ILLINOIS STATE
WATER SURVEY
PRAIRIE RESEARCH INSTITUTE

Ontario Winter Lake-effect Systems
OWLeS

University of Illinois at Urbana-Champaign

Agenda – Monday, 24 June

8:45-9:00 Opening Comments

9:00-2:15 Scientific Objectives

- Long-Fetch Lake-effect Systems
  - Bart
  - Jeff Frame and Scott
  - Kevin
  - Karen and Josh
- Short-Fetch Lake-effect Systems
  - Dave
  - Rich, George and Todd
  - Neil and Nick
  - Alexei
- Influences of Topography – Jim and Justin
- Numerical Modeling – Bob

2:15-3:15 Flight Tracks – Bart, Jeff French, Brett

3:30-3:45 Rawinsonde Intercomparison – Junhong

3:45-4:45 Surface Facility Siting – Jim, Rich

Agenda – Tuesday, 25 June

8:30-9:30	Operational Decision-making – Dave, Bart, Jim
9:30-10:30	Operations Center - Scott
10:45-11:45	Daily Schedule and Communications – Dave, Bart, Jim
1:15-2:15	Data Collection, Availability, Management – Steve, Greg
2:15-3:15	Positions, Responsibilities, Date Scheduling – Scott, Neil
3:30-4:30	Project Safety DOWS – Karen, Josh King Air – Jeff French Sounding Sites – Rich, Dave, Scott, Jim, Neil Snow Obs – Scott, Josh
4:30-5:00	Action Items, Wrap-up

Influence of Upwind Lakes On Lake-effect Systems

Justifications

- ***Outstanding Fundamental Scientific Problem***

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Lake-effect Boundary Layers

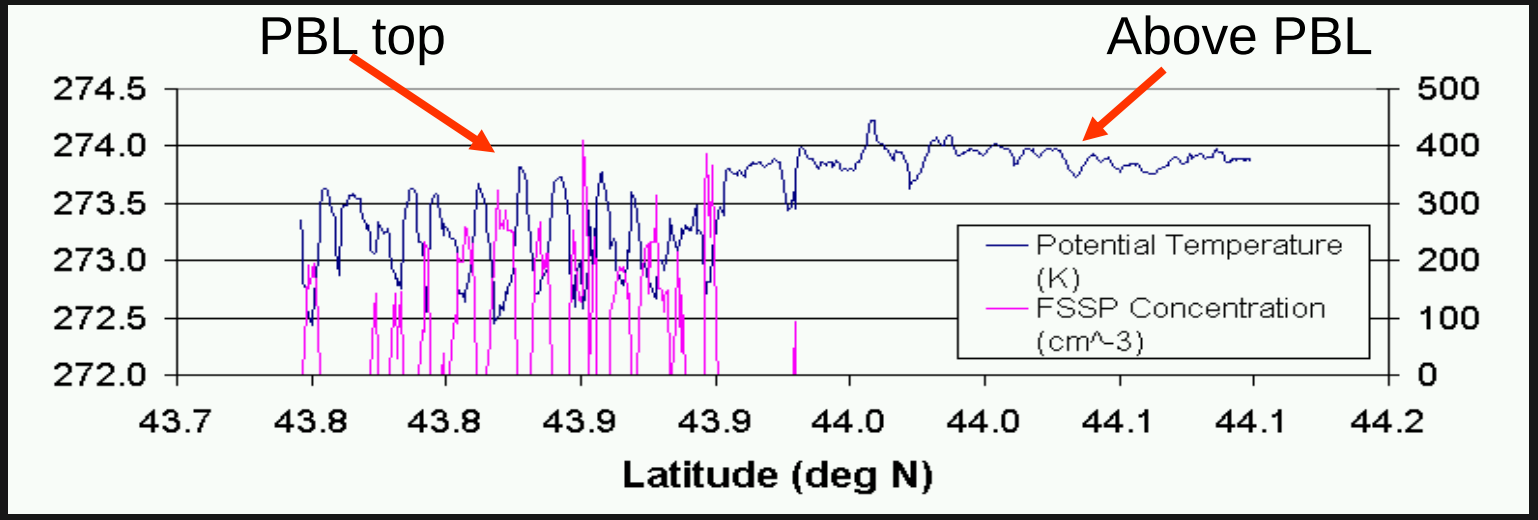
Articles Published by AMS (1 yr): 221 with PBL in abstract (≈10%)

Aircraft observations of Potential Temperature, Clouds

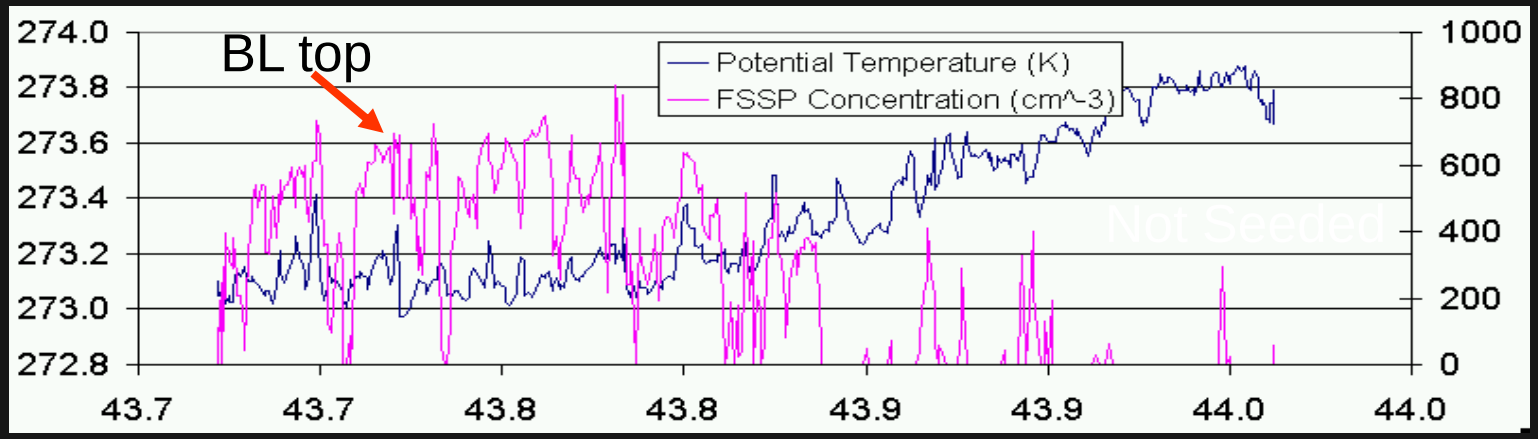
"Enhanced" Case
5 Dec 1997

Flight Leg:

AB2



EF2



Adapted from Figure 12 in Schroeder, J. J., D.A.R. Kristovich, and M. R. Hjelmfelt, 2006: Boundary layer and microphysical influences of natural cloud seeding on a lake-effect snowstorm. Mon. Wea. Rev., 134, 1842-1858.

Influence of Upwind Lakes On Lake-effect Systems

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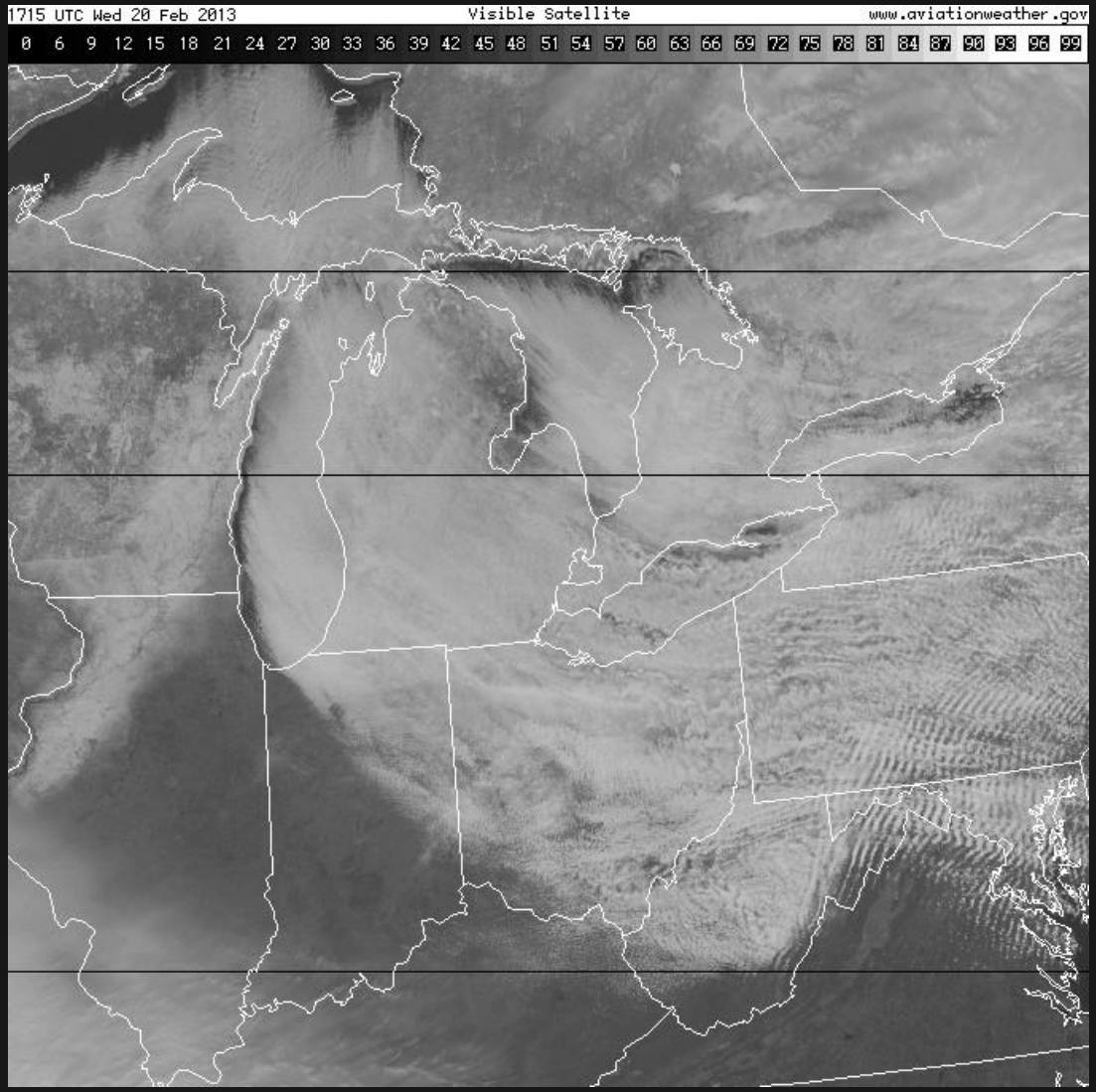
Lake-effect Snow System
Atmospheric Convective Boundary Layers



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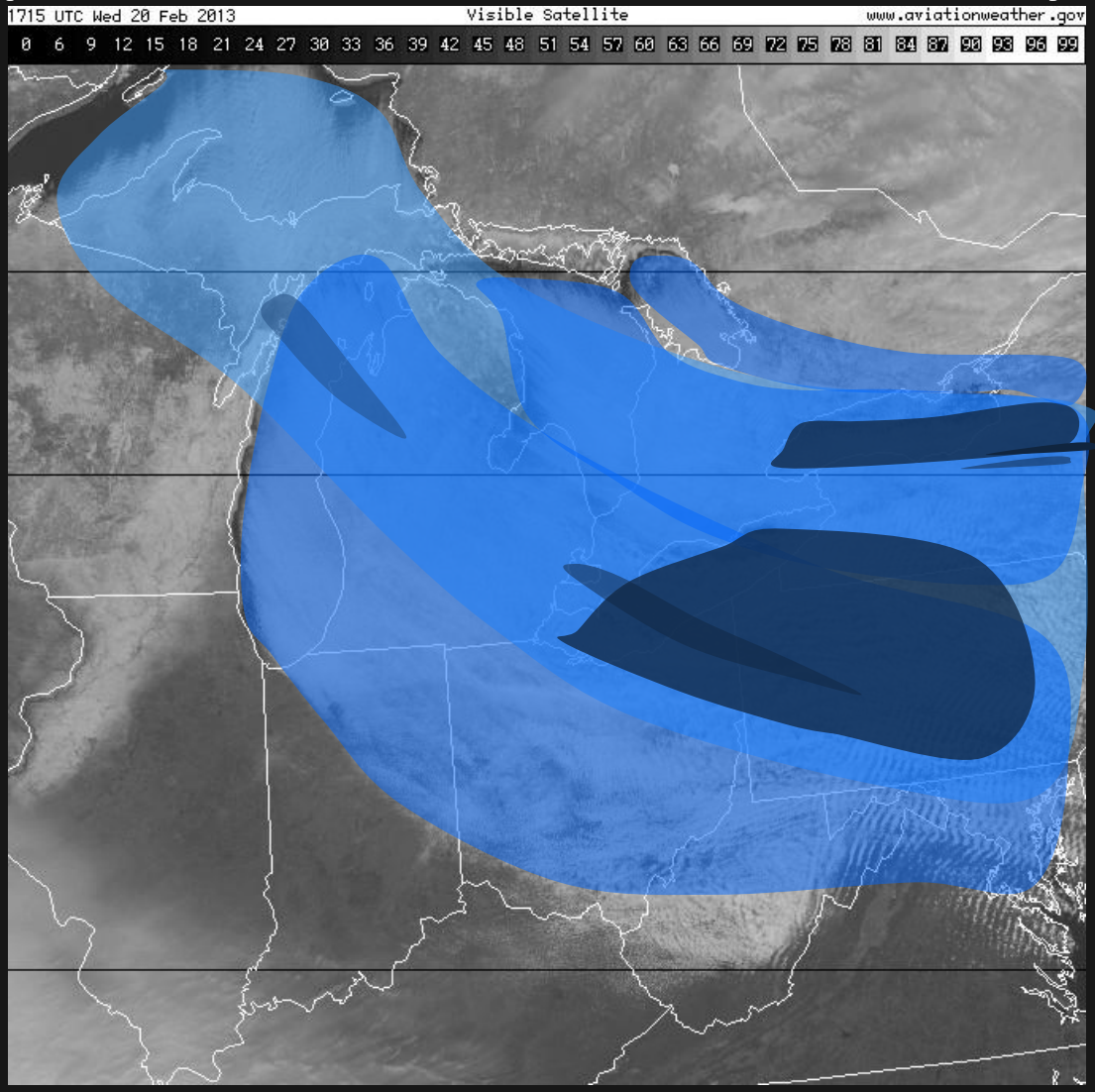
Lake-effect Snow System
Atmospheric Convective Boundary Layers



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Lake-to-Lake Lake-effect Cloud Bands

Rodriguez, Y., D.A.R. Kristovich, and M.R. Hjelmfelt, 2007: Lake-to-lake cloud bands: Frequencies and Locations. Mon. Wea. Rev., 135, 4202-4213.

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Influence of Upwind Lakes On Lake-effect Systems

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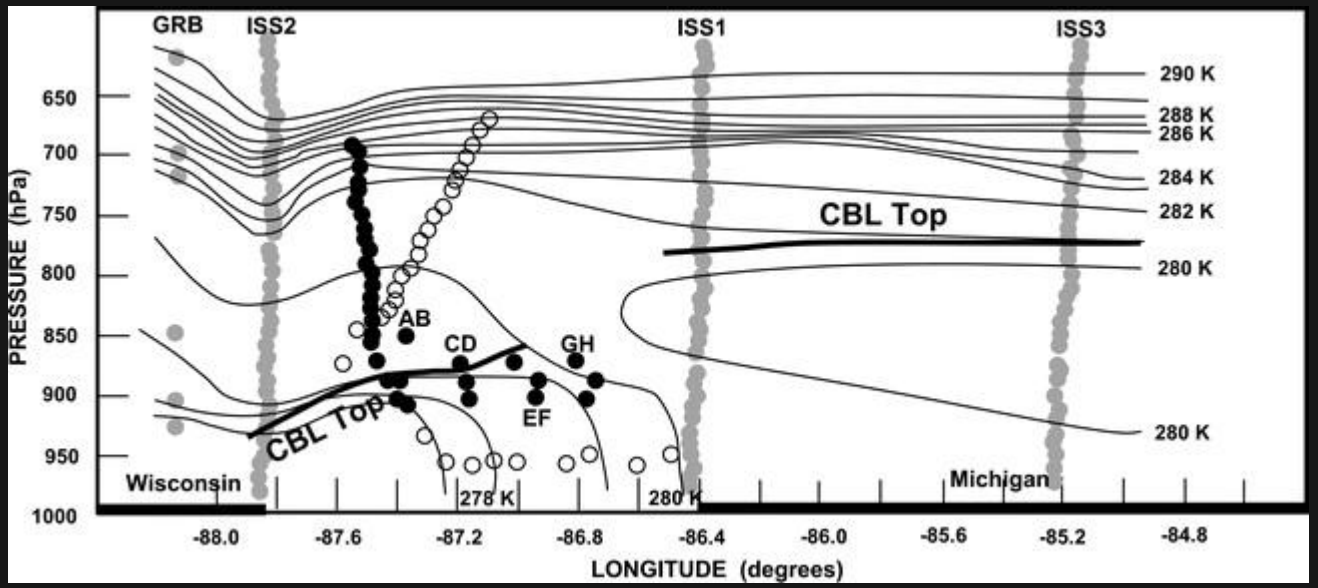
- ***Relative importance of mechanisms unknown***
  - ***Reduce upwind stability***
  - ***Retained circulations***
  - ***Natural Cloud Seeding with snow***

Spatial Evolution of Lake-effect Snow

5 Dec 1997



SLOW Growth

FAST Growth

VERY SLOW Growth

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Schroeder, J. J., D. A. R. Kristovich, M. R. Hjelmfelt, 2006: Boundary Layer and Microphysical Influences of Natural Cloud Seeding on a Lake-Effect Snowstorm. *Mon. Wea. Rev.*, **134**, 1842–1858.

North vs. South Spectra Comparison

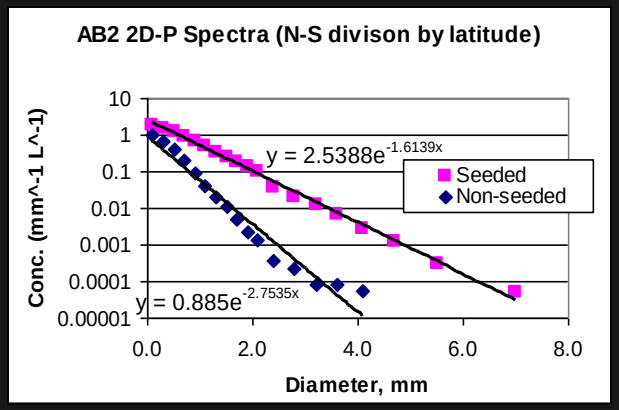
“Enhanced” Case
5 Dec 1997

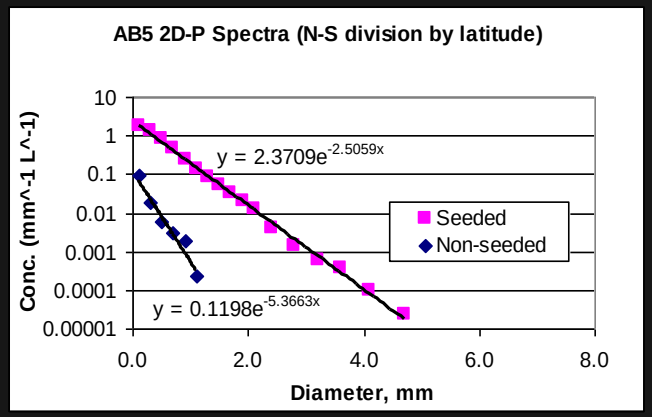
820 m

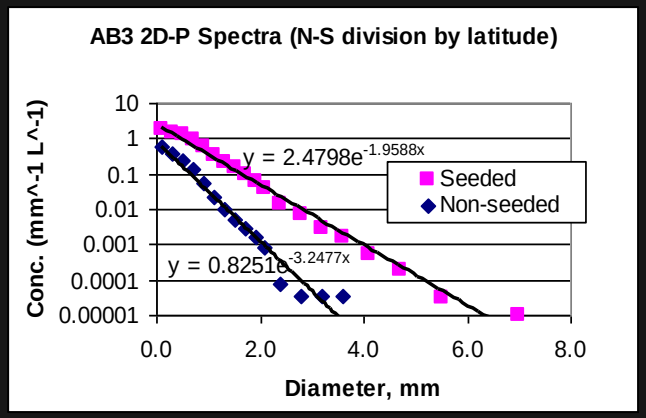
700 m

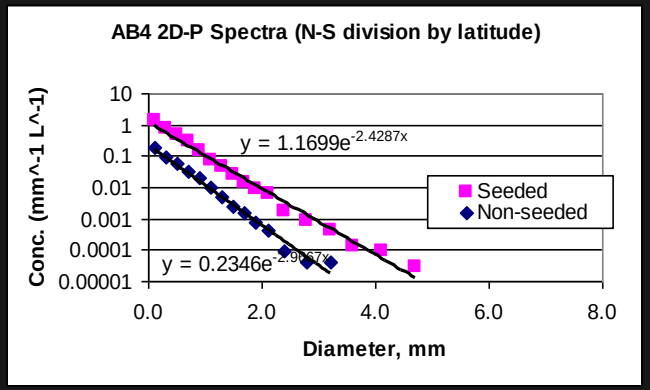
650 m

Altitude above lake









Adapted from Figure 11 in Schroeder, J. J., D.A.R. Kristovich, and M. R. Hjelmfelt, 2006: Boundary layer and microphysical influences of natural cloud seeding on a lake-effect snowstorm. Mon. Wea. Rev., 134, 1842-1858.

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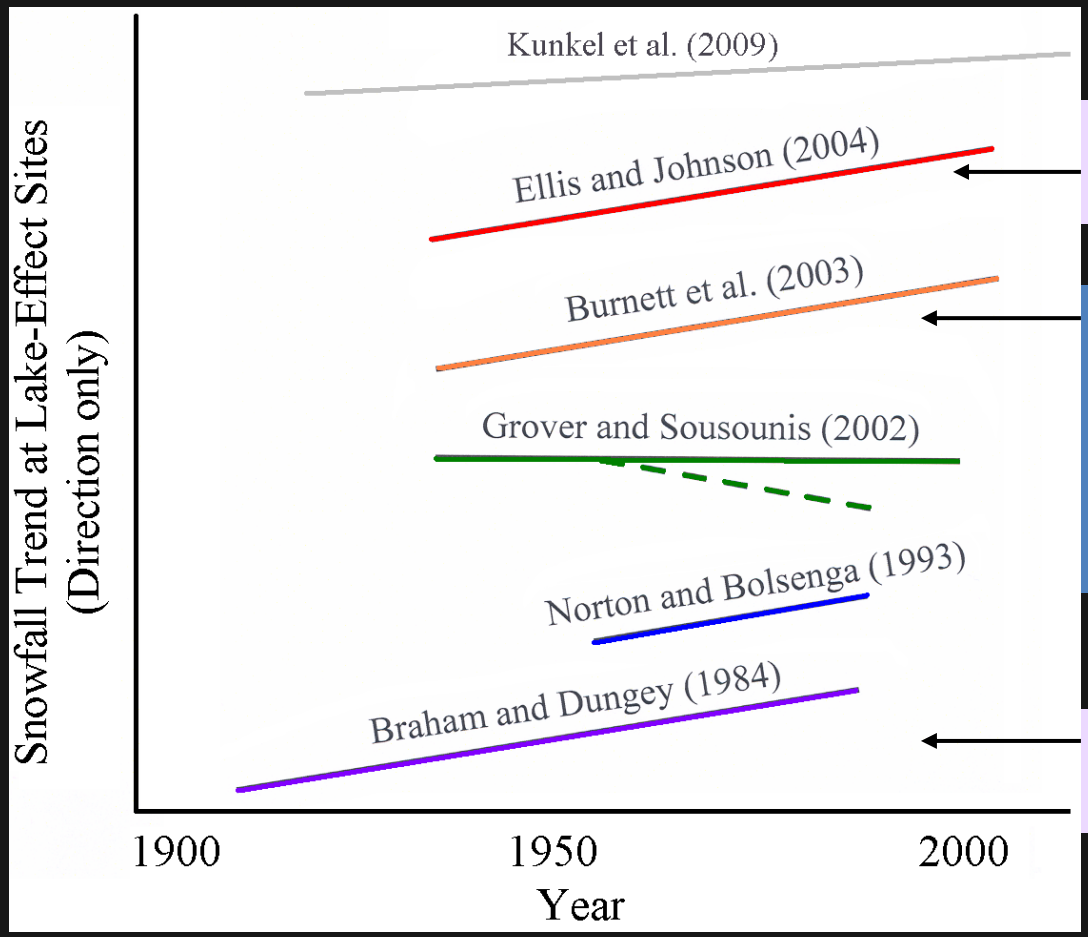
  - ***Natural Cloud Seeding with snow***
- ***Potential Climate Implications***

Lake-Effect Snowfall Trends



Decreased average air temperatures through 1980s

Increased lake surface temperatures, decreased average ice pack on eastern lakes (more heat & moisture fluxes off the lakes)

Decreased average air temperatures through 1980s

Adapted from Kristovich, D. A. R., 2009: Climate Sensitivity of Great Lakes – Generated Weather Systems. In Climatology, Variability, and Change in the Midwest, S. C. Pryor, Editor. Indiana University Press, 236-250.

Influence of Upwind Lakes On Lake-effect Systems

Outstanding Questions

- ***How do multiple internal boundary layers develop and interact as an air mass progresses over multiple mesoscale stretches of open water and intervening land?***
- ***What role does the variation in these multiple internal boundary layers have on the circulation patterns, longevity, and intensity of LeS?***
- ***How are PBL circulations and LE intensity affected by coastal transitions?***

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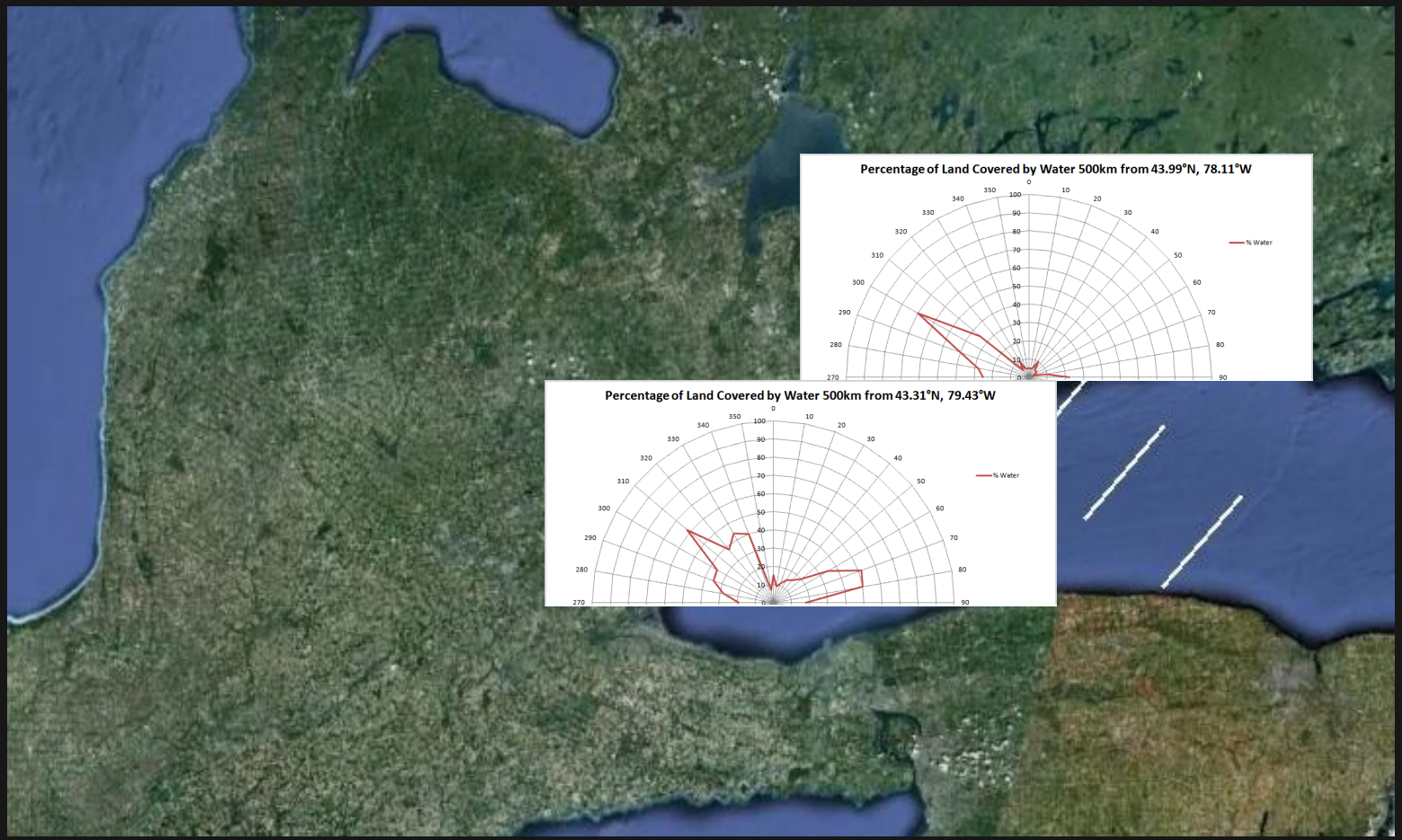

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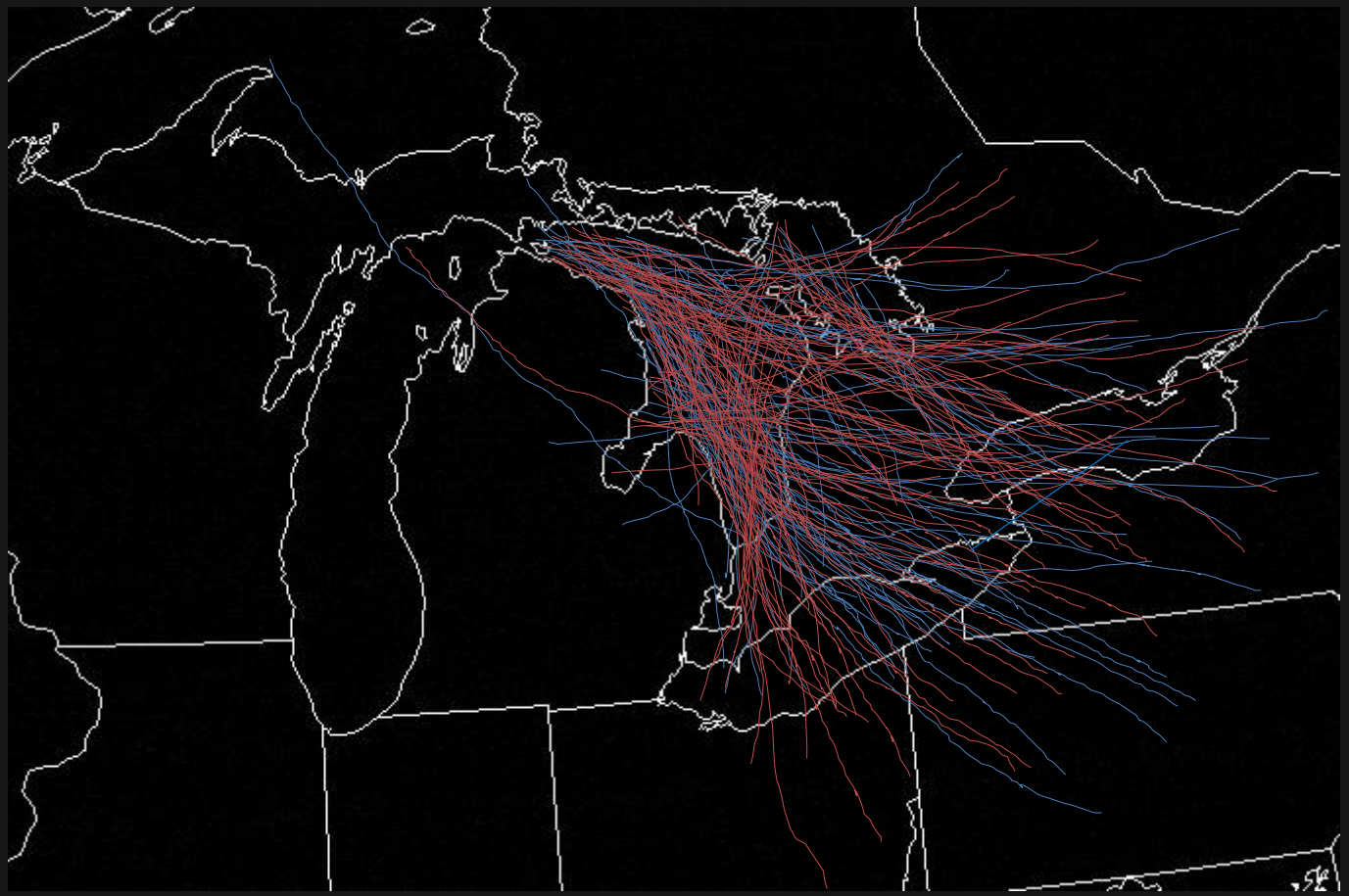
Influence of Upwind Lakes On Lake-effect Systems

2004-2013; December & January
Visible Satellite Imagery



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Influence of Upwind Lakes On Lake-effect Systems

2004-2013; December & January
Visible Satellite Imagery

Number Crossing Northern Border (yr^{-1})

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OWLeS Decision-Making

Limited Resources; Obligation to Give All Projects Opportunity to Collect Needed Data

- 75 KA flight hours (21 flights, as few as 10 IOPs)
- _____ Hours of DOW operations
- _____ Rawinsondes
- _____ MUPS
- _____ MIPS
- _____ Snow Gages

How split up among the projects?

OWLeS Decision-Making

In case of a conflict, who has the last word?

Steering Committee?

Ops Director?

Boxing Ring?

Date	Ops Director	Facilities Coordinator	Lead Forecasters
Dates 1	Ops Director 1	Facilities Coord 1	Forecaster 1
Dates 2	Ops Director 2	Facilities Coord 2	Forecaster 2
Dates 3	Ops Director 3	Facilities Coord 3	Forecaster 3

Backup Director, Coordinator, Forecaster?

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OWLeS Daily Schedule & Communications

Day 1

Evening Weather Update (if needed)

Information On Decision Available

Daily Weather Briefing

Day 2
OWLeS IOP

Weather Update

Soundings, Other Facilities

UWKA Flight

Operations Reports Due

Flight Debrief

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OWLeS Project Safety