The O-Buoy Chemical Network for Long Term Studies of \( \text{O}_3 \), \( \text{CO}_2 \), and \( \text{BrO} \) 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 (O₃, BrO, and CO₂)
• 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 CO₂ 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 O₃ chemistry?
• And many more!
Power
DOAS Scan head

Assembly & Cold Testing

Comms.

Meteorology

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

O₃: atm. conc.; instrument temp, press., flow rate, etc.
Spring-Fall = 60x/h; up to 1800/h
Winter = 4h/ 3d

CO₂: 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

http://o buoy.datatransport.org
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
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

Locations:

- 2009-14
- 2013 NABOS
- 2015 (4)

AON 2015, Seattle, WA
<table>
<thead>
<tr>
<th>OB1</th>
<th>OB2</th>
<th>OB3</th>
<th>OB4</th>
<th>OB5</th>
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<th>OB8</th>
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**O-Buoy Data Coverage Chart**

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

**Seasonal O-Buoy Data Coverage (OB 1-OB12)**

- Number of Observation days
- Day of year

**Images**: OB-4, OB-6, OB-8
Atmospheric concentrations of CO\textsubscript{2}, BrO, and O\textsubscript{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.

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

NABOS 2013, Arlington, VA 23 April 2014
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

http://greatwhitecon.info/
Next? Understanding!

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

1. Under what conditions are \( \text{CO}_2 \) air-ice-ocean fluxes important causes of atmospheric \( \text{CO}_2 \) 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