THE INLAND EXTENT OF LAKE-EFFECT SNOW BANDS

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Outline

- Motivation
- Inland Extent (IE) Forecasting Tool
  - Original Concept
  - Nuts and Bolts
  - Latest Research
- Current and Future Applications

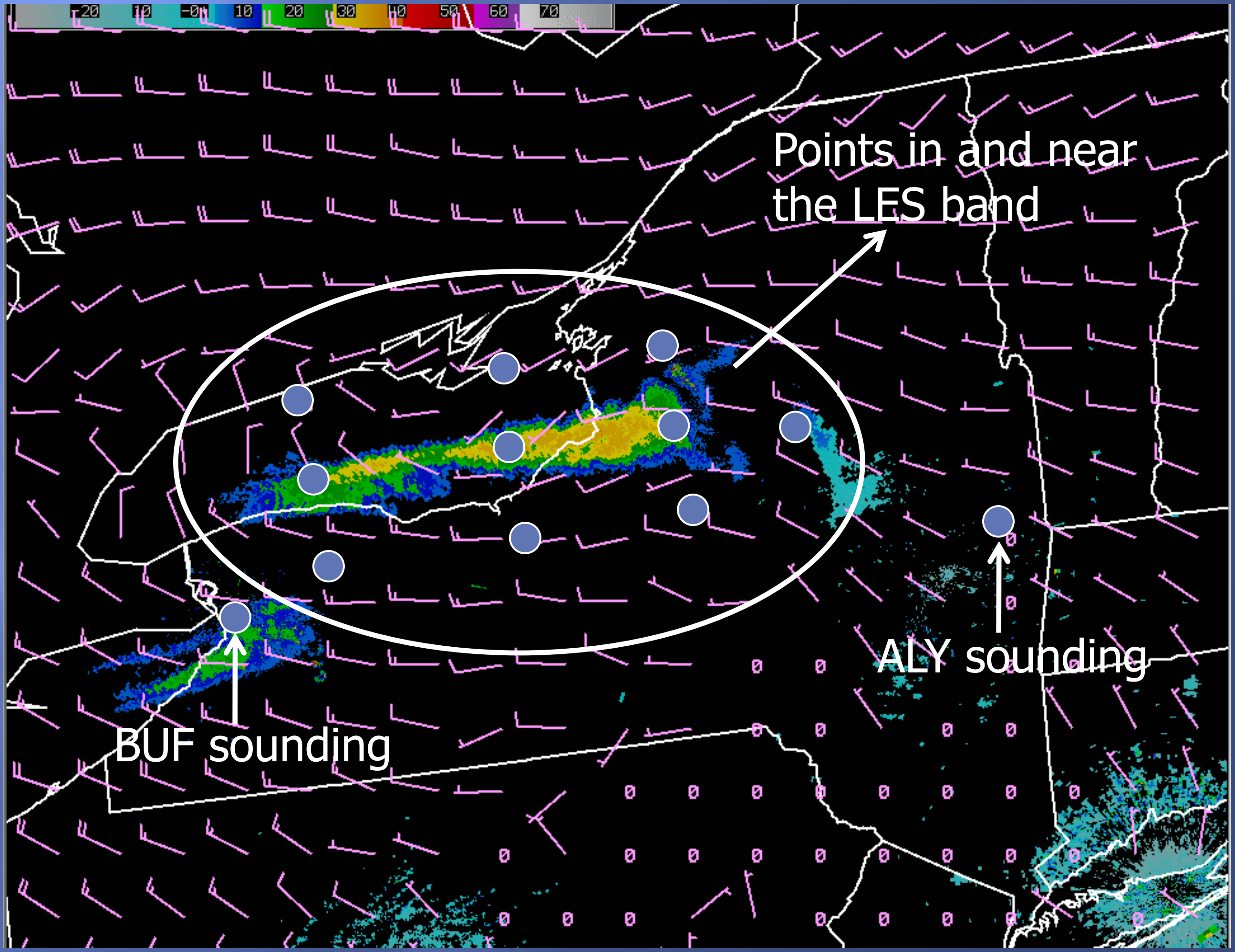
Motivation

- Much collective research has been focused on better understanding/anticipation of Lake-effect Snow (LES):
  - Formation/intensity
  - Placement/movement
  - High-resolution modeling
- ***However, IE is not on this list***
  - Theories from limited research (Niziol 1995, Evans/Wagenmaker 2000) have pointed to the following potential modulating factors:
    - Mid-level short-waves
    - Low-level convergence boundaries
    - Ambient moisture
    - Strength of mixed-layer flow

An Idea is Born

- Identify the atmospheric ingredients / land-sea interactions that have the greatest influence on IE of LES bands
- Used previous research /forecaster suggestions to come up with an initial list of parameters to look at
  - Used near-term (0-3 hour) NAM model data at select locations and observed 00z/12z soundings for input
  - Original dataset looked at 2006-2010 Lake Ontario single-band cases, with more recent events viewed from 2012-2014
  - Compared observed IE with parameter values

Example of Data Point Strategy

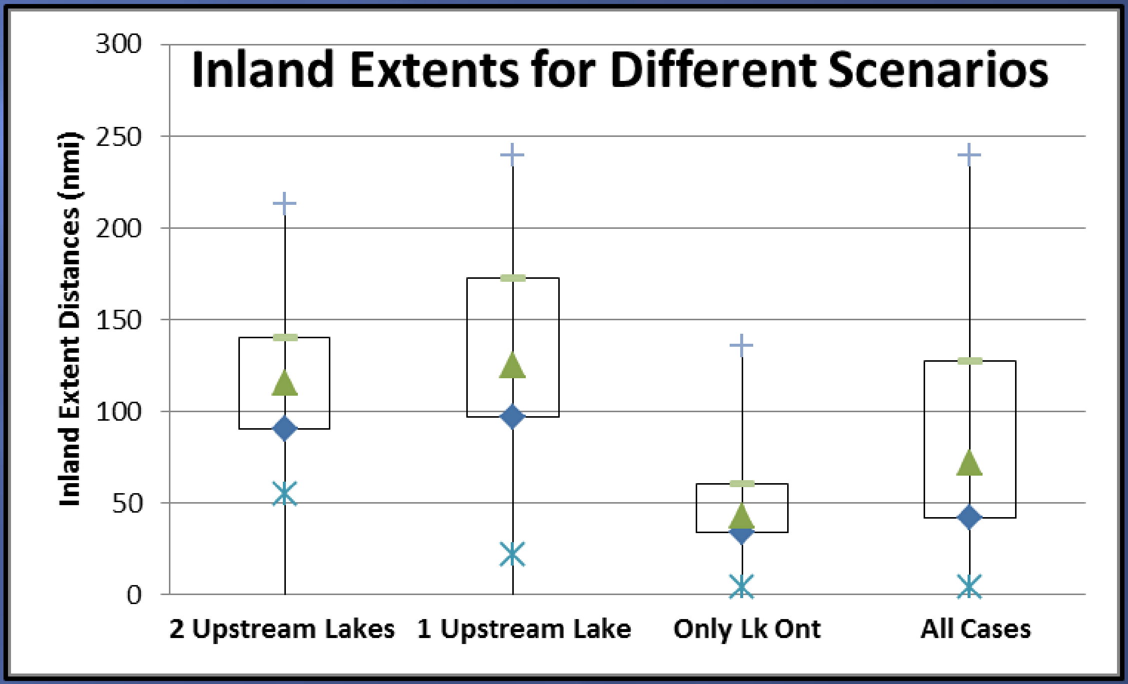


Latest Results

- Most highly correlated IE parameters
  - The existence of a Multi-Lake connection (MLC)
  - 850/700 mb lake-air differentials (strong negative correlations)
    - Conditional to low-end moderate instability classes seen as favorable
    - More extreme instability classes generally unfavorable
  - 0-1 km Speed Shear
    - 1-3 km Speed Shear had much weaker correlation
  - Moisture depths/Mixed-layer dew point depressions

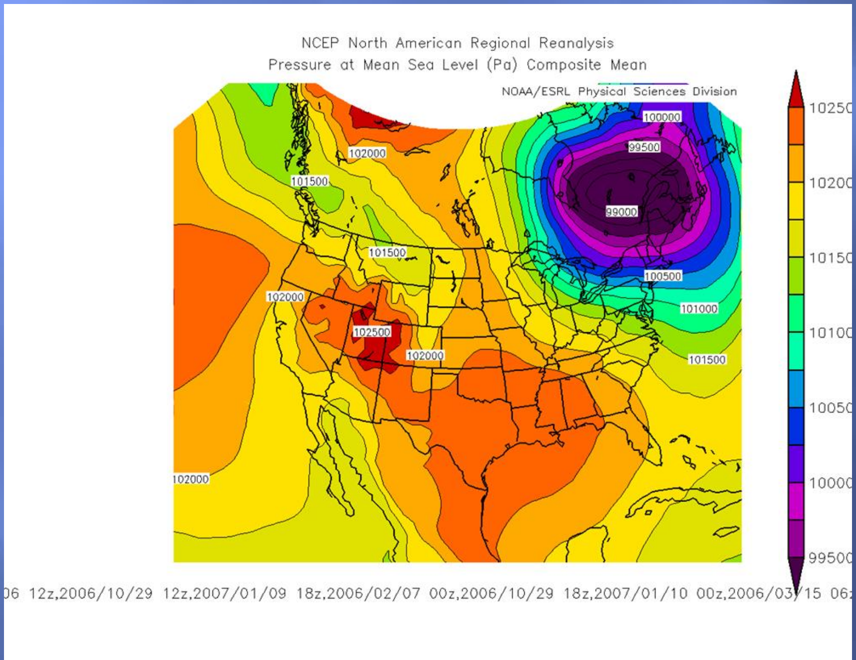
MLC Findings / IE Quartiles

- The existence of a MLC seemed to be more important than how many upstream lakes were involved
- Quartiles used to help define different IE categories:
    - Shallow (IE 45 miles or less)
    - Moderate (IE 45-130 miles)
    - Deep (IE greater than 130 miles)

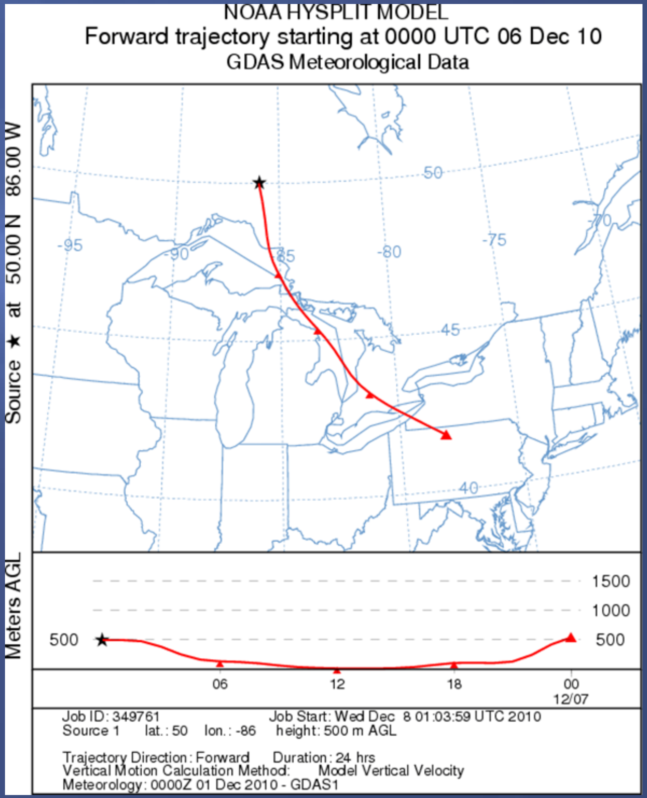


Anticipating MLC

COMPOSITES CONSTRUCTED FOR "TYPE A" (DEEP IE) EVENTS (MSLP, 850 MB, 700 MB, AND 500 MB)

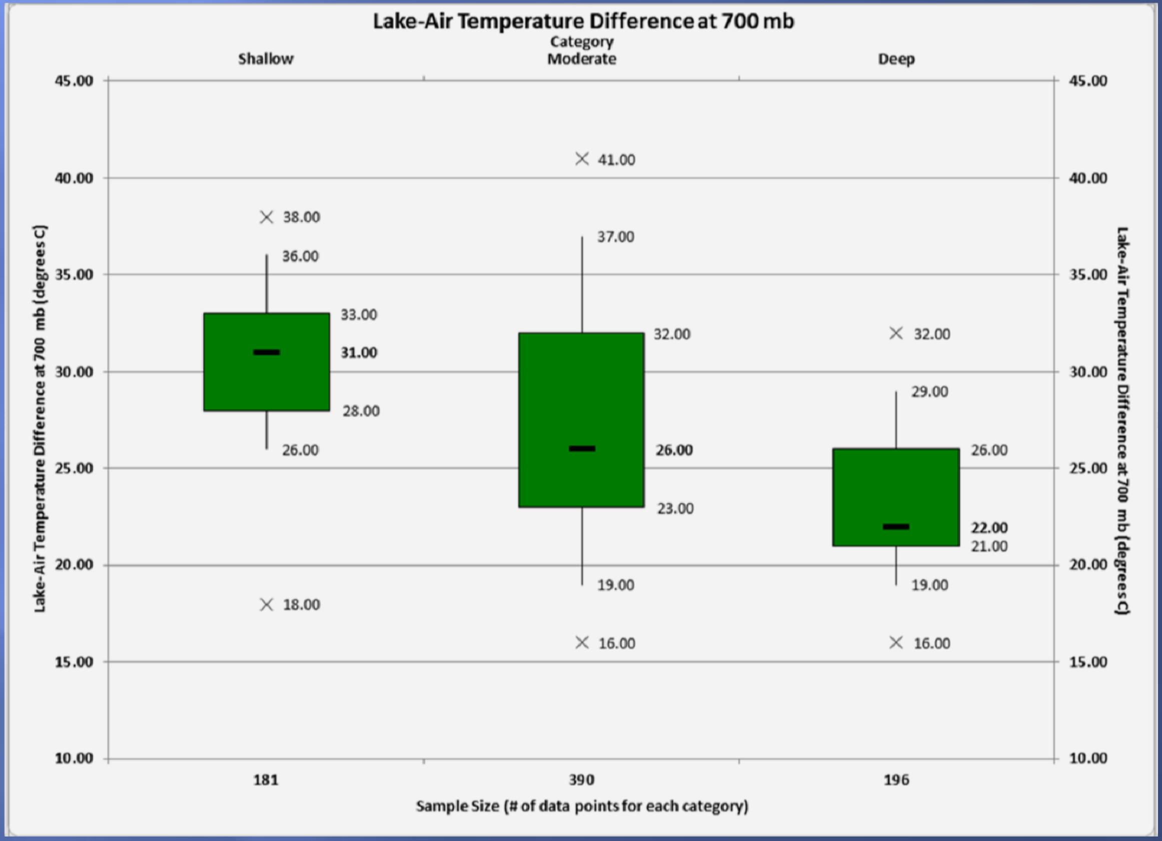


MODEL TRAJECTORY ANALYSES CAN ALSO BE USEFUL



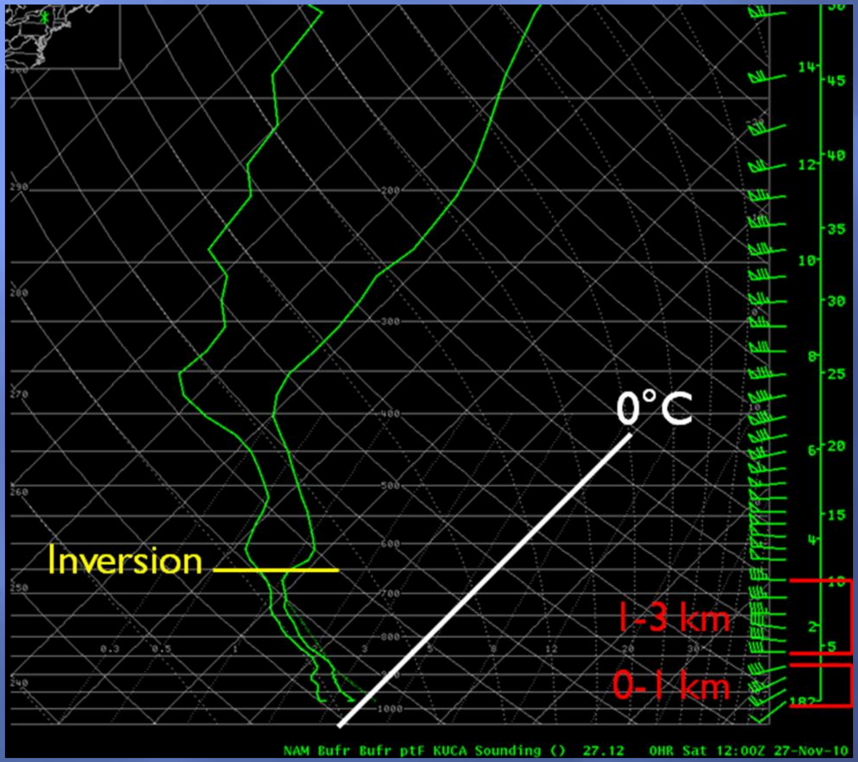
Parameter Values vs. IE

An example of how stability class tends to modulate IE

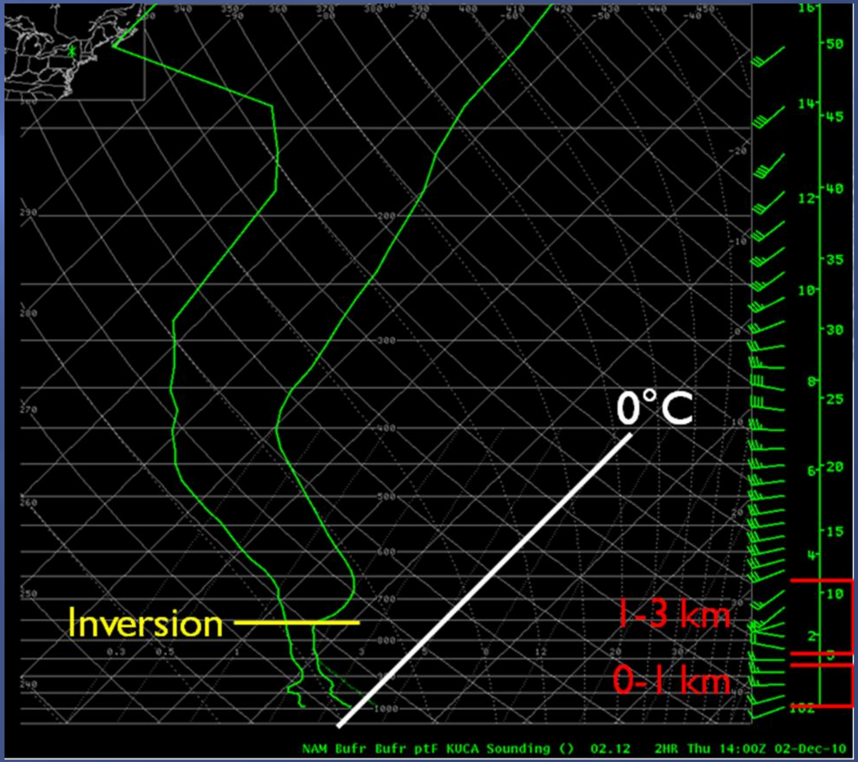


Environment Examples

"TYPE A" SOUNDING – PROMOTES DEEPER IE



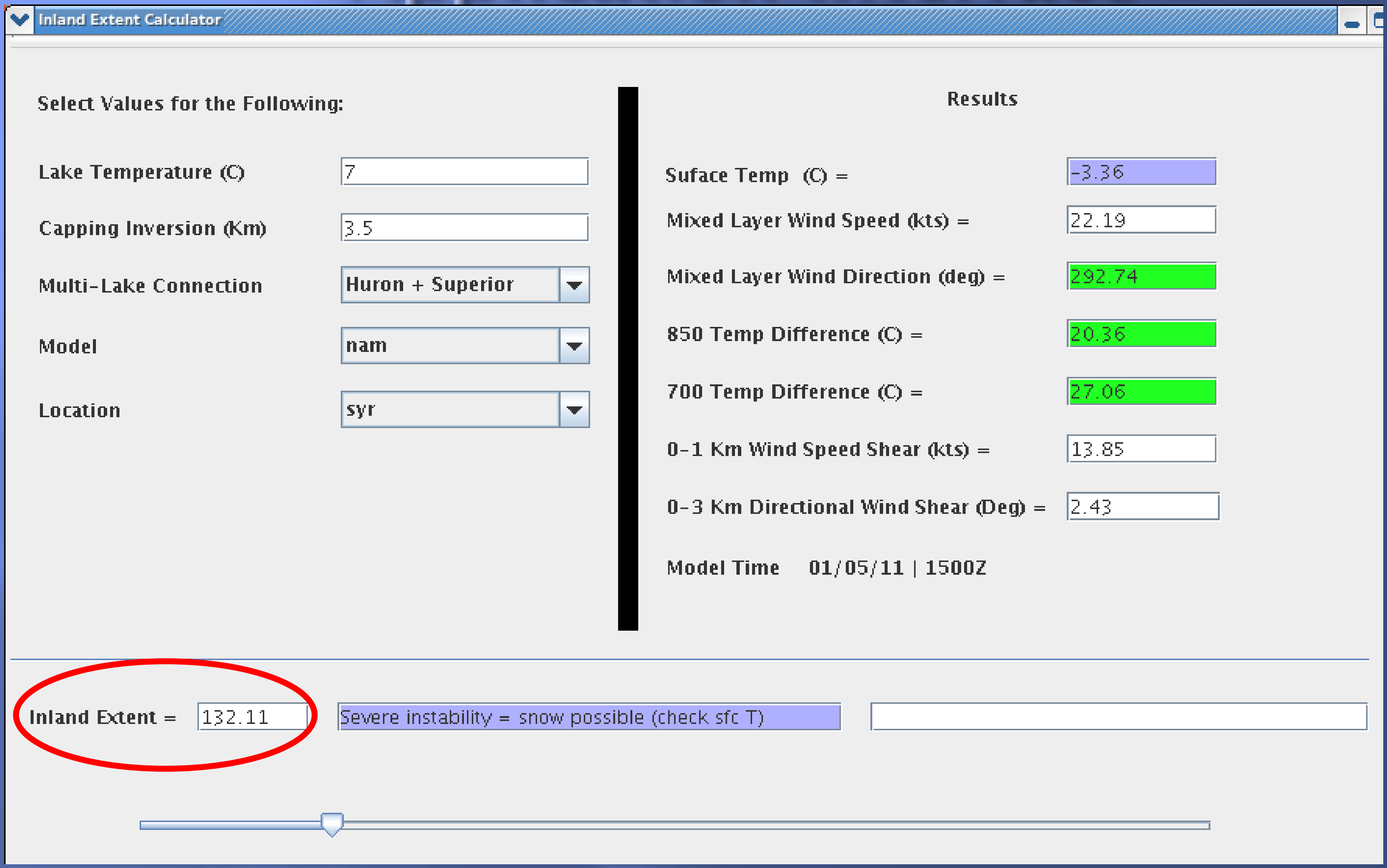
"TYPE B" SOUNDING – PROMOTES SHALLOWER IE



Current IE Forecasting Tool

- Functional on AWIPS 1 and 2
- Forecaster inputs certain variables and others are automatically ingested from the latest model data
- Output = IE mileage values over time
  - Mean absolute error for all database events was around 20 miles
  - Application did especially well in Deep IE cases

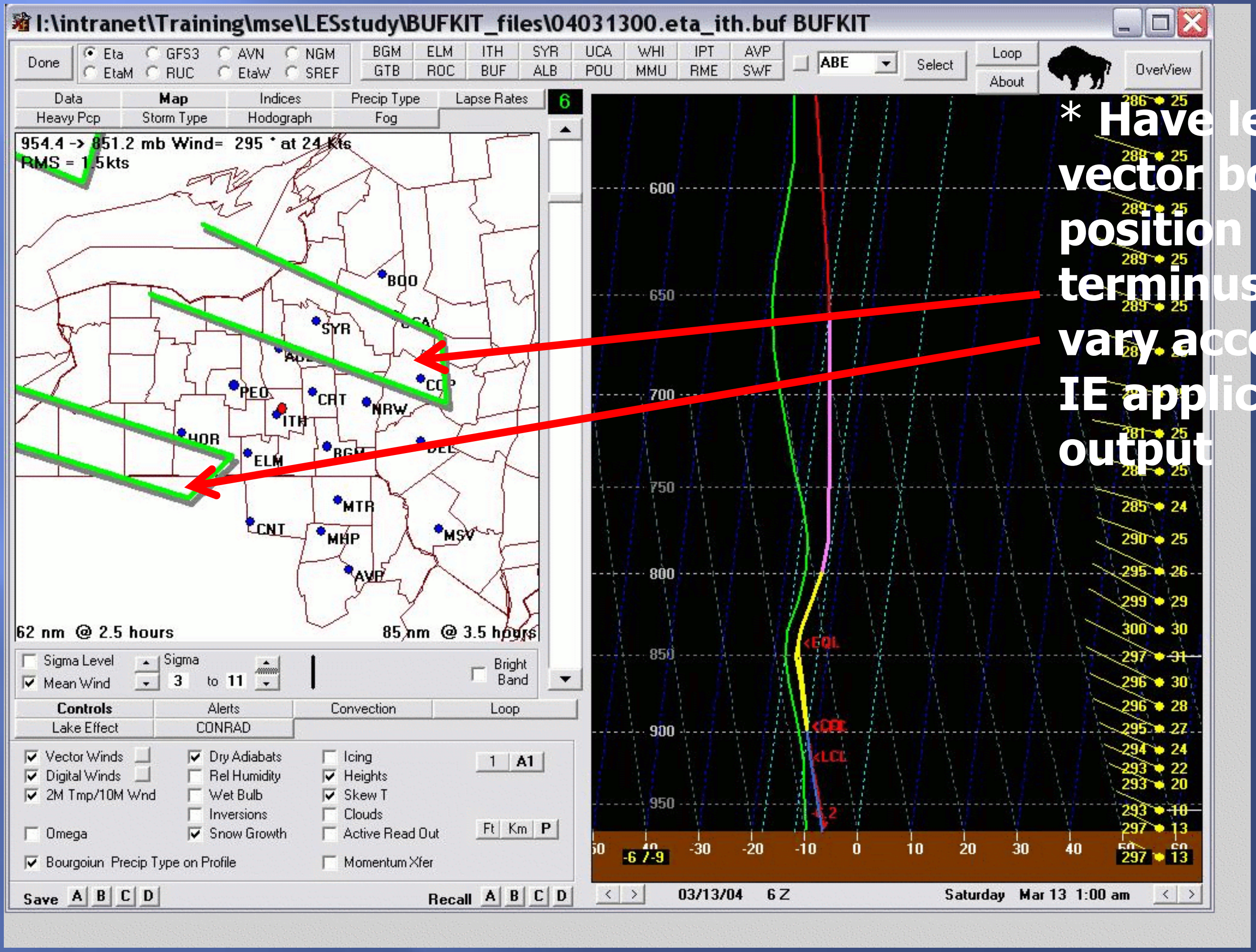
Example of Current IE Application Interface



The Future

- Better visualization
  - IE graphical interface is being overhauled
    - Hope to have new version ready this coming winter
  - Incorporate this research into BUFKIT
- Do high-resolution models reasonably simulate inland extent ?
- Future LES Polygon experimentation ?
  - Could be extremely useful in this paradigm
- Similar methodology could be used in other portions of the Great Lakes region

Possible BUFKIT Enhancement?

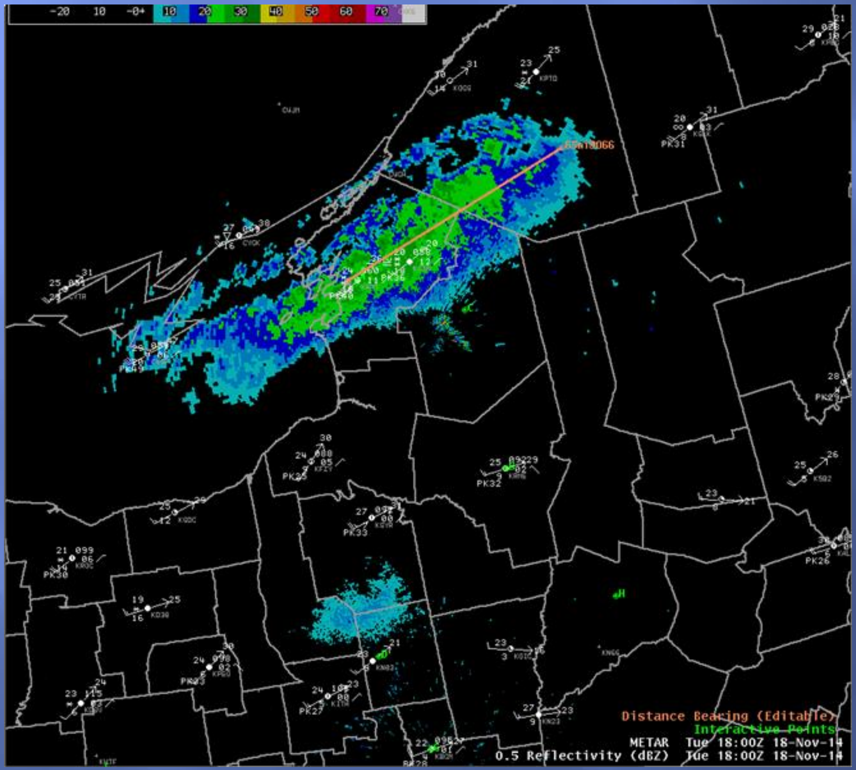


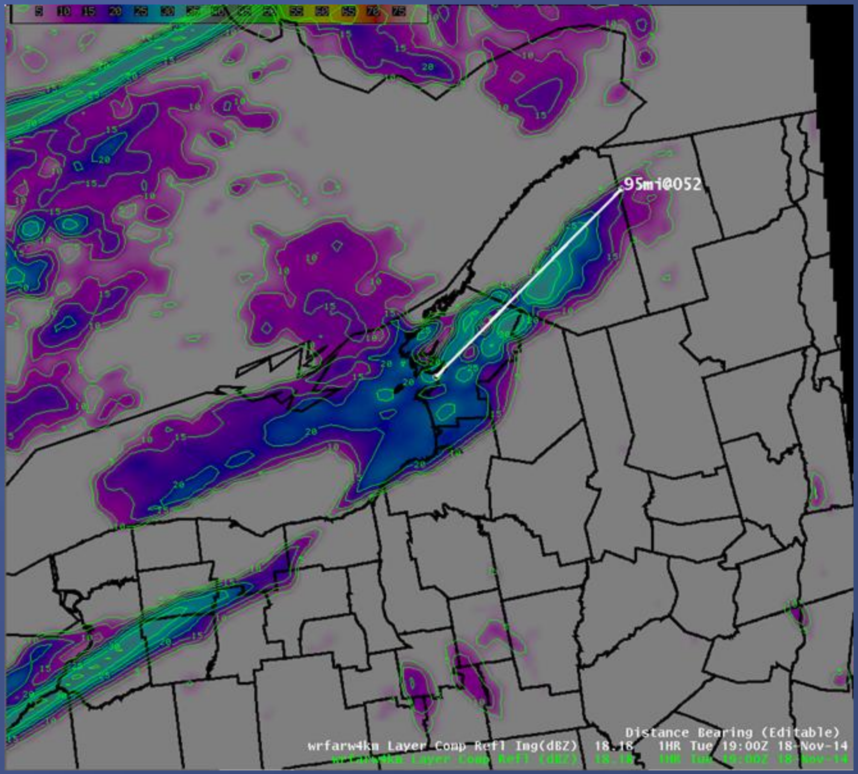
*** Have length of vector boxes and position of terminus points vary according to IE application output**

Reality, IE Output, and WRF Comparisons at 18z, 18 Nov 2014

REALITY = 65 MILES (SHOWN HERE);
IE APPLICATION = 75 MILES

WRF IE = 95 MILES





QUESTIONS?

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