The O-Buoy Chemical Network for Long Term Studies of O_3, CO_2, and BrO over the Arctic Ocean

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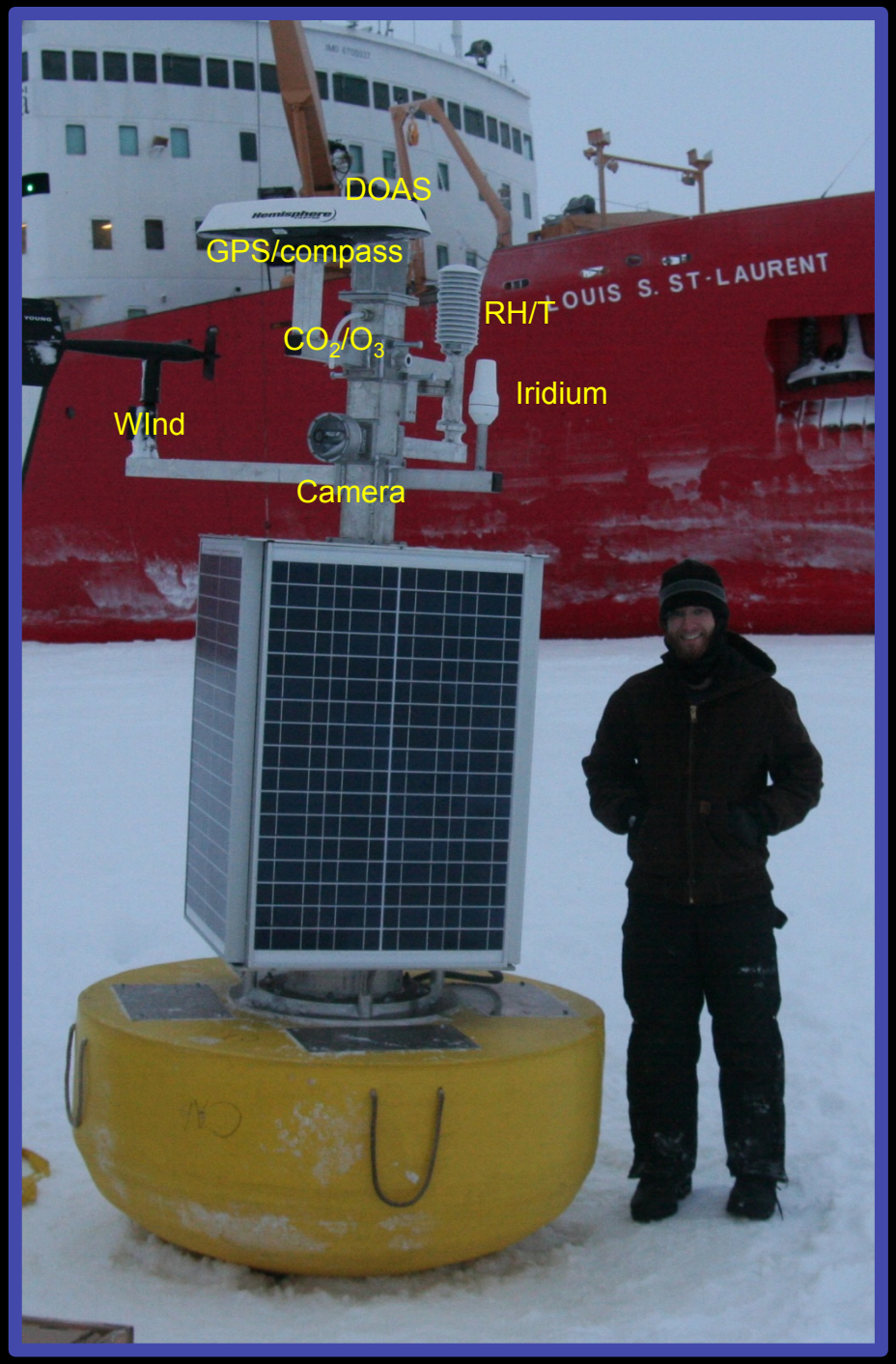
AON 2015, Seattle, WA

The O-Buoy Network: over the Arctic Ocean

Our scientific objectives:

- A network of on-ice atmospheric chemical measurements (O_3, BrO, and CO_2)
- Multi-year measurements for seasonal and interannual variability
- Validate satellite observations with *in-situ* data

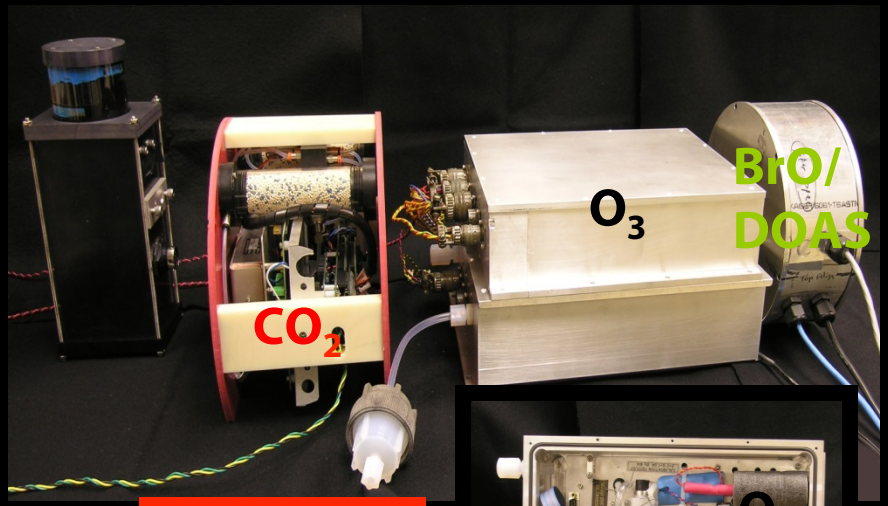
- Some scientific questions:
- Will more seasonal ice in spring enhance Br chemistry and result in additional oxidized mercury inputs during transition to open waters?
- Will net atmospheric CO_2 concentrations change as a function of sea ice cover and quality?
- Will changes in Arctic sea ice extent and snow cover (salinity, acidity, temperature, radiation) affect halogen activation and O_3 chemistry?
- And many more!

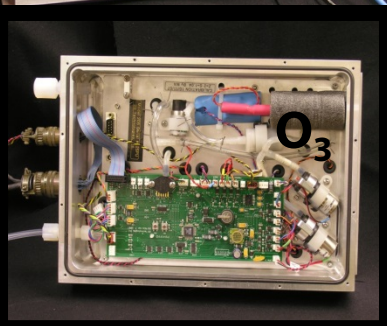

DOAS
GPS/compass
RH/T
CO_2/O_3
Iridium
WInd
Camera
LOUIS S. ST-LAURENT

Power

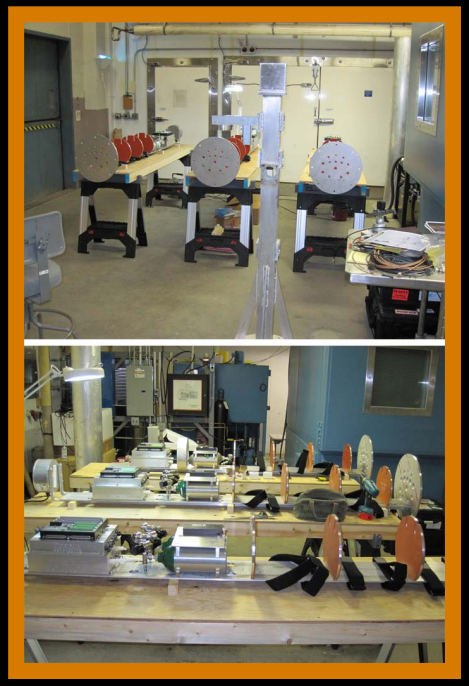

10.01.2009 05:34

DOAS Scan head

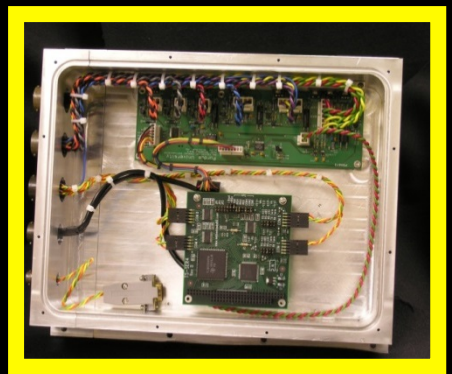




Assembly & Cold Testing



Comms.



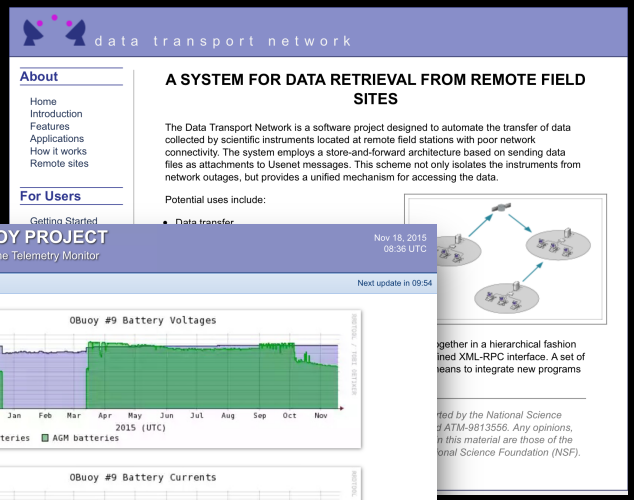
Meteorology

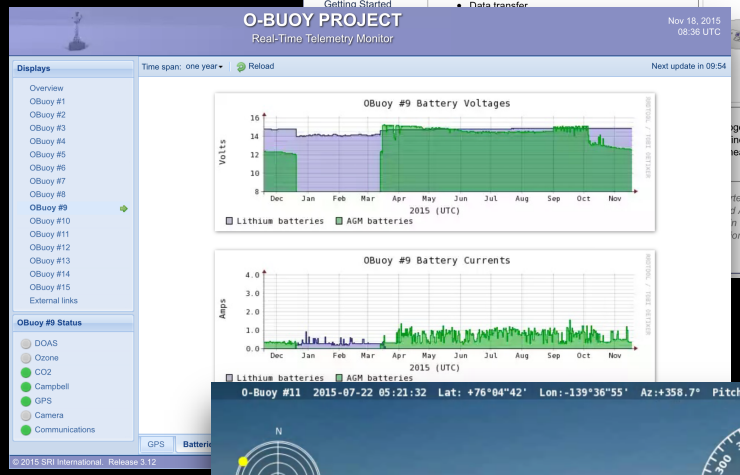
Knepp et al. (2010) Atmos. Meas. Tech.

DATA TRANSPORT NETWORK

RELIABLE COMMUNICATIONS IN AN UNRELIABLE WORLD

- Data collection
- Monitor health and status
- Schedule and control
- Iridium transfer offsite
- Bandwidth management
- Post processing

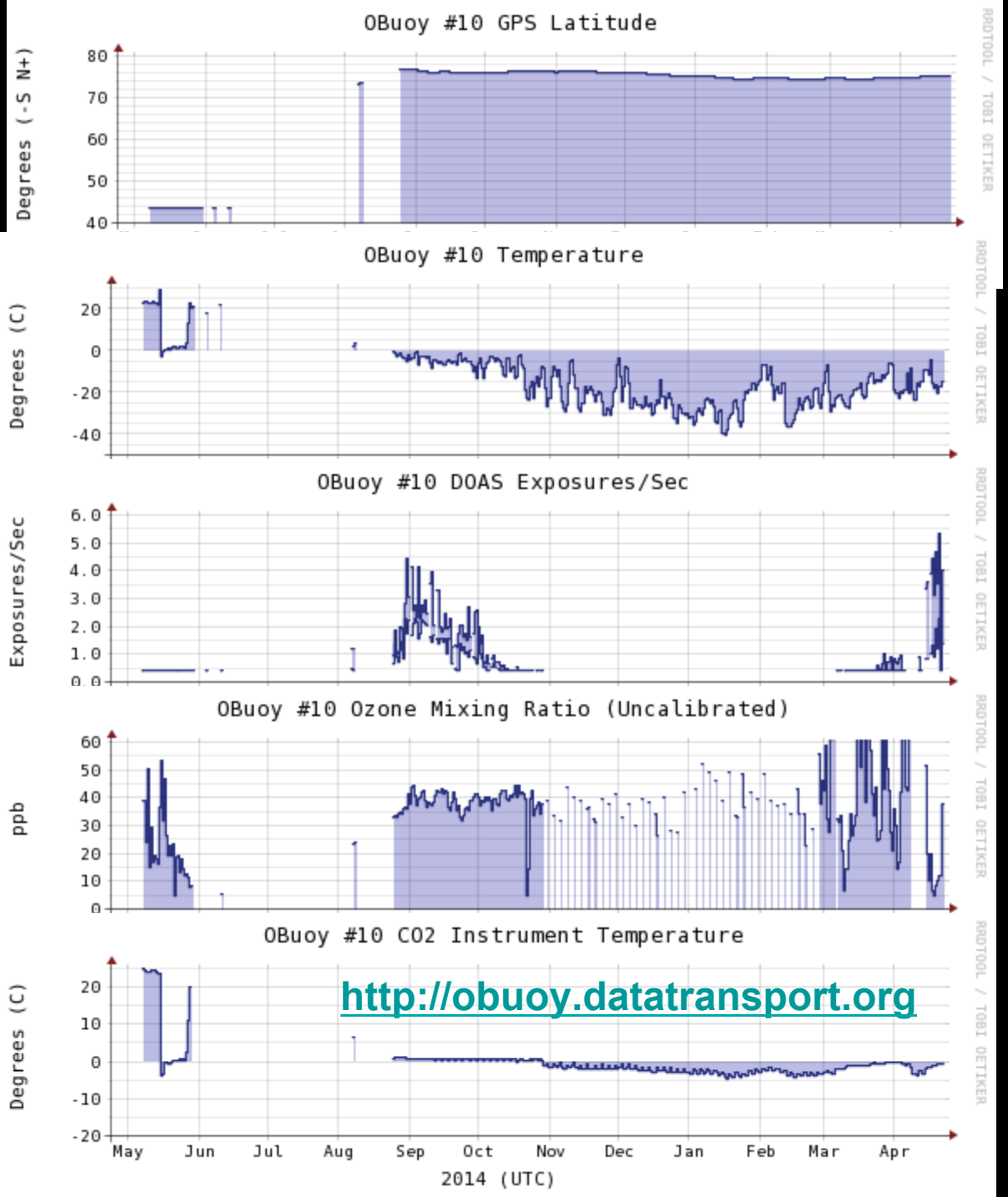




Totals

- 15 buoys, 7 years
- 780,000 files / 18GB
- 106,600 photos

All through a low-bandwidth Iridium link with no lost data!



GPS: Latitude, longitude, speed, azimuth, pitch, roll
Spring-Fall = 1x/h; recovery higher;
Winter 1x/d

Met: air temp, RH, atm press, wind speed and direction
Year-round = 12x/h => WMO

BrO (DOAS): atm. conc.; instrument temp, scan head tilt, frost counts, etc.
Spring-Fall = 30x/h
Winter = off

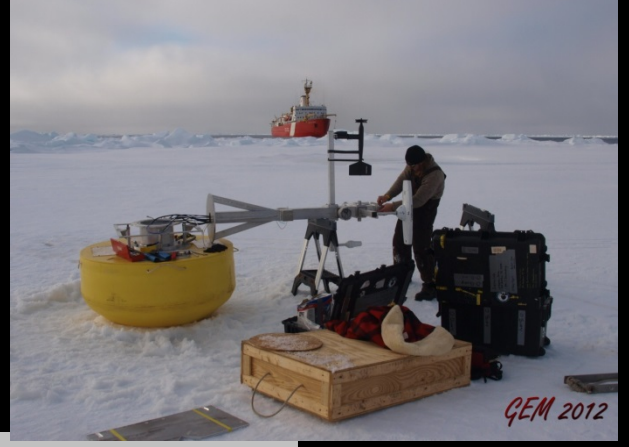
O_3: atm. conc.; instrument temp, press., flow rate, etc.
Spring-Fall = 60x/h; up to 1800/h
Winter = 4h/ 3d

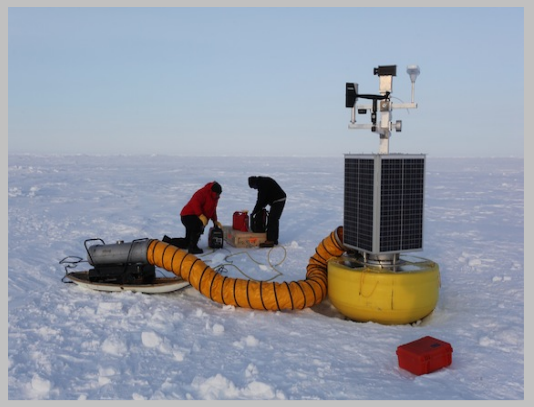
CO_2: atm. conc.; instrument temp, air pressure, etc.
Year-round = 2x/h

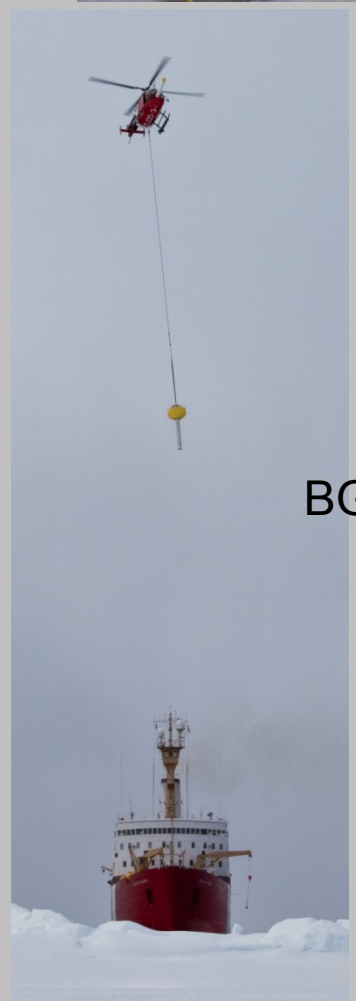
Camera: 3x/h -> movie. Winter: 1x/h
Comms: 1x/h; winter: 1-2x/d)
State: 12x/h

Deployments

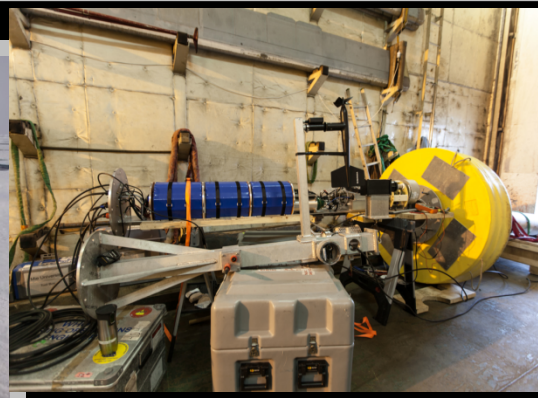
NPEO







BGEO



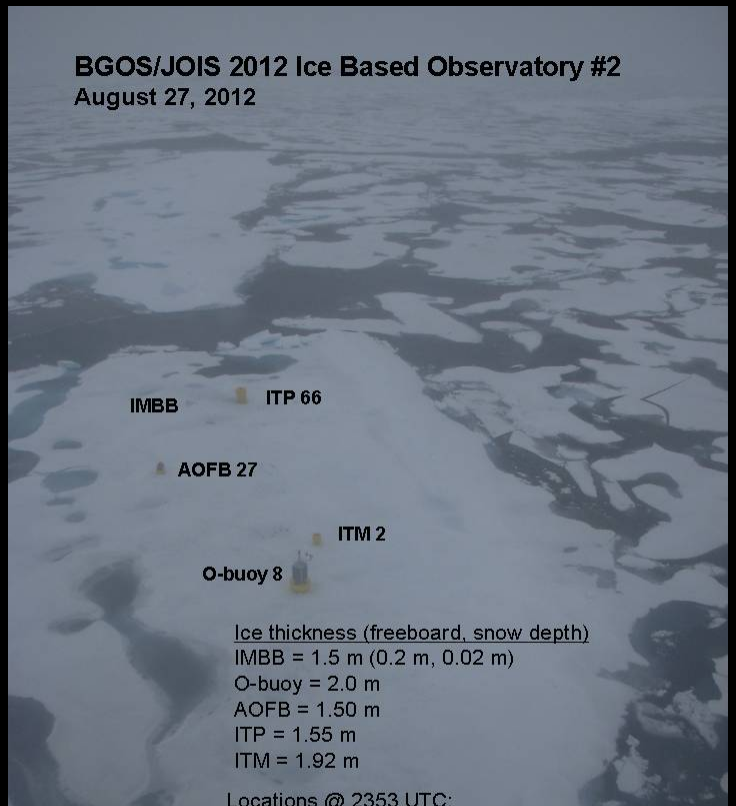
NPEO

Barrow


NABOS 2013


OB-7

Challenges


BGOS/JOIS 2012 Ice Based Observatory #2
August 27, 2012
IMBB
ITP 66
AOFB 27
ITM 2
O-buoy 8
Ice thickness (freeboard, snow depth)
IMBB = 1.5 m (0.2 m, 0.02 m)
O-buoy = 2.0 m
AOFB = 1.50 m
ITP = 1.55 m
ITM = 1.92 m
Locations @ 2353 UTC:


OB-8

Locations:

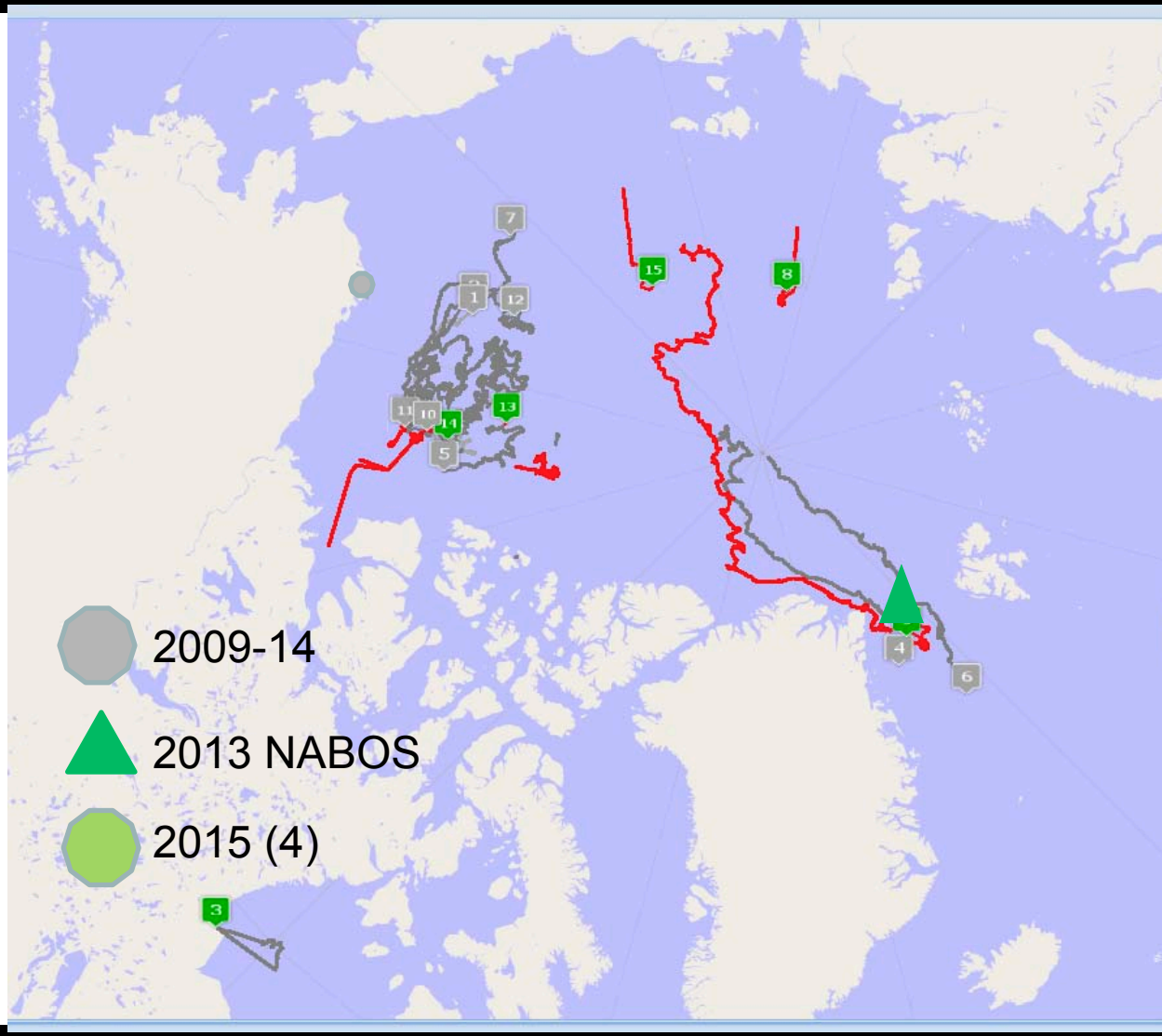
O-Buoy websites:

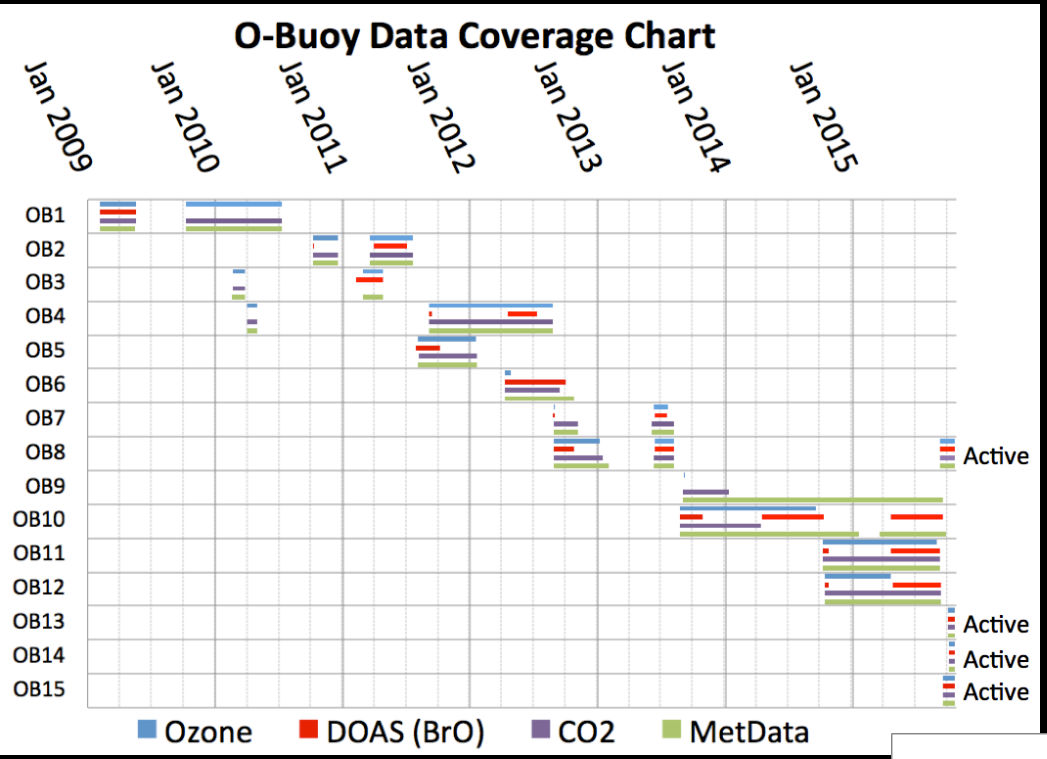
1) General public information:
http://www.o-buoy.org

2) Project data portal, storage, and display:
http://obuoy.datatransport.org

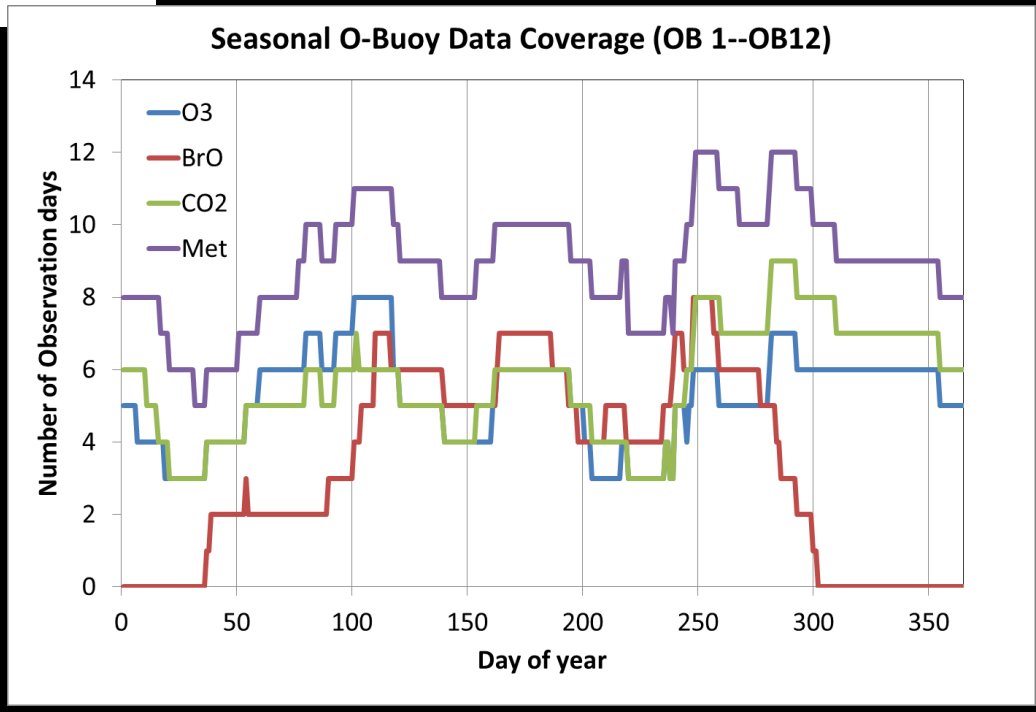
3) Project Management:
https://obuoy.basecamphq.com

4) Data archival:
http://www.acadis.org

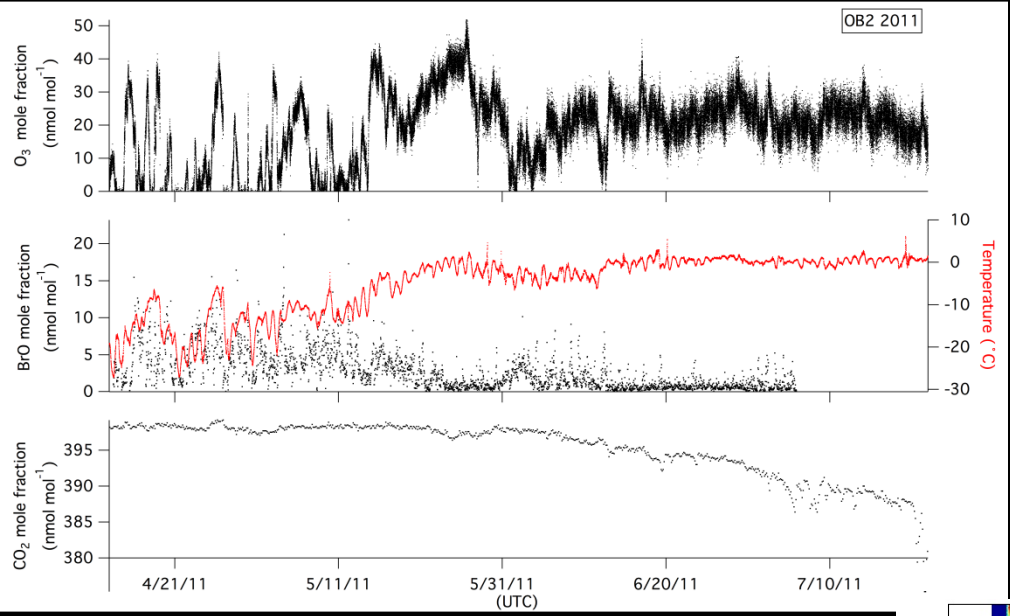




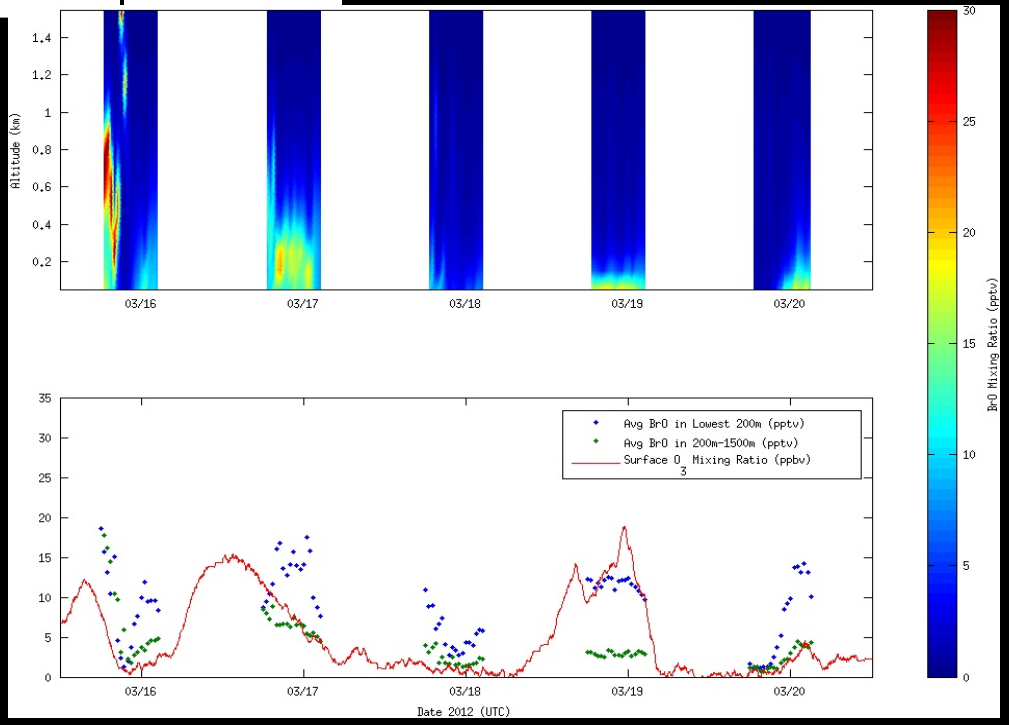
Deployments = 18
Recoveries = 5 +1
Re-deployments = 3



Pre-AON science (OB-1&2; Canadian OB-3&4)

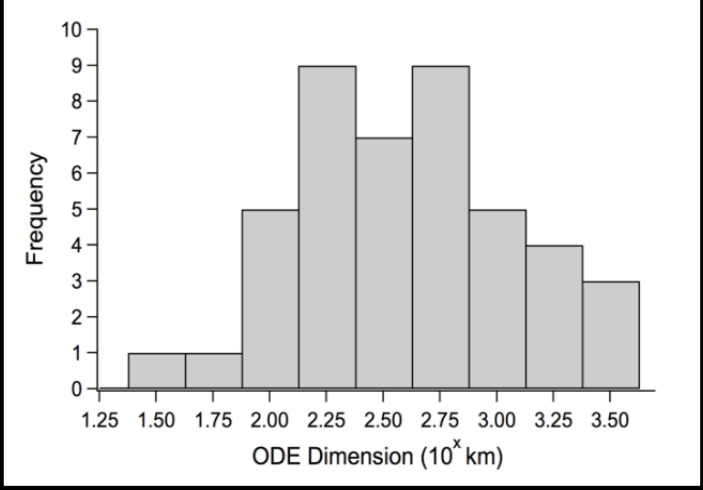


Atmospheric concentrations of CO_2, BrO, and O_3 from OB-2, deployed in the Beaufort Gyre from October 2010 through July 2011. Only a partial summer deployment (2011) is shown to emphasize short-term variability.

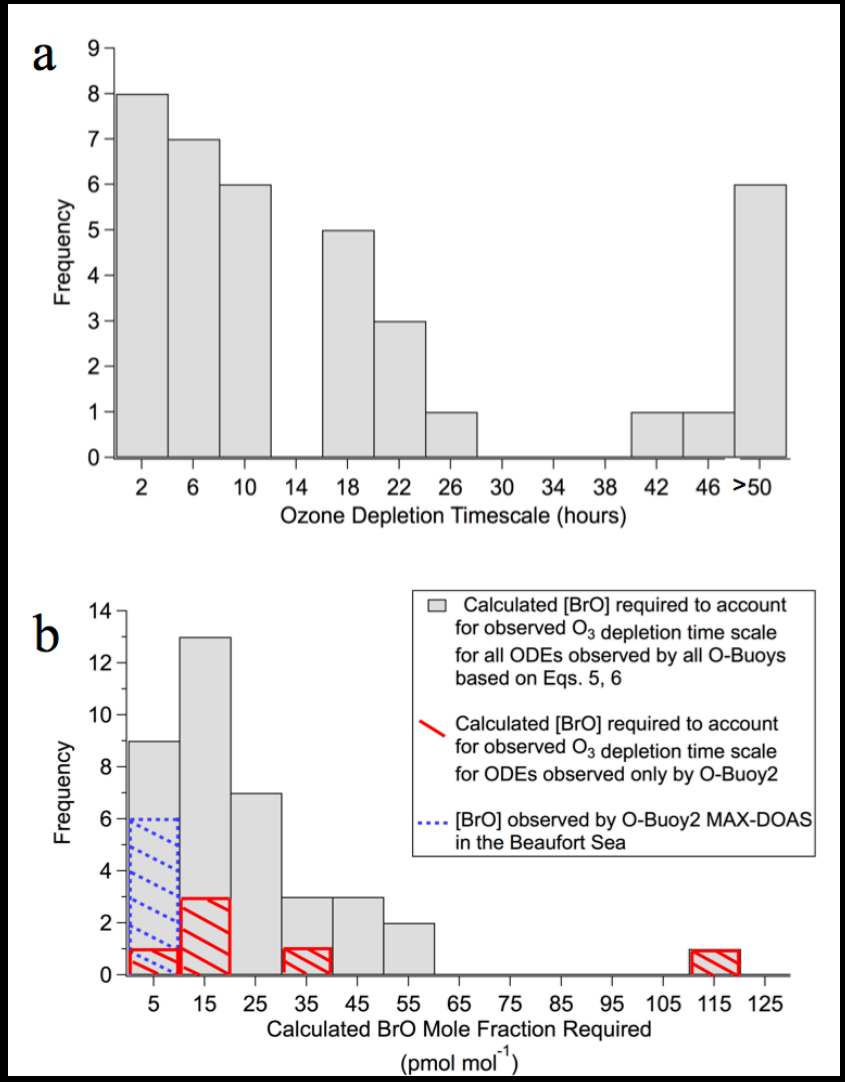


Atmospheric vertical profiles (a) and surface conditions (b) of BrO measured with MAXDOAS over the course of four days in spring 2012.

Ozone Depletion Events (ODE) (OB-1-4) (Halfacre et al. 2014 ACP)

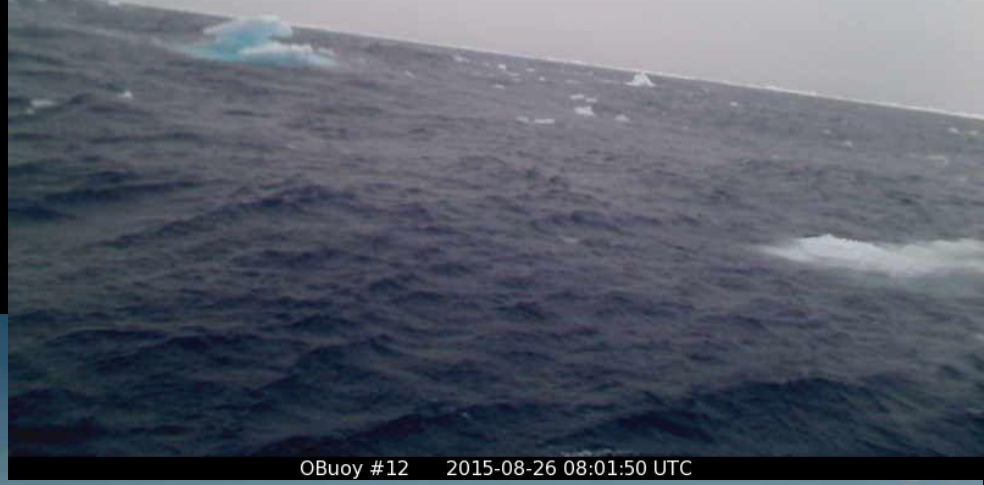


Dimensions of ODEs observed in the Beaufort Sea from OB-1 and OB-2 data



Unusual views & uses

https://sunriseswansong.wordpress.com



Next? Understanding!

With O-Buoy data, we can now answer questions such as:

(1) Under what conditions are CO_2 air-ice-ocean fluxes important causes of atmospheric CO_2 variability over the Arctic Ocean and, conversely, when is long-range transport important?

(2) How do Arctic Ocean sea ice, snow, and vertical mixing conditions affect major atmospheric oxidants (ozone and reactive halogens)?

(3) How do interannual variability and long-term declines in sea ice affect atmospheric contaminants in the Arctic?

(4) Your question! => www.acadis.org


Thank you