



Use of ground-based and airborne MAX-DOAS to examine horizontal and vertical BrO gradients at Barrow, Alaska

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Arctic Halogen Activation



- Heterogeneous chemistry on snow and ice thought to be source of reactive halogens ¹
- Br radicals linked to:
 - ► O₃ depletion
 - Hg deposition
 - Changes in oxidative chemistry
- What environmental conditions facilitate release of halogens from saline ice surfaces?
- What are the horizontal and vertical distributions of halogen species in the Arctic?

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BROMEX MAX-DOAS Measurements Overview



¹General et al 2014, AMT

²Frieß et al 2011, JGR, Peterson et al 2015, ACP

Introduction

More on Airborne Measurements



Flights occur during variety of BrO and O_3 conditions



Moderate wind speeds, temperatures, wind out of NE



Good agreement between Air and Ground LT-VCDs



BrO higher over Tundra Snow than Sea Ice Snow



BrO is enhanced during ODEs



Highest LT-VCDs of BROMEX observed March 15th



Airborne Measurements from March 15th



March 15 Local Sea Ice Conditions



- MODIS data show ice is closed up, no lead activity in the immediate vicinity of Barrow
- Low and high BrO trajectories are similar
- Suggests snow pack source of bromine
- Currently working on modeling this day with MISTRA

March 28th Flight Data



O₃ gradients tied to lead activity



- Black lines show trajectories within 10 km of Barrow and Atqasuk
 Barrow trajectories interact with
 - lead, replenish O_3^1 , not so at Atgasuk

^aMoore et al 2014 Nat GeoSci

March 28th Flight

Lead Interactions do not explain BrO Gradient



- Black lines show trajectories
 >1.5×10¹³ BrO
- Trajectory differences do not explain region of inland BrO, imply observed activation is locally occuring

March 28th Flight



What Do We Know?

- Airborne LT-VCDs calculated using geometric approximations compare well with ground-based retrievals using radiative transfer modeling
- Highest levels of BrO observed inland during an ODE
- Analysis of Mar 15 observations suggests locally occurring activation in the snowpack
- Enhanced limb BrO dSCDs at 1-3 km over closed sea ice suggests lofting of BrO occurs independently of local lead formation
- ► Ozone varies on differing spatial scales than BrO. Mechanisms explaining recoveries in O₃ do not explain concurrent spatial gradients in halogens

Conclusions

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Ability to retrieve LT-VCD depends on visibility



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