# Comparison of Continuous Surface Ozone Measurements from Two Arctic Observatories

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# NOAA continuous Surface $O_3$

| Code | Location | Code | Location |
|---|---|---|---|
| ARH | Arrival Heights, Antarctica | NWR | Niwot Ridge C-1, Mountain Research Station, Colorado |
| PCO | Azores, Portugal | SMO | Cape Matatula, Samoa |
| BAR | Ragged Pt., Barbados | SPO | South Pole, Antarctica |
| BAO* | Erie, Colorado | SUM | Summit, Greenland |
| BER | Tudor Hill, Bermuda | THD | Trinidad Head, California |
| BRW | Barrow, Alaska | TIK | Tiksi, Russia |
| ICE | Storhofdi, Iceland (1992-2010) | TUN | Tundra Lab, Mountain Research Station, Colorado |
| LDR | Lauder, New Zealand | WKT* | WKT tower, Texas |
| MLO | Mauna Loa, Hawaii | WVR | Weaverville, California |

* tall-tower data exists  ftp://ftp.cmdl.noaa.gov/ozwv/towers/

Data at ftp://ftp.cmdl.noaa.gov/ozwv/towers/

**Barrow, AK**

71.32, -156.61 Alt:8.0 mASL

NOAA Observatory

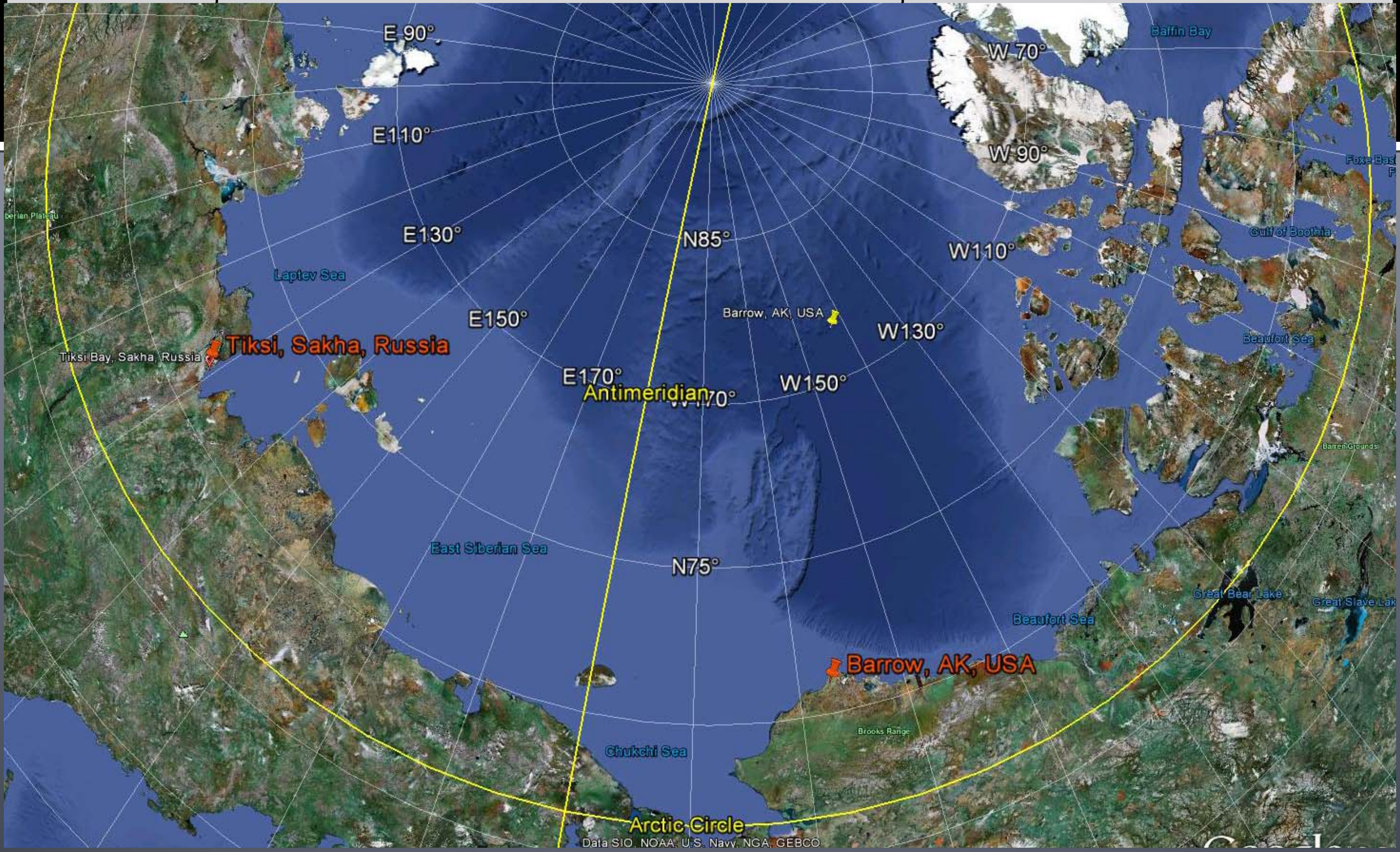
Surface $O_3$ 1973-present

**Tiksi, Russia**

71.6 ,-128.9 Alt: 249.3 mASL

NSF, NOAA, Roshydromet

Surface $O_3$: 2010-present



# Motivations for Arctic surface ozone measurement

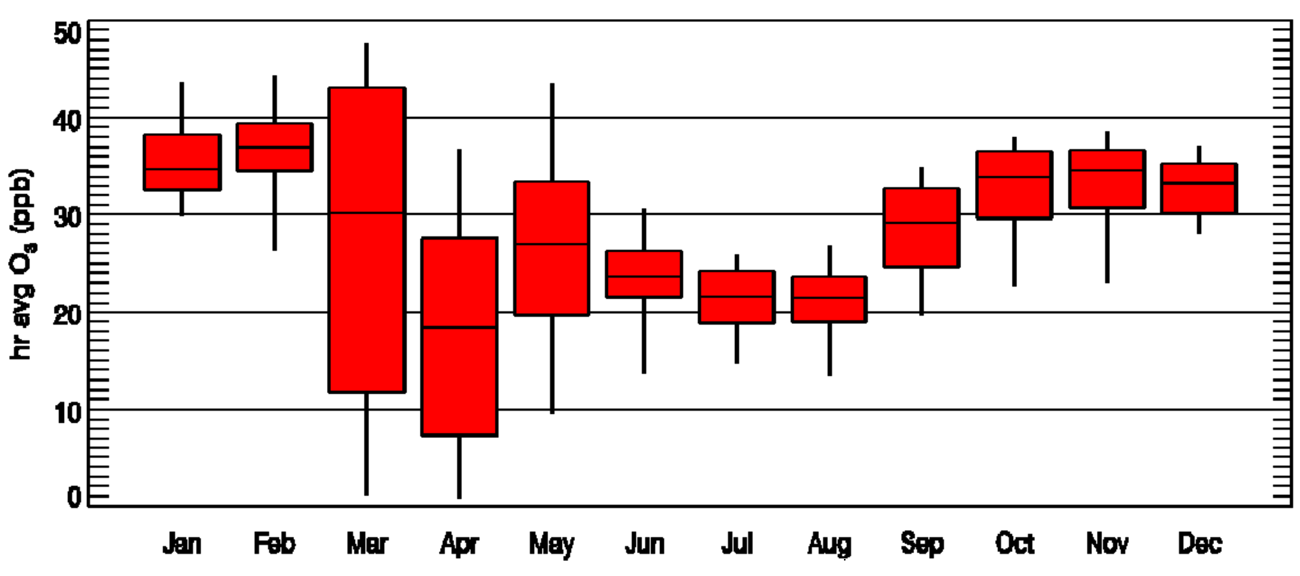
- long-term observation for baseline ozone
  - Are remote levels of ozone (non-polluted) changing over time?
- Pollution events
- ozone depletion events (ODEs)
- chemistry is rapidly changing

# Instrumentation: Thermo Scientific 49 Series

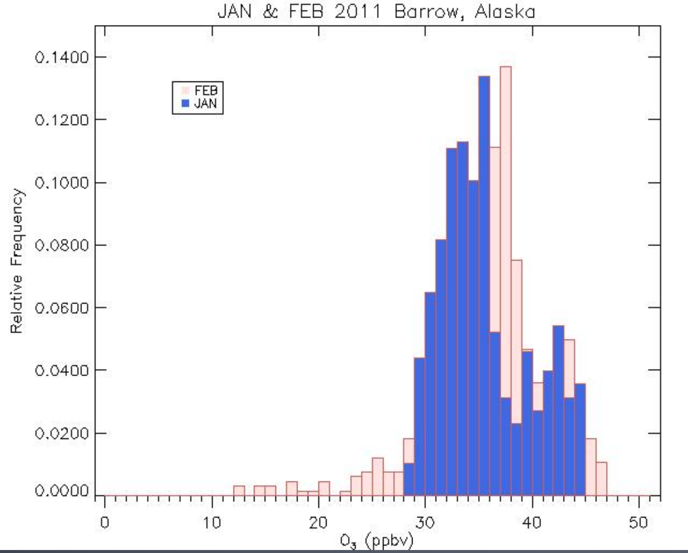
- utilizes UV dual-cell photometry
- has precision of 1 ppb
- has very little drift

- Inlets: ozone conditioned Teflon PFE
  - Inverted funnel to avoid rain and snow in line

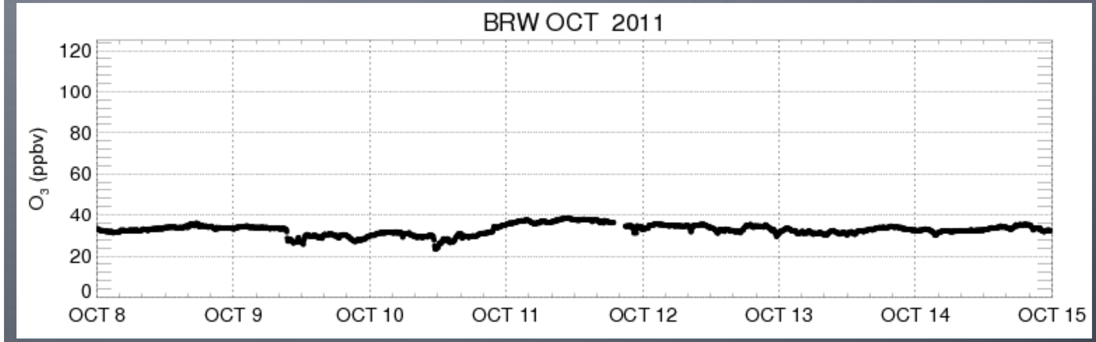
# Typical surface ozone behavior - Barrow



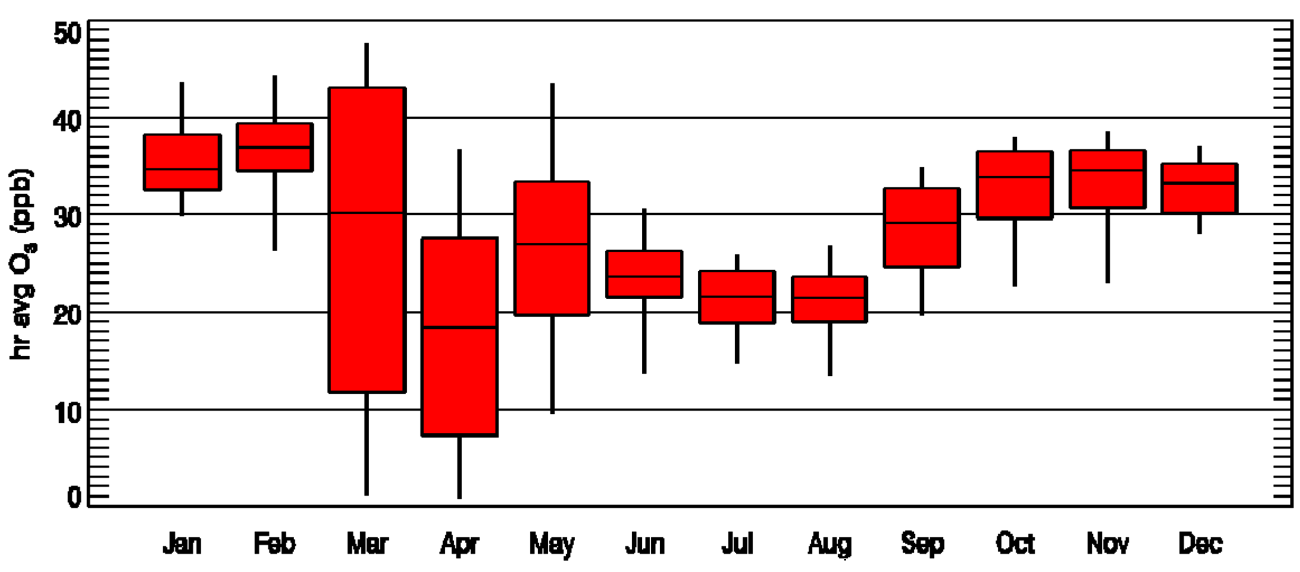

- Narrow range of values, except for M, A, M



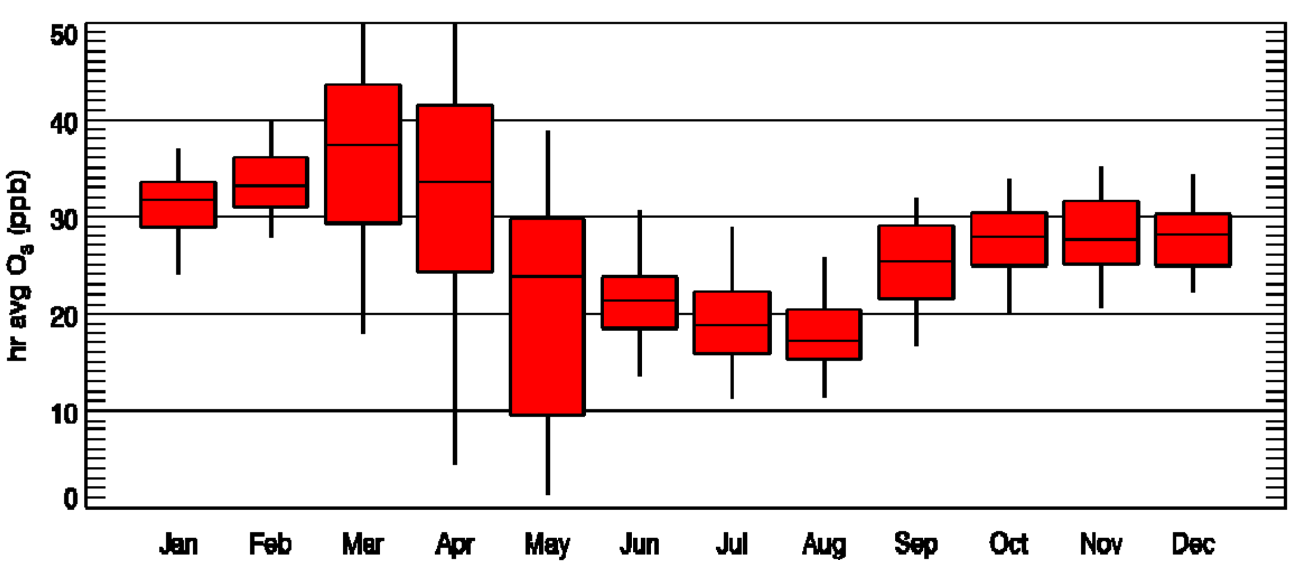

←Jan/Feb



# Typical surface ozone behavior




←Barrow




←Tiksi

Narrow range of values, except for M, A, M

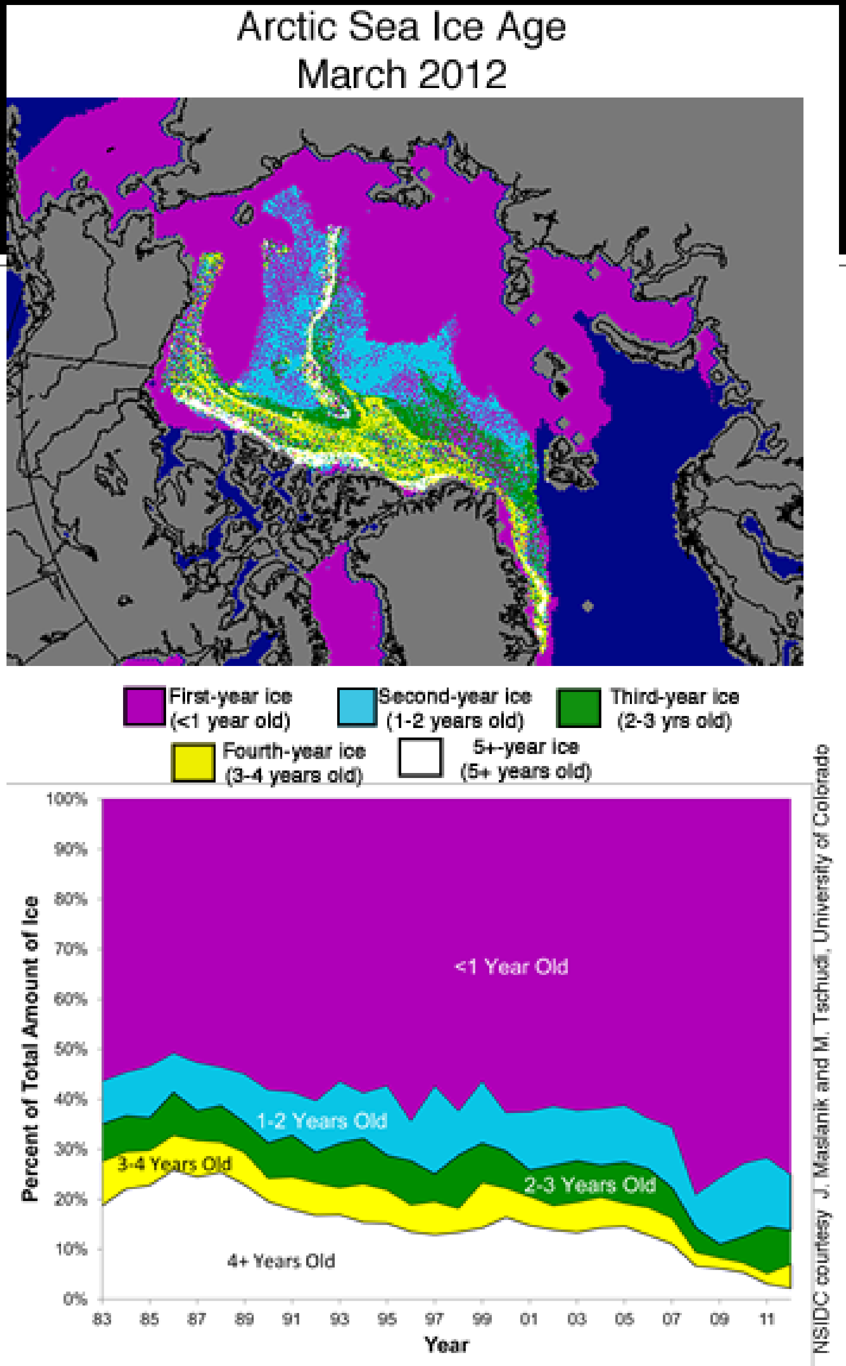
# Polar Ozone Depletion Events

- Exceptionally low ozone in spring
- First reported in the Arctic in the 1980s [*Oltmans*, 1981; *Bottenheim et al.*, 1986]
- Br- ↑ $O_3$ ↓ GEM ↓ MeHg ↑
- Younger ice – saltier – intensifies release of halides → more ODEs

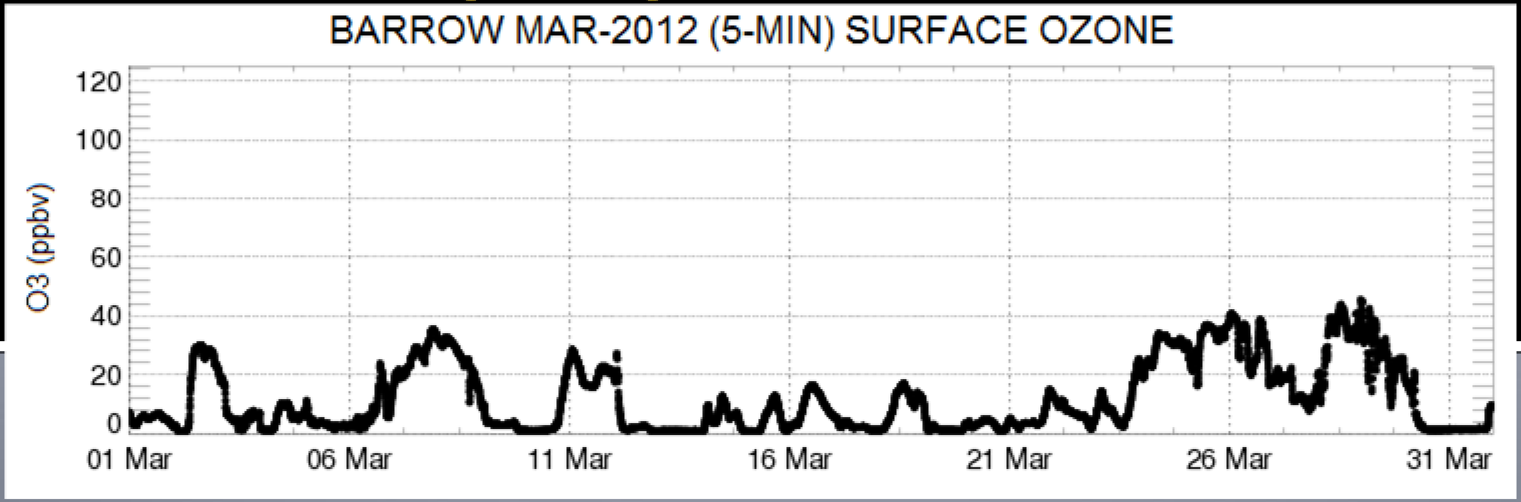
# Shifting to a new ice regime

- first-year ice made up 75% of the Arctic sea ice cover March, 2012
- Multiyear ice now only constitutes only 2%.

*Credit: NSIDC courtesy J. Maslanik and M. Tschudi, University of Colorado*



# ODEs occur yearly at Barrow



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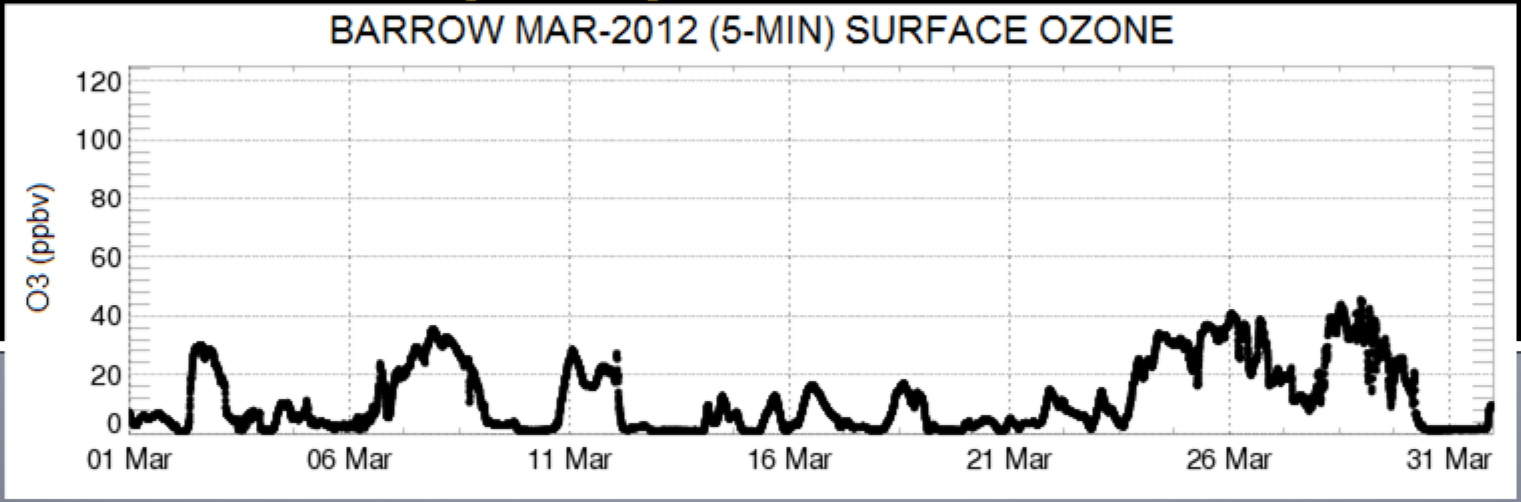
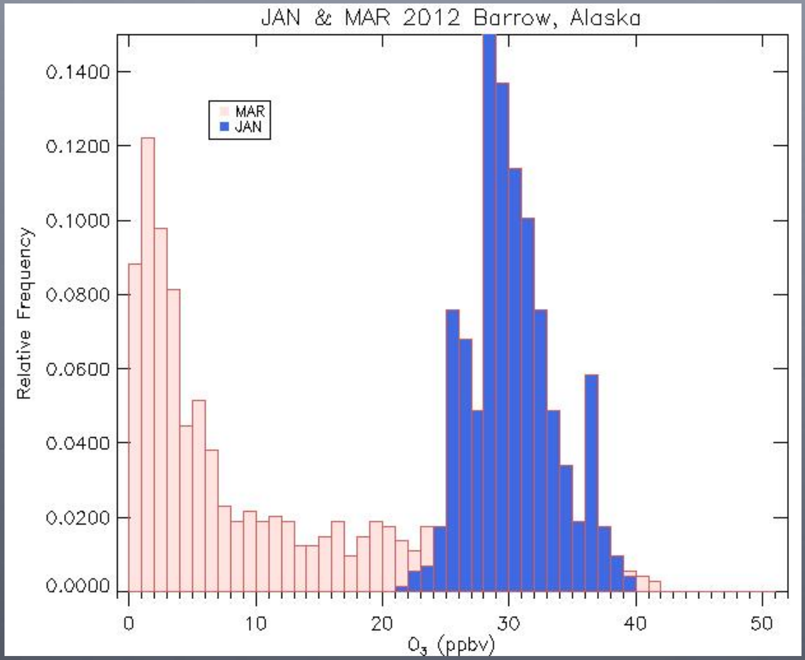
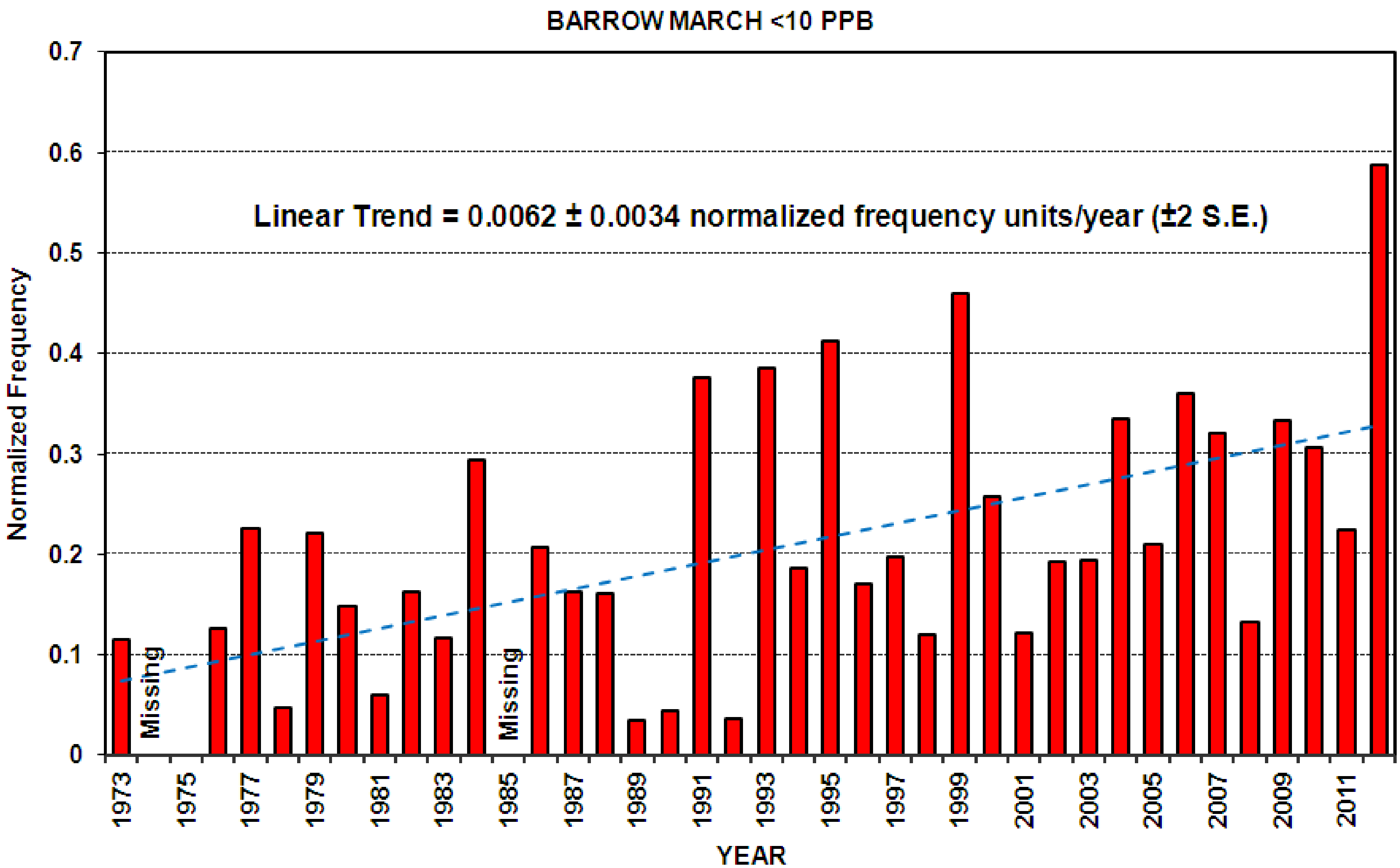
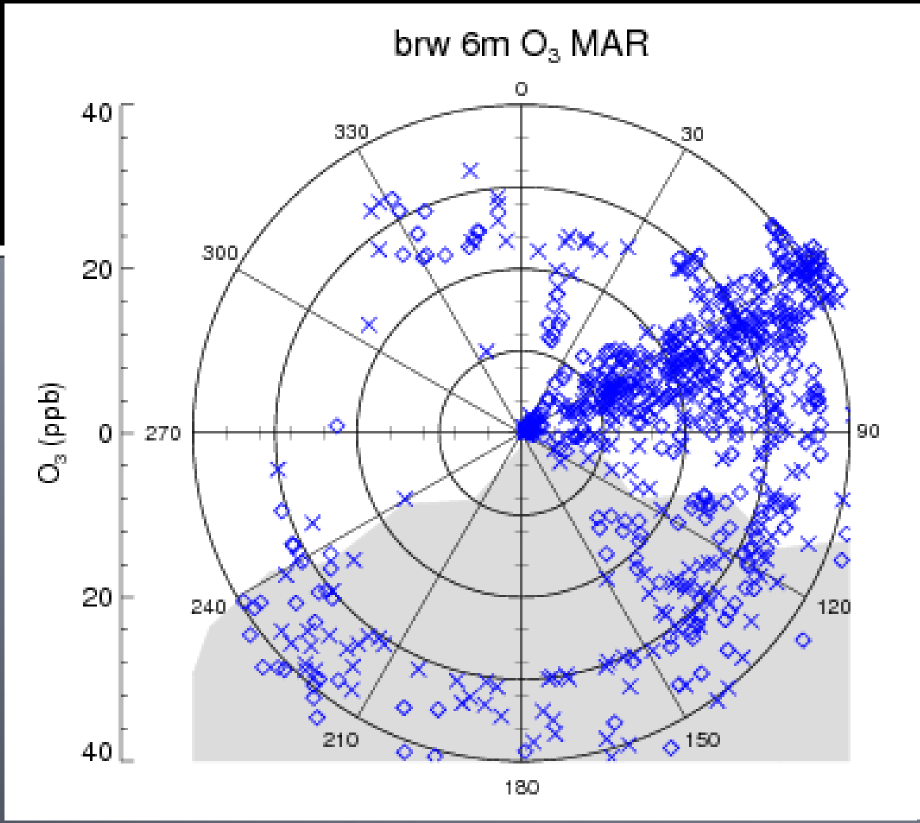


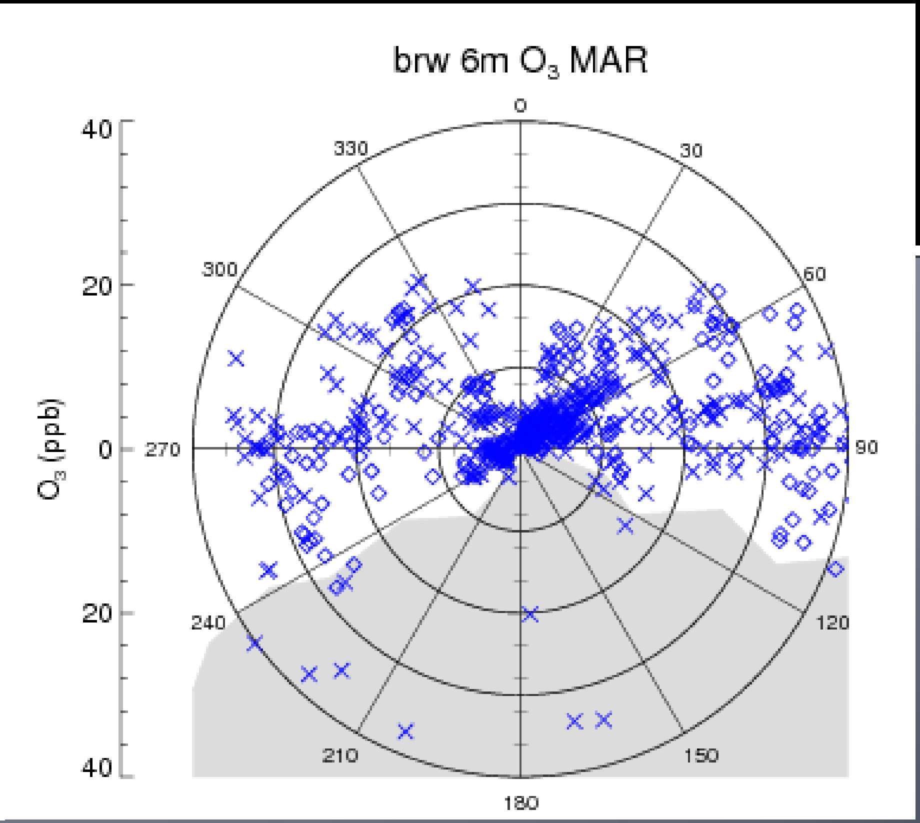
# March 2012 at Barrow



# Wind direction influences ODE frequency

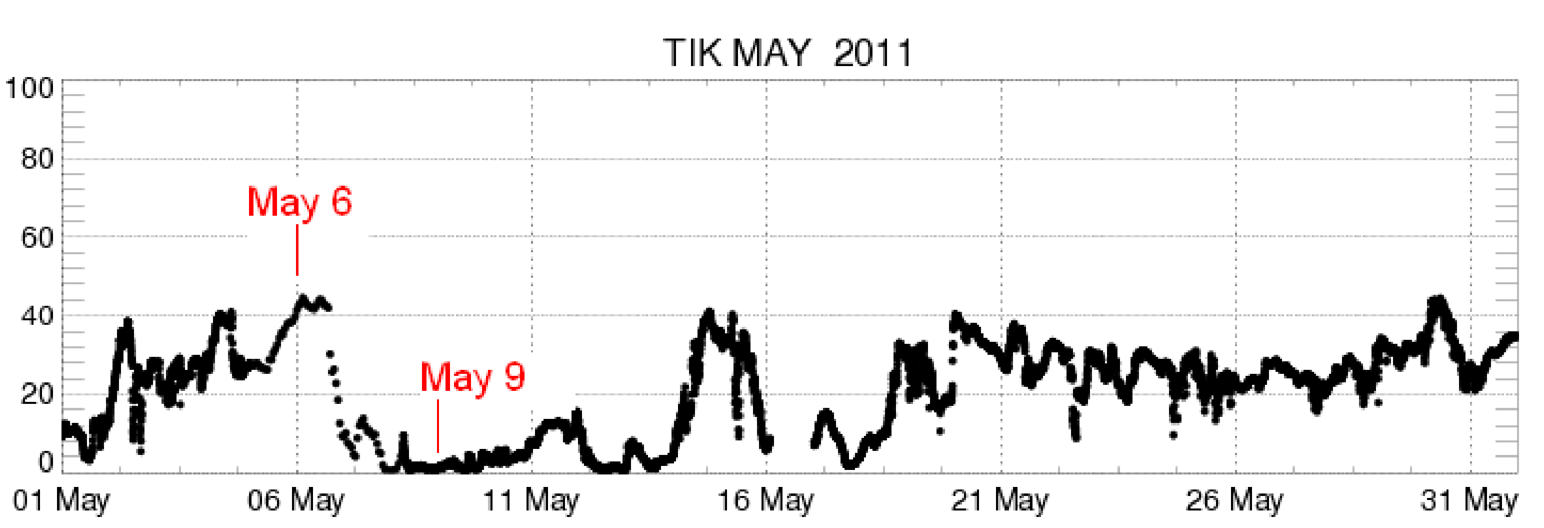


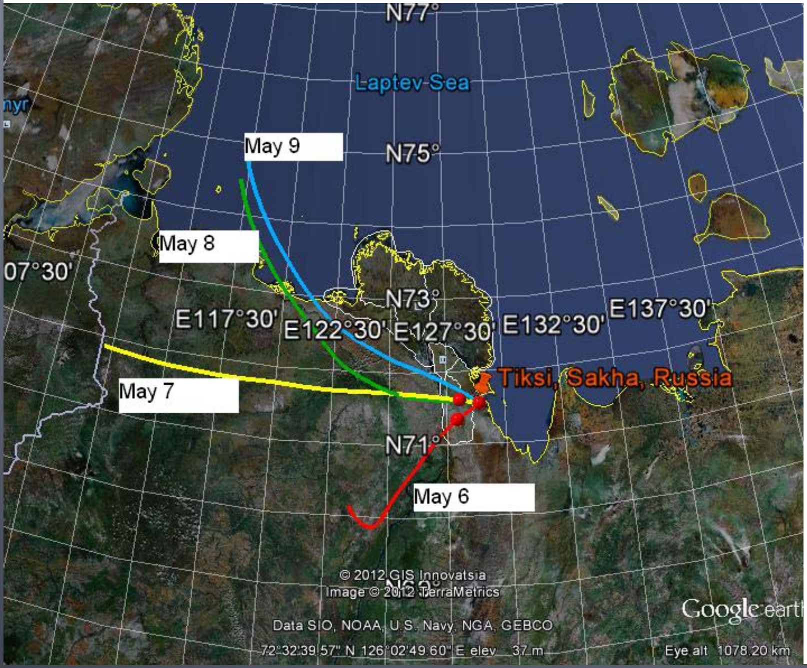

2008 – a year of fewer ODEs

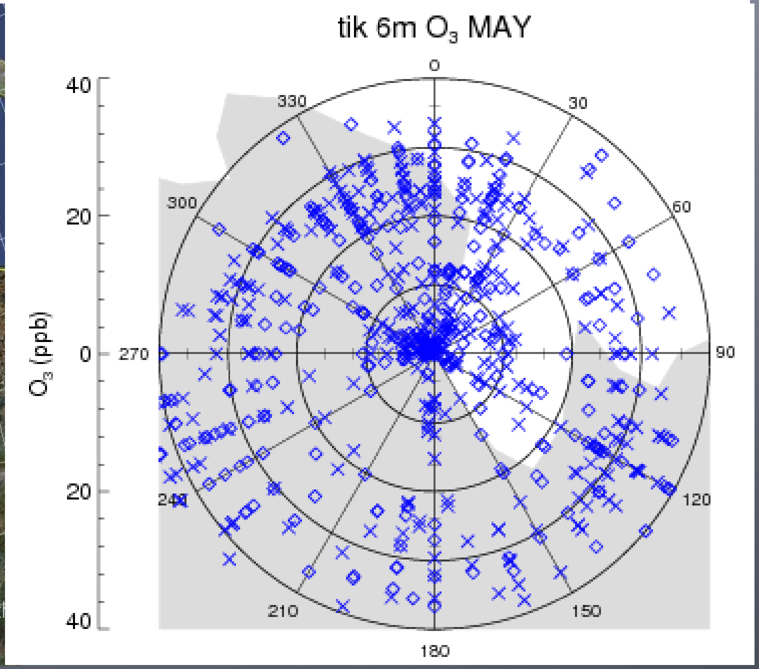



2012 – frequent ODEs

# ODEs occur at Tiksi in 2011…but in May



# Conclusions

- Wind directions play a part in how much depletion is seen
- Tiksi observes ODEs similar to those at Barrow since 1973
- Events are increasing as portion of new ice (higher bromine) increases