Ontario Winter Lake-effect Systems (OWLeS)

Scientific Research Objectives

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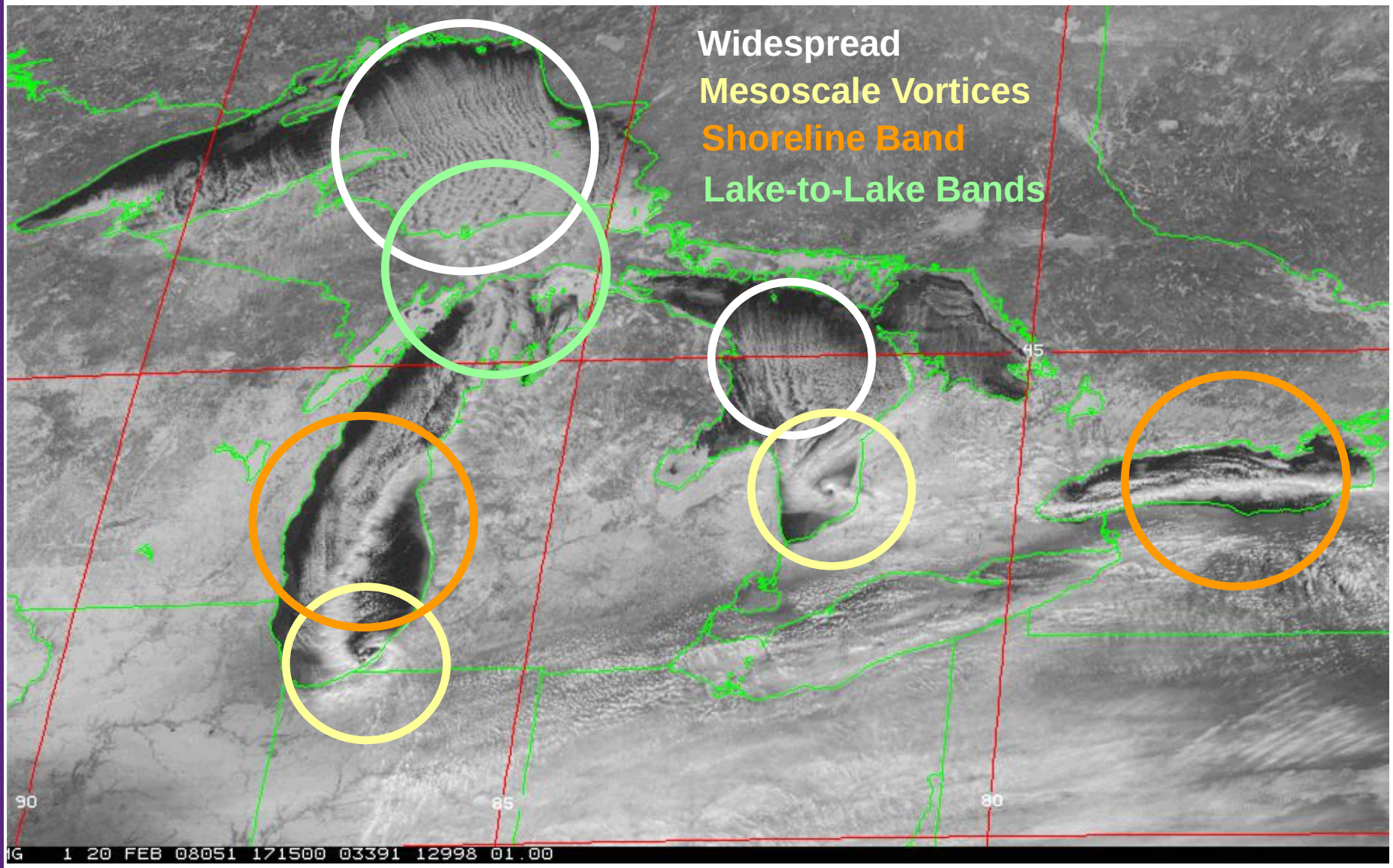
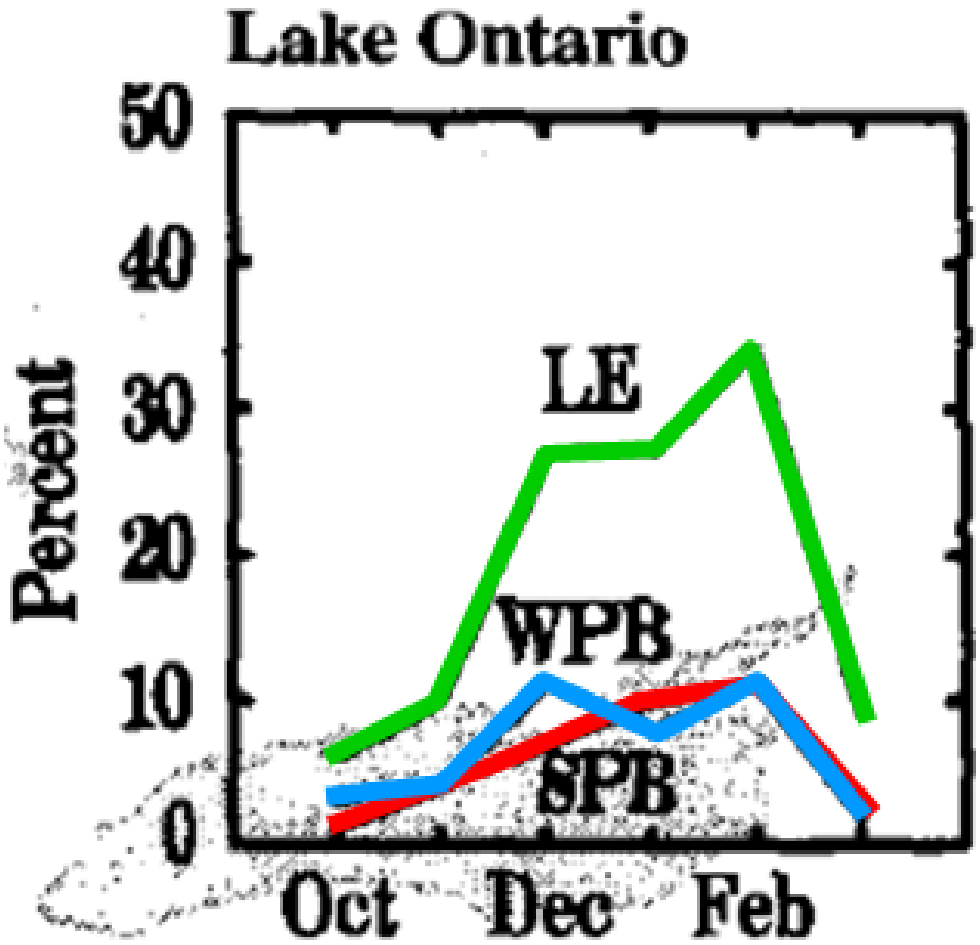
Cold Season Lake-Effect Systems – GOES 12 Visible



Lake Ontario Lake-effect Climatology

Kristovich and Steve (1995): Frequency of LE cloud bands over Lake Ontario during **five winters** (1988/89 -1993/94) using VIS satellite



Expanded Lake Ontario Lake-effect Climatology

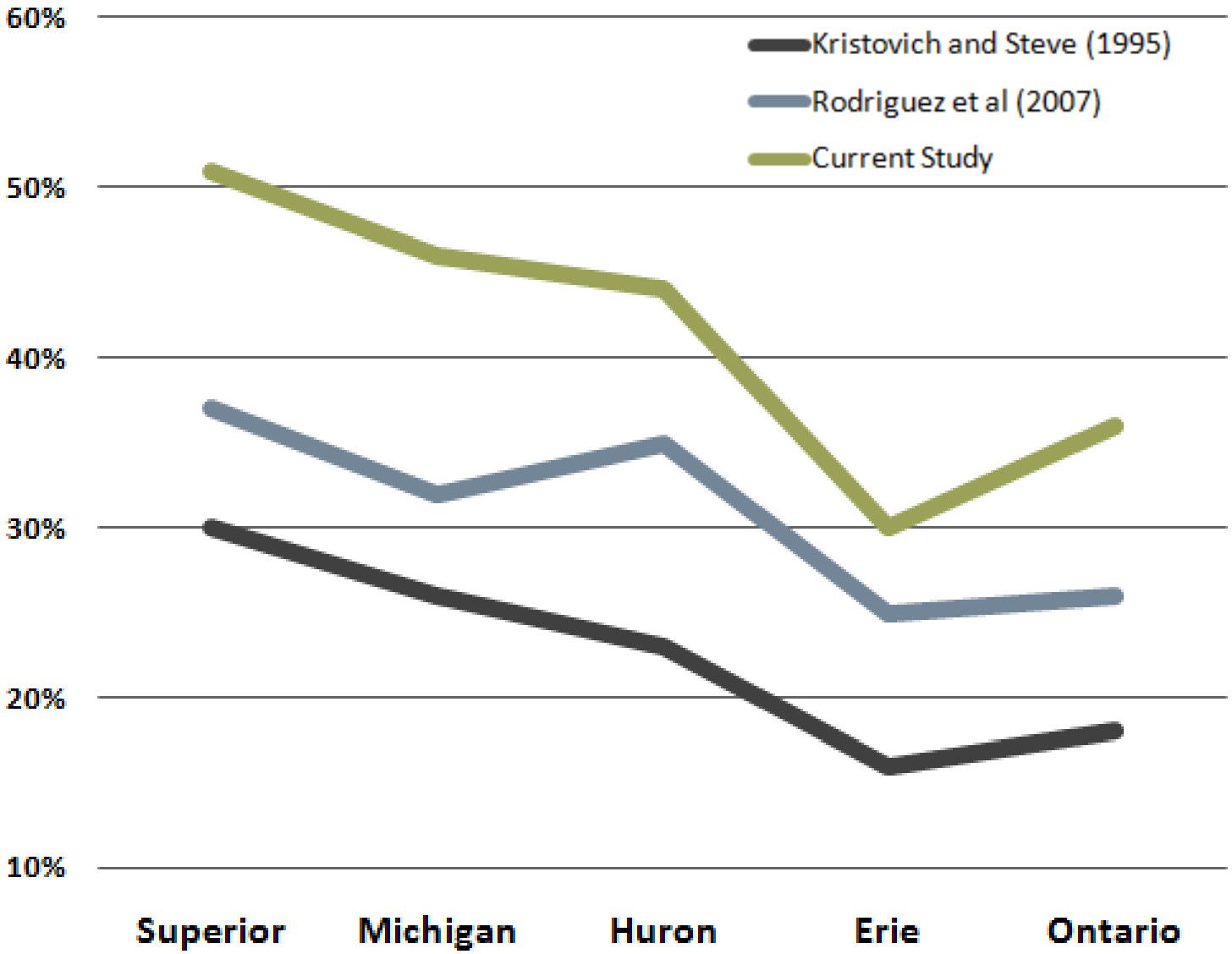
GOES: Geostationary Operational Environmental Satellites

- Obtained from NOAA's Comprehensive Large Array-data Stewardship System (CLASS)
- 1-km resolution digital imagery
- Examined using animation of images for each day
- More than one LE cloud type per day can occur over an individual lake
- Included undefined LE cloud type in study

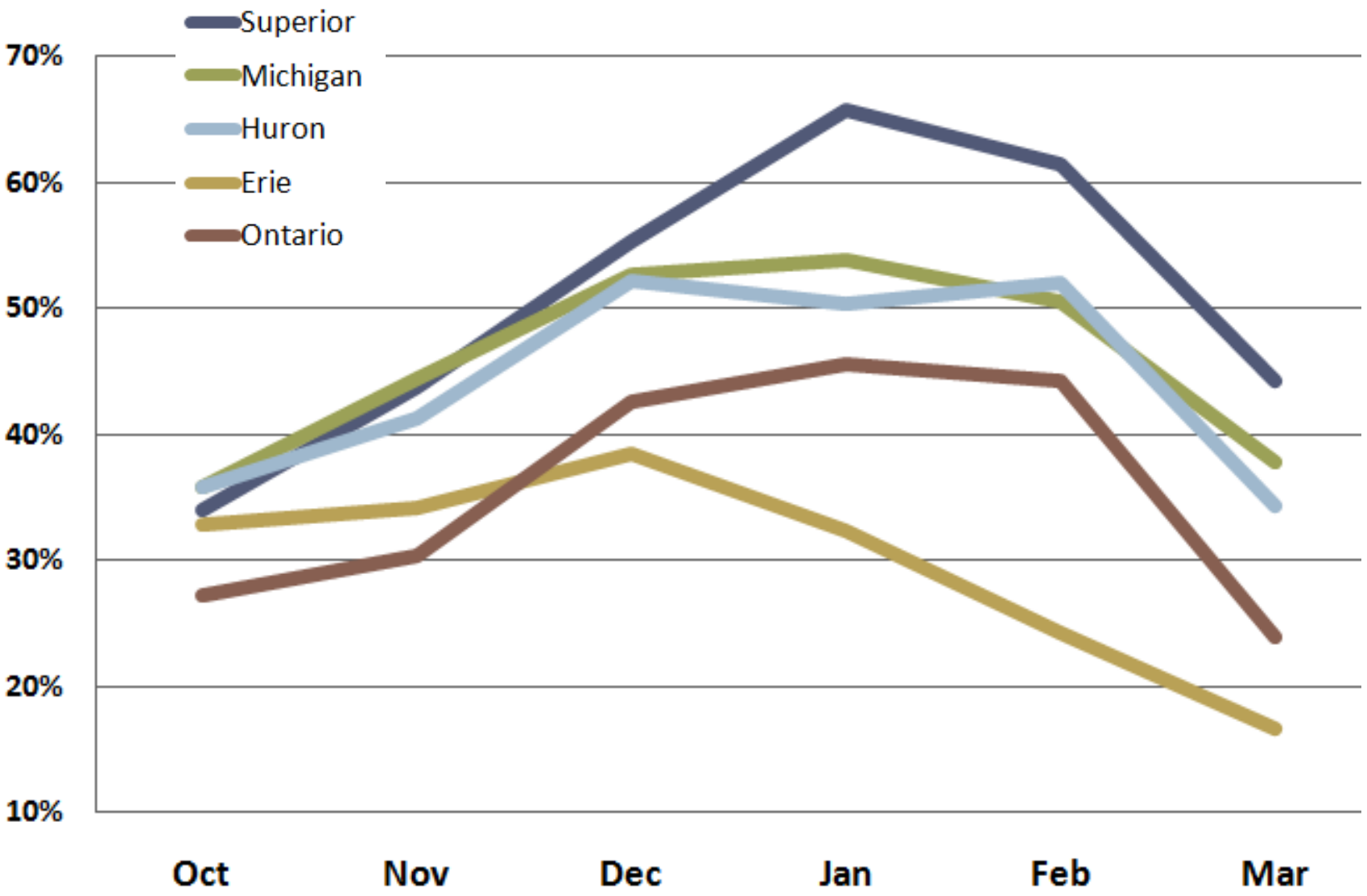
15 winter time period (1997/98 – 2011/12)

- Cold Season: October – March
- Daytime Hours: 14:00 – 20:00 UTC (approximately 9AM – 3PM EST)
- 24,878 images for 2,552 days
  - An average of one image per 35 minutes

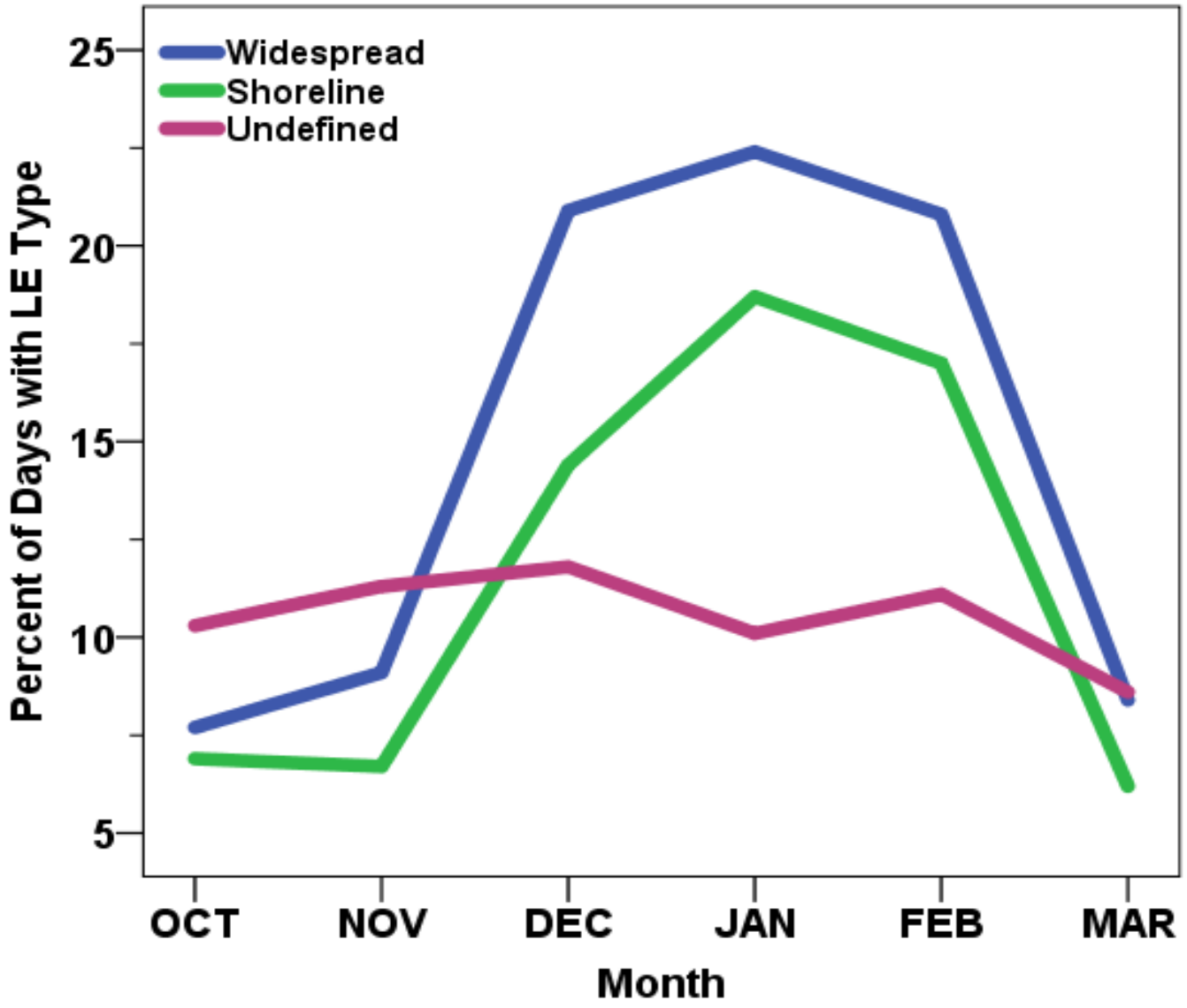
Great Lakes: Cold Season (Oct – Mar) % Days with Lake Effect



Great Lakes: % Days with Lake Effect per Month



Lake Ontario: % Winter Days with Type of Lake Effect per Month



HWS Scientific Research: Small Lakes

Hypothesis:

Mesoscale circulations, PBL evolution, and snowfall distribution are altered and enhanced through downstream interactions of residual boundary layers with internal layers generated by smaller water bodies (such as individual Finger Lakes in New York). Additional enhancement comes from changes in downstream orography through channeling convergence and topographic lift.

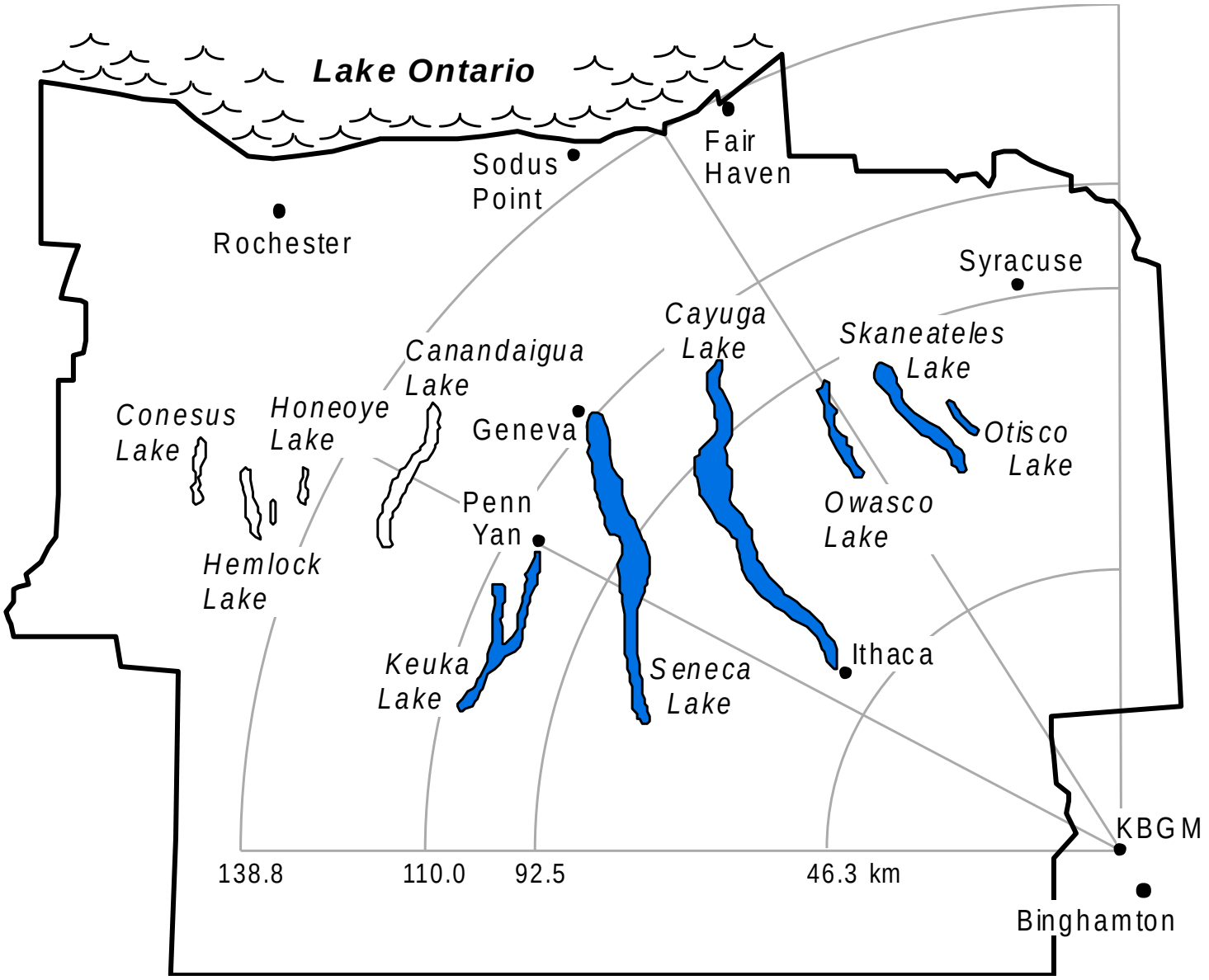
Plan:

We plan to use analysis of at least three OWLeS Lake Ontario short-fetch LE IOP events along with several arrays of Weather Research and Forecast (WRF) mesoscale model simulations to investigate the thermodynamic, dynamic, and topographic forcing of small-lake LE events.

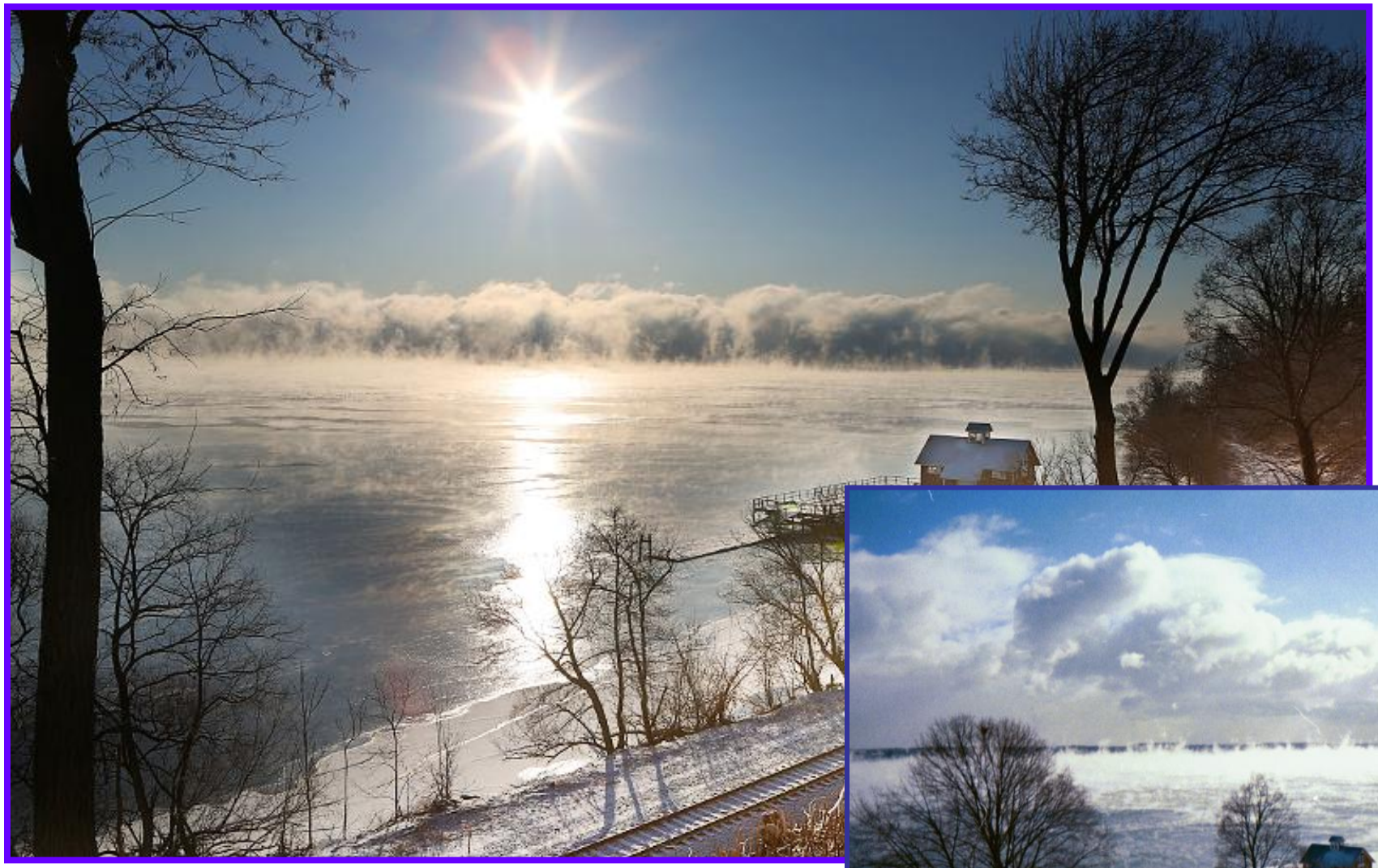
Objective:

Specific focus of this research will be on understanding the interaction of Lake Ontario and Finger Lakes BLs and the role of those interactions on the development of snow bands over the smaller Finger Lakes.

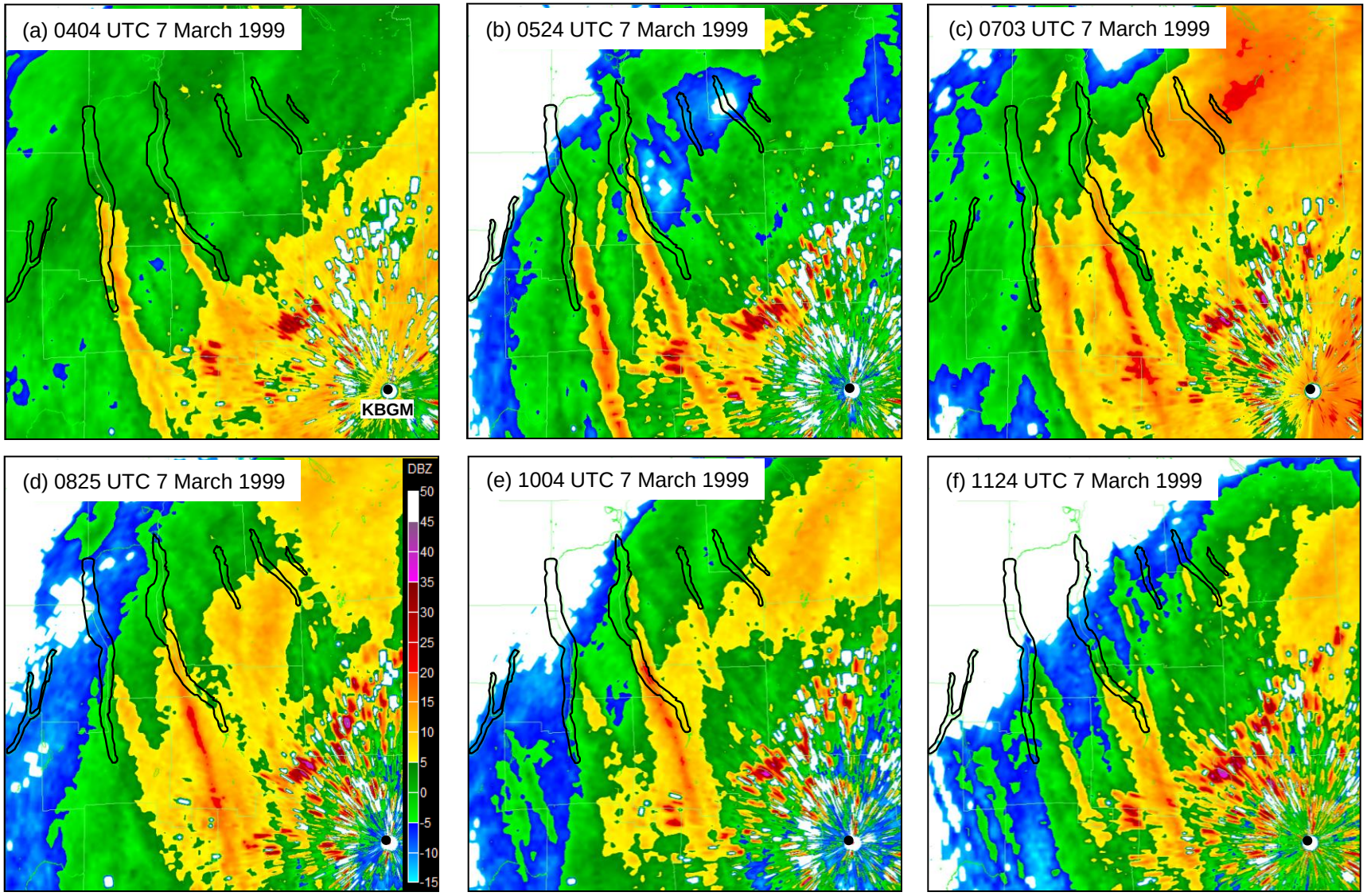
NYS Finger Lakes Region



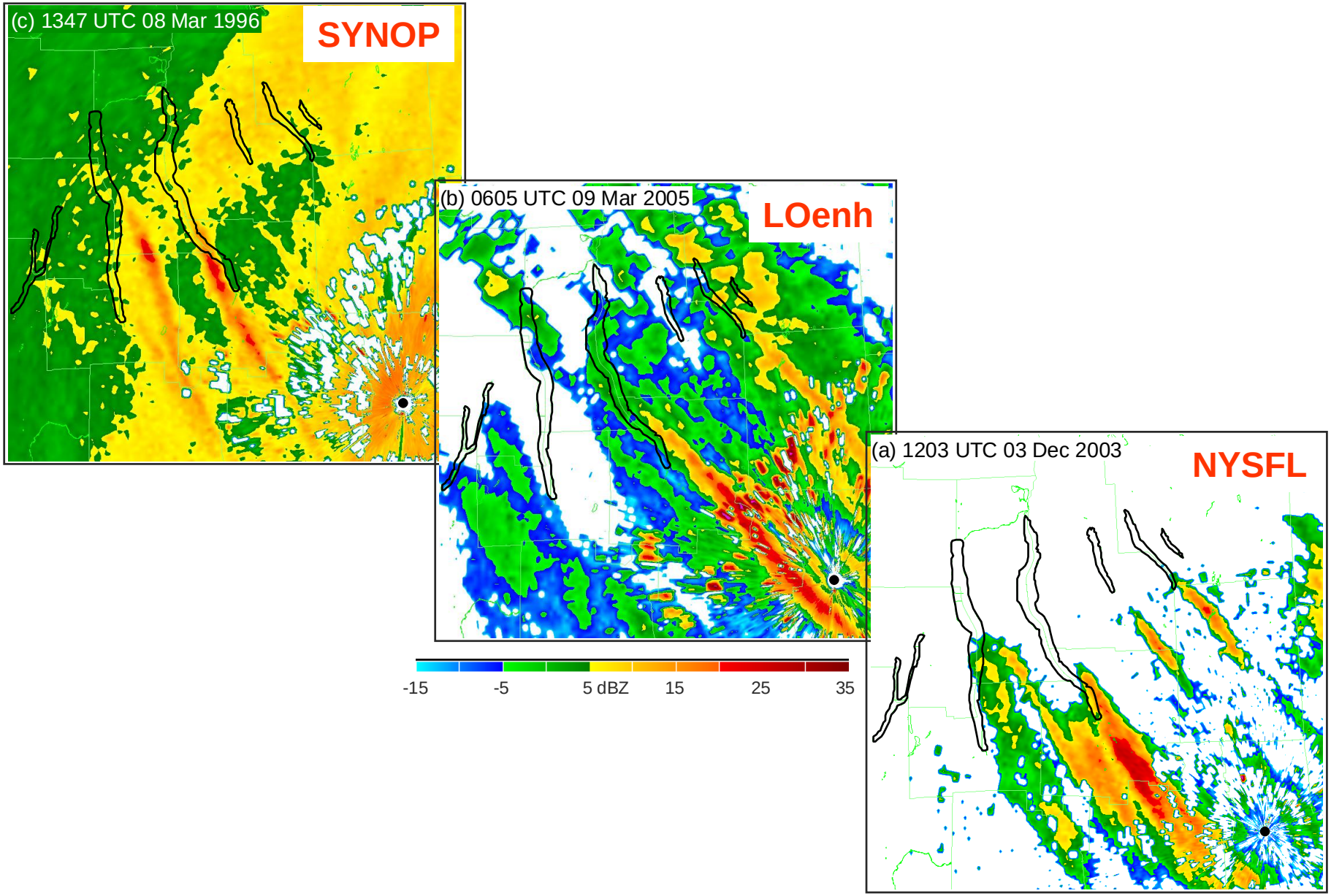
NYS Finger Lakes Lake Effect: Northern Seneca Lake



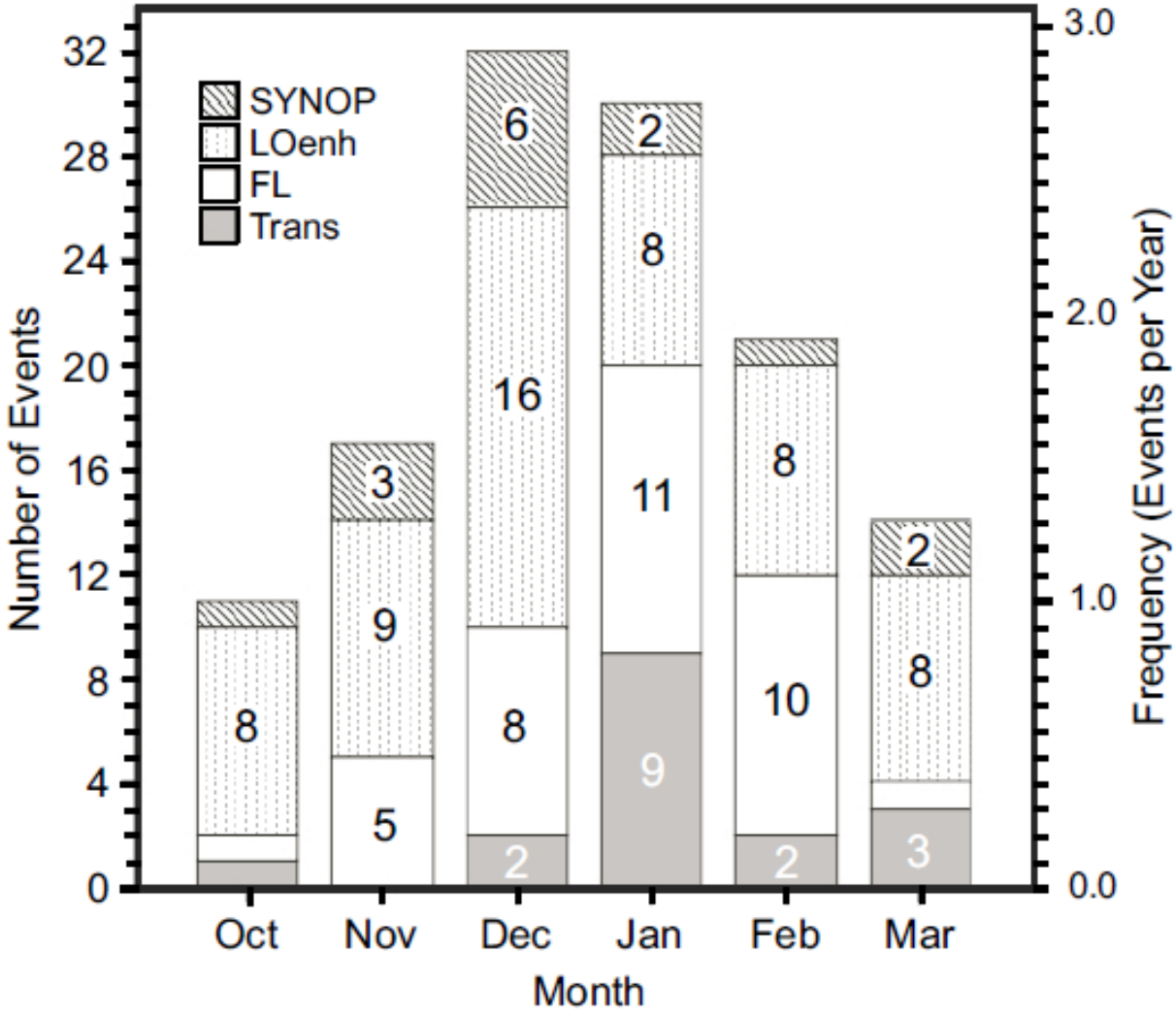
NYS Finger Lakes: KBGM WSR-88D radar reflectivity



NYS Finger Lakes Lake Effect Types



NYS Finger Lakes: Lake Effect Intra-annual Frequency



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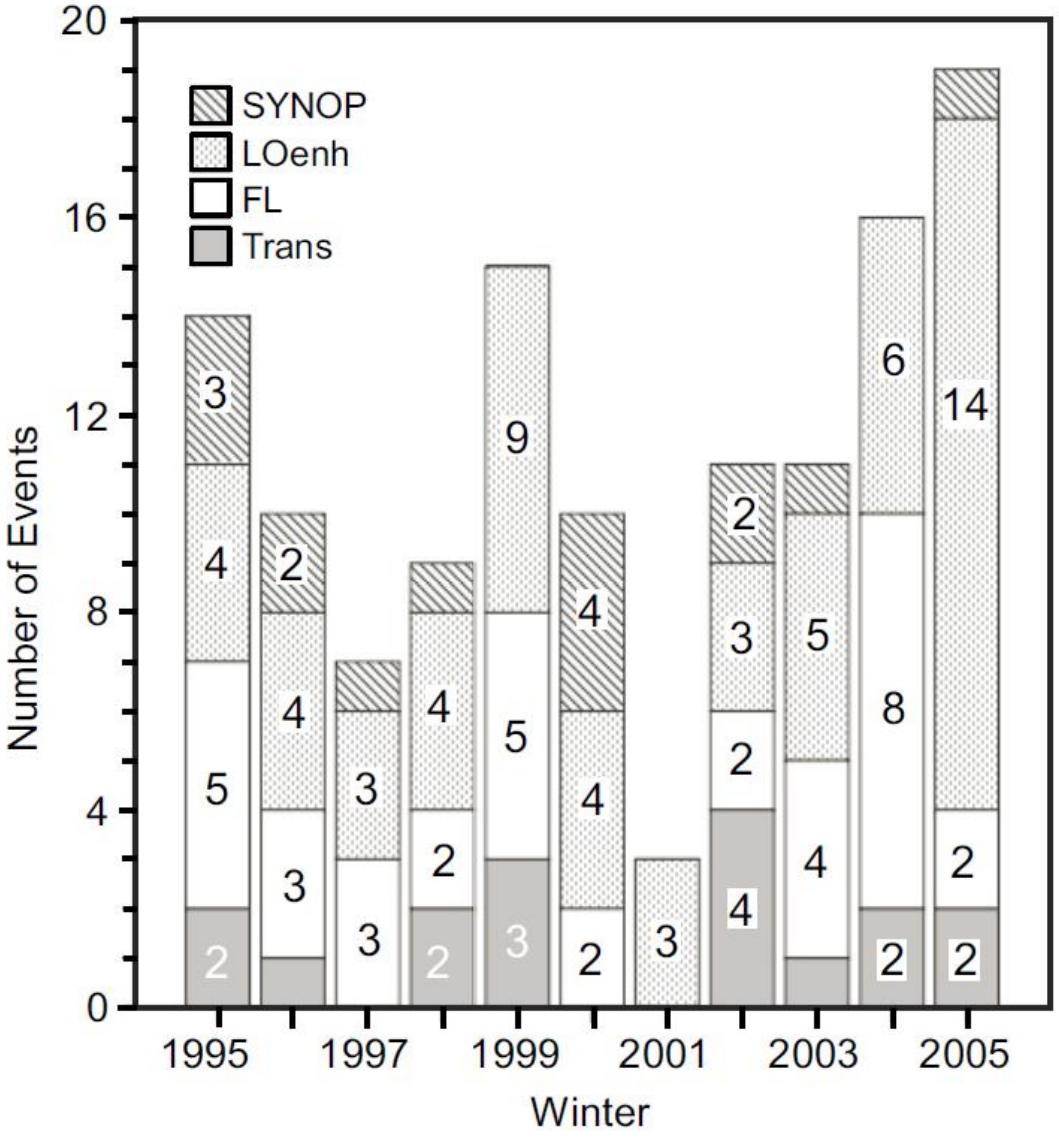
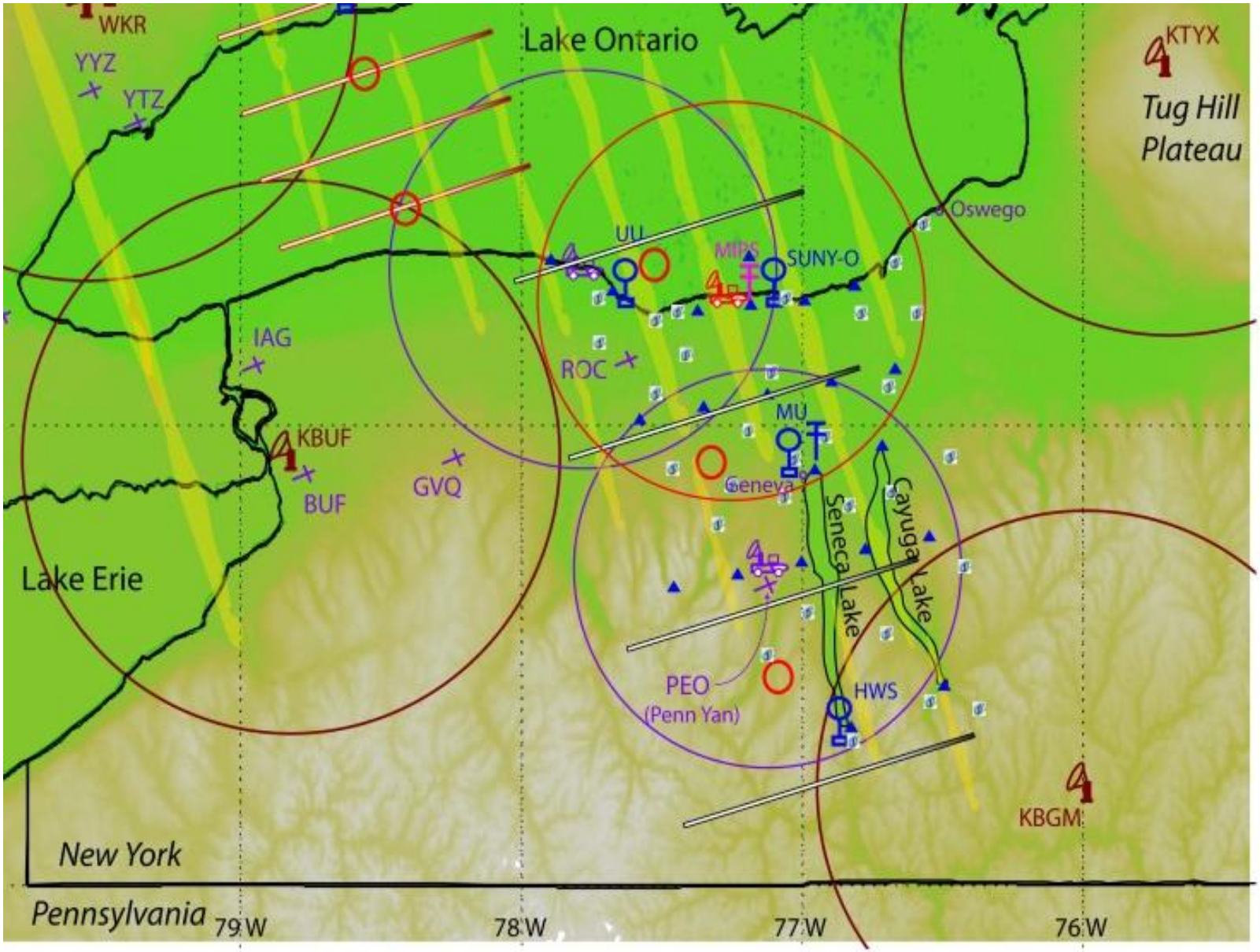


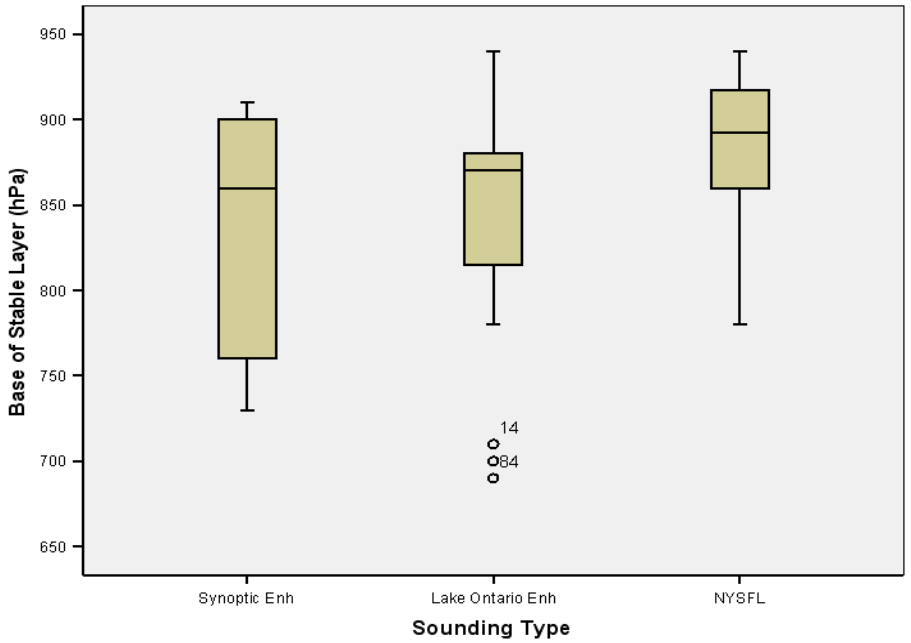
HWS Scientific Research: Observations

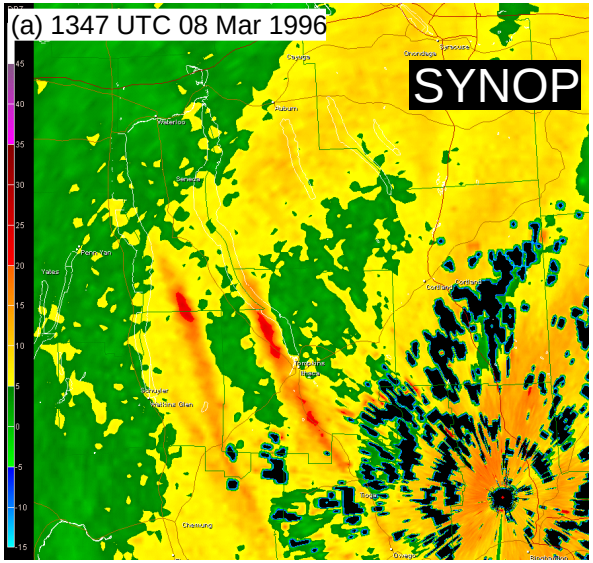


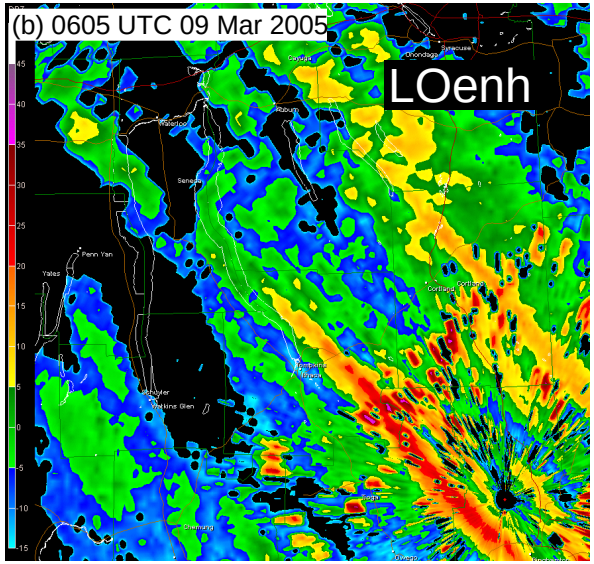
HWS Scientific Research: Observations

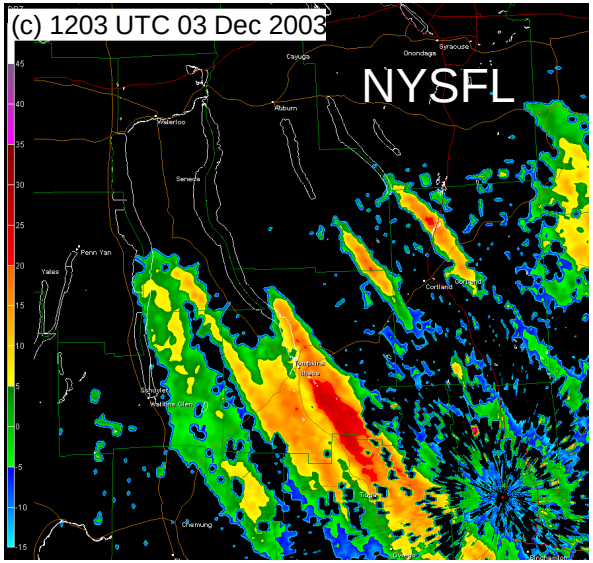
Lower Height

Higher Height



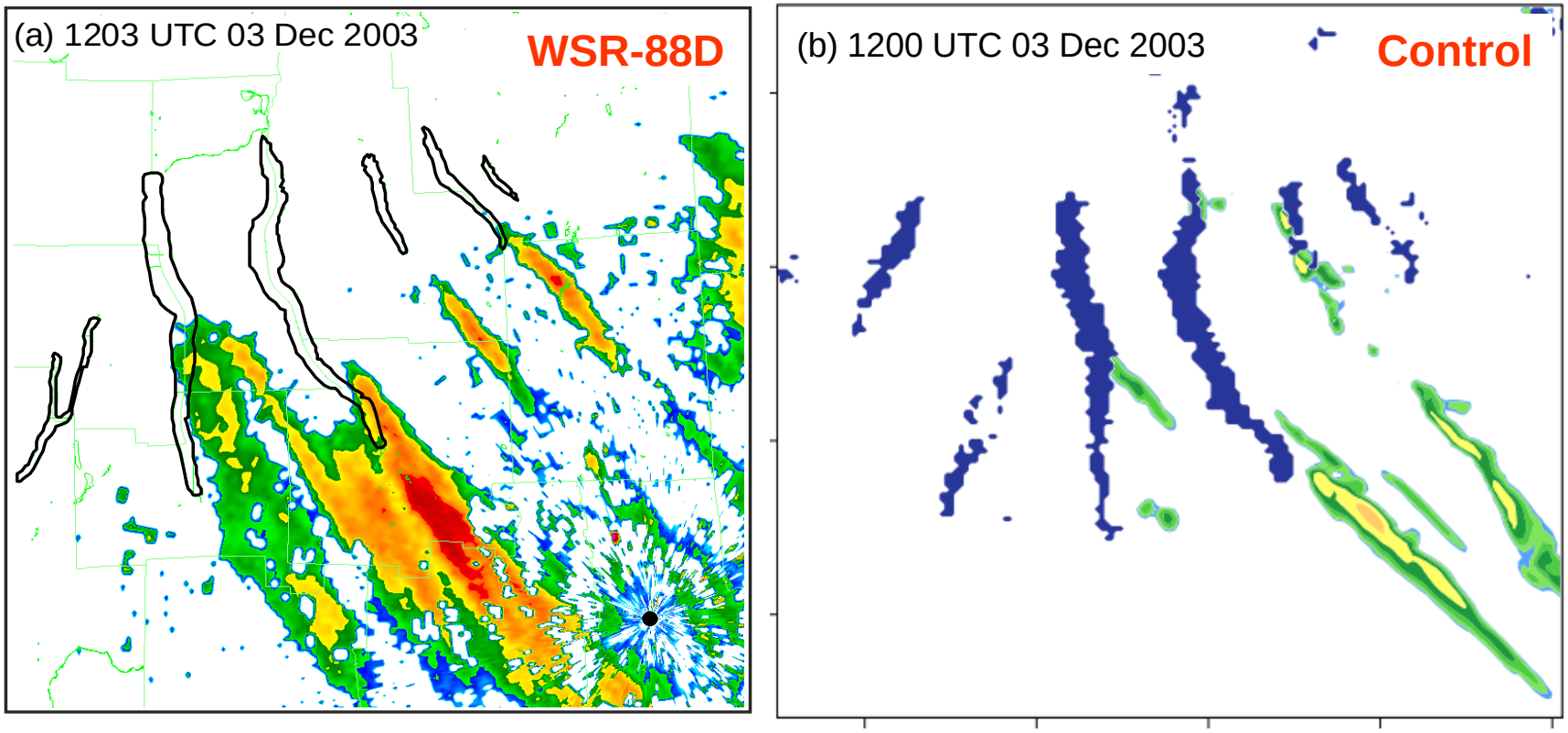






Simulation Suite:

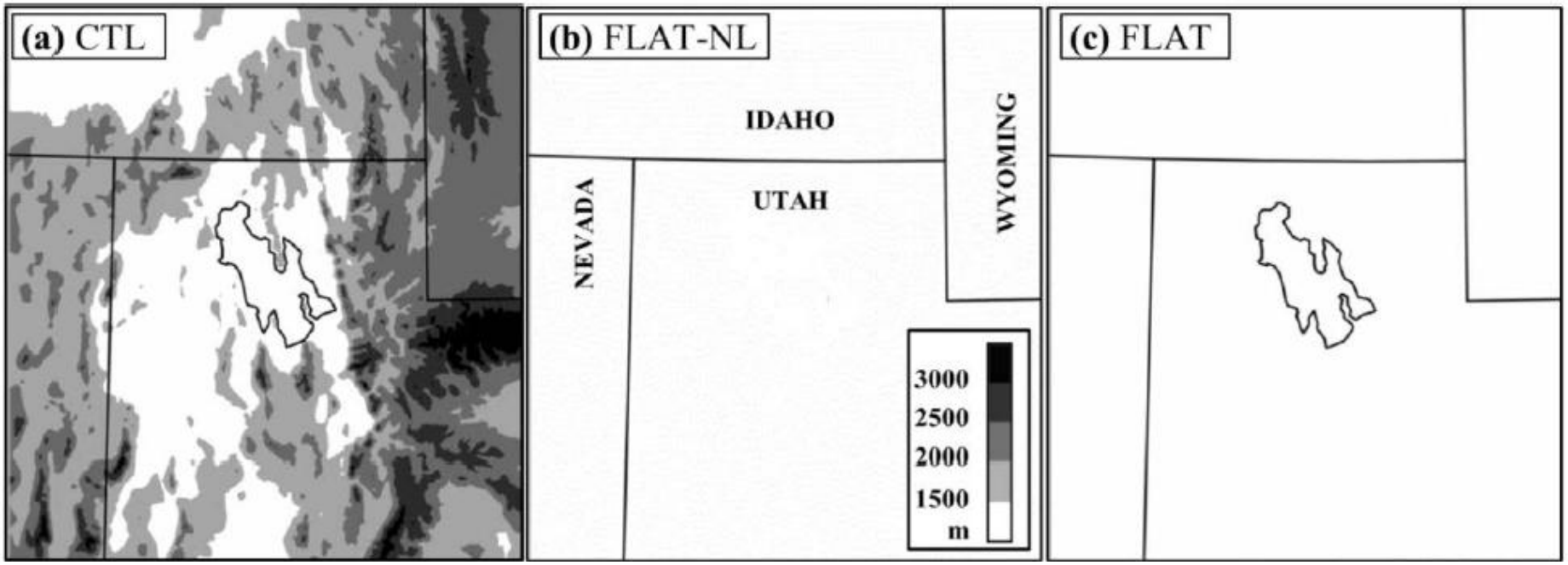
Control Runs – vary grid resolution, microphysics, boundary-layer, and various other parameterizations for OWLeS IOP cases



HWS Scientific Research: Modeling

Simulation Suite:

- No Finger Lakes/Lake Ontario
- No Topography



Alcott and Steenburgh (2013): Variety of WRF sensitivity tests

HWS Scientific Research: Preliminary WRF Simulation

Control **No Seneca Lake**