Previous Aerial Campaigns

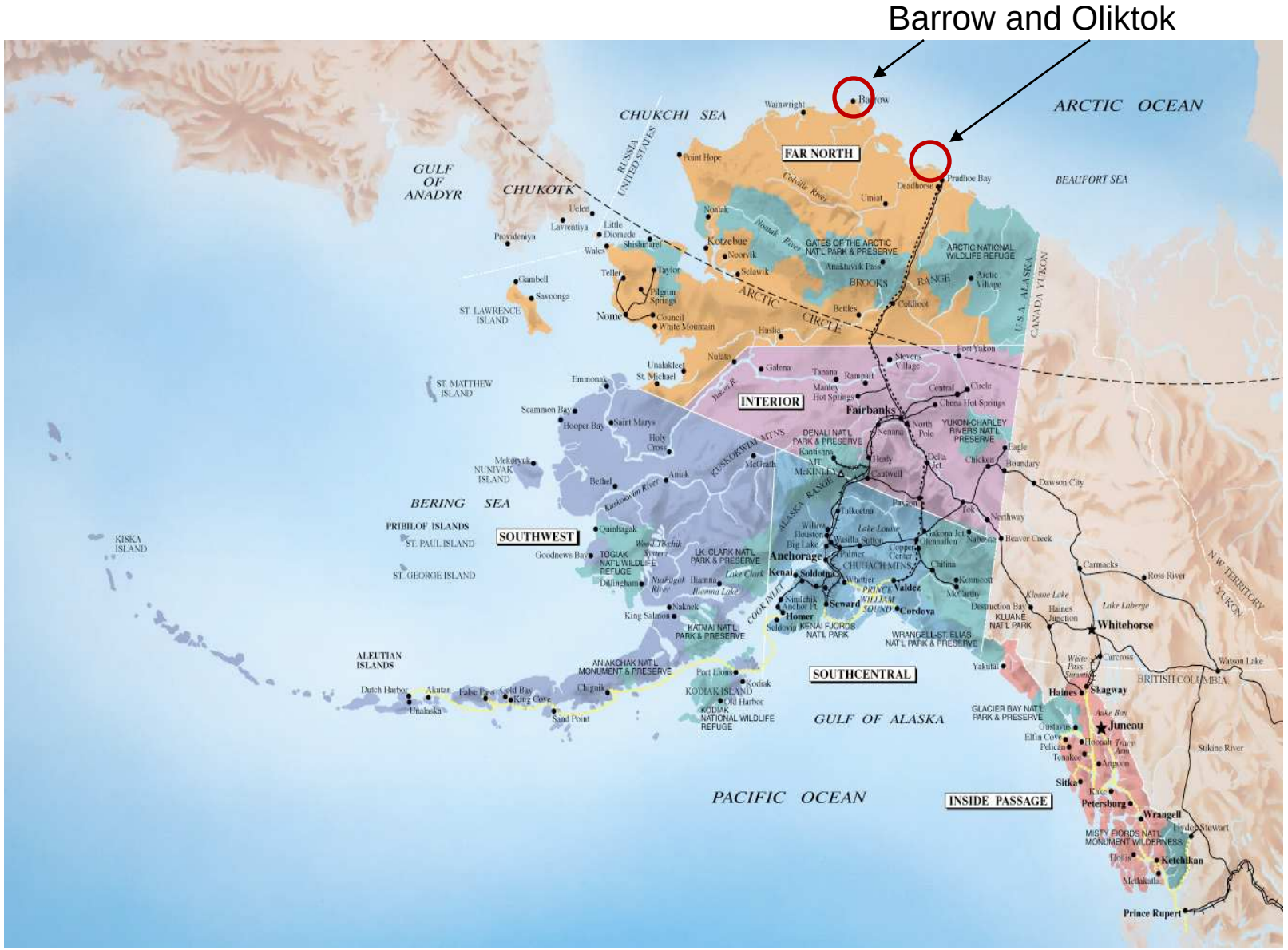
and

Selected Results and Lessons Learned From Previous IOPs

AMF3/Oliktok Breakout Session, ARM Science Team, March 2013

Scott Richardson

ARM Climate Research Facilities in Alaska



Oliktok Point, Alaska

We are pursuing establishment of a designated DOE User Facility at Oliktok Point

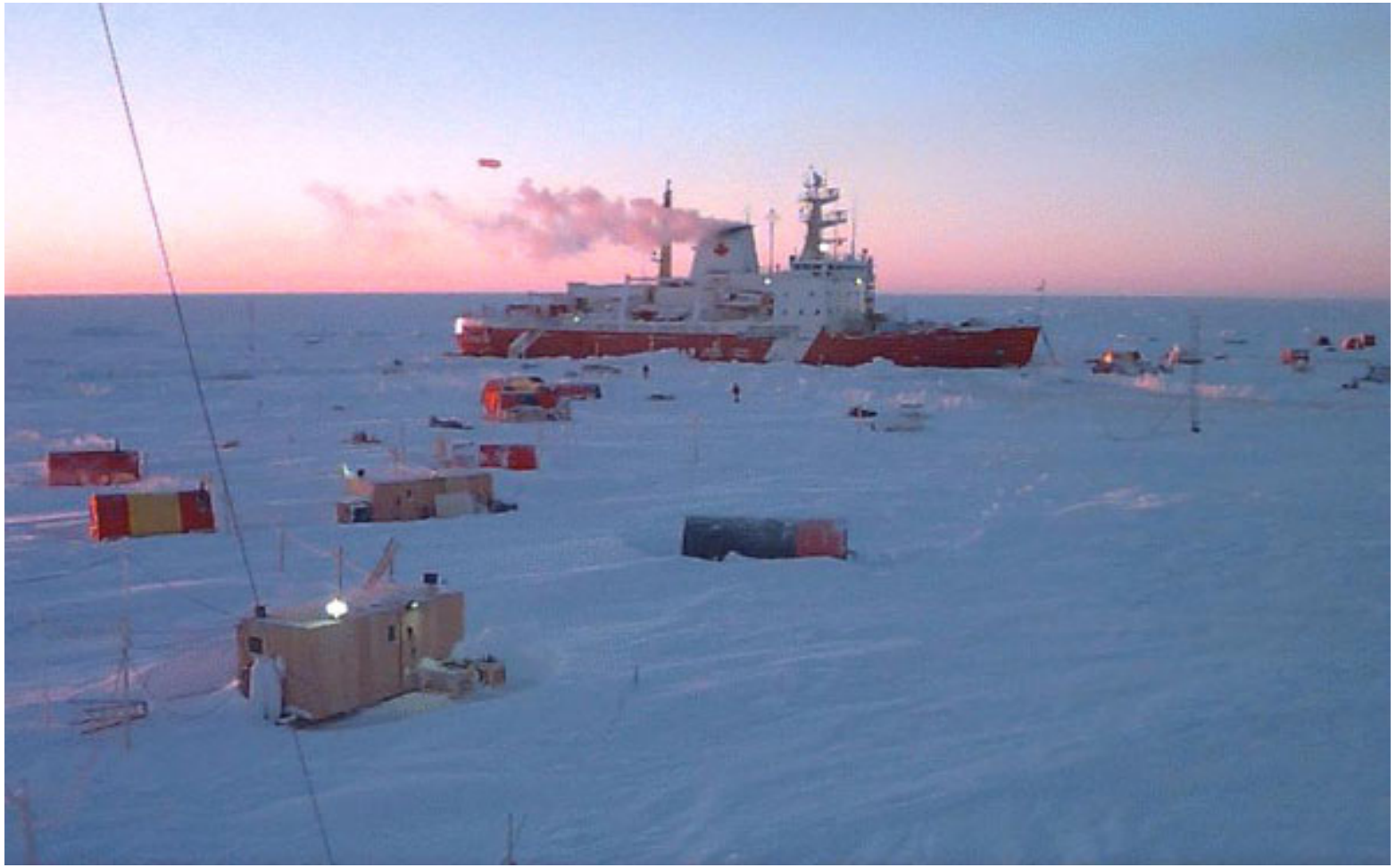
Oliktok Point Alaska

USAF Oliktok Point Long Range Radar Station: Sandia has a permit from the USAF for use of selected facilities at Oliktok Point, just as Sandia has a permit for use of selected areas on Kirtland AFB; Oliktok is one of several old Distant Early Warning (DEW Line) radar stations that are still active.

SHEBA
(Surface Heat Budget of the Arctic Ocean)

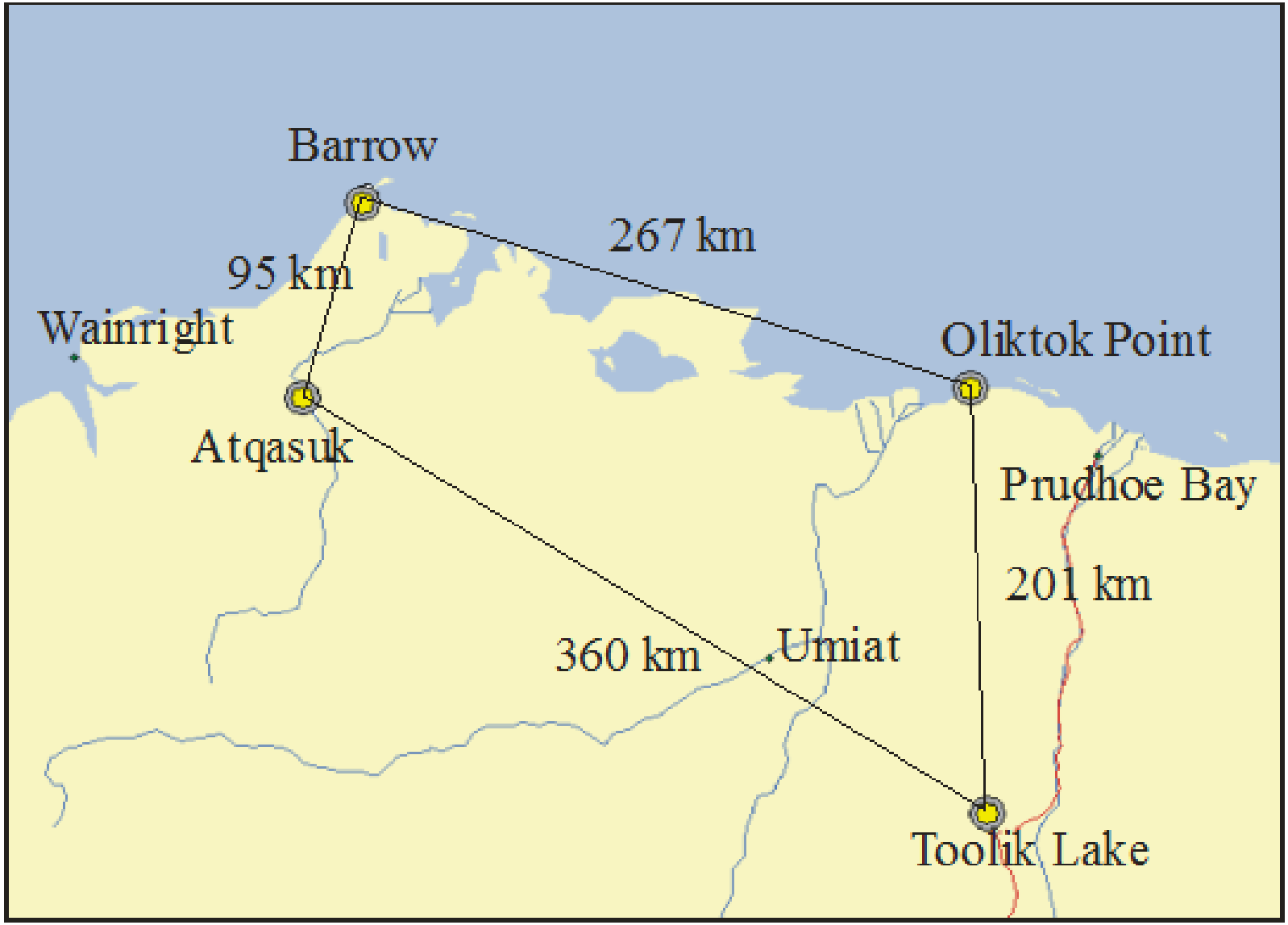
- 1997-98
- Main platform: **Surface inst., aircraft**
- Initial arctic campaign
- ARM – Surface based remote sensing
- NSF – C130
- Lesson learned
  - **Prevalence of mixed phase clouds**

SHEBA Campaign, Ice Breaker and Ice Camp



- Beaufort Sea ~ 75 N, 145 W
- The Des Groseilliers moored to a large floe and drifted with the pack ice until October 1998.
- This was the principal research platform for the SHEBA field observations.
- The ship and measurement sites (ARM instruments included) drifted with the pack ice from September 1997 to October 1998

MPACE
(Mixed-Phase Arctic Cloud Experiment)

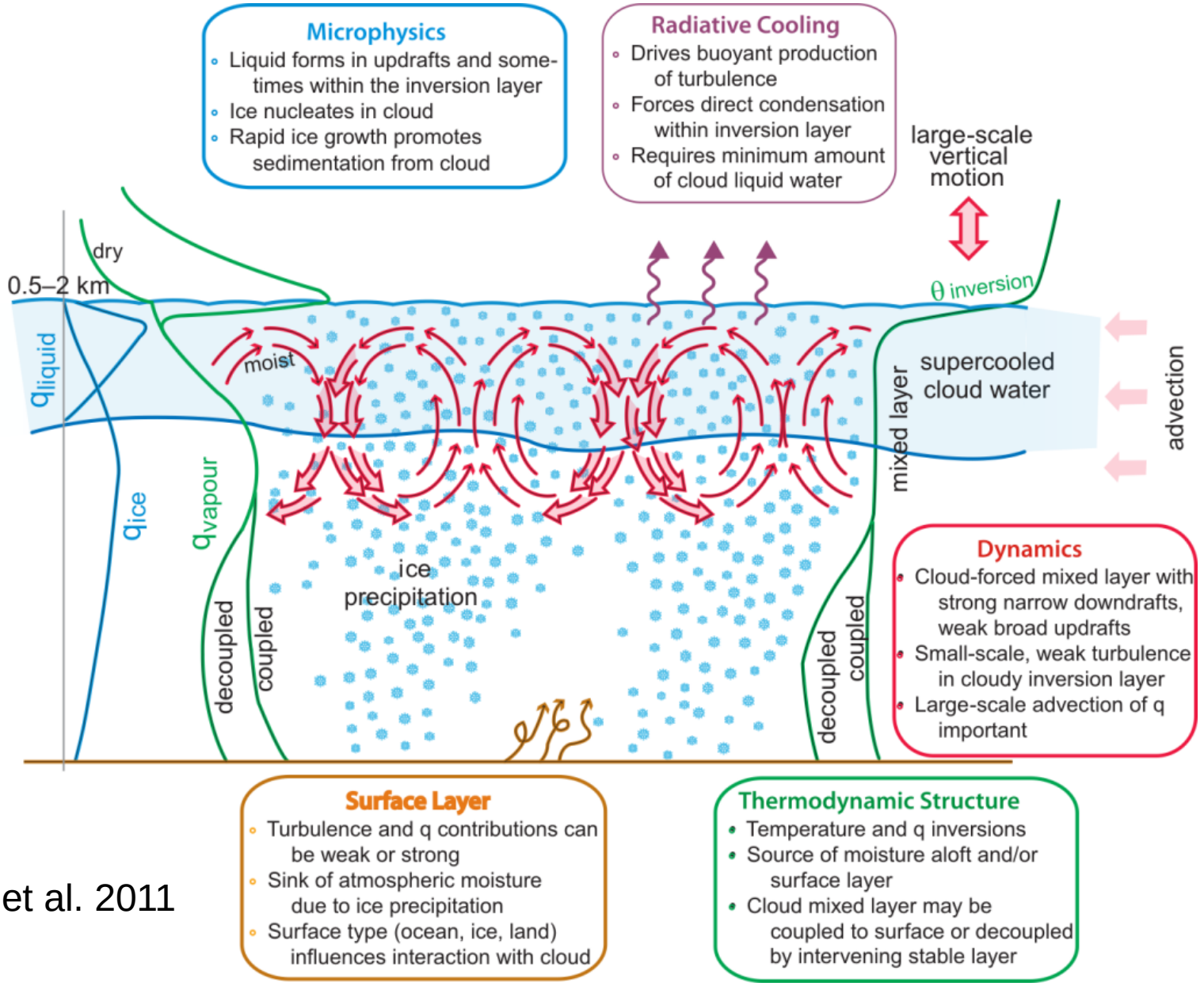


ISDAC

(Indirect and Semi-Direct Aerosol Campaign)

- Spring 2008
- Main platform: **Aircraft** (Canadian NRC-Convair)
- Follow-up to MPACE in different aerosol environments
- Together with MPACE, gained a better understanding of single layer, surface-forced boundary layer clouds (Morrison et al.)

Conceptual Model: Single layer cloud



Morrison et al. 2011

ALTOS
(Arctic Lower Troposphere Observed Structure)

- Fall/winter 2010
- Main Platform: **Tether Balloon System**
- Attempt to get statistical representation of in-cloud processes
  - Examine (attempt to separate) microphysics and dynamics
- Moved away from aircraft due to icing issues
- The need remains

ALTOS – Lesson's learned

- Difficulty of in cloud measurements in icing environments
  - Tethered system preferred
  - Characterize environment
    - Complicated atmospheric structure with Brooks Range to south
- UAV option for extended measurements
  - Aircraft icing always problematic - avoid
    - Contingency plan to get out/through icing
  - Or if in cloud is required
    - Inexpensive aircraft
    - Build into the management plan to anticipate losses

Up Next: AMF3 Deployment

END

MPACE Flight Domain

Tethered Balloon Operations at Oliktok

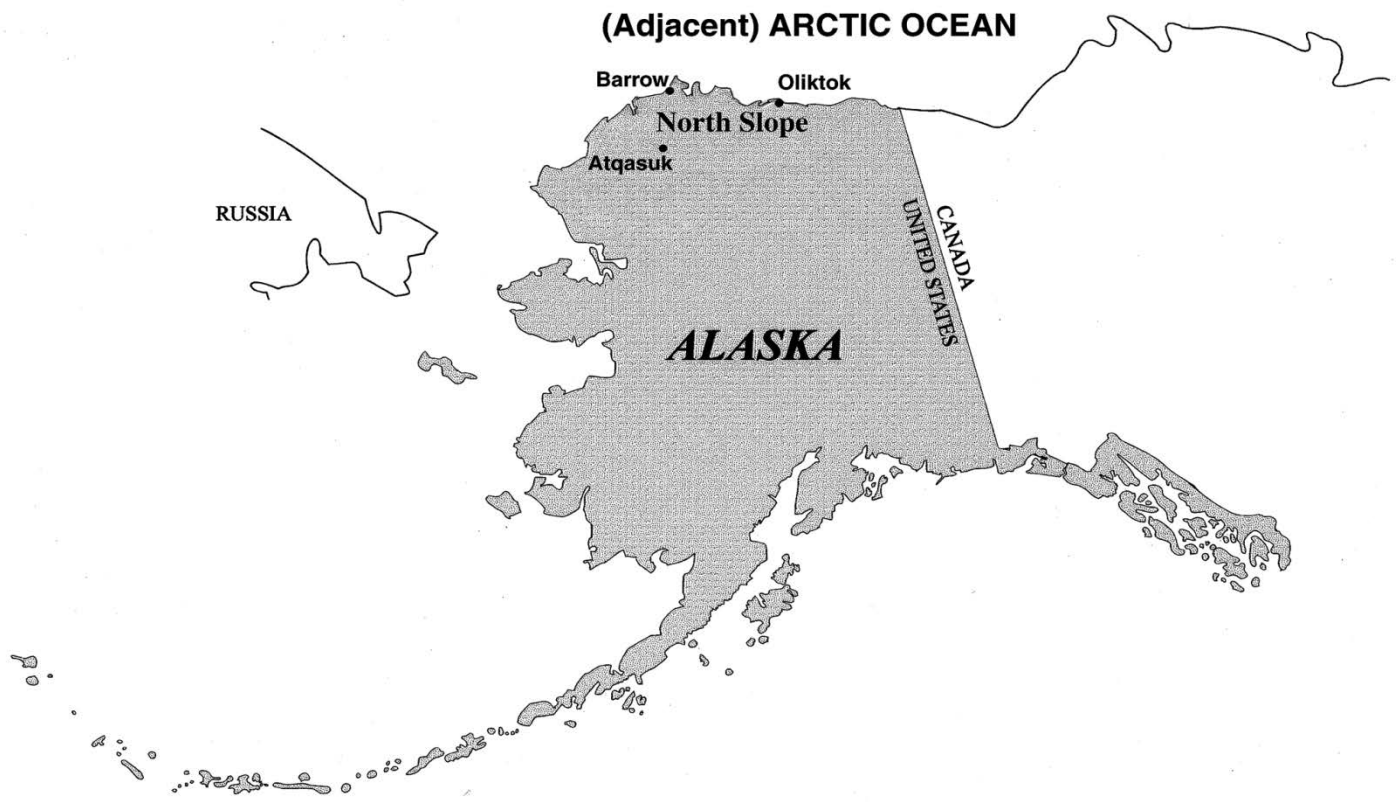
Flying an instrumented tethered balloon in cloud was the activity that required Restricted Airspace during M-PACE, and that also requires it during the upcoming ALTOS field experiment. Restricted Airspace also makes flying unmanned aircraft much easier under FAA rules.

Categories of Instrumentation at Barrow

-Surface Meteorological Sensors
-Wind, Temperature and Humidity Profilers
-Cloud Observation Instrumentation
-Downwelling Radiation Sensors
-Upwelling Radiation Sensors
-Aerosol Instrumentation
-Gas Instrumentation

Emphasis for the next decade:
Scanning instruments,
3D and 4D cloud profiles

Oliktok Point Arctic Research Facility (OPARF)

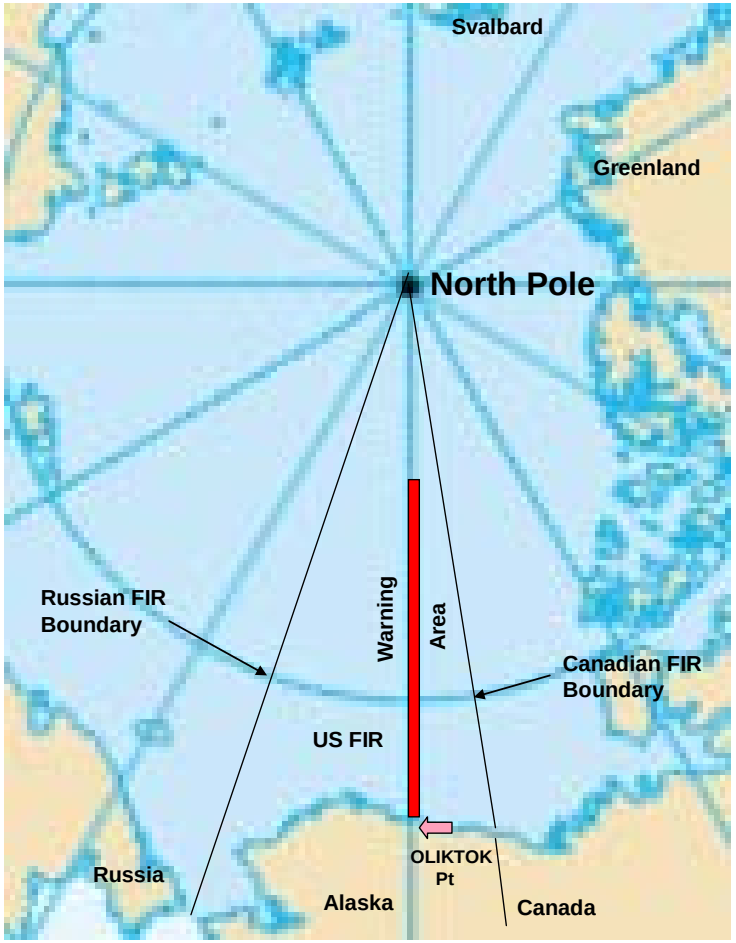


A Step Towards an Arctic Climate Observatory

DOE has requested from the FAA the creation of a Warning Area over International Waters adjoining Oliktok to accommodate unmanned aircraft flights and other research activities out over the Arctic Ocean focused on the rapid retreat of the sea ice; Warning Areas confer similar advantages to Restricted Airspace.

Proposed Warning Area (in red)

FIR = Flight Information Region (relevant country controls flight in that region)



Restricted Airspace R2204 at Oliktok Pt; originally obtained by Sandia for a field experiment at Oliktok in 2004 (Mixed-Phase Arctic Cloud Experiment [M-PACE]); It's airspace that, when activated (at DOE discretion), DOE controls; Restricted Airspace is the mechanism through which FAA keeps non-participating aircraft out of an area.