

# Oliktok Point Science and Infrastructure

**Gijs de Boer**<sup>1,2</sup>, Mark Ivey<sup>3</sup>, Martin Stuefer<sup>4</sup>, Matthew Shupe<sup>1,2</sup>, Allison McComiskey<sup>1,2</sup>, Amy Solomon<sup>1,2</sup>, Sergey Matrosov<sup>1,2</sup>, Christopher Williams<sup>1,2</sup>, Jessie Creamean<sup>1,2</sup>, David Turner<sup>2</sup>, Fred Helsel<sup>3</sup>, Dan Lucero<sup>3</sup>, Valerie Sparks<sup>3</sup>, Darin Desillets<sup>3</sup>, Al Bendure<sup>3</sup>, Dean Archuleta<sup>3</sup>, Dari Dexheimer<sup>3</sup>, Erika Roesler<sup>3</sup>, Gene McGill<sup>4</sup>



Funding:

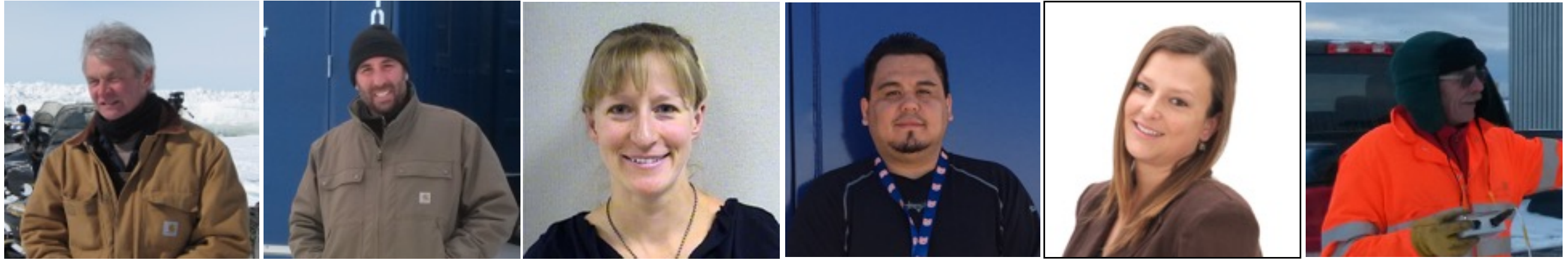


**ARM**

CLIMATE RESEARCH FACILITY



# Introduction to Site Teams



*Top:* Mark Ivey, Darin Desilets, Erika Roesler, Dean Archuleta, Dari Dexheimer, Al Bendure  
*Bottom, from center:* Valerie Sparks, Fred Helsel, Dan Lucero, Scott Richardson (PSU)



# Introduction to Site Teams



Gijs de Boer



Matthew Shupe



Allison McComiskey



Christopher Williams



Sergey Matrosov



Amy Solomon



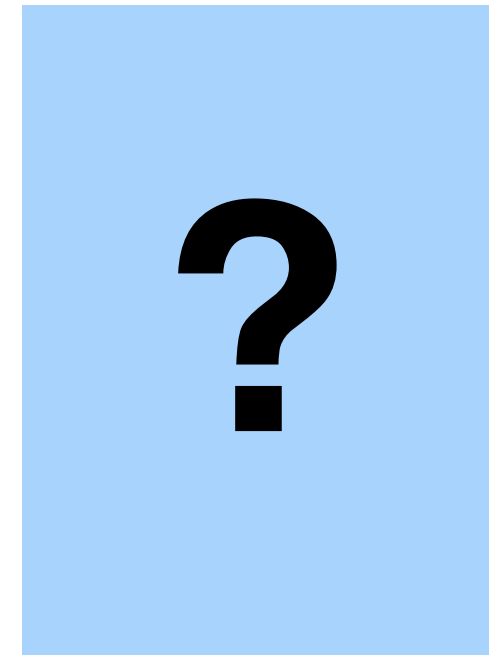
David Turner



Jessie Creamean



Postdoc (TBD)



Student (TBD)



University of Colorado  
Boulder





# Introduction to Site Teams



Martin Stuefer (top), Gene McGill (left)



# Site Overview





# Site Overview



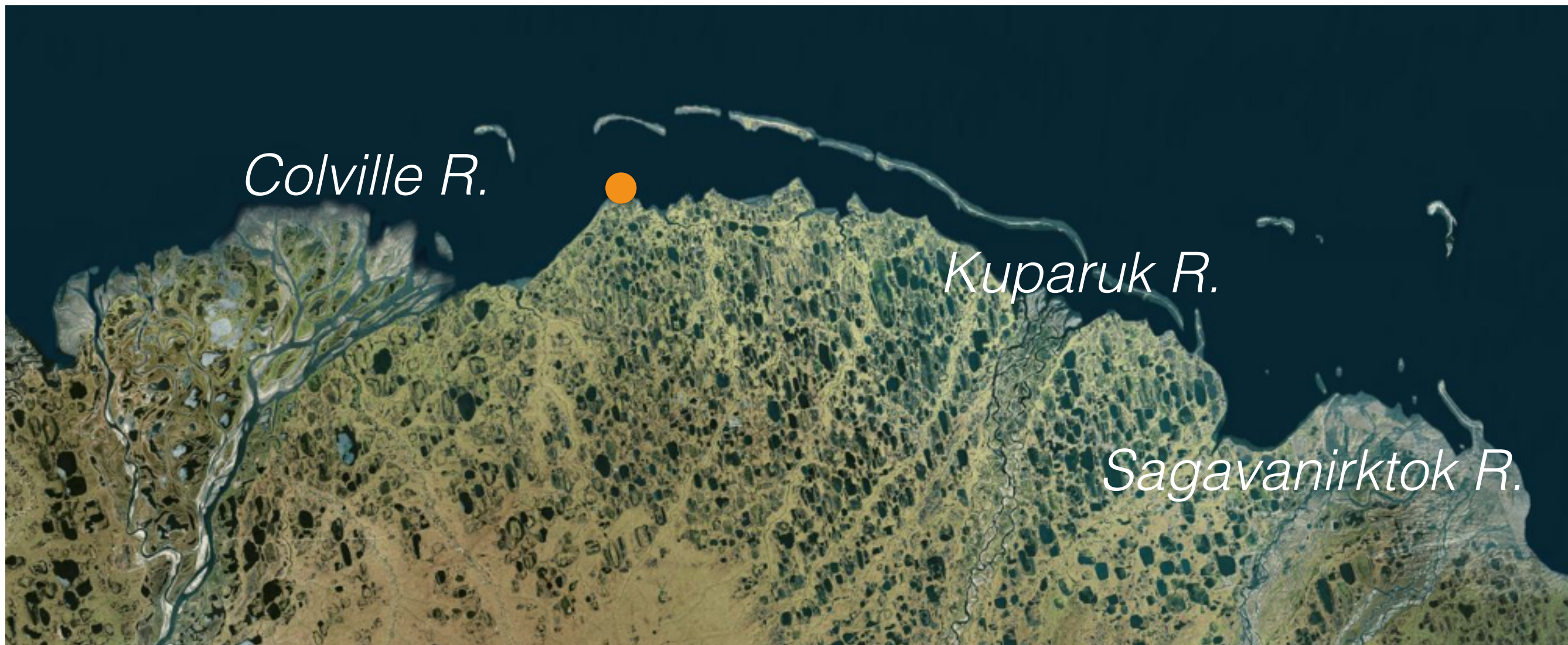


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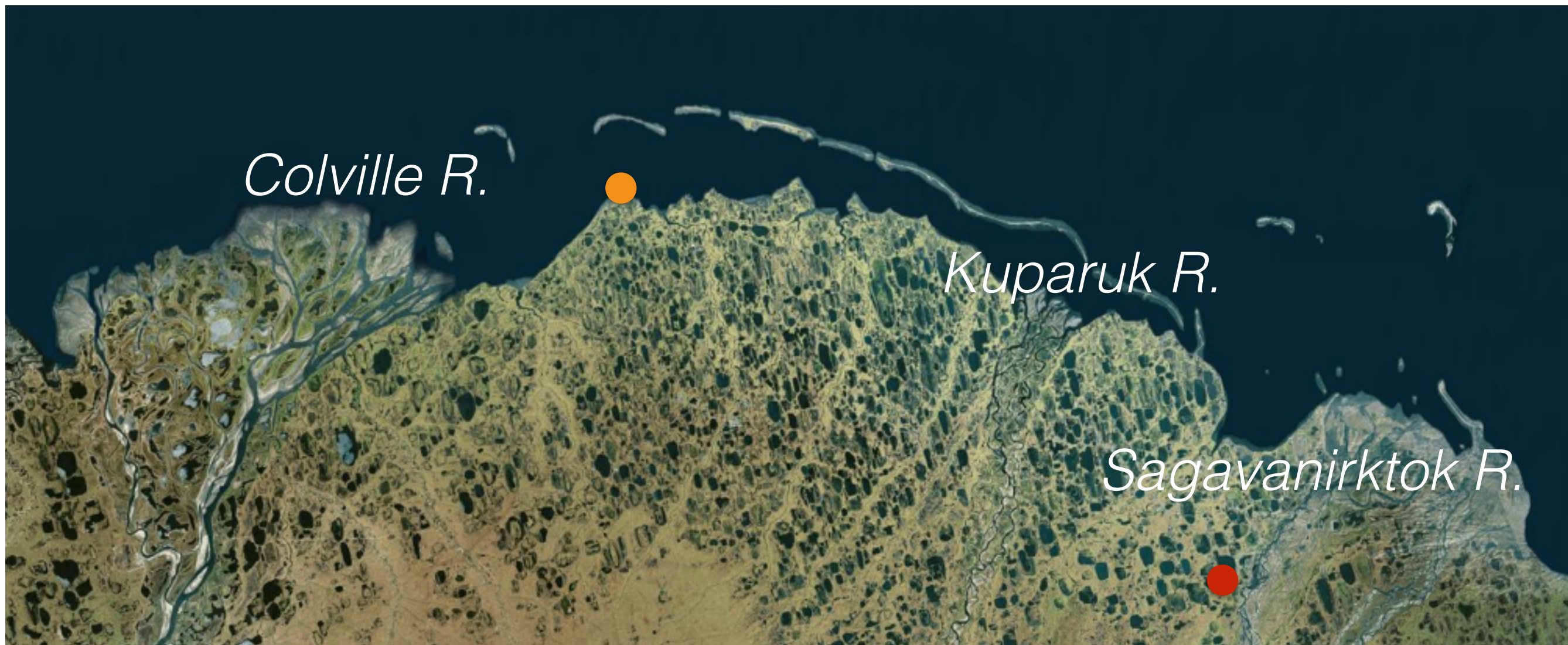


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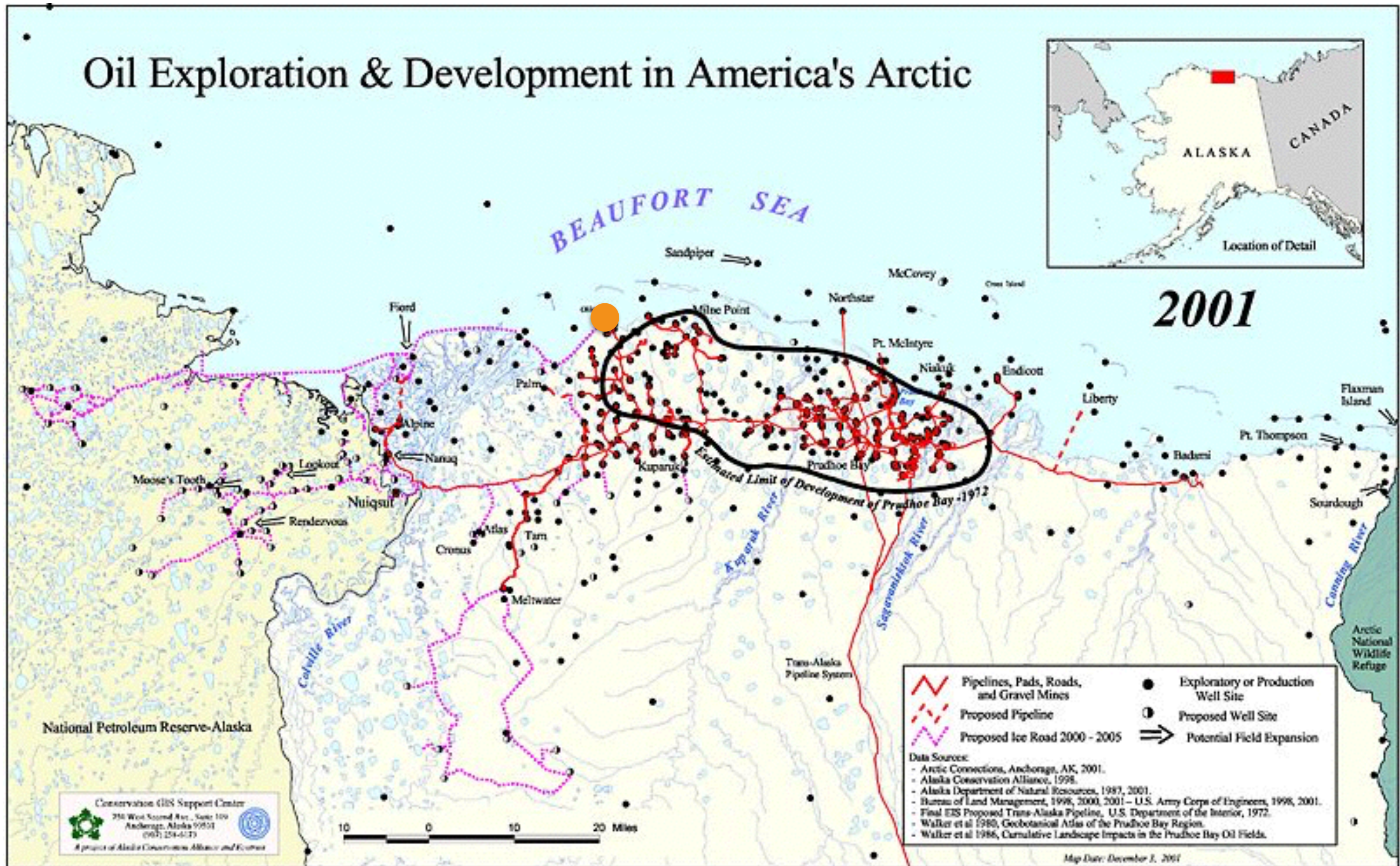


# Site Overview





# Oil Exploration Activities



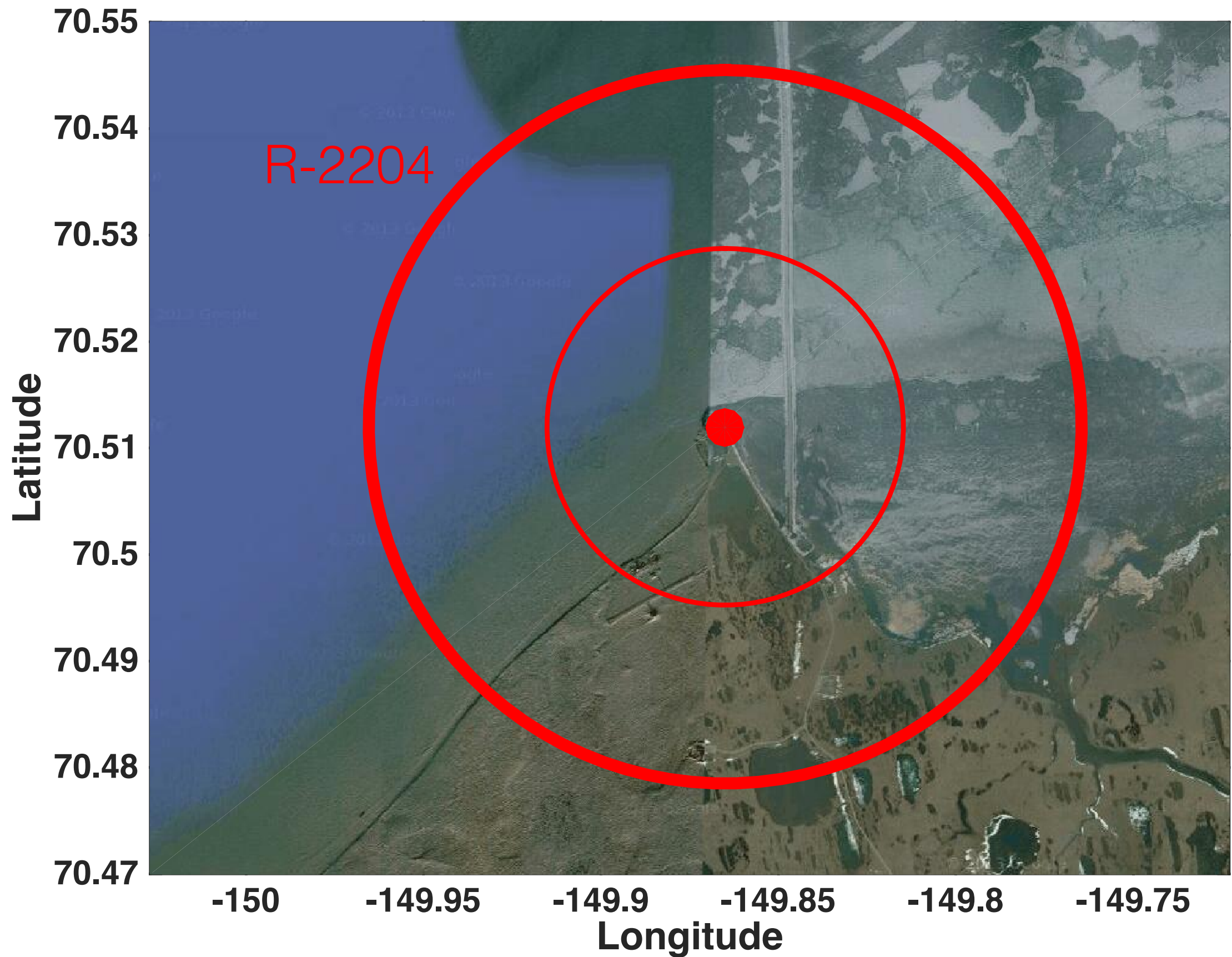


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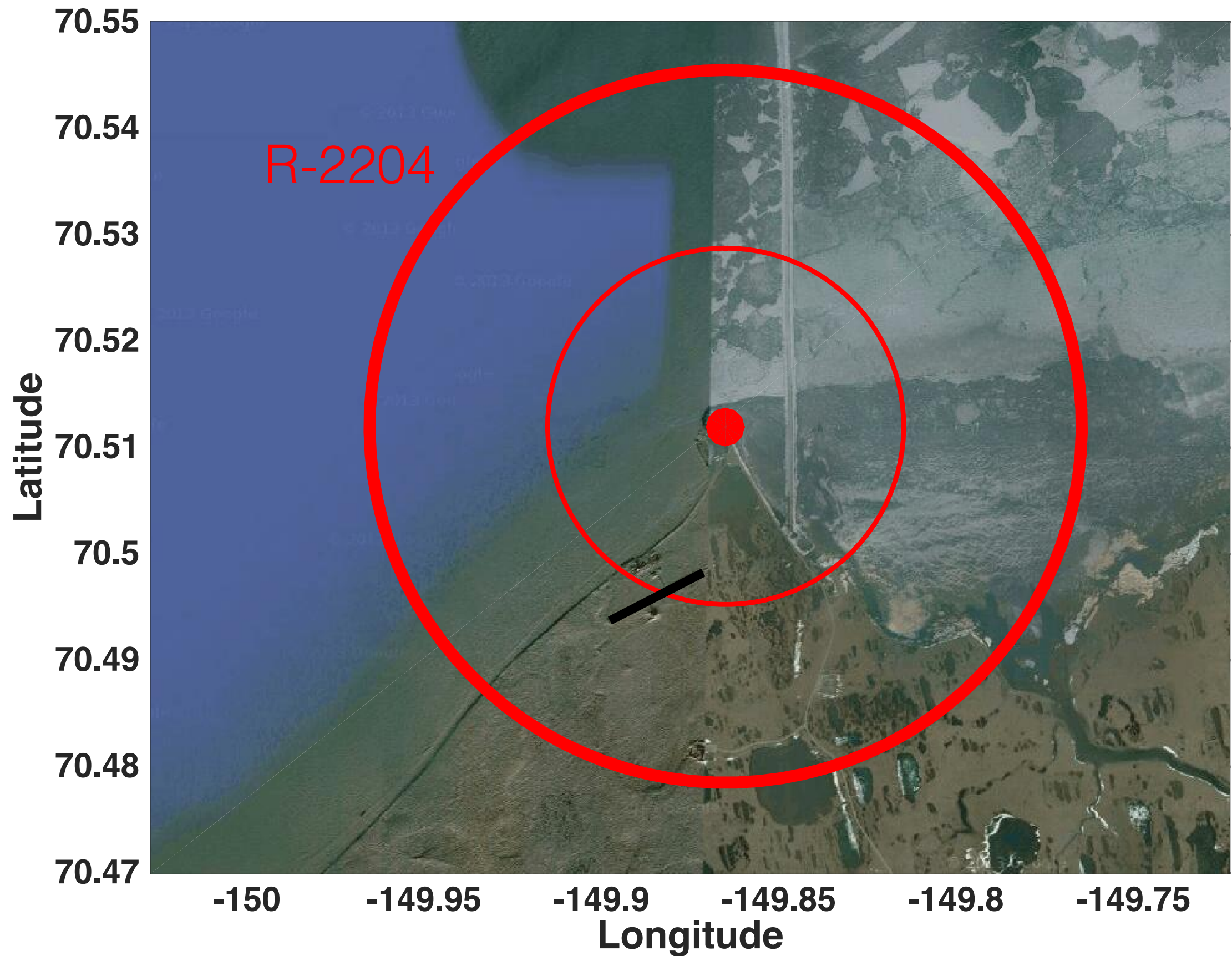


# Restricted Airspace



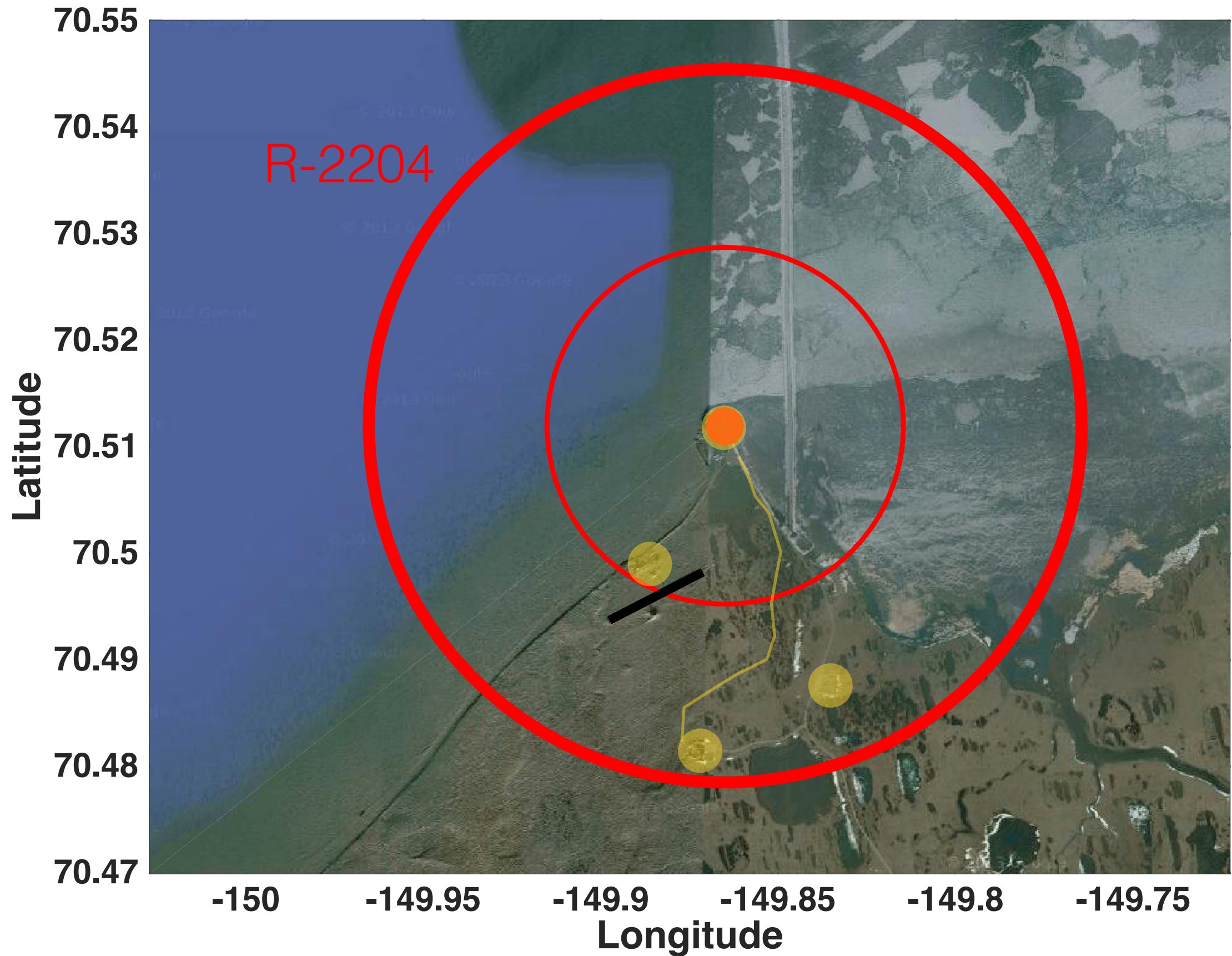


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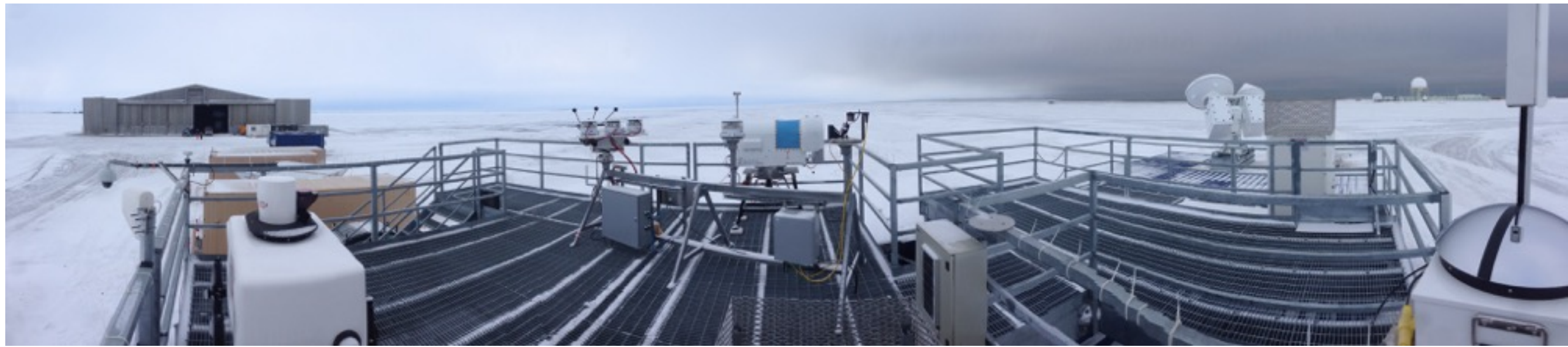


# Restricted Airspace





# Site Instrumentation



## AMF3 includes:

### *Clouds:*

- MPL, Raman Lidar, Ceilometer
- KAZR, KASACR, WSACR, CSAPR
- 3-channel MWR

### *Profiling:*

- Sonde
- 915 MHz RWP
- Doppler Lidar

### *Radiometric*

- AERI
- MFR, MFRSR
- Up/Downwelling radiation
- IRT

### *Surface Meteorology/Precip:*

- Surface Met
- ECOR
- Total Precipitation Sensor
- MASC

### *Aerosols:*

- AOS
- CSPHOT

### *Additional Capabilities*

- Tethered-balloon profiling
- UAS

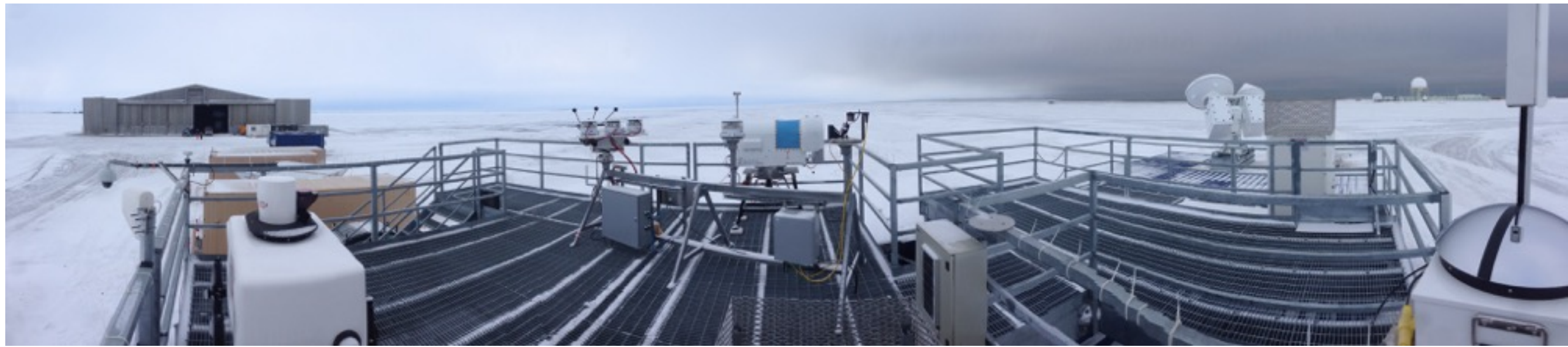
Installed

To be installed in coming months

Fate uncertain



# Site Instrumentation



## AMF3 includes:

### *Clouds:*

- MPL, Raman Lidar, Ceilometer
  - KAZR, KASACR, WSACR, ~~CSAPR~~
  - 3-channel MWR
- X-band system?

### *Profiling:*

- Sonde
- 915 MHz RWP
- Doppler Lidar

### *Radiometric*

- AERI
- MFR, MFRSR
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### *Surface Meteorology/Precip:*

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Fate uncertain



# Site Challenges



Early March, 2015



# Site Challenges



Remains of ENI NOC Camp, December 2014



# Oliktok Point Site Science Themes

## **Characterization of cloud properties and their climatic relevance (Shupe, Turner, de Boer)**

*Key Question(s):* How representative are clouds observed at Barrow for Alaska's North Slope?, How do Oliktok Point clouds impact surface radiation, and is this different seasonally than at Barrow?

*Key Instruments:* Radars, lidars, AERI, MWR3C, TSI, radiosondes, Total Precip sensor, MASC

*Data Products to be Applied:* MWRRET.v2, KAZR-ARSCL, MergeSonde, MPL-Cloudmask/depol, AERI-OE, MIXCRA, Shupe-Turner microphysics retrieval, QCRad



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## **Improved characterization of Arctic precipitation processes (Matrosov, Williams)**

*Key Question(s):* What relationships exist between ice crystal habit and cloud-base precipitation rate? To what extent does precipitation intensity correspond to cloud liquid water path? Are precipitation processes responsible for the decoupling of clouds from the near-surface atmosphere?

*Key Instruments:* Radars, Total Precip Sensor, MASC, radiosondes, MWR3C, Doppler Lidar, Raman Lidar, AERI, Surface meteorology

*Data Products to be Applied:* Scanning-radar derived ice crystal habit estimation, vertically-pointing radar derived hydrometeor identification product, precipitation rate products



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*Data Products to be Applied:* Scanning-radar derived ice crystal habit estimation, vertically-pointing radar derived hydrometeor identification product, precipitation rate products

## **Characterization of aerosol properties (McComiskey, Creamean)**

*Key Question(s):* Is there a detectable signature of Prudhoe Bay industrial activities on aerosol properties observed at Oliktok Point? How do Oliktok Point aerosol properties compare to those observed at Barrow?

*Key Instruments:* AOS, CSPHOT, surface meteorology, radiosondes, Raman Lidar, surface radiation, MFR, MFRSR, Profiling from UAS and balloons

*Data Products to be Applied:* Aerosol best estimate, Column intensive properties, QCRad



# Oliktok Point Site Science Themes

## **Understanding aerosol-cloud interactions in the Arctic (de Boer, McComiskey, Creamean, Solomon)**

*Key Question(s): To what extent can we use surface-based aerosol measurements as a proxy for in-cloud aerosol in the Arctic atmosphere? How do aerosol particles impact precipitation susceptibility in high-latitude, liquid-containing clouds?*

*Key Instruments:* AOS, AERI, MWR3C, Radars, Lidars, radiosondes, MFRSR, Profiling from UAS and balloons

*Data Products to be Applied:* Aerosol best estimate, AERI-OE, QCRad



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*Data Products to be Applied:* Aerosol best estimate, AERI-OE, QCRad

## **Understanding clear-cloudy transitions in Arctic stratiform clouds (Solomon, de Boer, Shupe, Turner)**

*Key Question(s): To what extent are transitions between radiatively clear and radiatively cloudy states governed by large-scale dynamics? How do local and distant sources of moisture vary by season or region, and do they lead to distinct cloud properties or longevity? What is the role of radiation in the initiation of the radiatively cloudy state? What processes determine cloud phase partitioning and the occurrence of liquid water? What mechanisms control the turbulence state of the sub-cloud environment?*

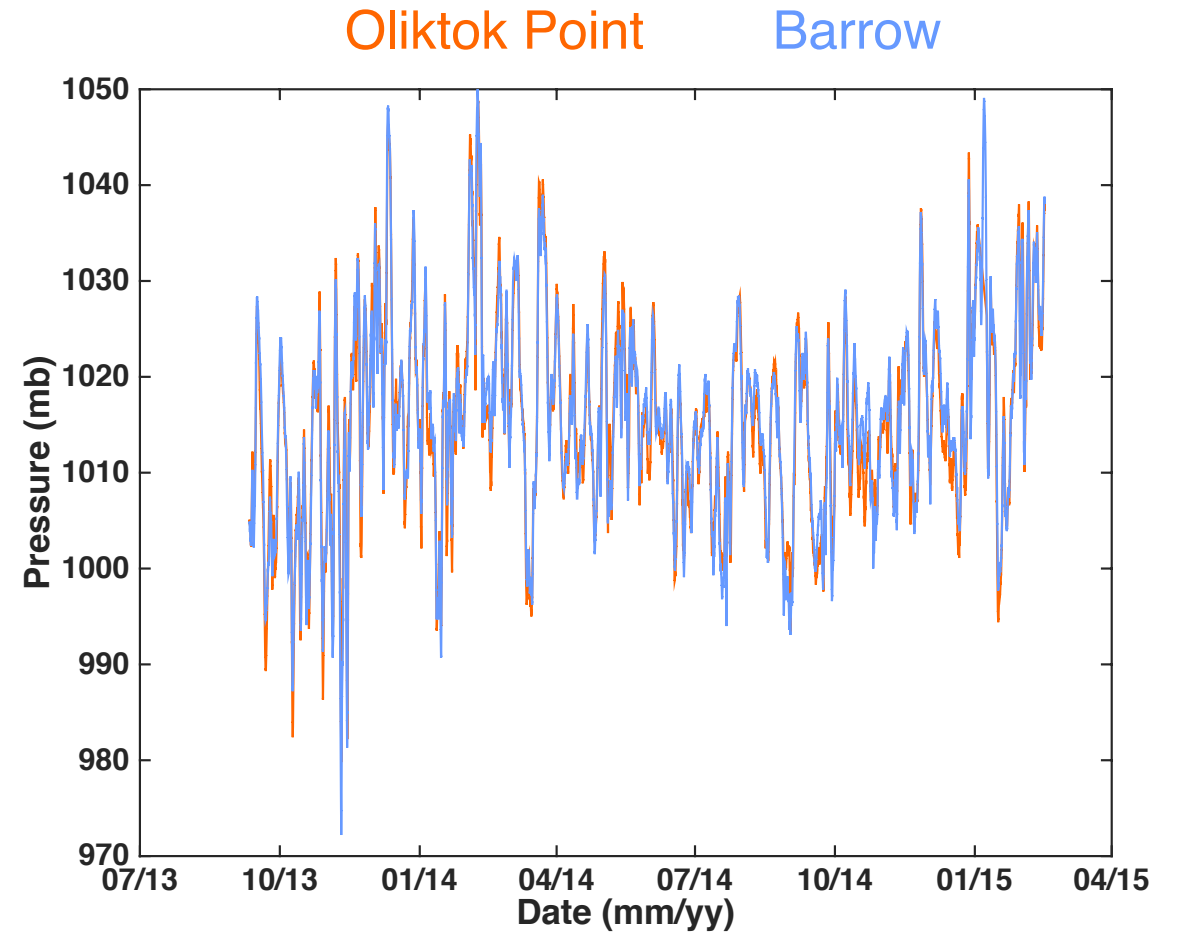
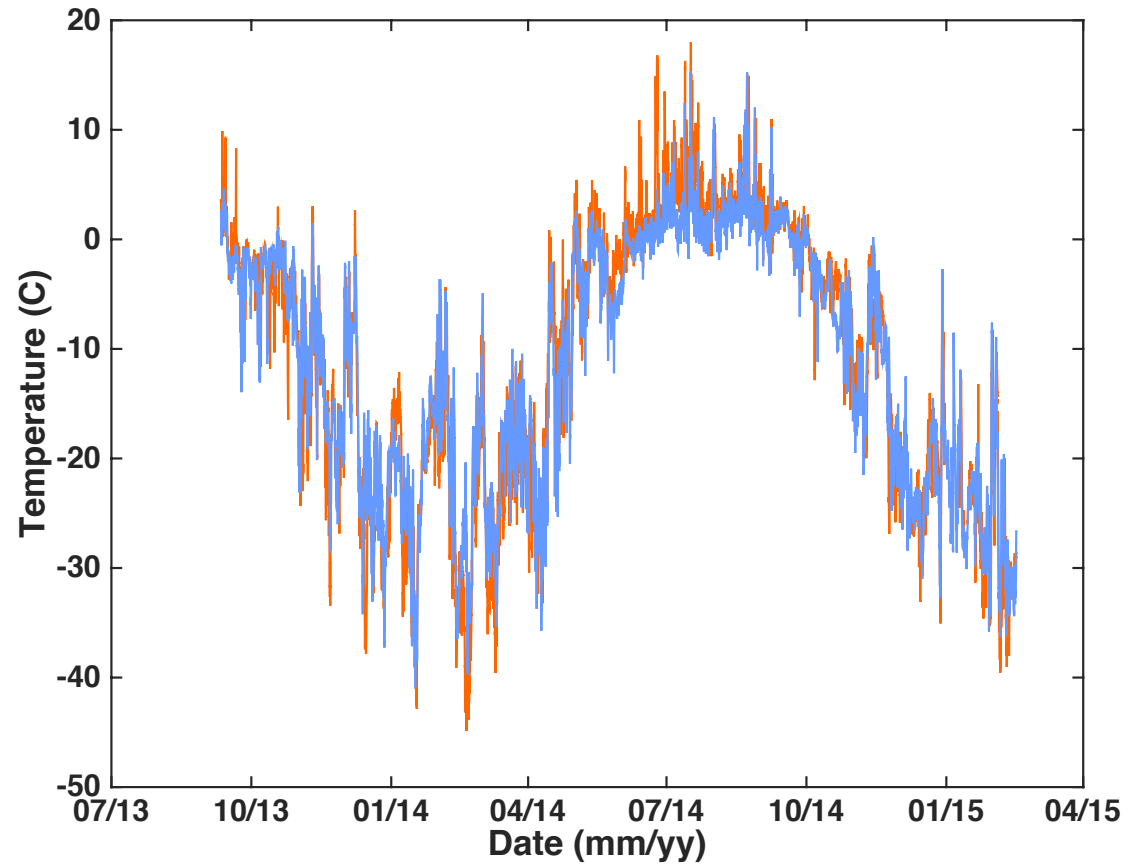
*Key Instruments:* Radars, lidars, AERI, MWR3C, TSI, radiosondes, surface meteorology, surface radiation, Profiling from UAS and balloons

*Data Products to be Applied:* Precipitation rate retrievals, ARSCL, AERI-OE, QCRad,



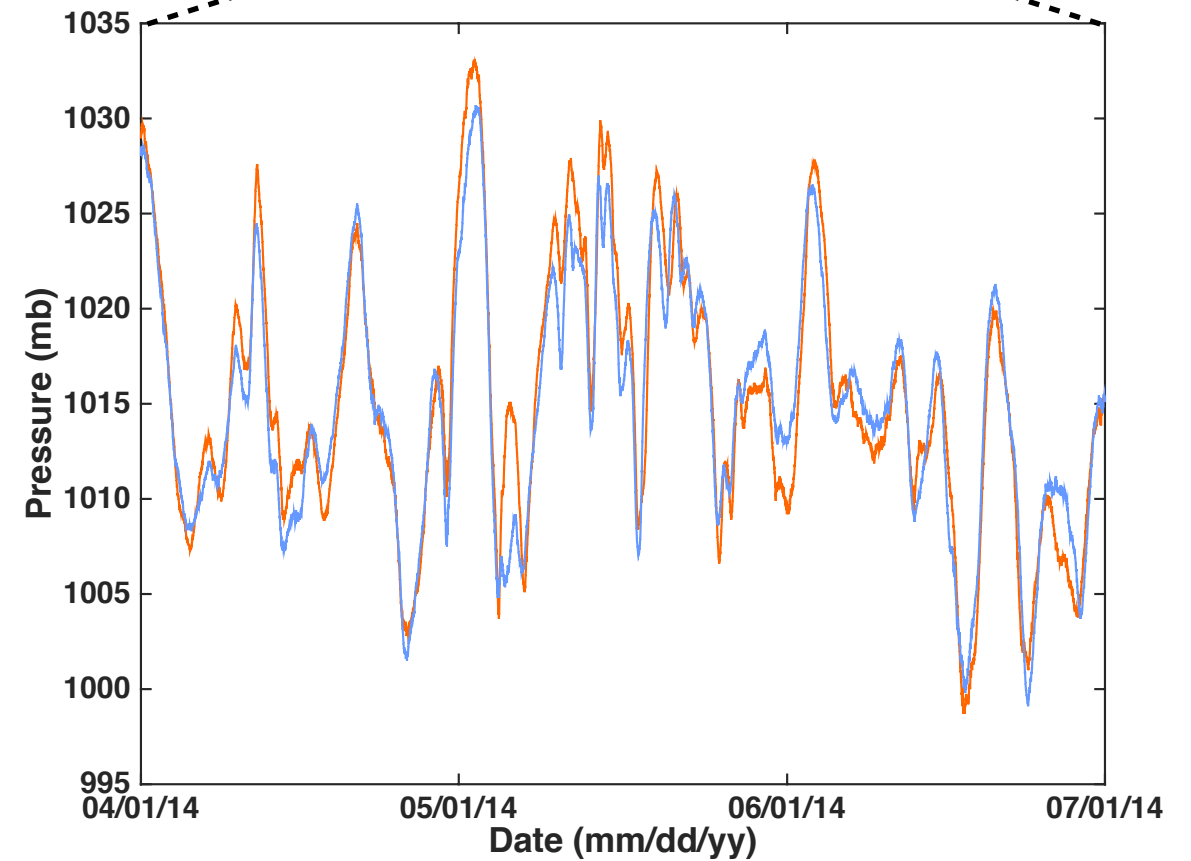
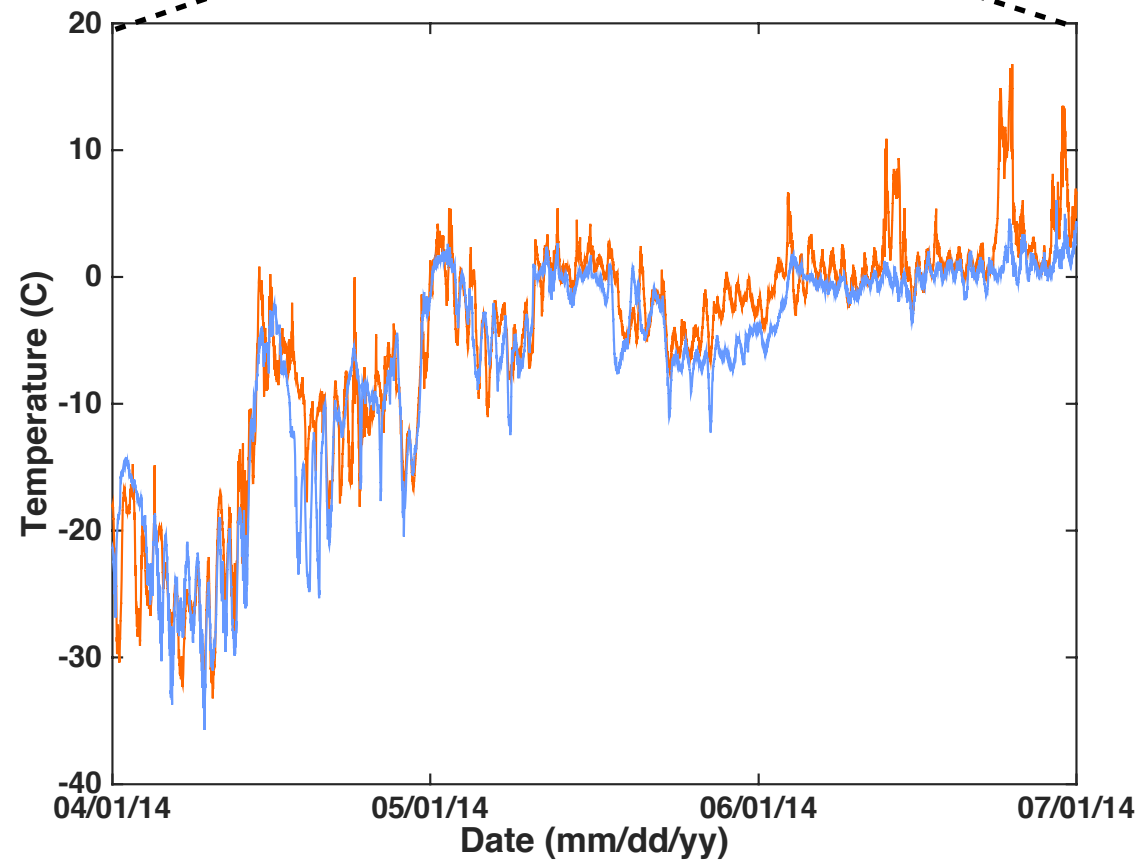
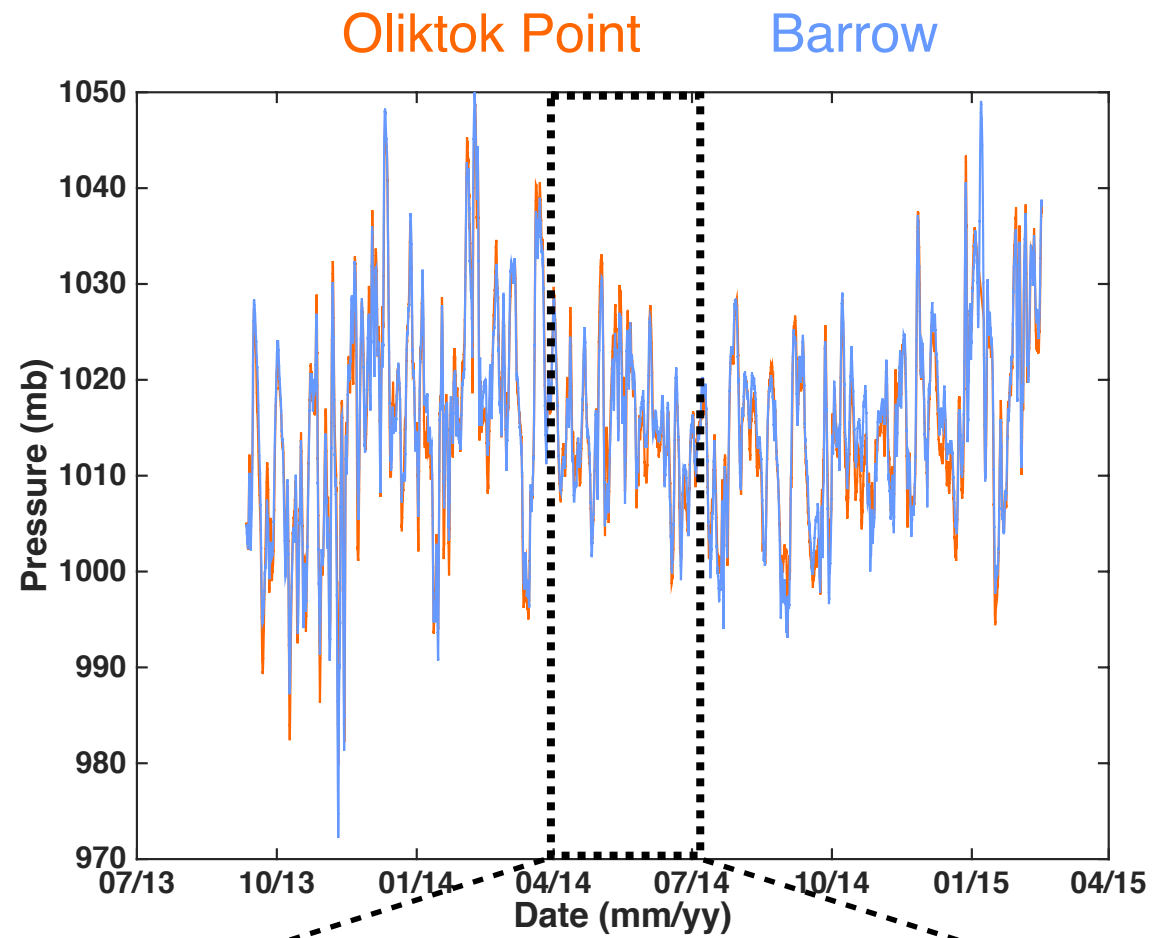
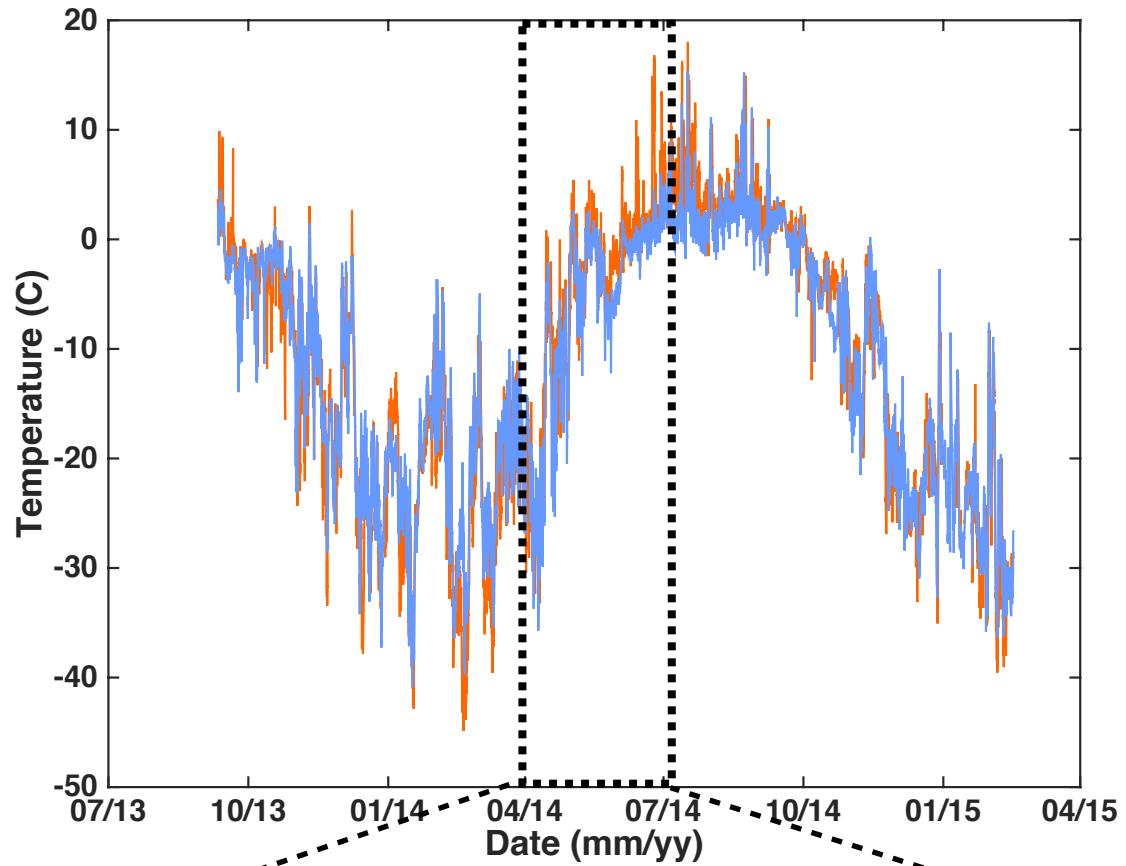
# First Steps and Early Progress

## Synoptic scale variability along the North Slope



# First Steps and Early Progress

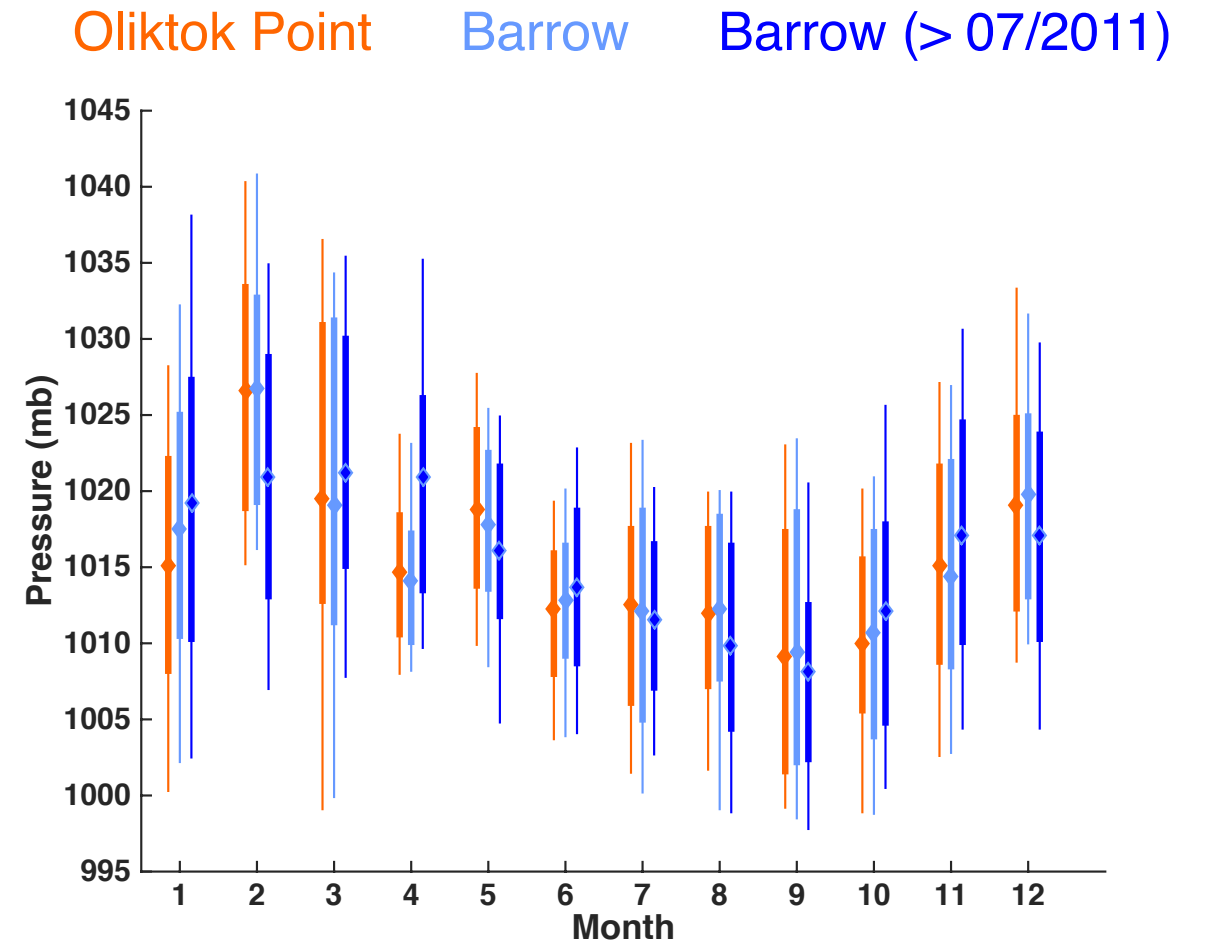
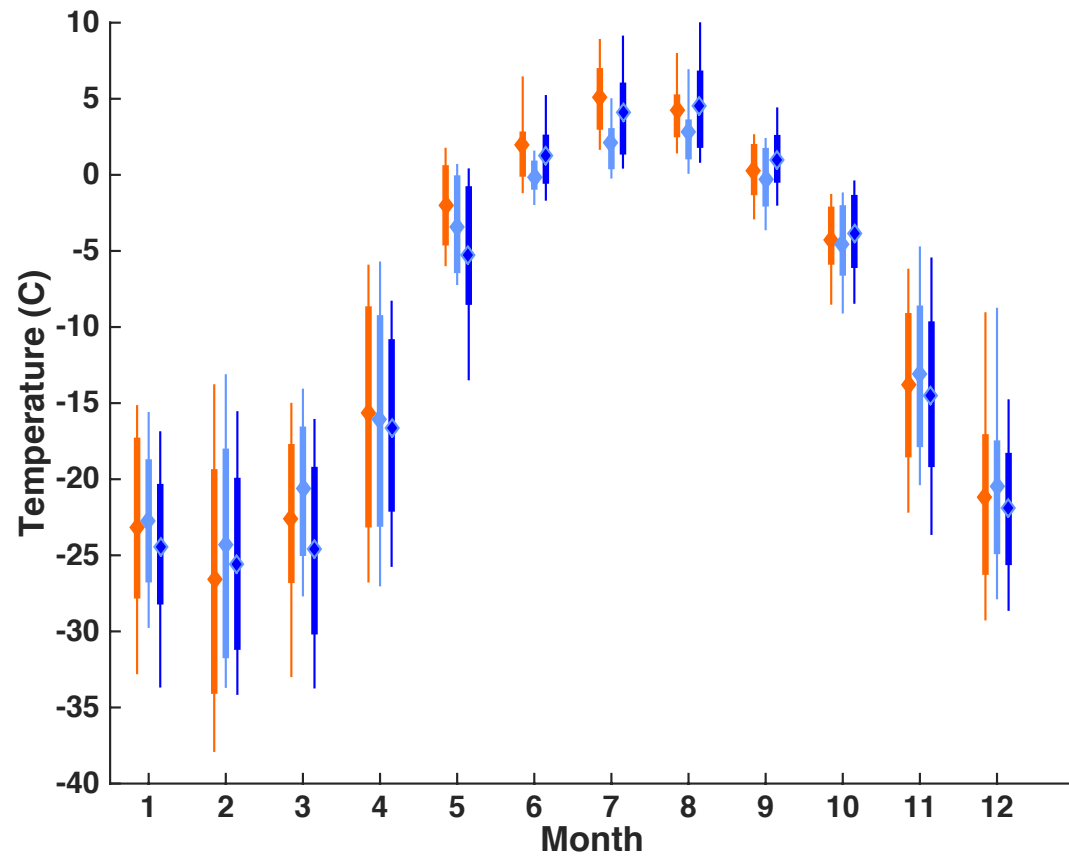
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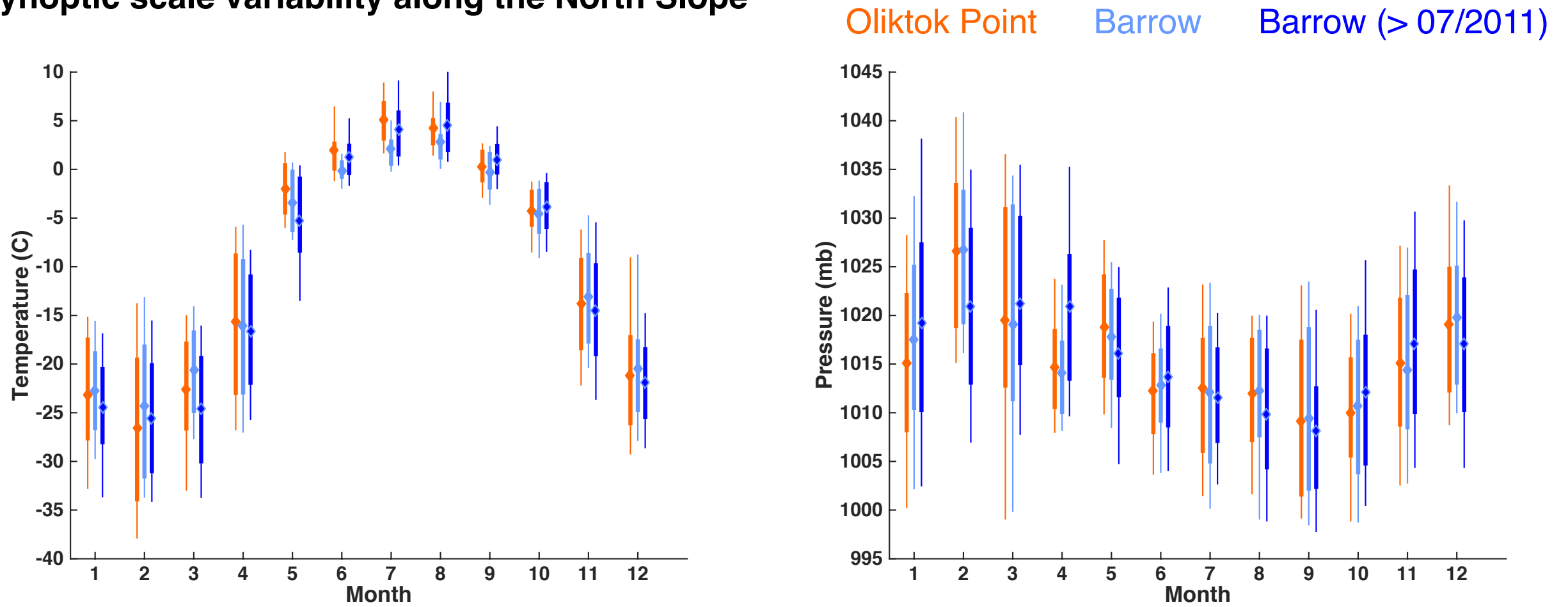
# First Steps and Early Progress

## Synoptic scale variability along the North Slope

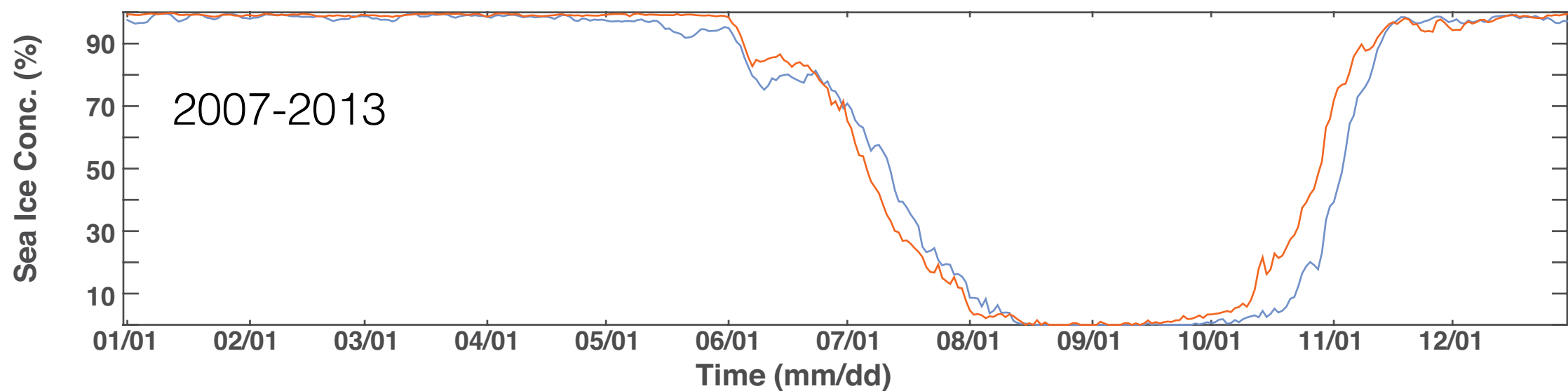


# First Steps and Early Progress

## Synoptic scale variability along the North Slope



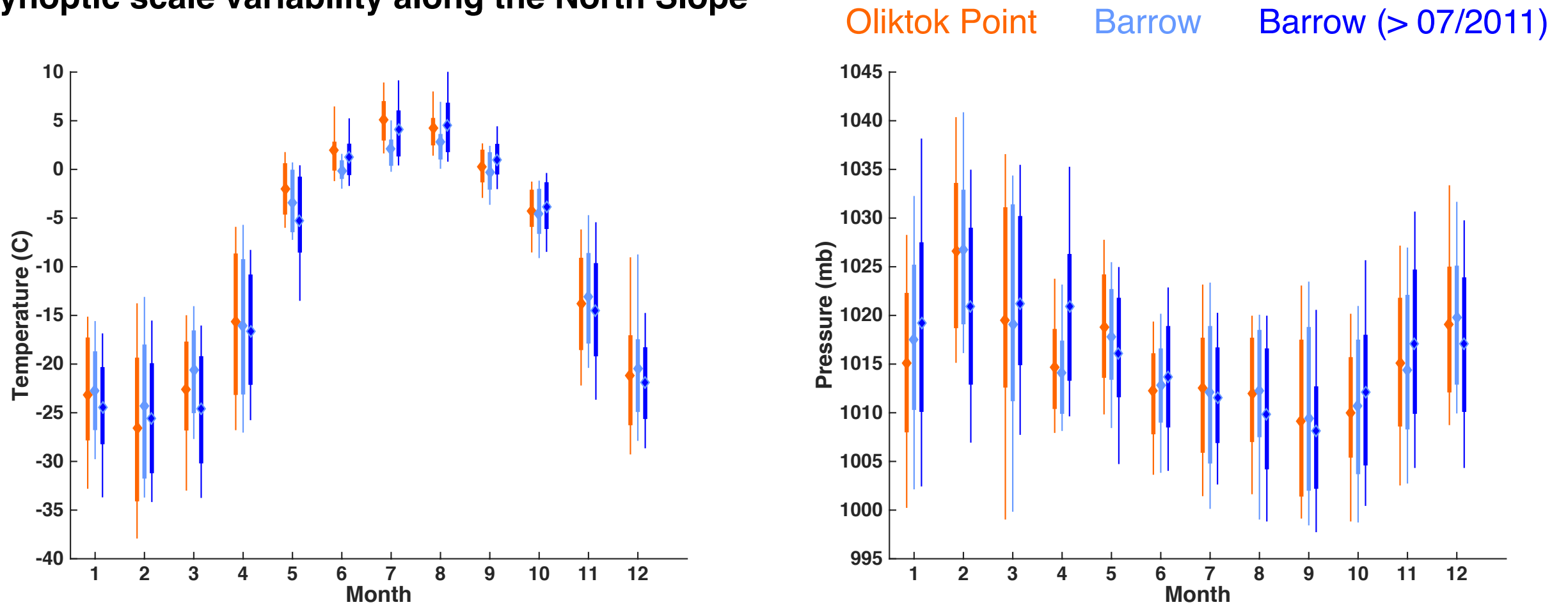
## NOAA/NSIDC CDR Passive Microwave Sea Ice Concentration



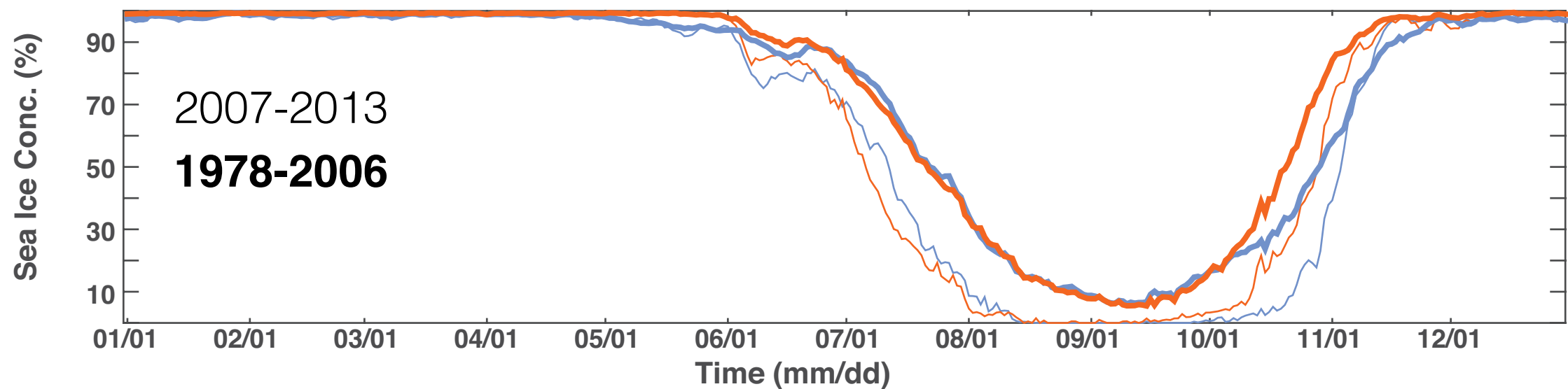


# First Steps and Early Progress

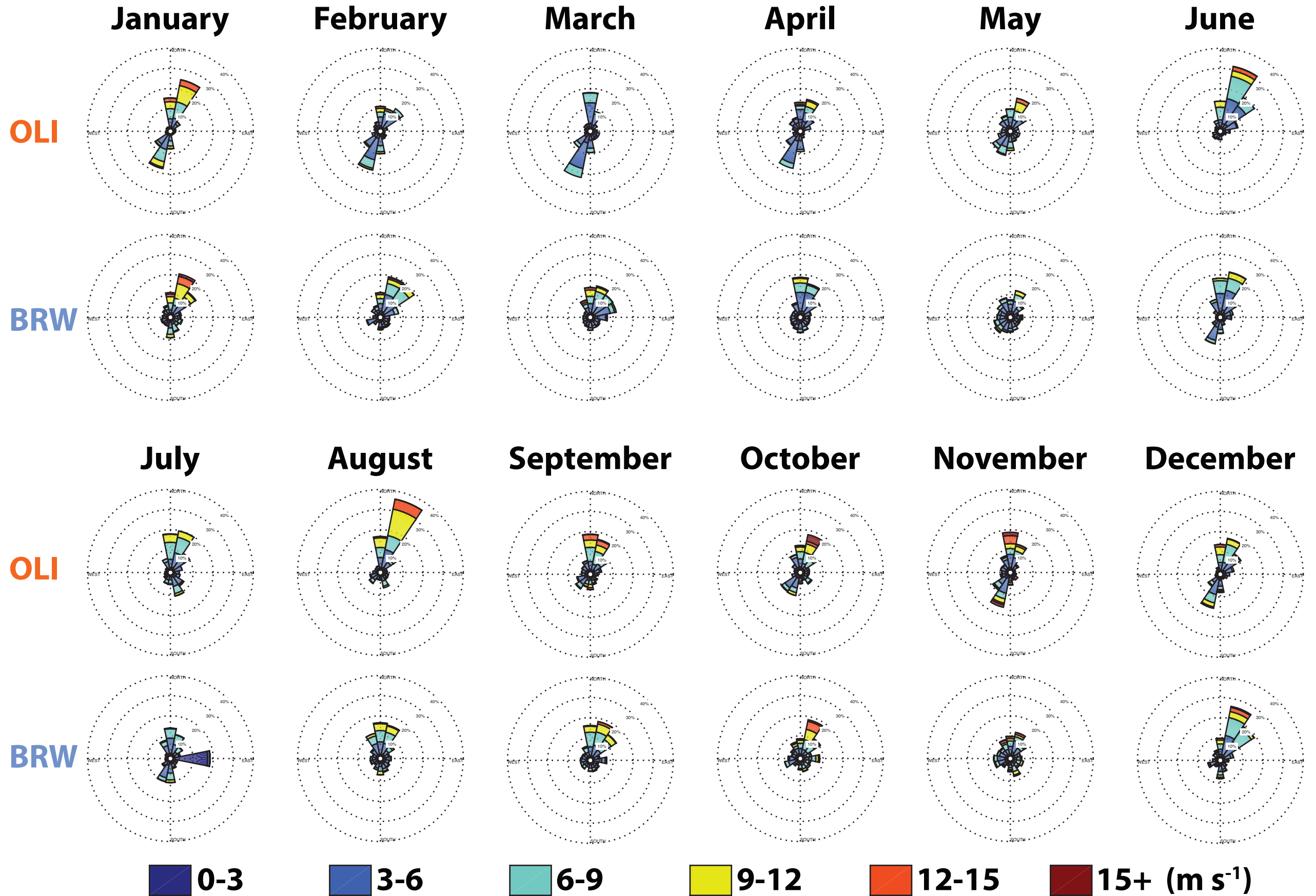
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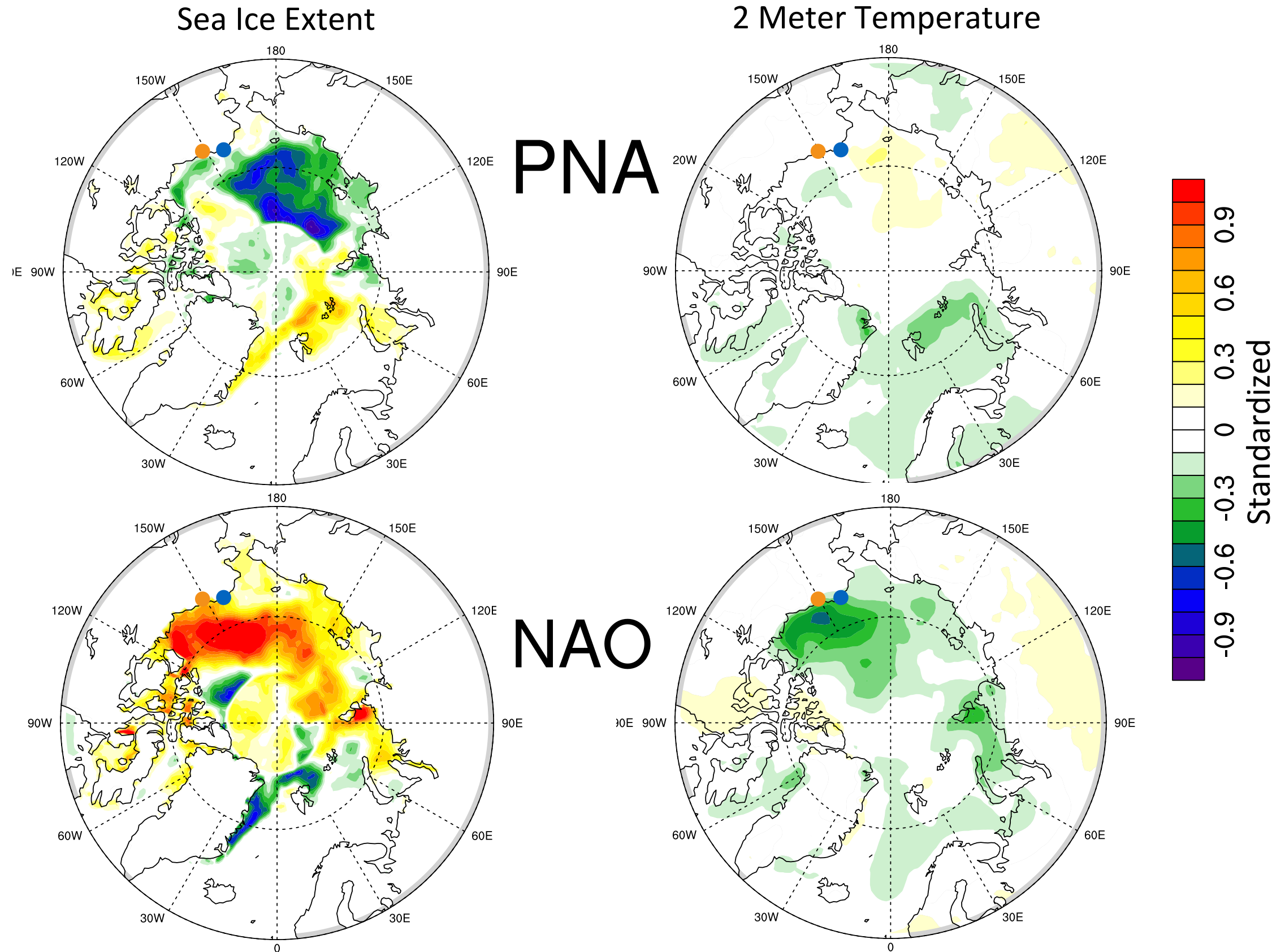
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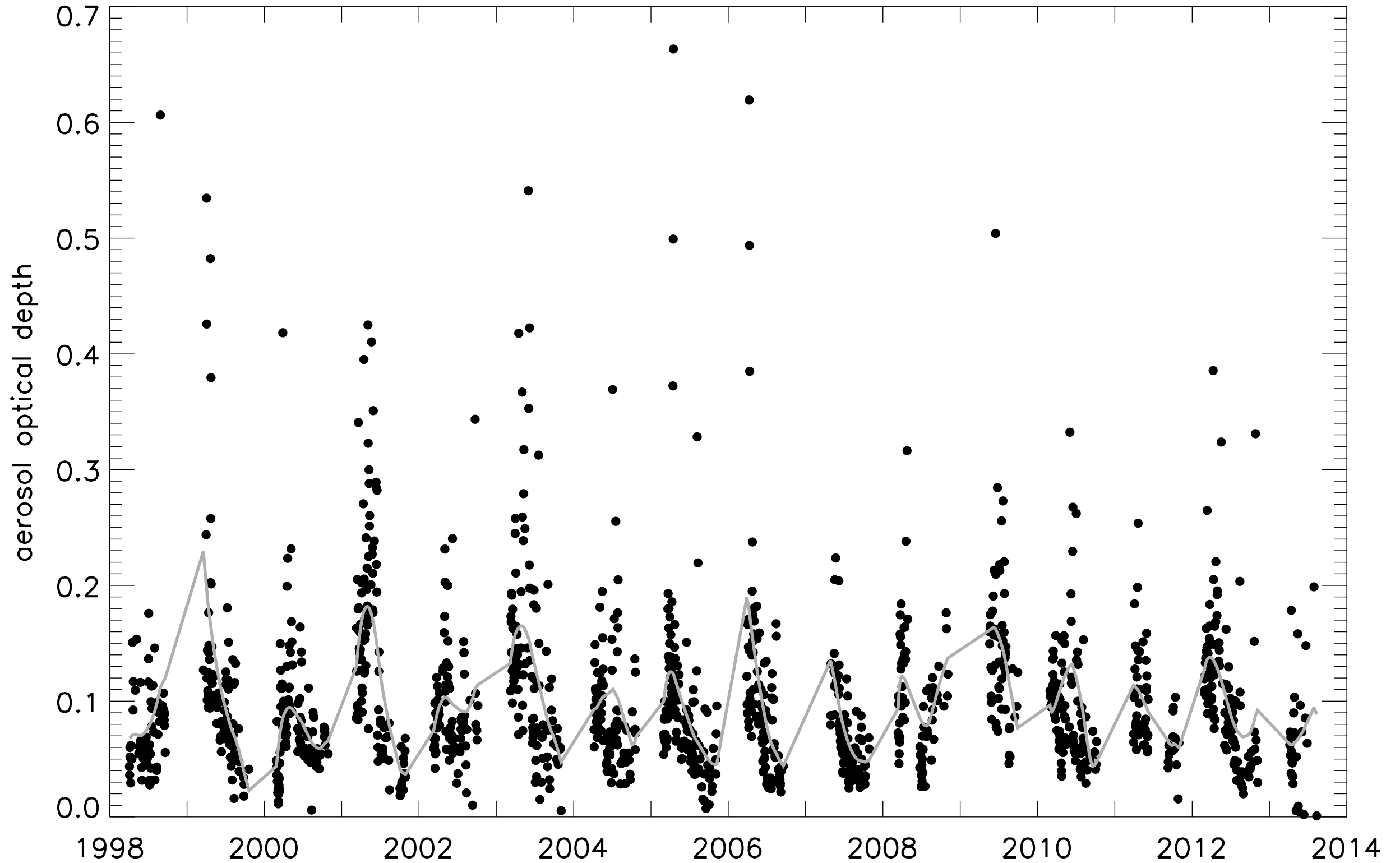


# First Steps and Early Progress

Regression Coefficients Between ERA 1979-2014 JJA Index and SON Surface Fields

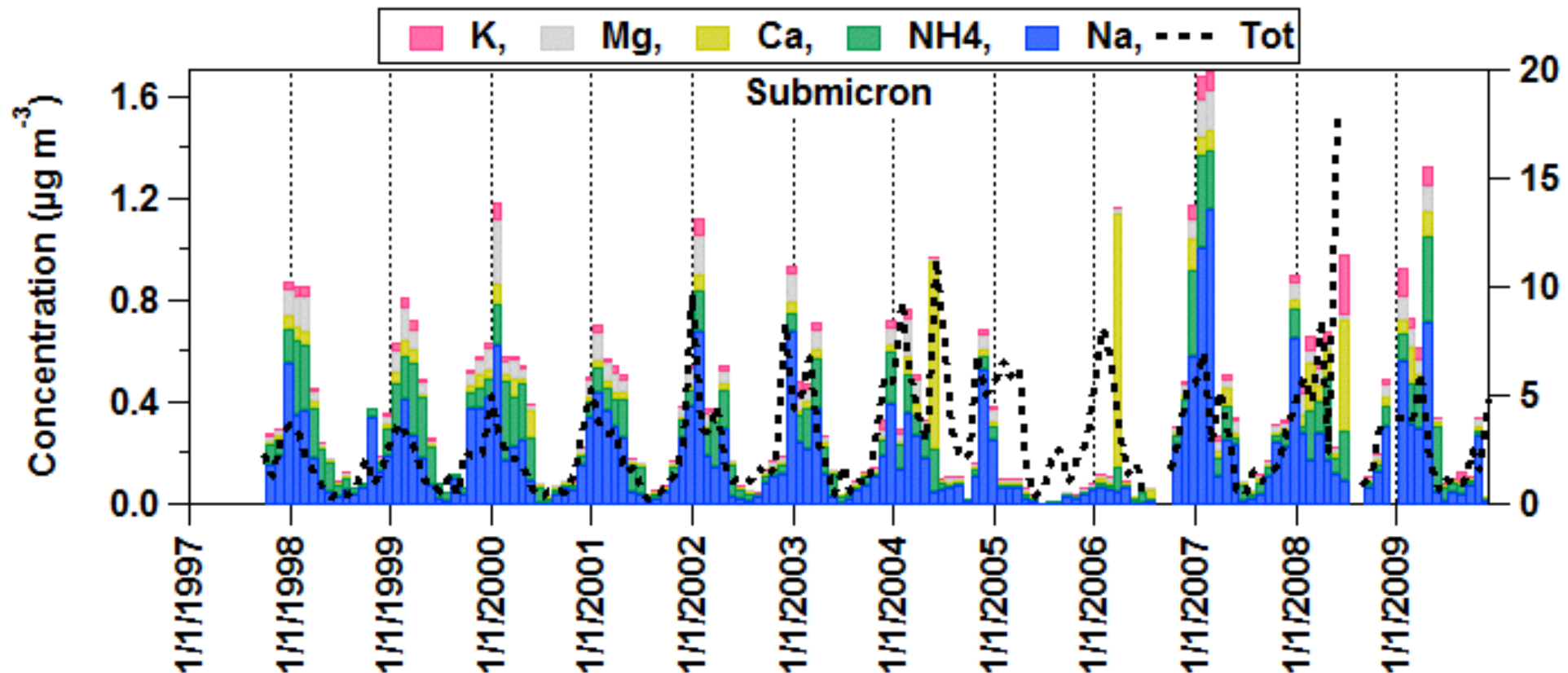
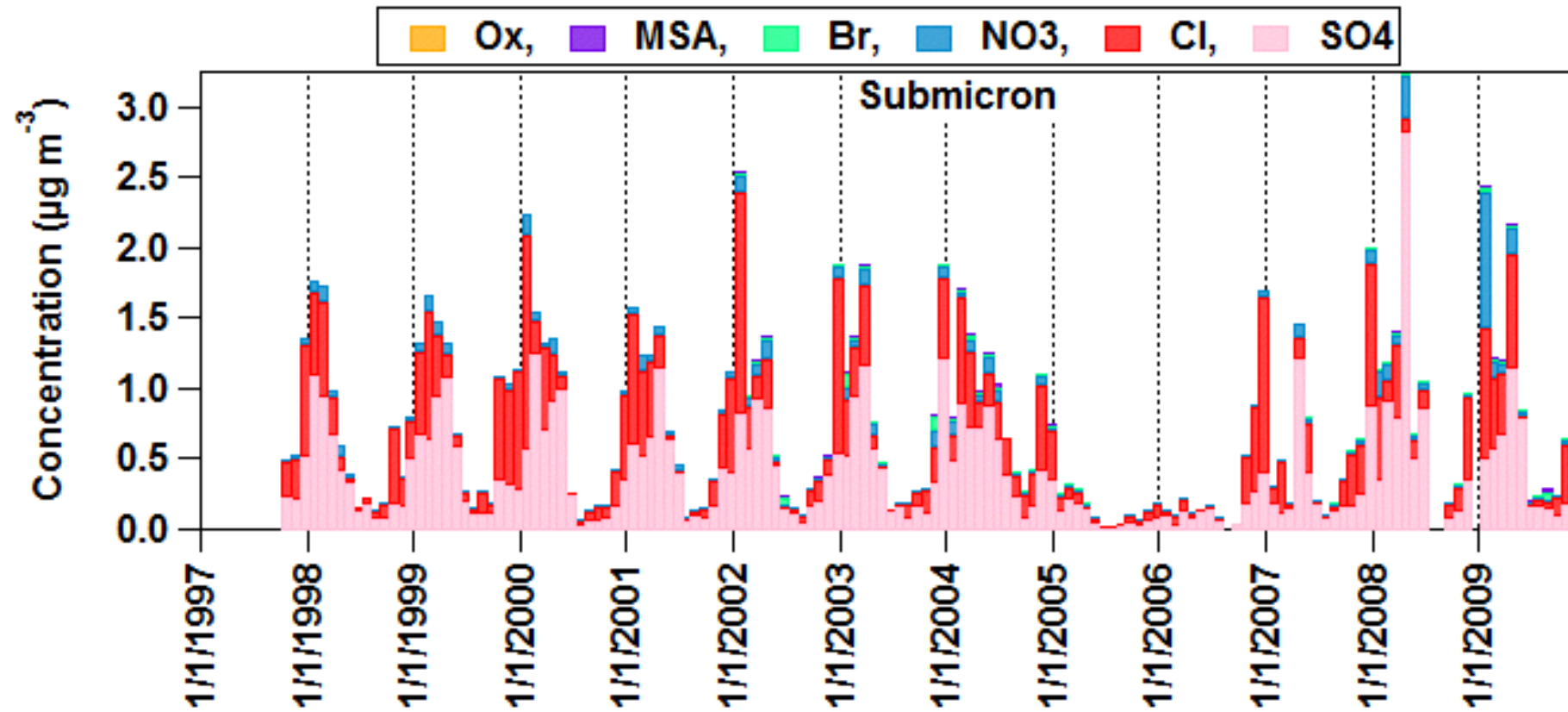


# First Steps and Early Progress



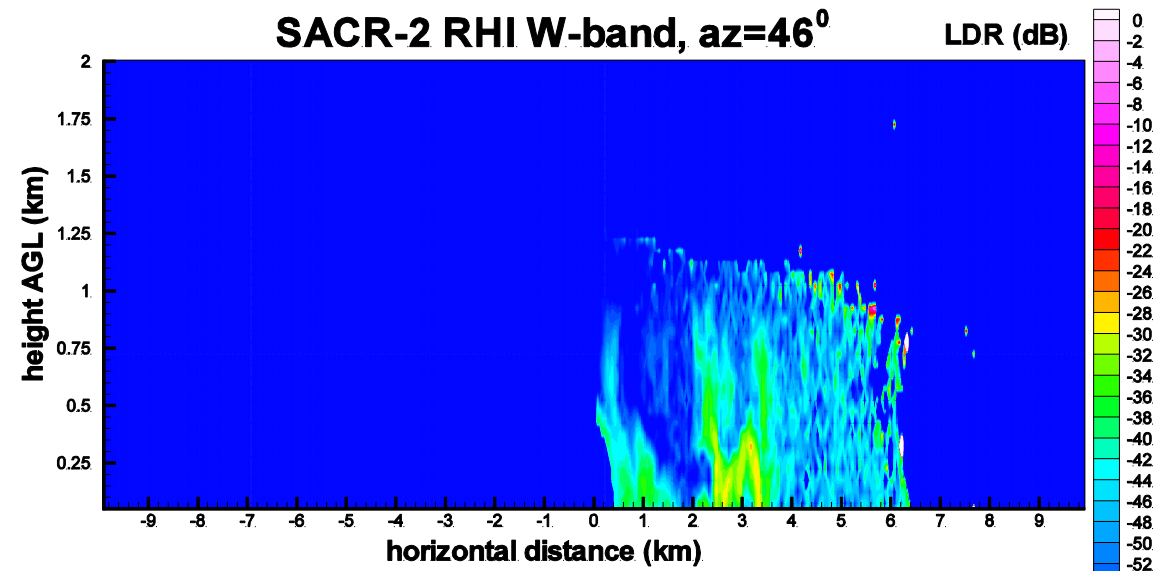
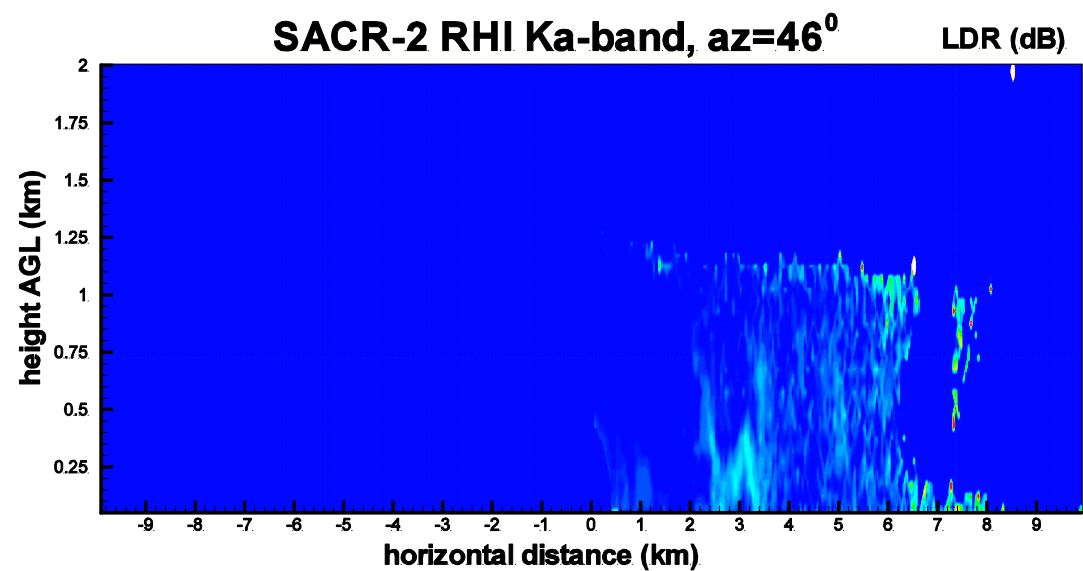
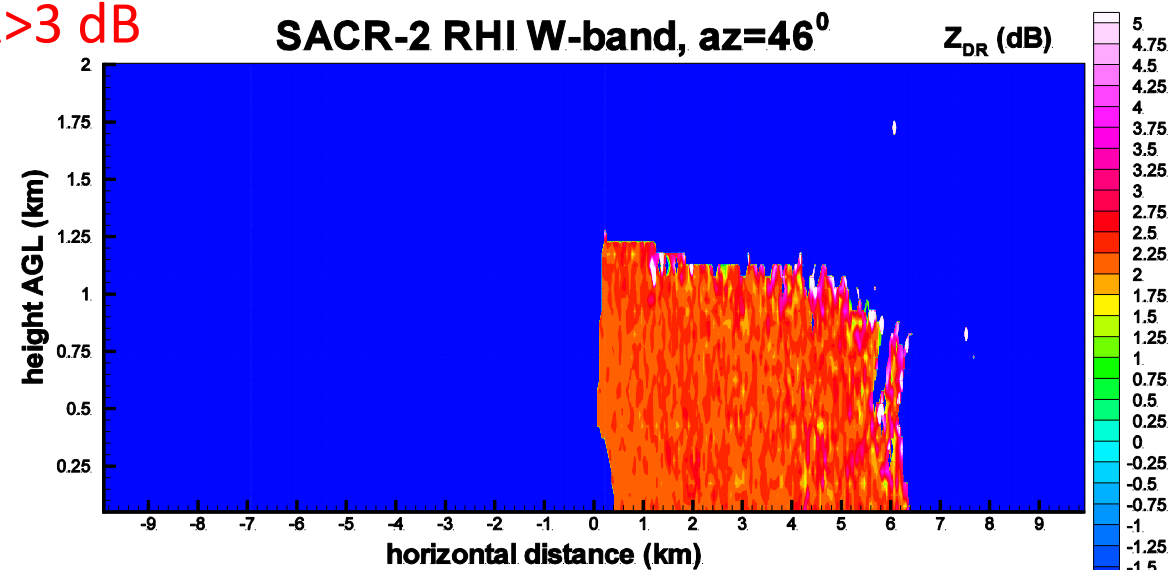
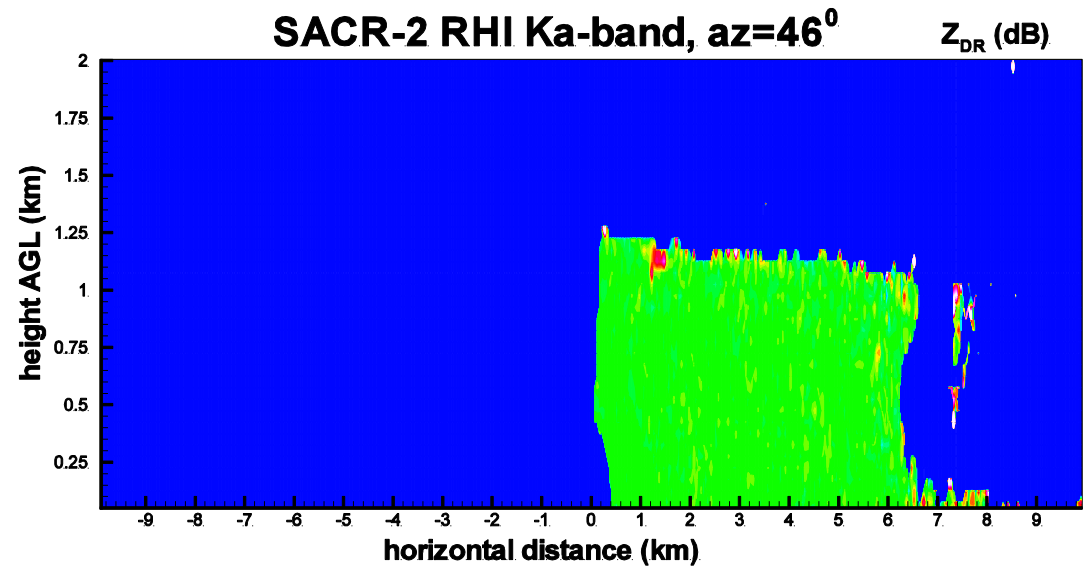
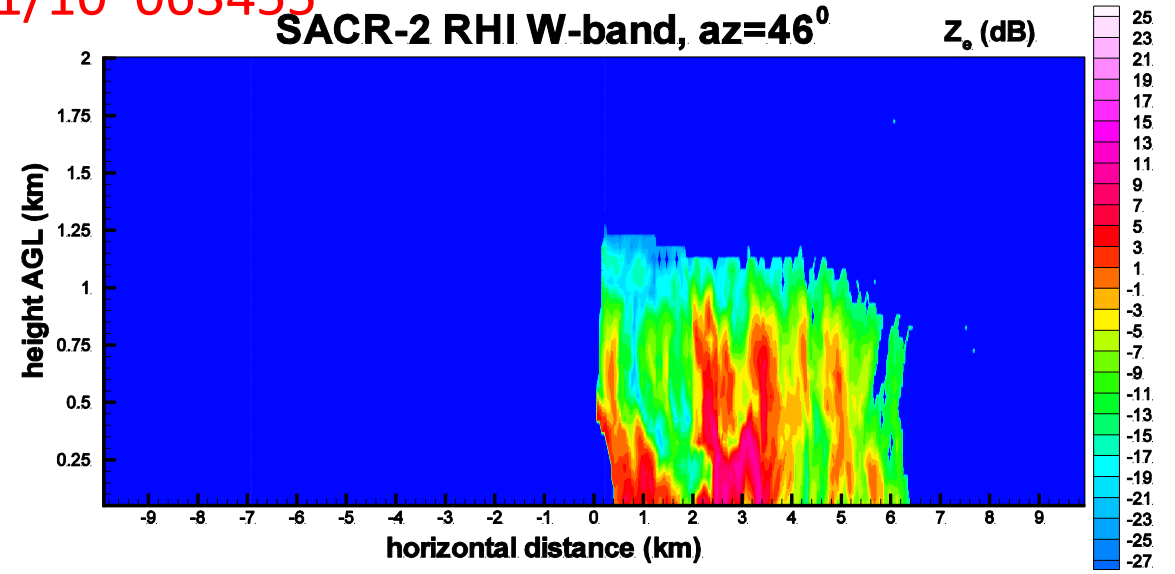
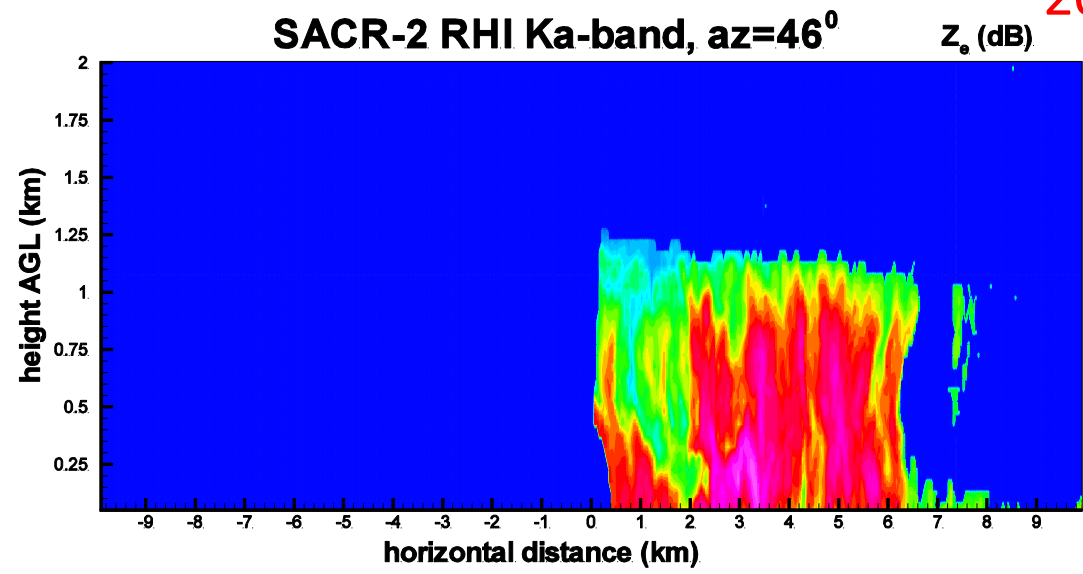


# First Steps and Early Progress



# First Steps and Early Progress

2015/01/10 063455

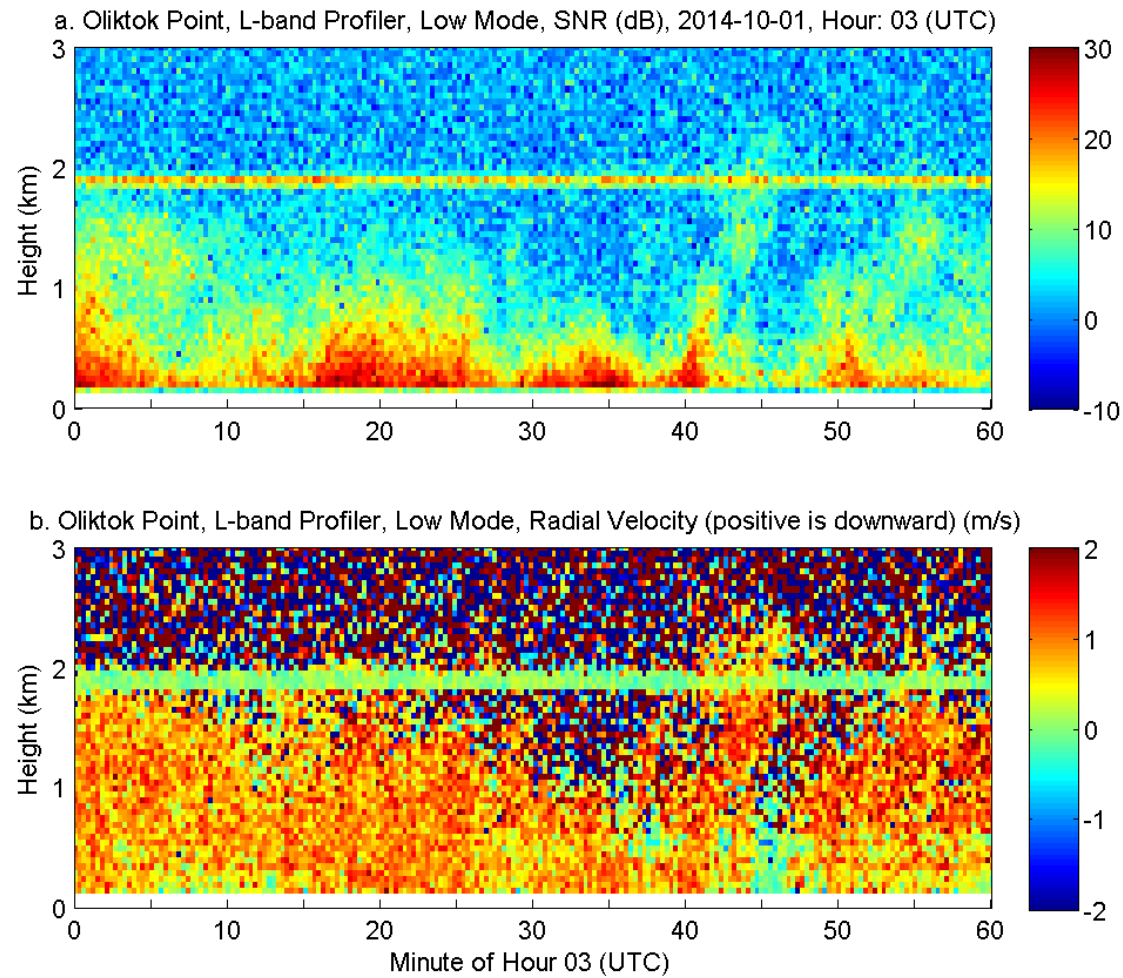




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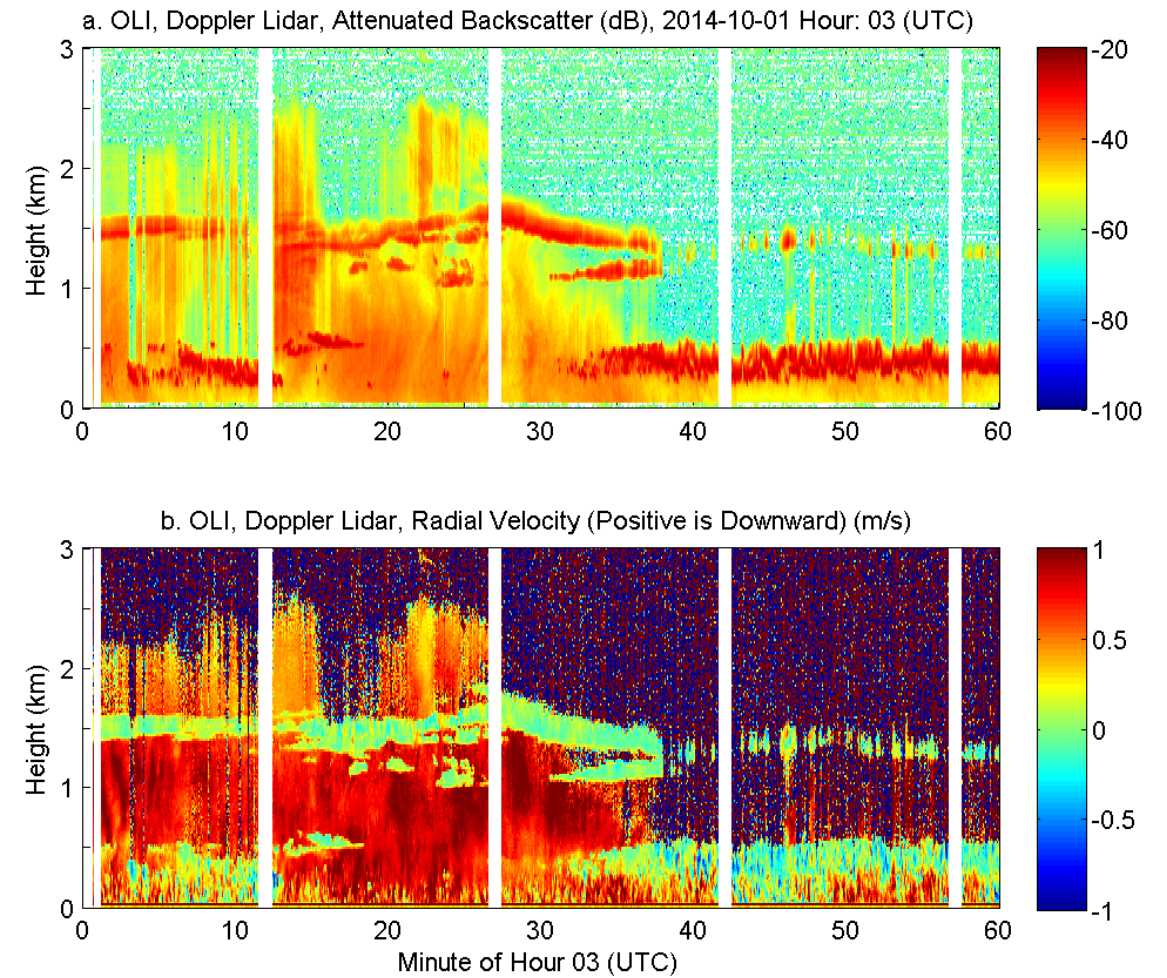
## Wind Profiler Low Mode

Low Mode - first gate: 125 m (center)



## Doppler Lidar

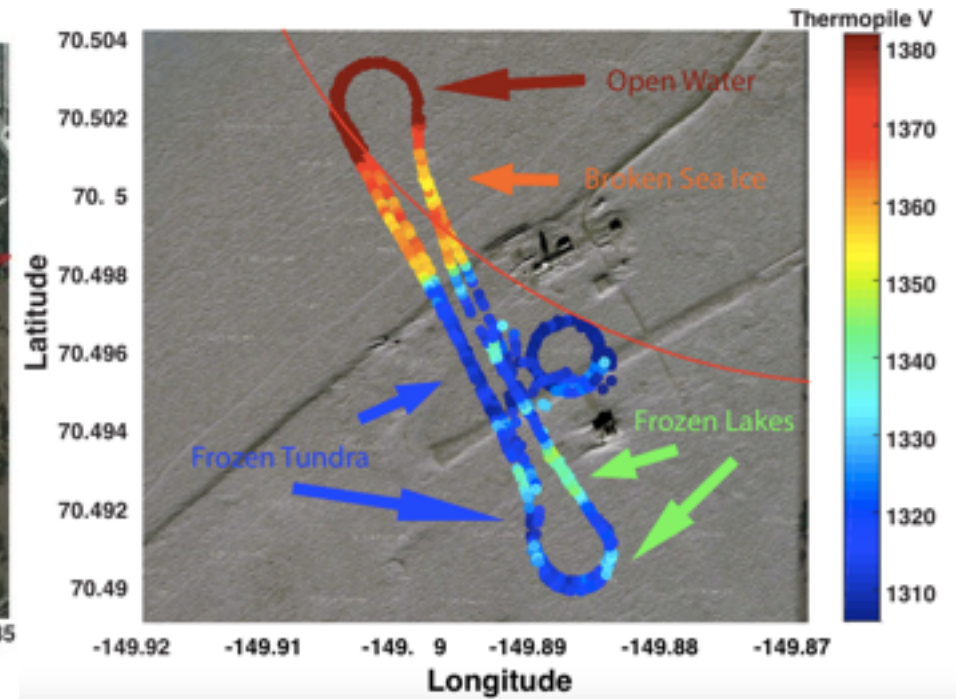
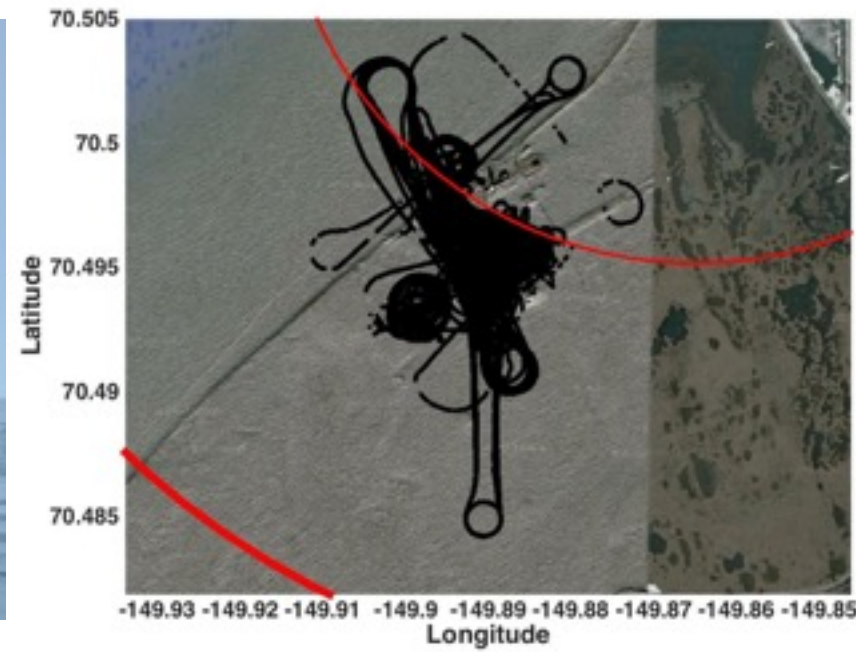
first gate: 18 m (center)



01-October-2014 Hour 03 (UTC)

# Recent and Upcoming Activities

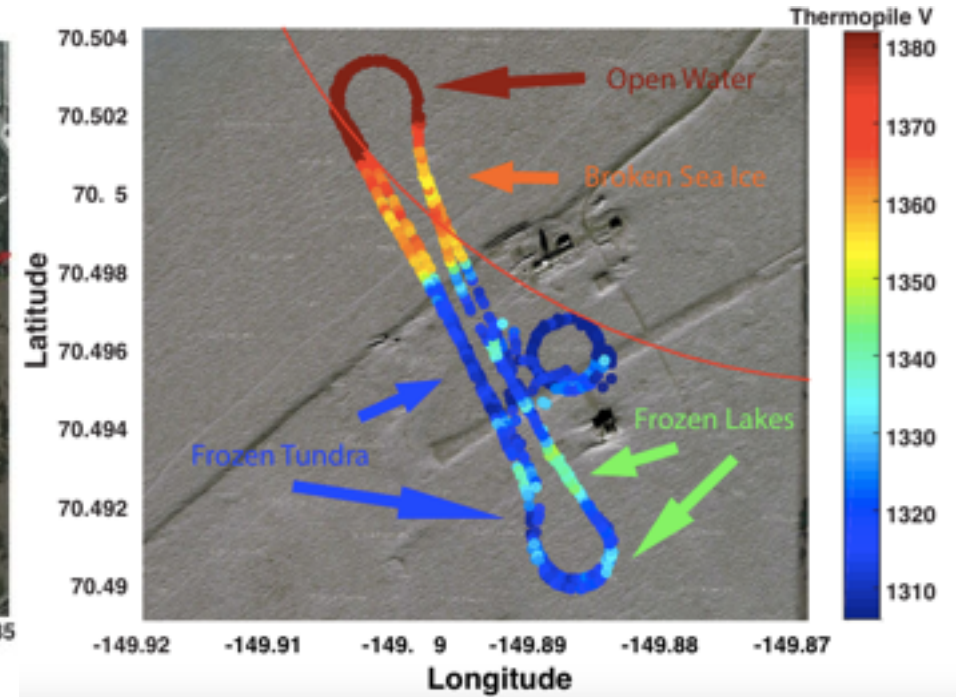
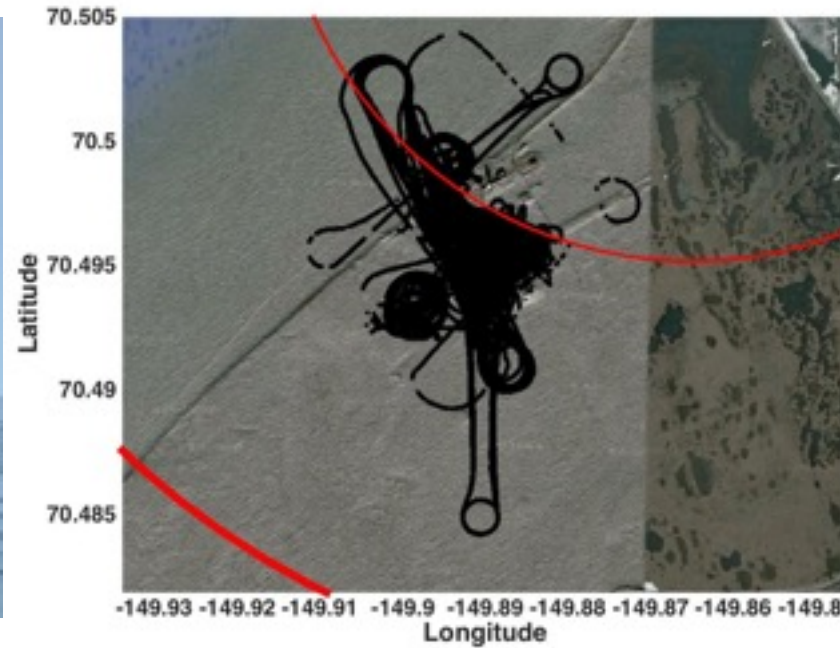
## Coordinated Observations of the Arctic Lower Atmosphere (COALA)





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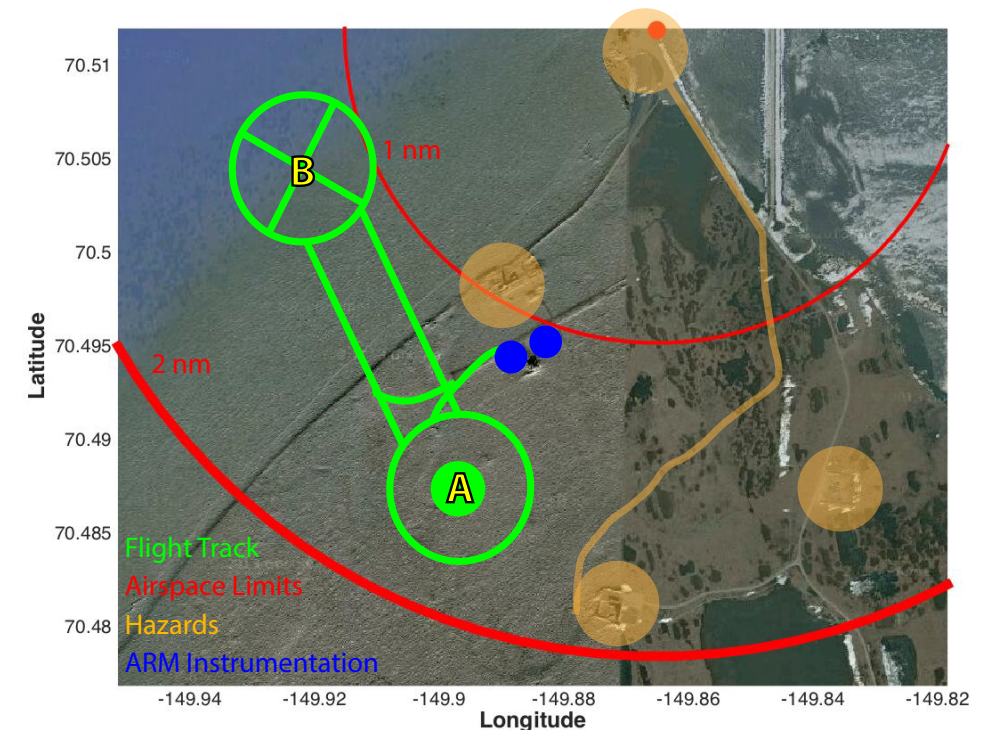
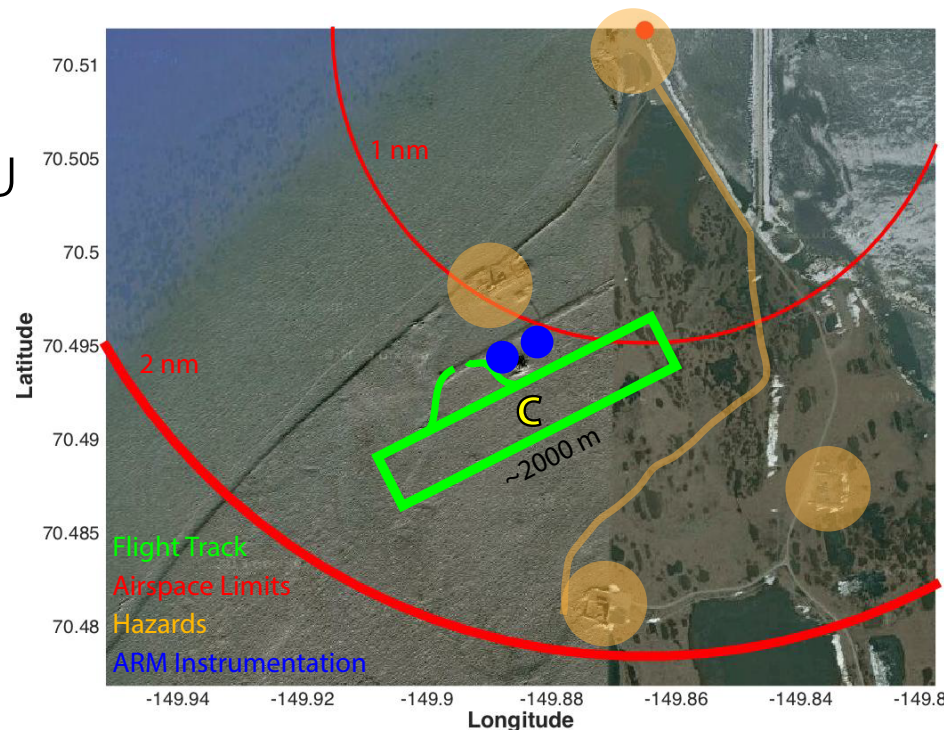
## Evaluation of Routine Atmospheric Sounding Measurements using Unmanned Systems (ERASMUS)

### Phase I

- CU Pilatus aircraft, carrying PNNL, NOAA, CU and NCAR-owned instruments
- Dates: 4/6-4/20

### Phase II

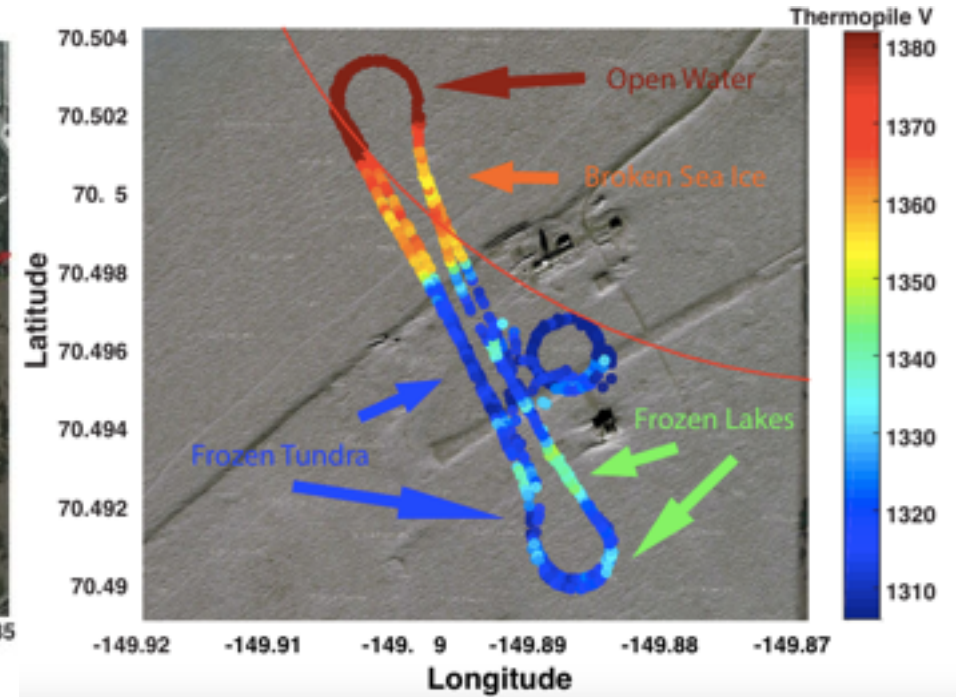
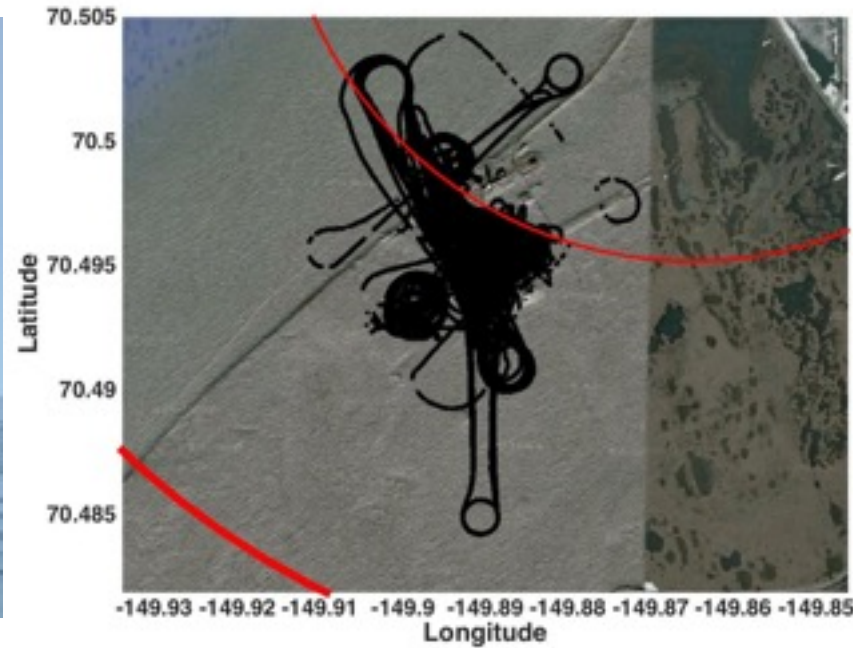
- DOE DataHawk2 aircraft
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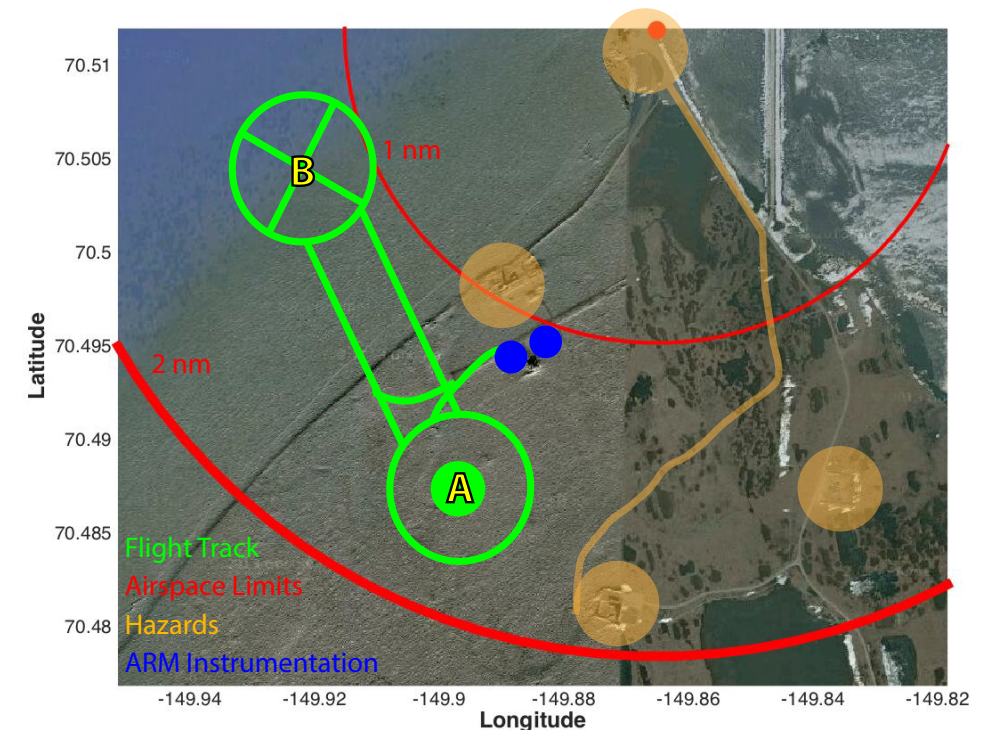
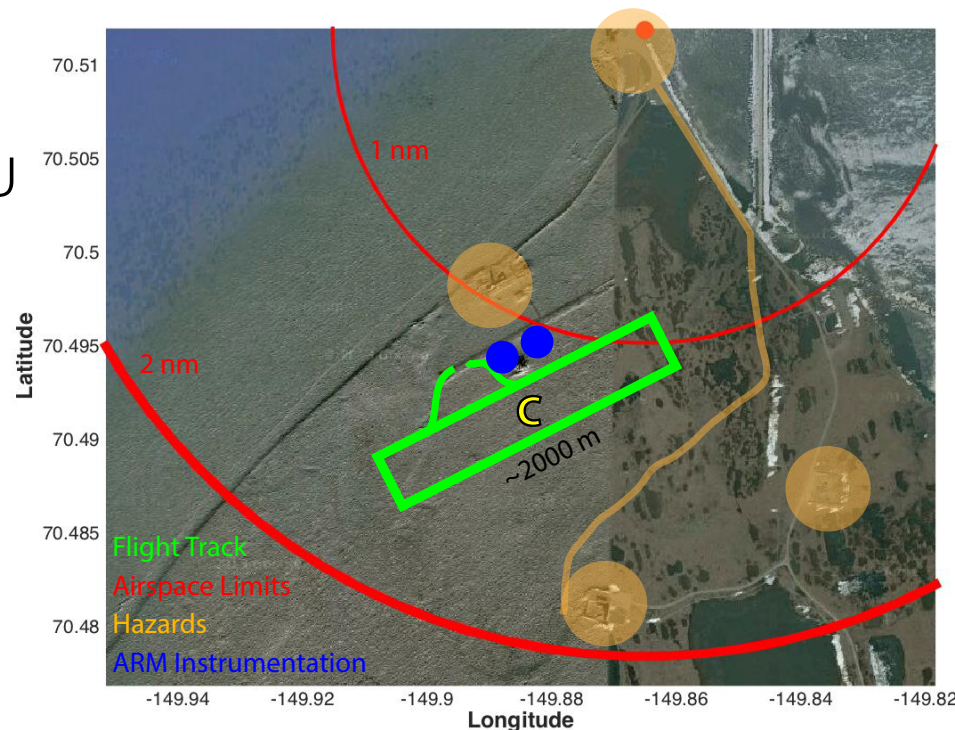
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Poster 119 (de Boer)



# Recent and Upcoming Activities

## Radar Calibration, Grooming, and Alignment (CGA) Activity



May-June 2015

Characterization and calibration of radar systems at Oliktok

Led by Ed Luke, Hans Verlinde, Eugene Clothiaux, Nitin Bharadwaj, Pavlos Koliass

Oliktok Point Science Team (Matrosov, Williams, Shupe) providing input on scanning pattern ideas

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## ARM Airborne Carbon Measurements (ACME-V)

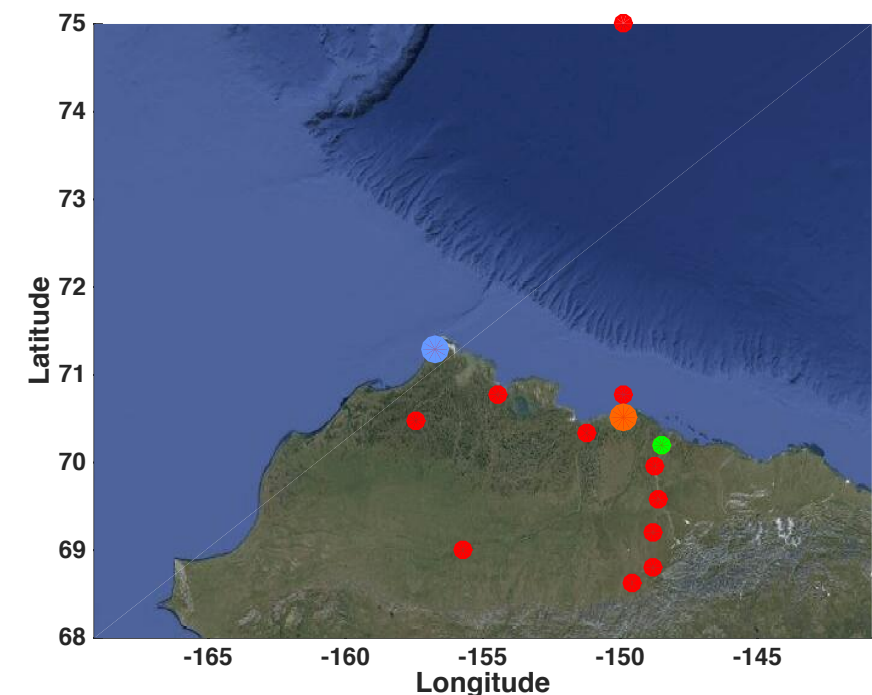
June-September 2015

Led by Sebastien Biraud

One flight every 3-4 days

Comprehensive trace gas, cloud microphysics and aerosol measurements

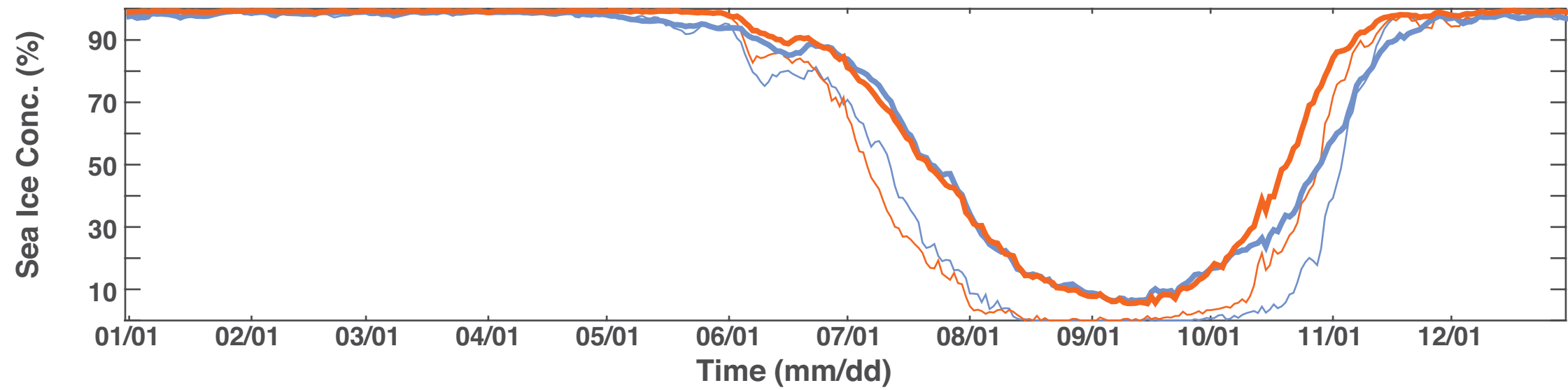
Profiles at Barrow and Oliktok Point





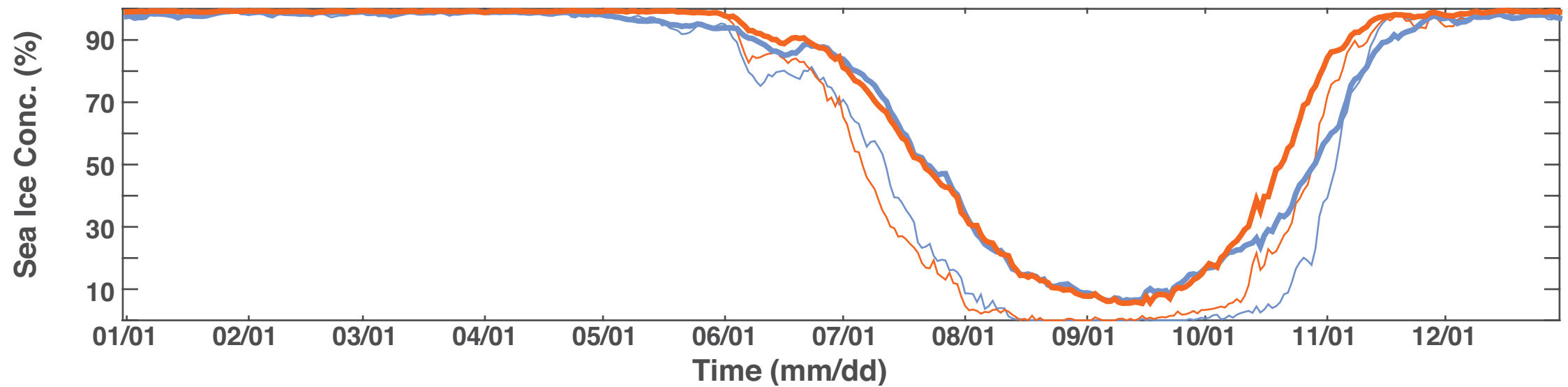
# Integration With Outside Datasets

NOAA/NSIDC CDR Passive Microwave Sea Ice Concentration

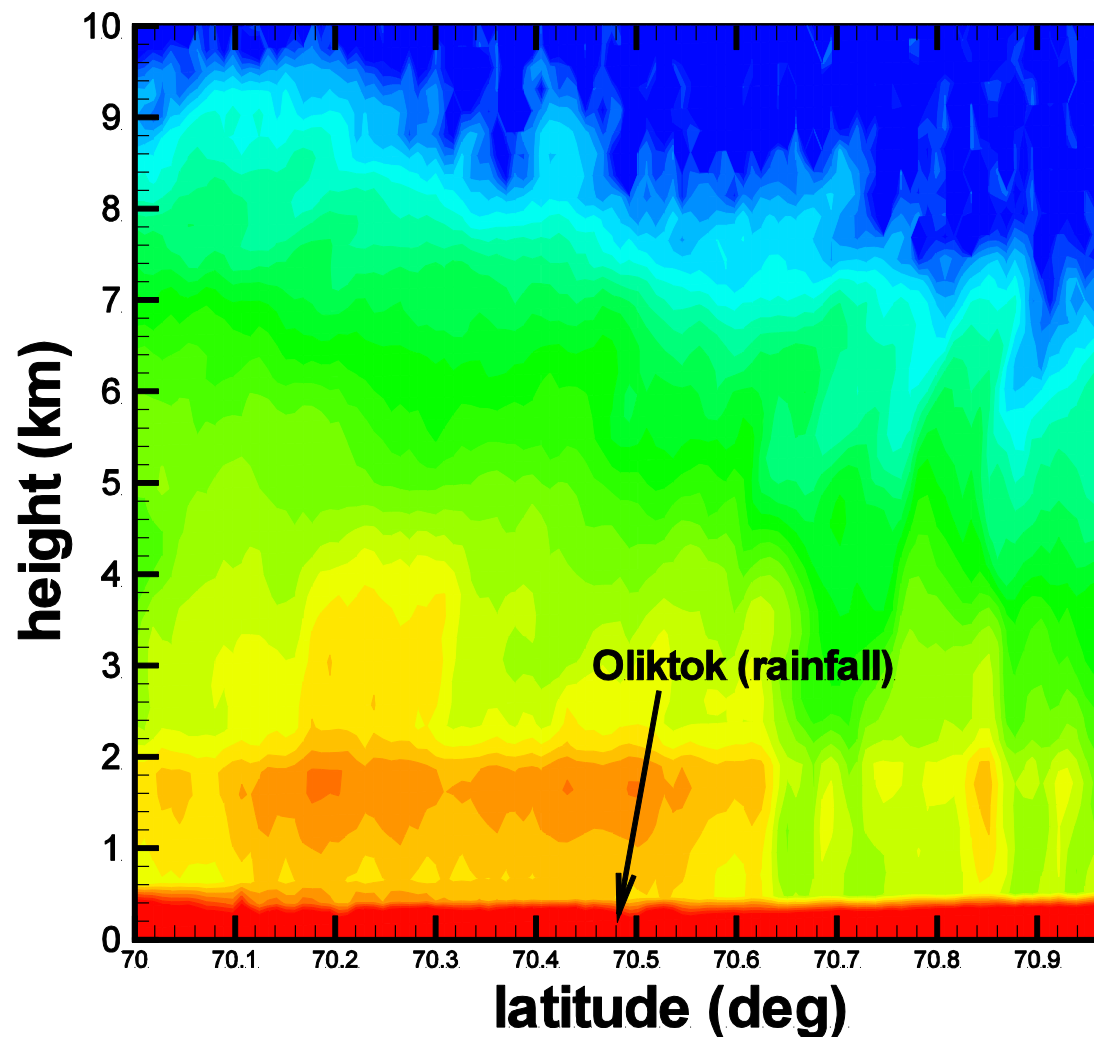


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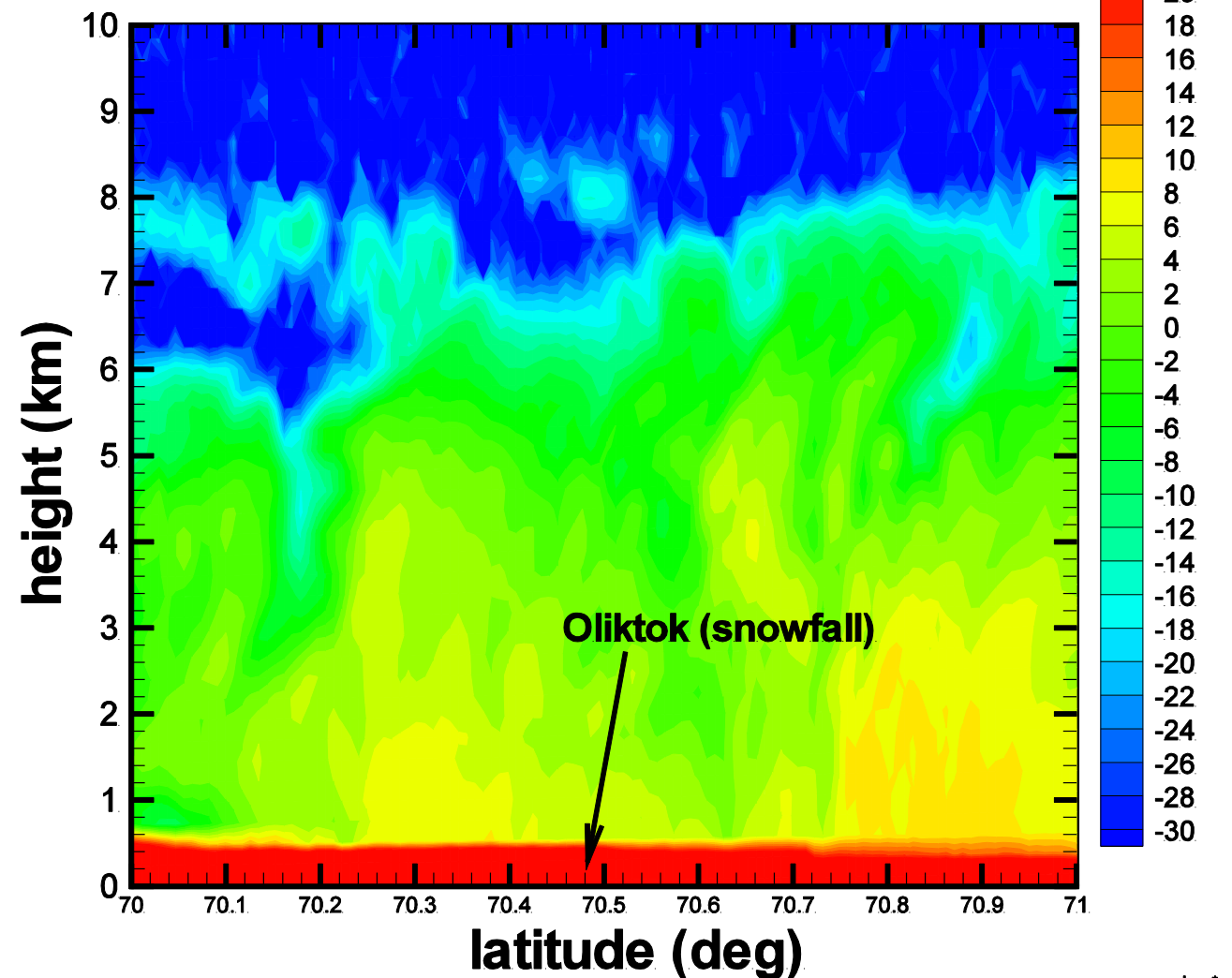
NOAA/NSIDC CDR Passive Microwave Sea Ice Concentration



CloudSat reflectivity cross section (1 June 2014 1321 UTC)



CloudSat reflectivity cross section (21 September 2014 1321 UTC)





# Integration With Outside Datasets



## IASOA Working Groups

Net Radiation

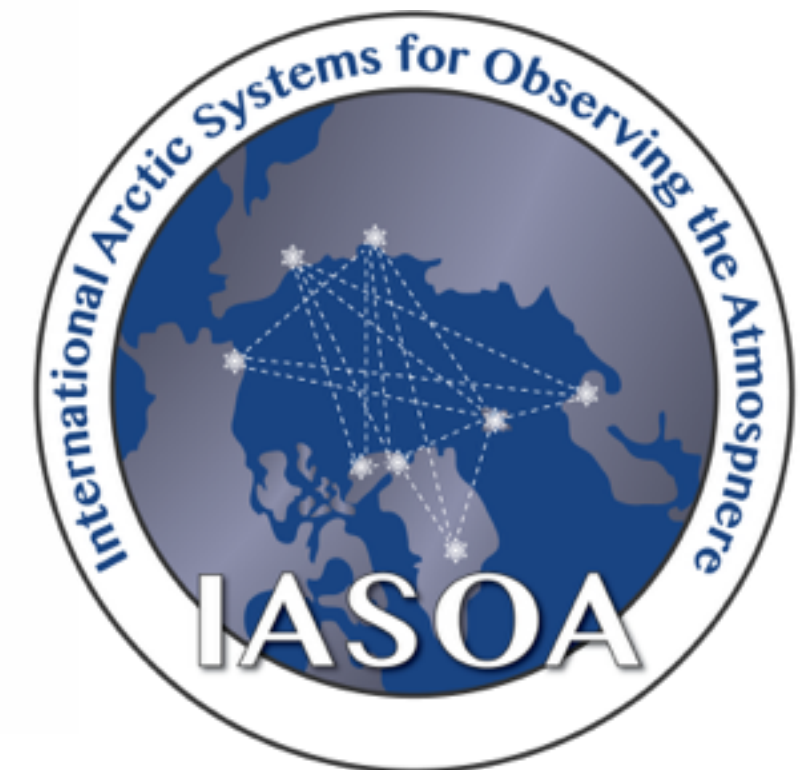
Aerosols

Atmosphere-Surface Exchanges

Regional Predictions

Methane, Ozone and other Trace Gasses

Clouds



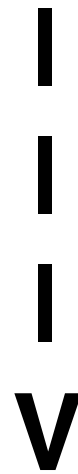


# Summary

- The AMF3 at Oliktok Point offers exciting new opportunities for Arctic science
- Site instrumentation is generally installed, though some key pieces are still missing and operational challenges exist
- Main areas of focus for the Oliktok Point site science team include:
  - Characterization of cloud properties at Oliktok Point
  - Improved understanding of high latitude precipitation, including retrieval of habit and precipitation rate
  - Characterization of aerosol properties at Oliktok Point
  - Understanding Arctic aerosol-cloud interactions
  - Understanding transitions between radiatively clear and cloudy states in the Arctic
- Early progress includes:
  - Investigation of the synoptic scale environment at Oliktok Point and comparison to that at Barrow
  - An initial look at Barrow aerosol measurements in preparation for comparison with Oliktok Point once the AOS comes online
  - Initial development of cloud characterization techniques using multiple vertically pointing sensors
- Upcoming Events include UAS campaigns, radar CGA activity and the ACME-V airborne campaign
- We are working to integrate existing Oliktok Point measurements with information from other sources (e.g. satellites, reanalyses, other observatories)



# **EXTRA SLIDES**



# Site Overview

