured air pressure and/or 2-m air temperature; 4 measured the sea ice mass balance, and 19 buoys that measured ocean temperature and/or salinity.

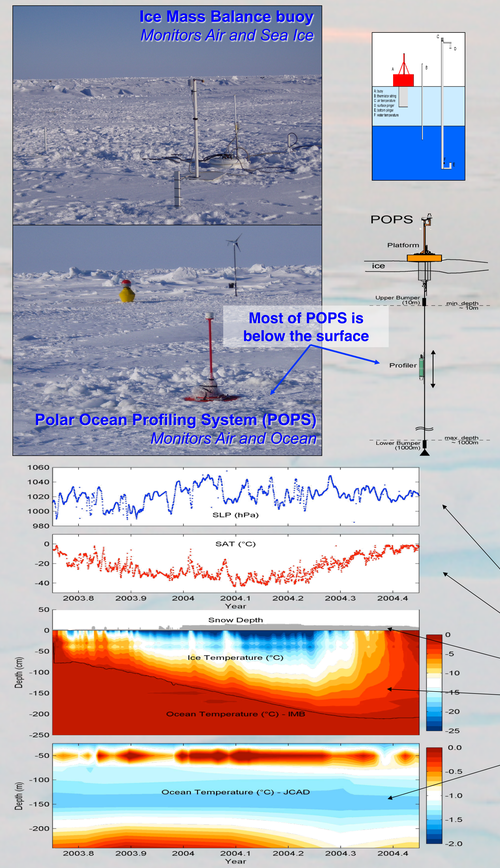


Figure 3. Ice Mass Balance and Ocean Profiling buoys (left) form part of an Automated Drifting Stations (ADS) at the North Pole Environmental Observatory (NPEO, http://psc.apl.washington.edu/northpole/).

Observations from ADS provide critical atmospheric, ice, and upper ocean hydrographic measurements that cannot be obtained by other means:

- Sea Level Pressure
- Surface Air Temperature
- Snow Depth
- Ice Thickness and Temperature
- Ocean Temperature and Salinity

Evolution of IABP

The IABP is evolving to better support the operational and research requirements of the community. For example, some of the Participants of the IABP have been deploying buoys which not only measure SLP and SAT, but also ocean currents, temperatures and salinity. Other buoys have been enhanced to measure the ice mass balance using thermistor strings and pingers aimed at the top and bottom of the sea ice. Most of these ocean and IMB buoys are deployed in close proximity to each other in order to provide a myriad of concurrent observations at a few points across the Arctic Ocean (Fig. 3). From these data we can also estimate time variations in other geophysical variables such as oceanic heat storage and heat flux.

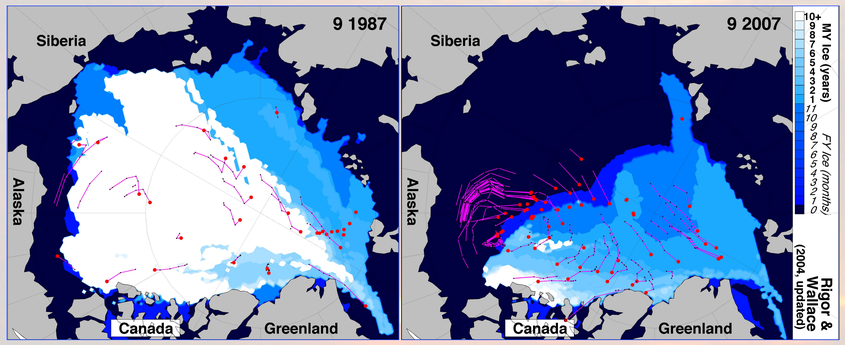


Figure 4. Age of sea ice based on buoy drift and sea ice concentration. Prior to 1988, most of the Arctic Ocean was covered by older, thicker sea ice (left). Changes in wind have reduced the area of older thicker sea ice (right).

Challenges

- Maintaining the array has been a challenge because of climate change. Note the hole in the observing network on the Eurasian side of the Arctic Ocean (Figs. 2 and 4)!
- Development of seasonal ice buoys is essential; and
- Engaging our Russian and Asian partners will be critical to maintaining the array.

Acknowledgements

The US Interagency Arctic Buoy Programme (USIABP) is funded by the National Aeronautics and Space Administration, National Ice Center, National Oceanic and Atmospheric Administration, National Science Foundation, Naval Oceanographic Office, Office of Naval Research, University of Alaska Fairbanks, and US Coast Guard.

The picture in the background shows the crew of the US Coast Guard ice breaker Healy transporting an IABP meteorological buoy for deployment on the sea ice in August 2007. This picture was taken by McKenzie Funk.