

P1.16 THE JUNE 1, 2011 HAIL MONSTER EVENT ACROSS EASTERN NEW YORK AND WESTERN NEW ENGLAND

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Motivation

- CSTAR IV project (2010-2013) with SUNY at Albany examines a variety of severe weather issues including the roles or impacts prefrontal troughs have on severe weather.

- From a multi-scale perspective this case will address:

- (1) Why anomalously large hail occurred ?
- (2) What caused it ??

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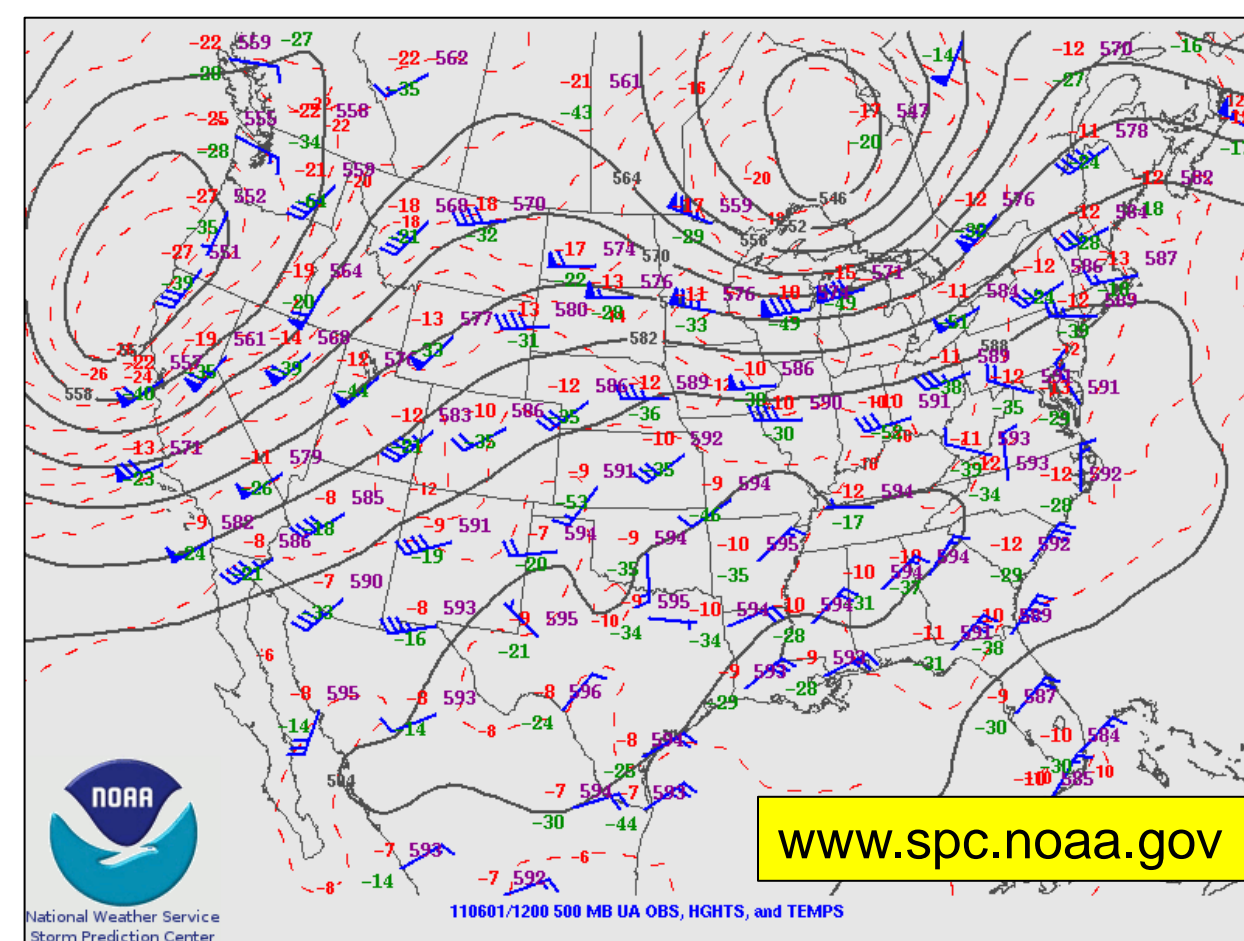
Outline

- Brief synoptic overview
- Ingredients for Large Hail/Hail Monsters
- Meso-scale and Sounding Analysis
- Storm-scale/Radar Highlights of the baseball-size and larger hail events

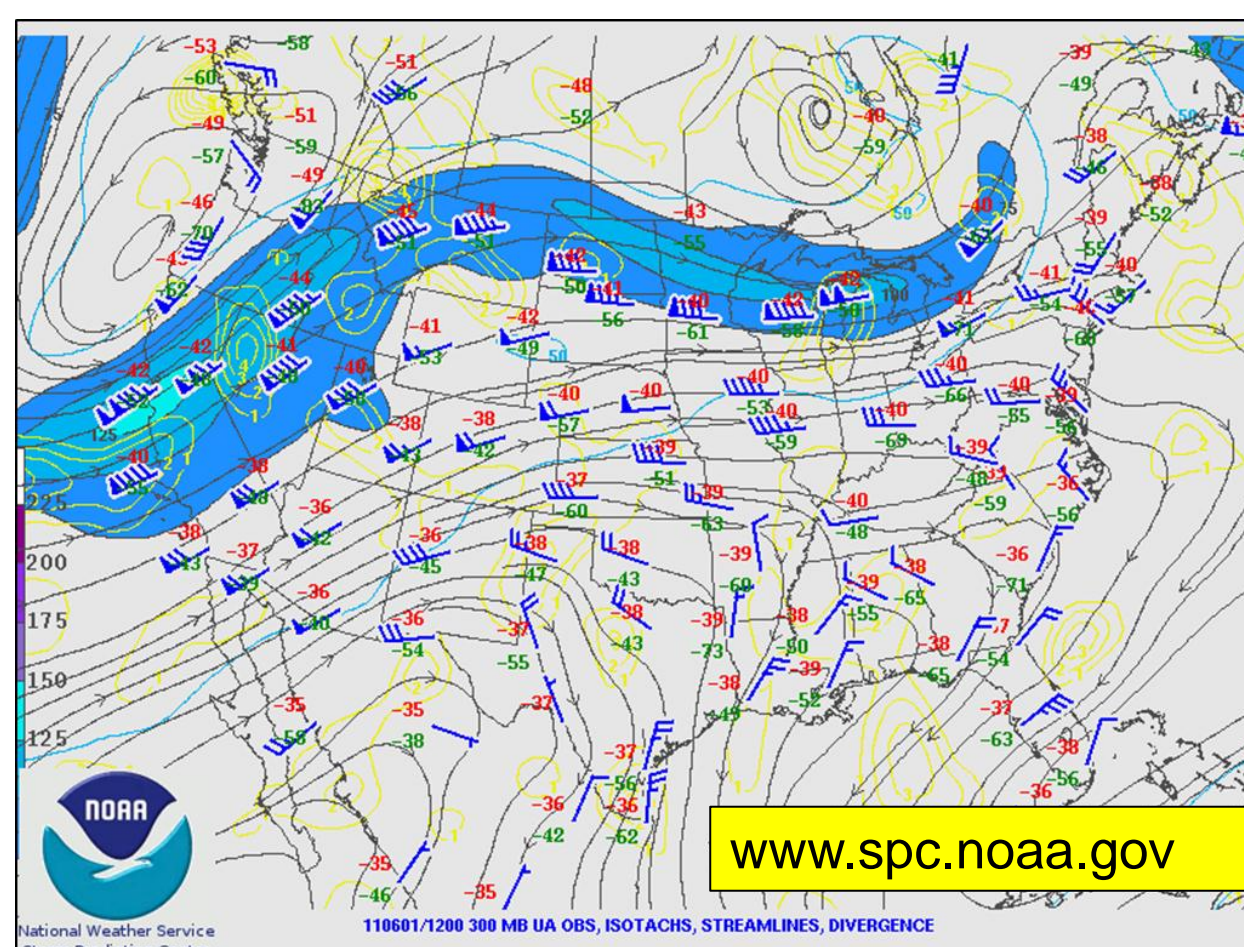
Background

- Anomalous severe weather event, where the ALY forecast area had 5 baseball-size (>2.75") and greater hail reports
- The early morning (0900 UTC – 1200 UTC) featured a golf ball-size hail report with the first prefrontal trough
- An Elevated Mixed Layer (EML) was present over NY and New England

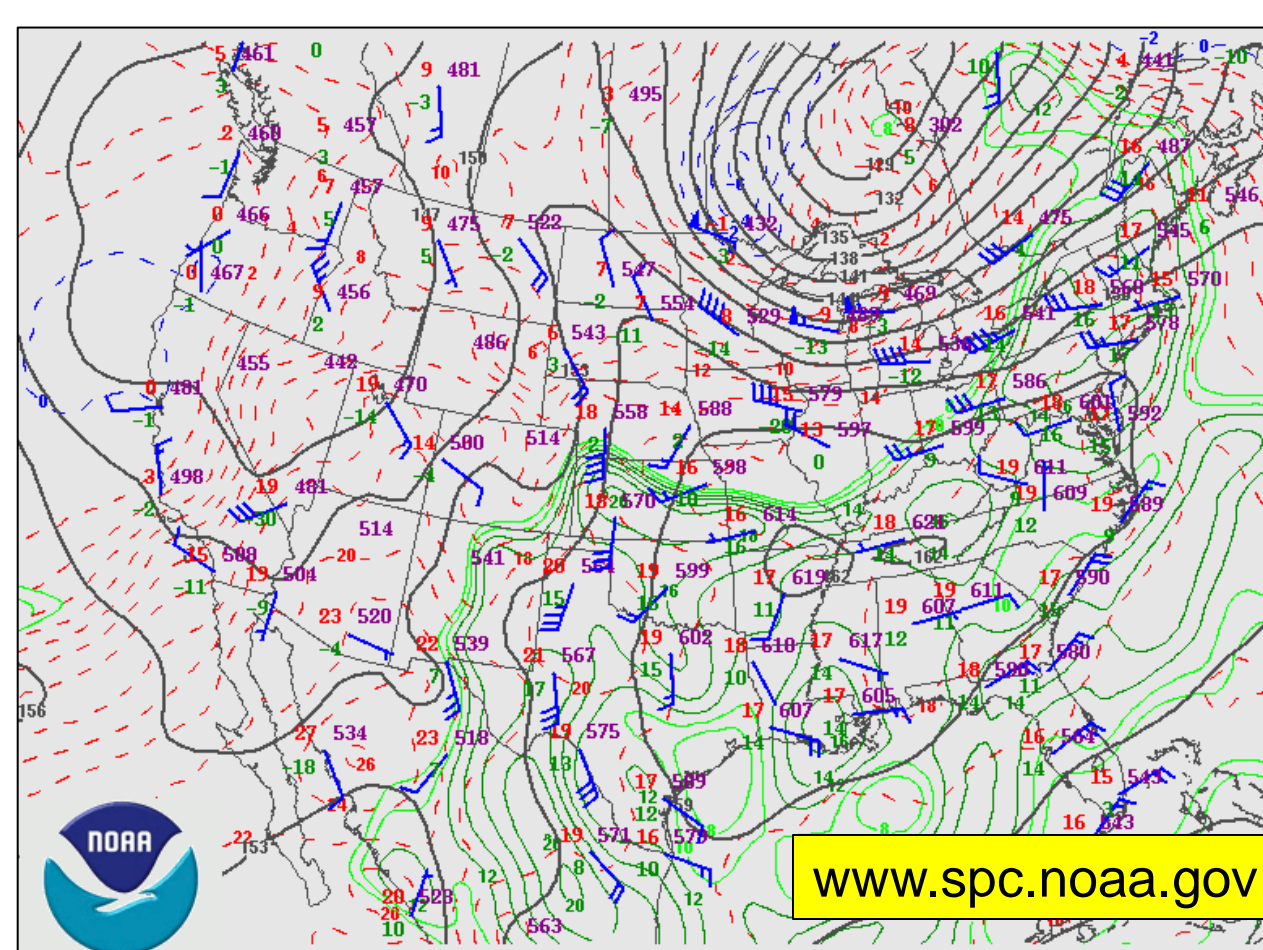
1200 UTC 1 June 2011 Upper Air Analysis



500 hPa Heights (dam), Temps (°C) & Winds (kts)

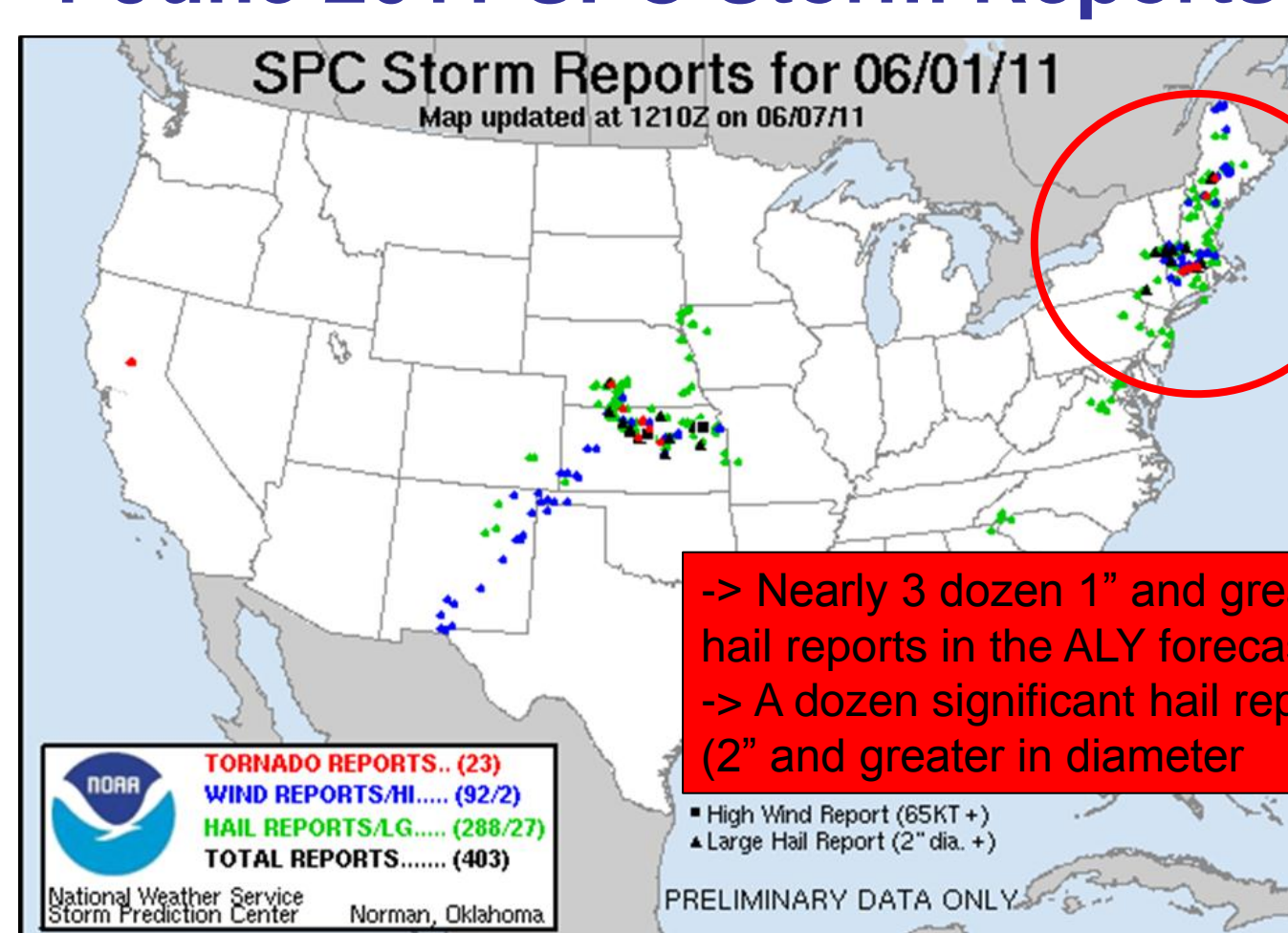


300 hPa Heights (dam), Streamlines & Divergence ($10^{-5} s^{-1}$)



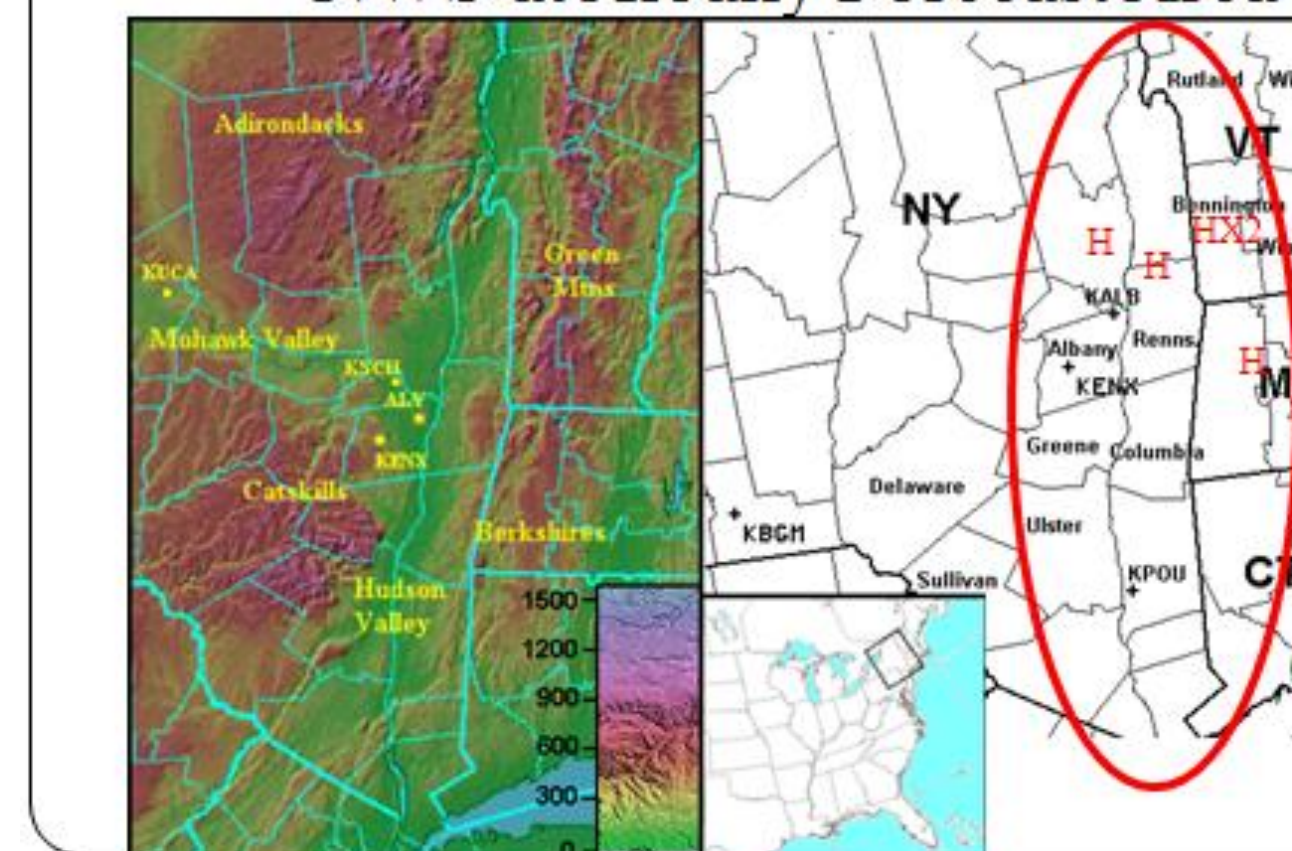
850 hPa Heights (dam), Dewpoints(°C), Temps (°C) & Winds (kts)

1 June 2011 SPC Storm Reports



-> Nearly 3 dozen 1" and greater hail reports in the ALY forecast area
-> A dozen significant hail reports (2" and greater in diameter)

NWS at Albany Forecast Area

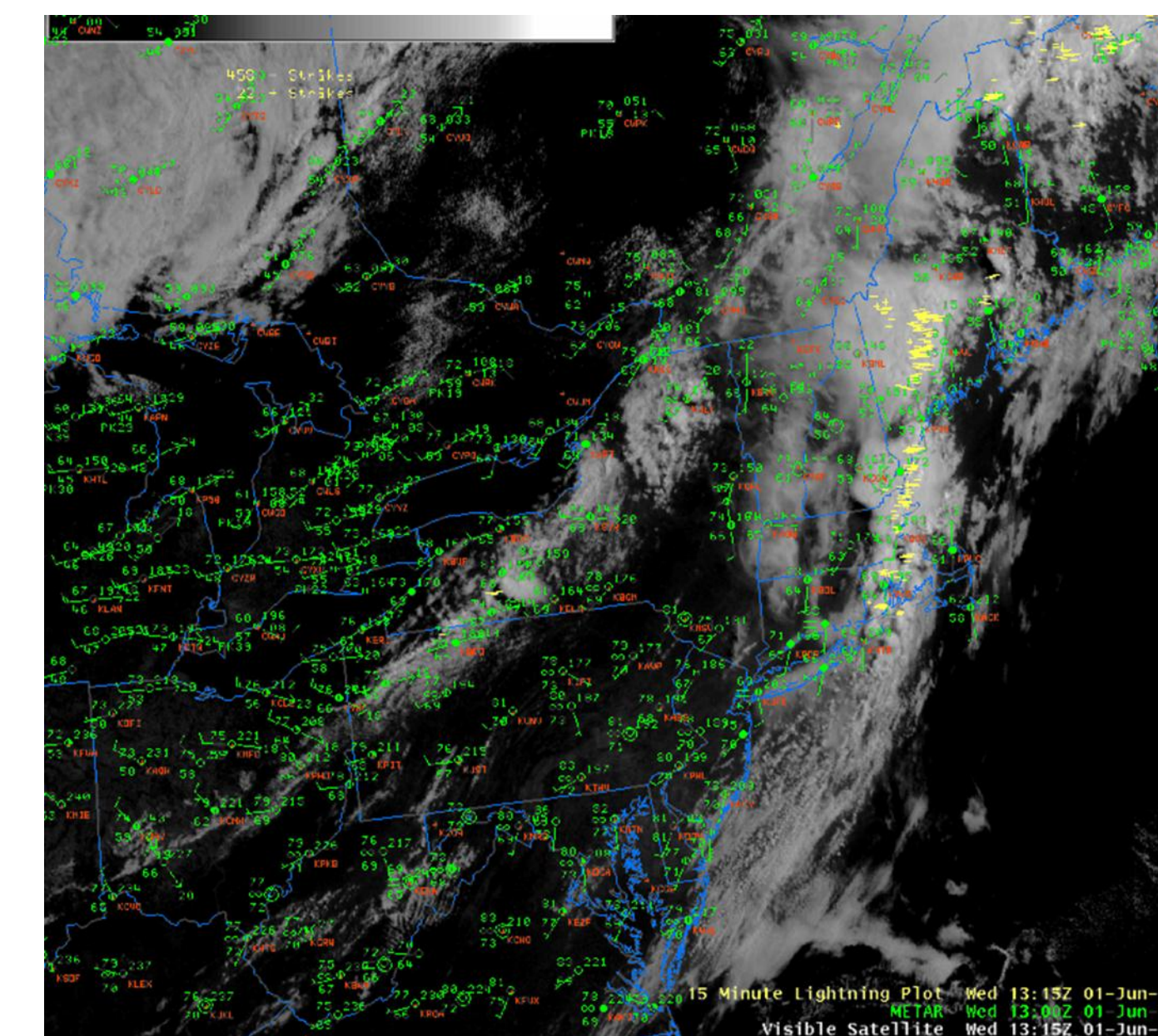


1300 UTC: SPC DAY 1 OUTLOOK

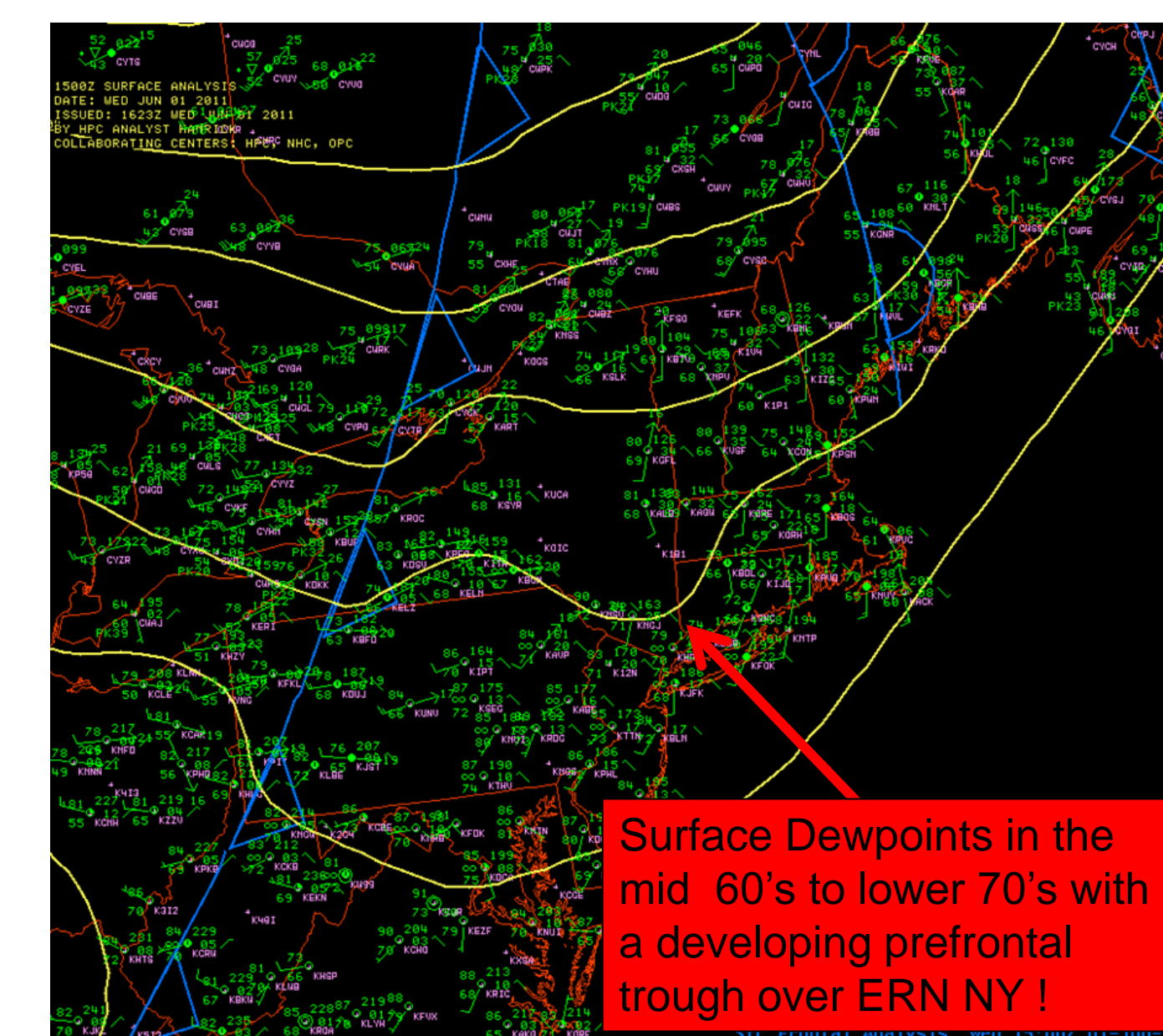
Ingredients for "Very" Large Hail

- | Favored Sounding Aspects: | Hail Monsters: |
|--|--|
| <ul style="list-style-type: none"> • Thick CAPE • Good Deep Layer Wind Shear • Deep Mid-level Lapse Rates • Light Storm-Relative Flow through the Updrafts | <ul style="list-style-type: none"> • Moderately reflective cores on the southern and forward flanks • Deep Convergent Zones (tremendous huge moisture convergence) • Few, if any tornadoes • Tremendous straight-line winds • Fast moving to the right of the mean winds (Right movers) |

Satellite, Surface, Sounding, & Meso-analysis

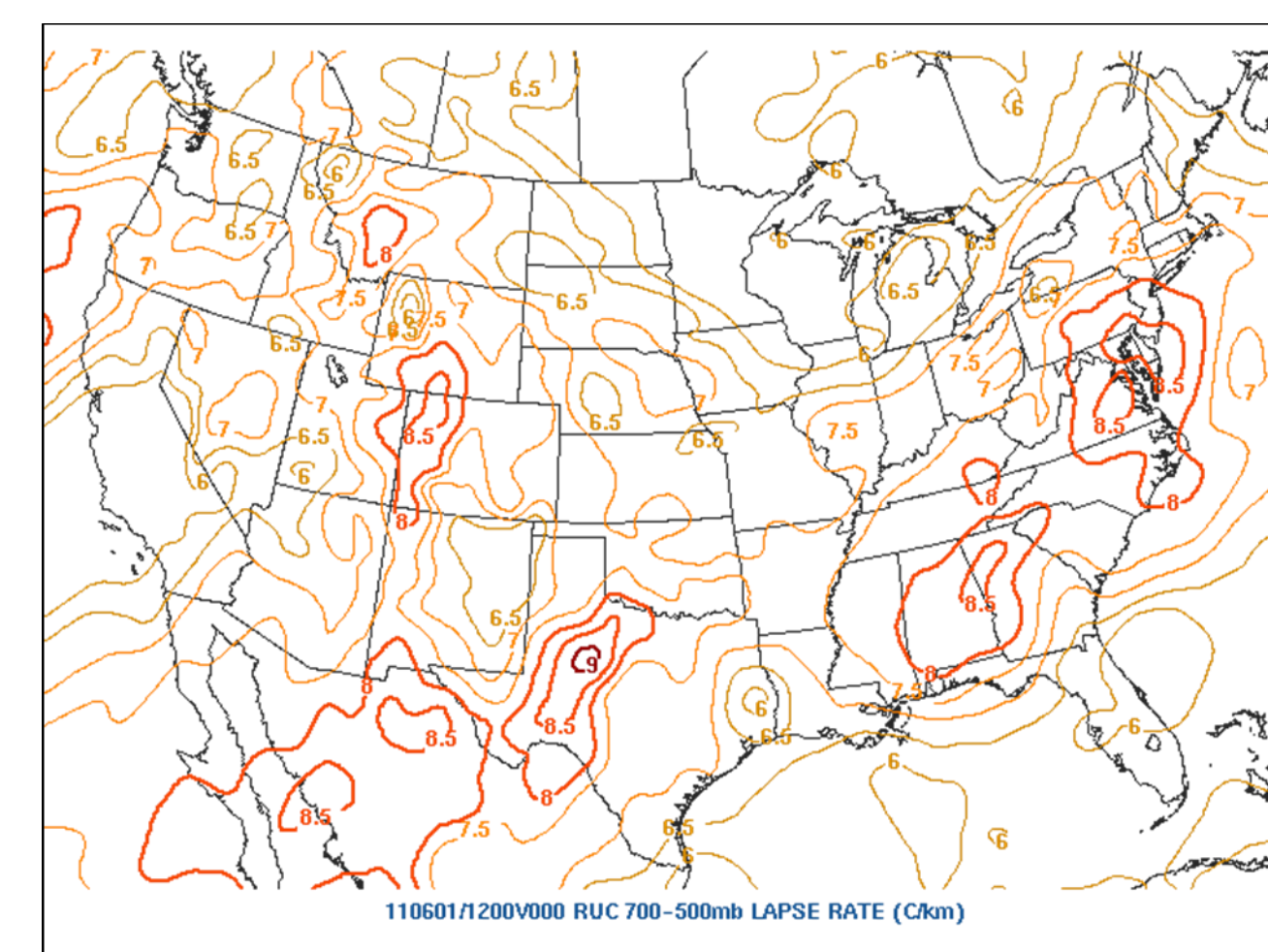


1315 UTC 1 June 2011 Visible, Surface, and LTG

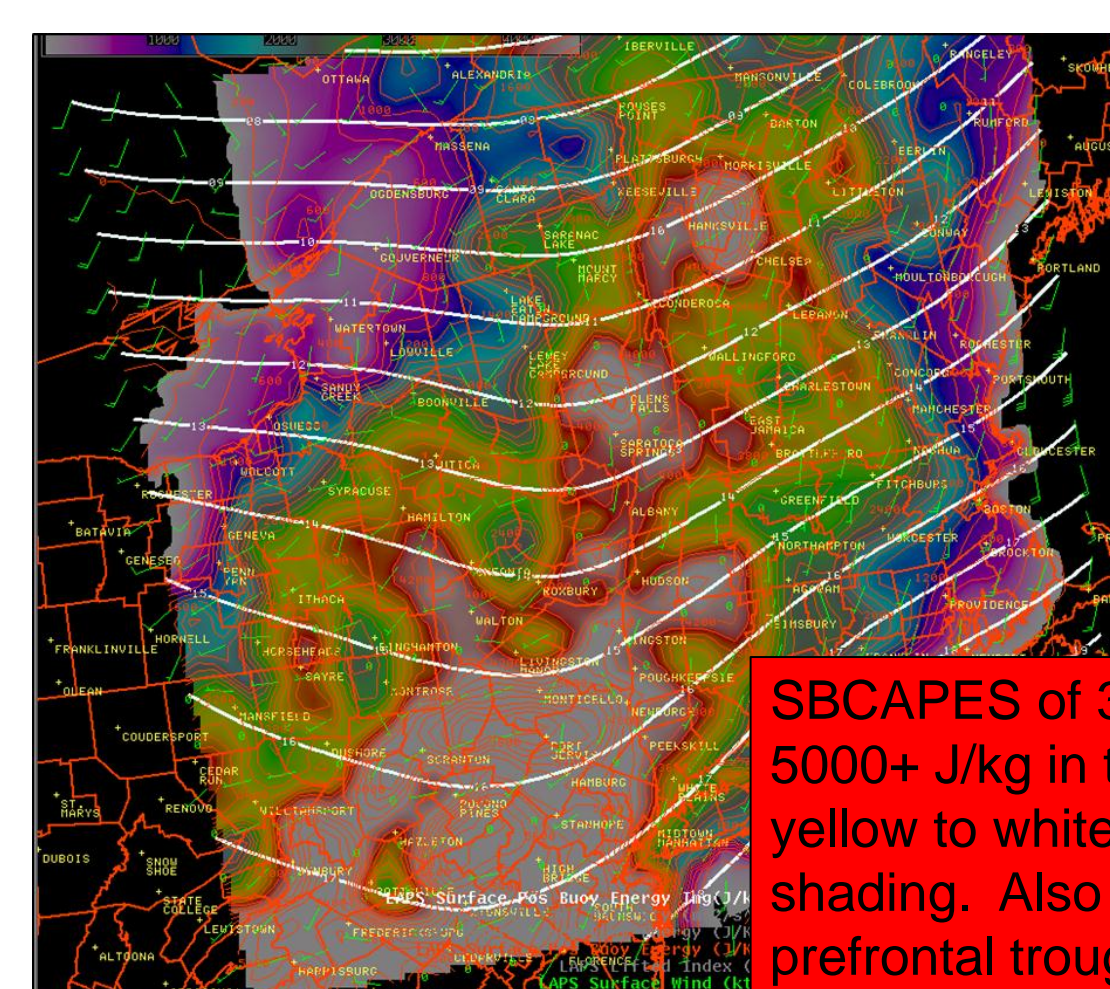


Surface Dewpoints in the mid 60's to lower 70's with a developing prefrontal trough over ERN NY!

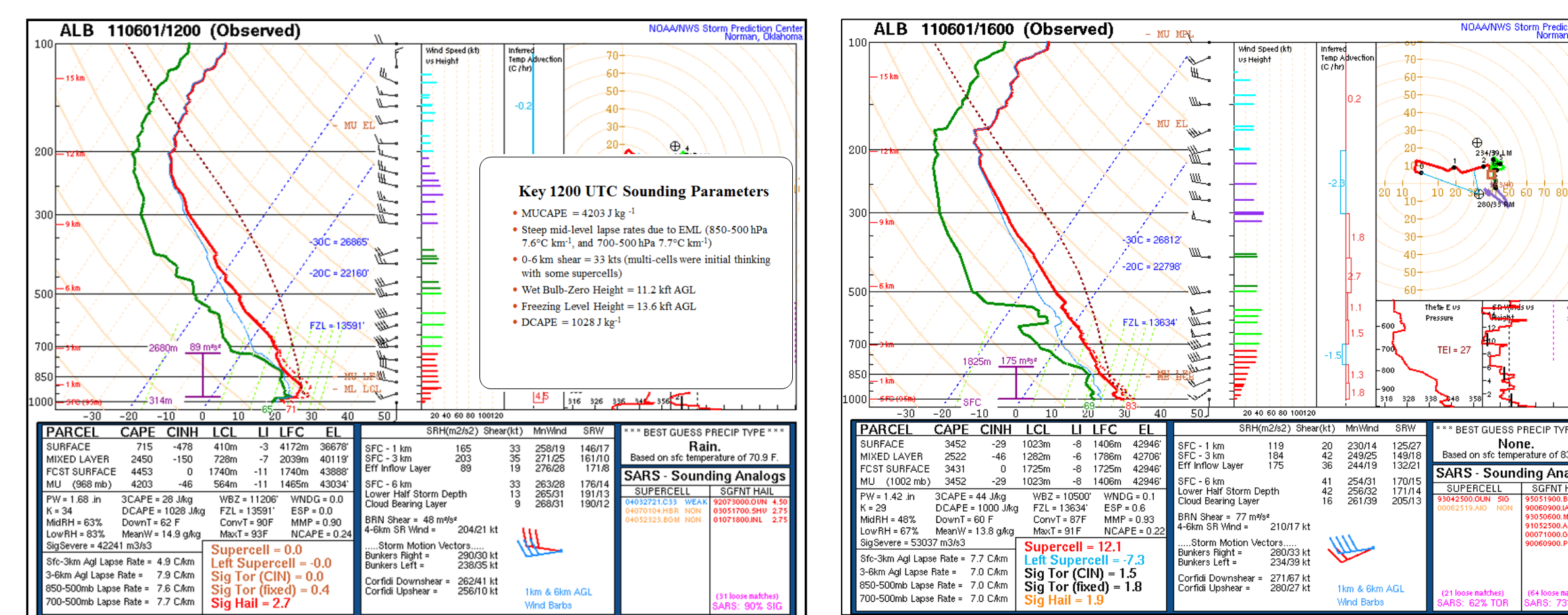
1500 UTC 1 June 2011 Surface Map



1200 UTC RUC 700-500 hPa lapse rates (°C km⁻¹)

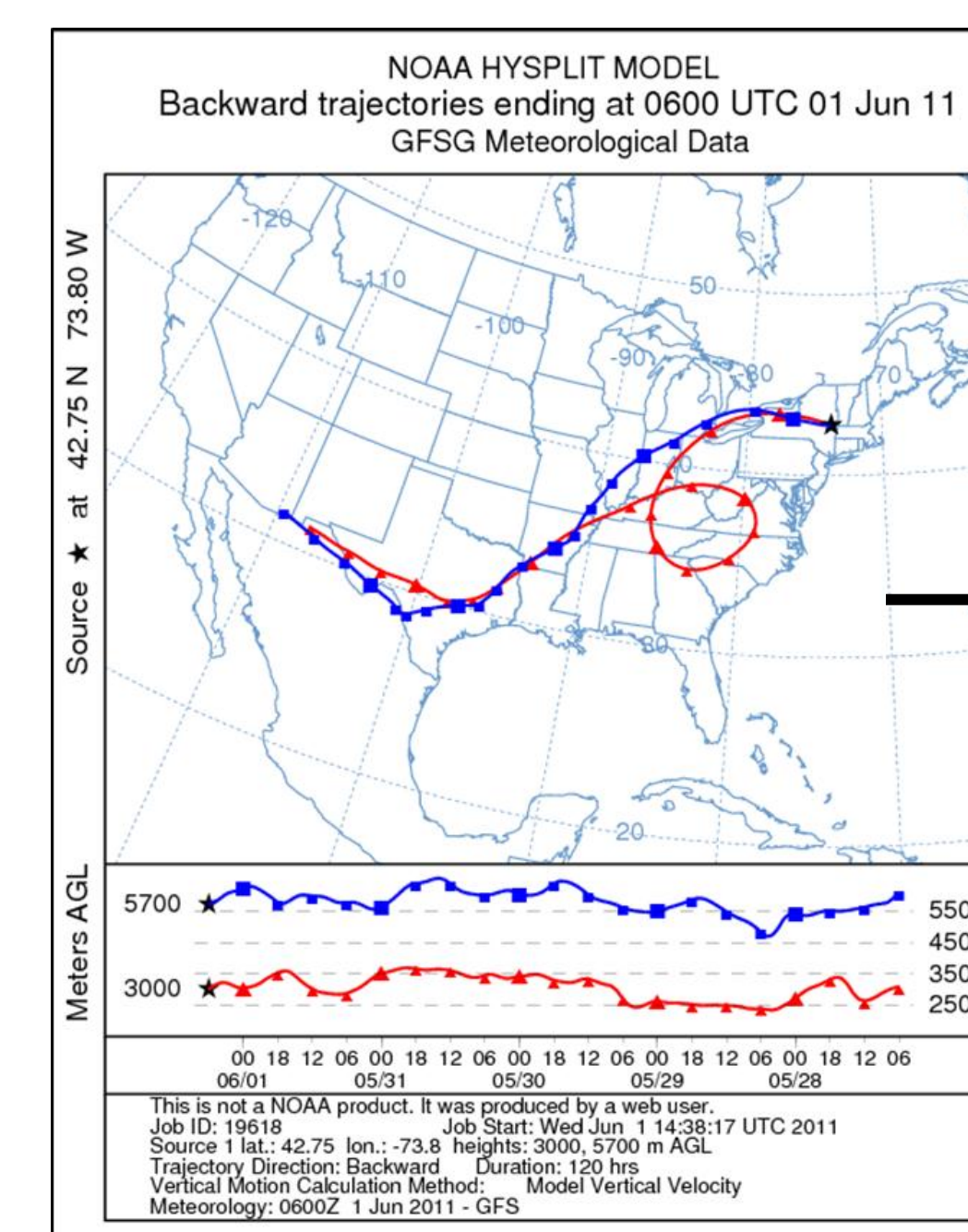


1600 UTC LAPS SBCAPES (J kg⁻¹) & MSLP (hPa)

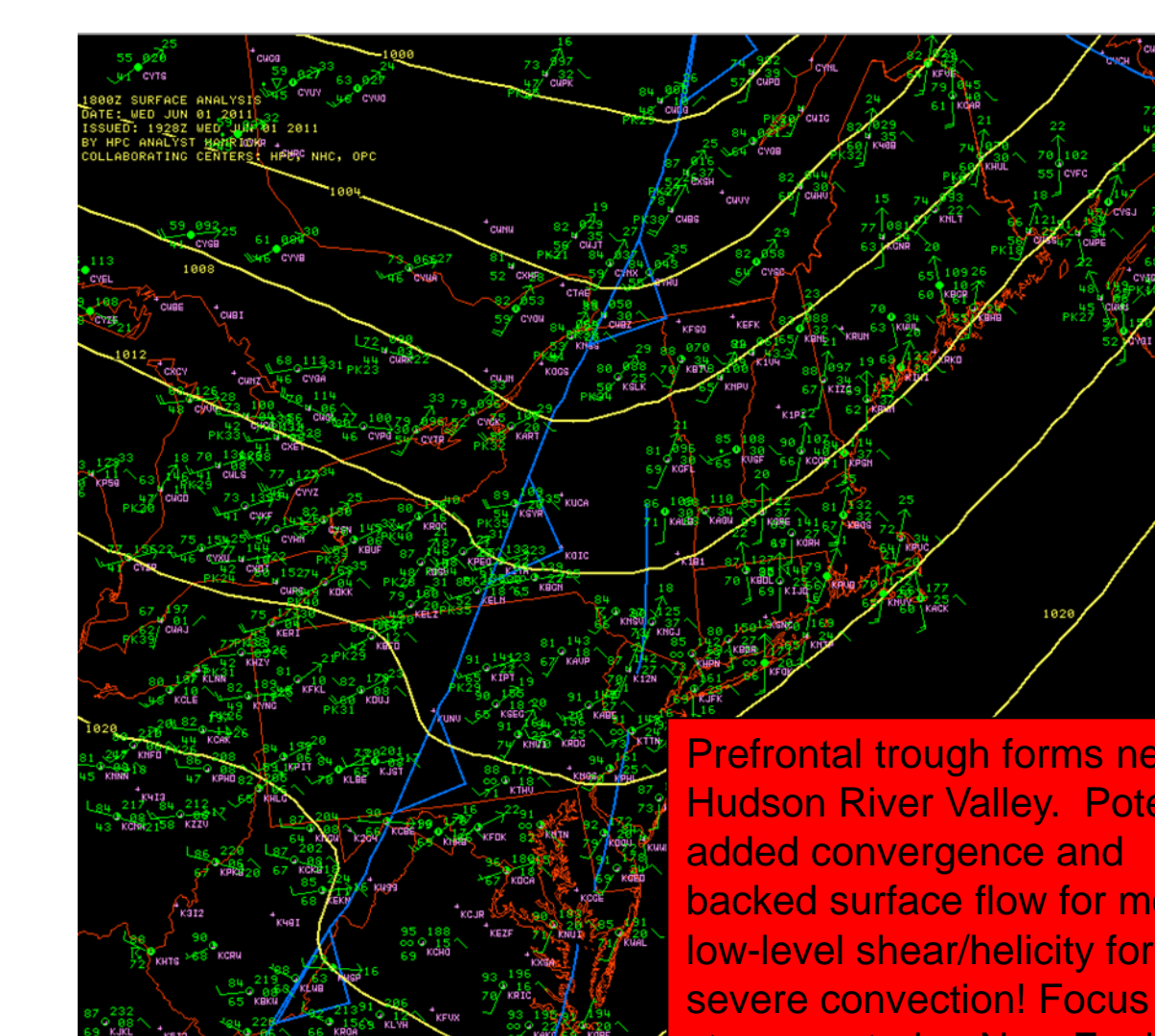


1200 UTC KALB Sounding

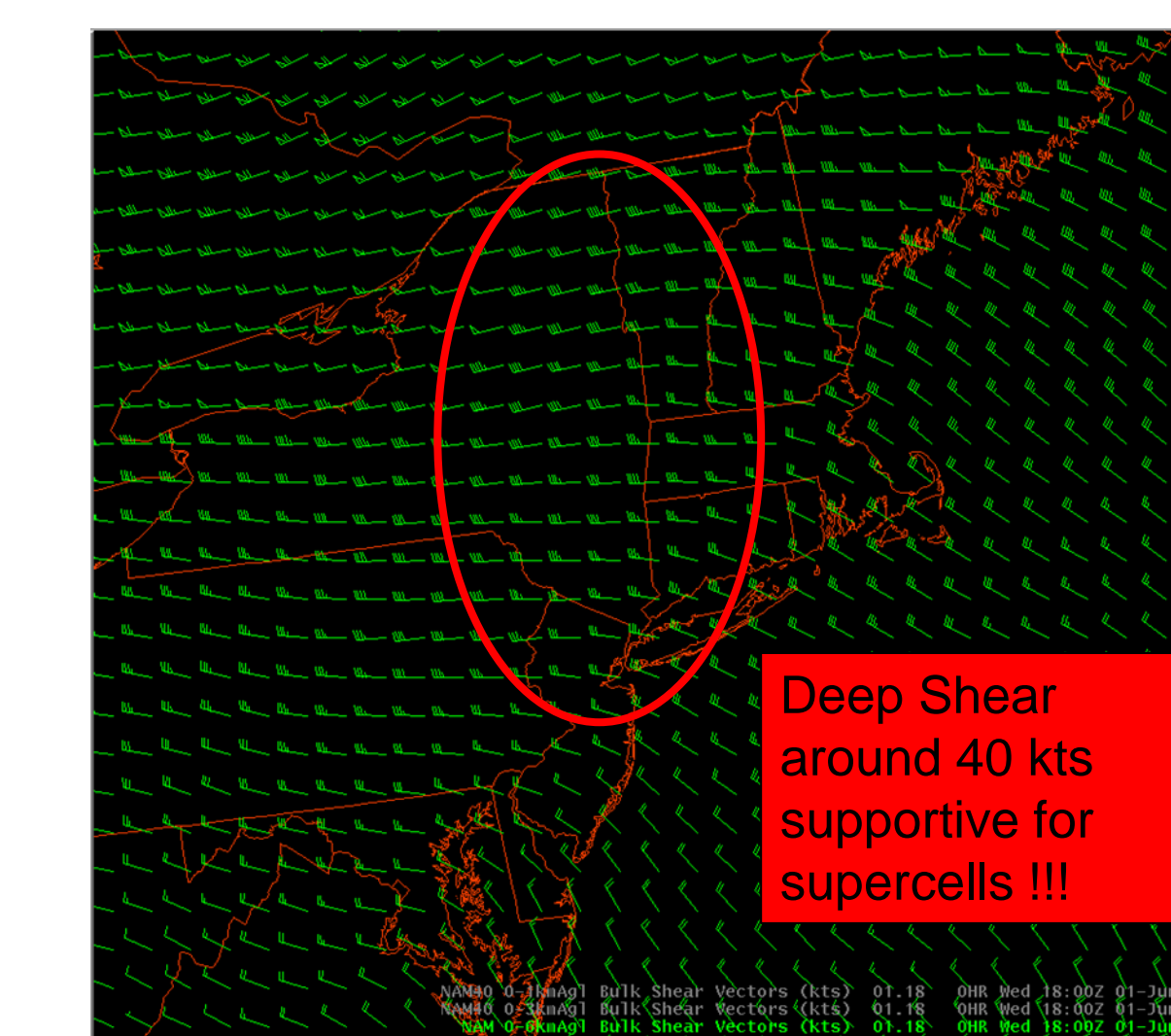
1600 UTC KALB Sounding



HYSPLIT Trajectories of EML



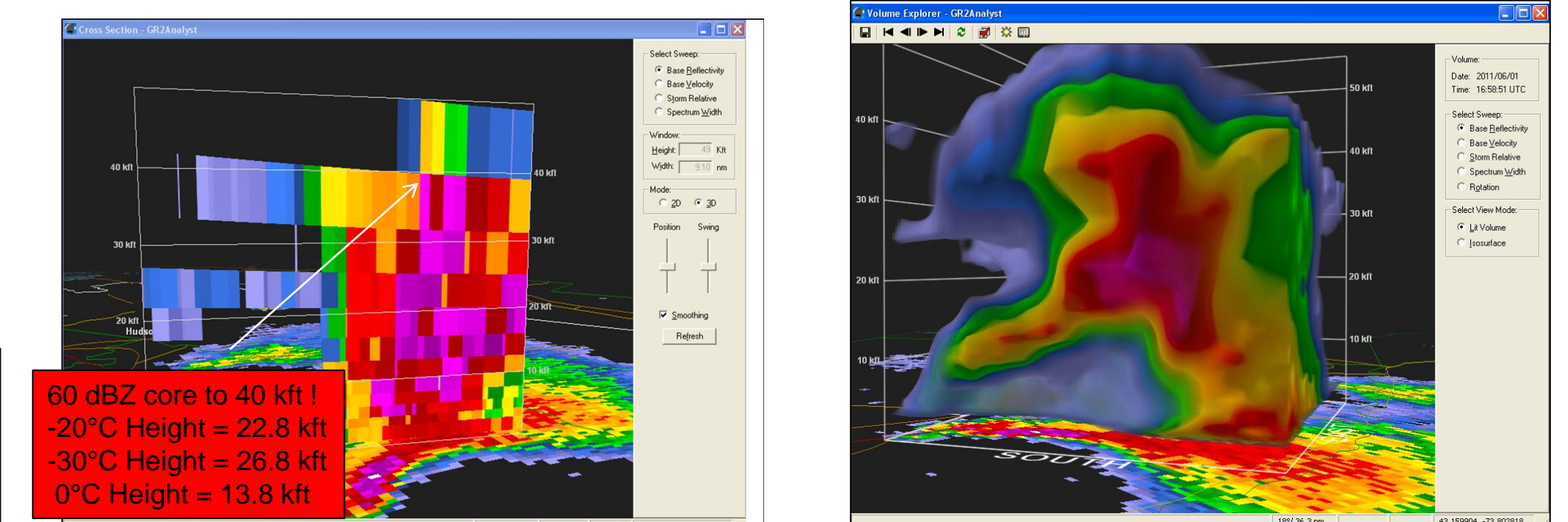
1800 UTC 1 June 2011 Surface Map



1800 UTC NAM 0-6 km Bulk Shear (kts)

Deep Shear around 40 kts supportive for supercells !!!

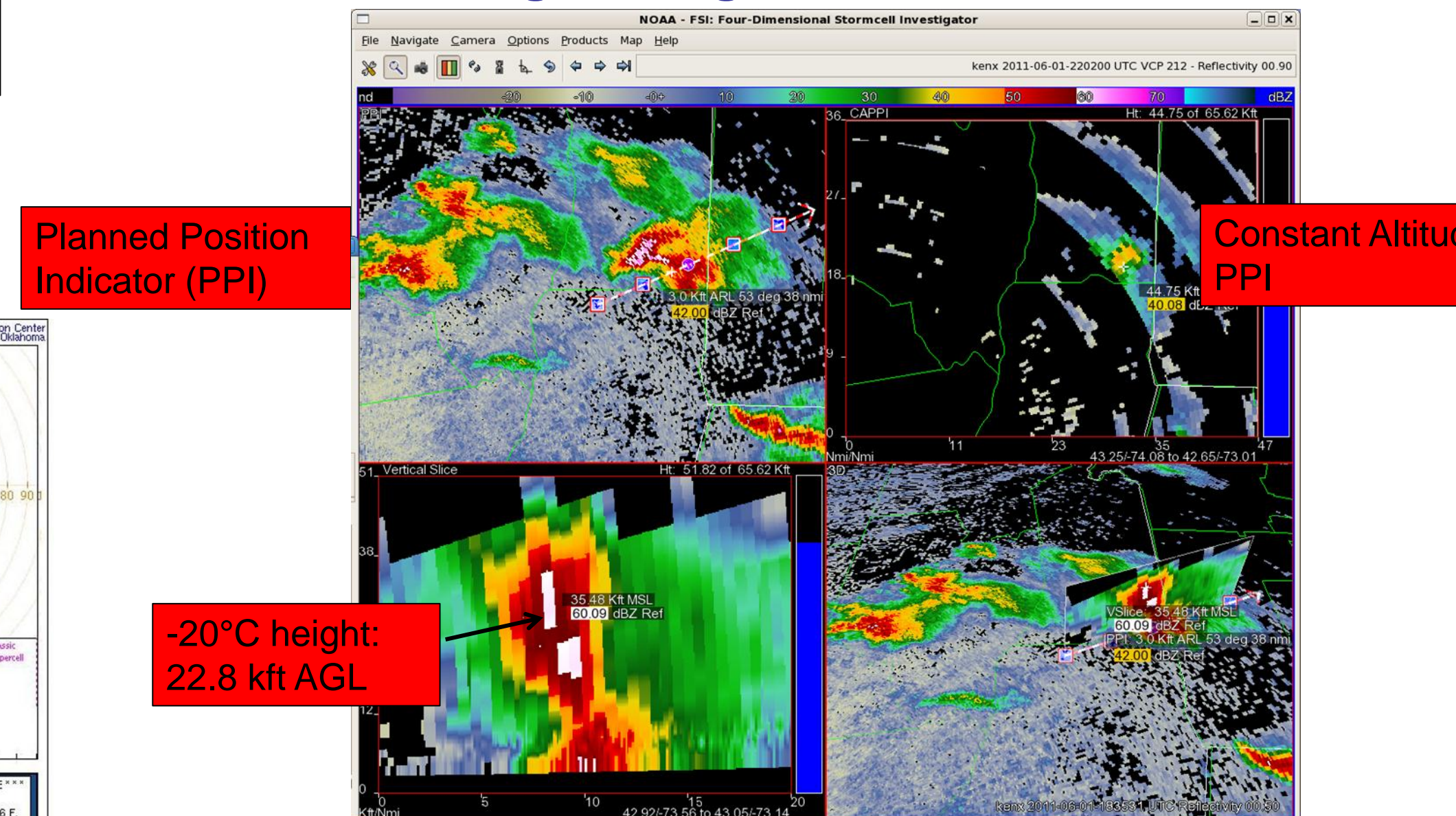
Storm-Scale Analysis



1658 UTC REF Cross-section: Saratoga Springs Baseball Hail

1658 UTC Saratoga Springs Baseball Hail: 3-D GR2Anlyst Lit Volume Perspective

1835 UTC Four Dimensional Storm Cell Investigator: Eagle Bridge Baseball Hail

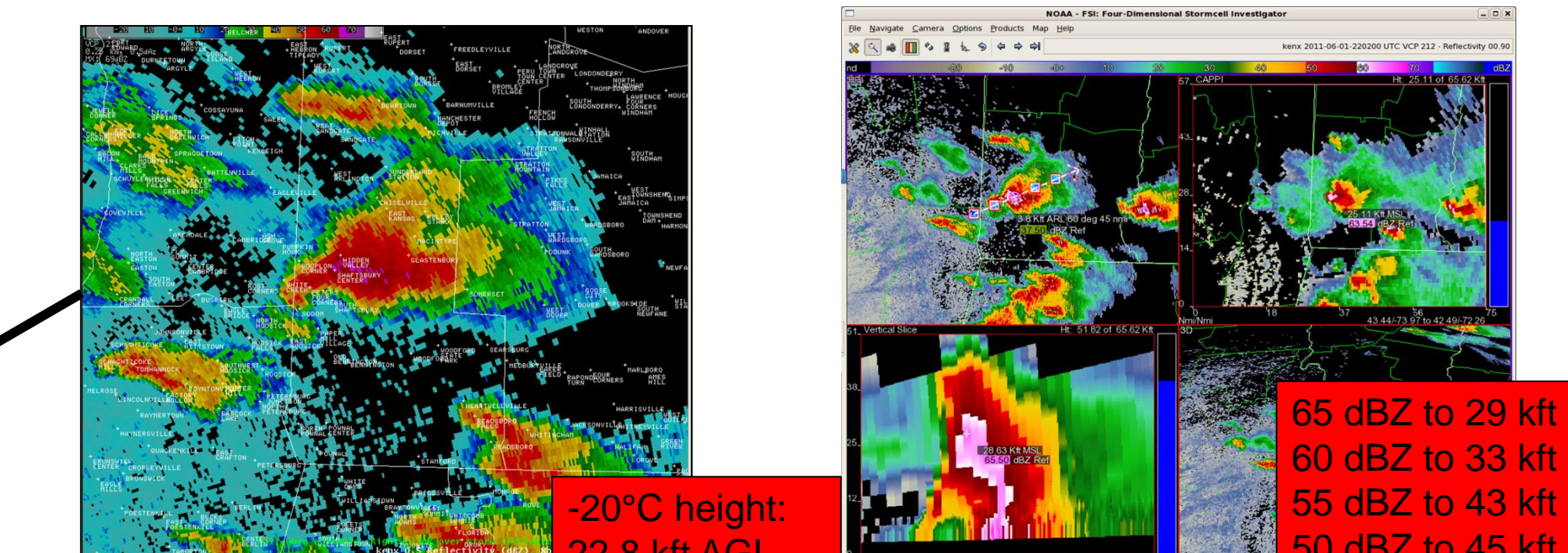


Planned Position Indicator (PPI)

Constant Altitude PPI

-20°C height: 22.8 kft AGL

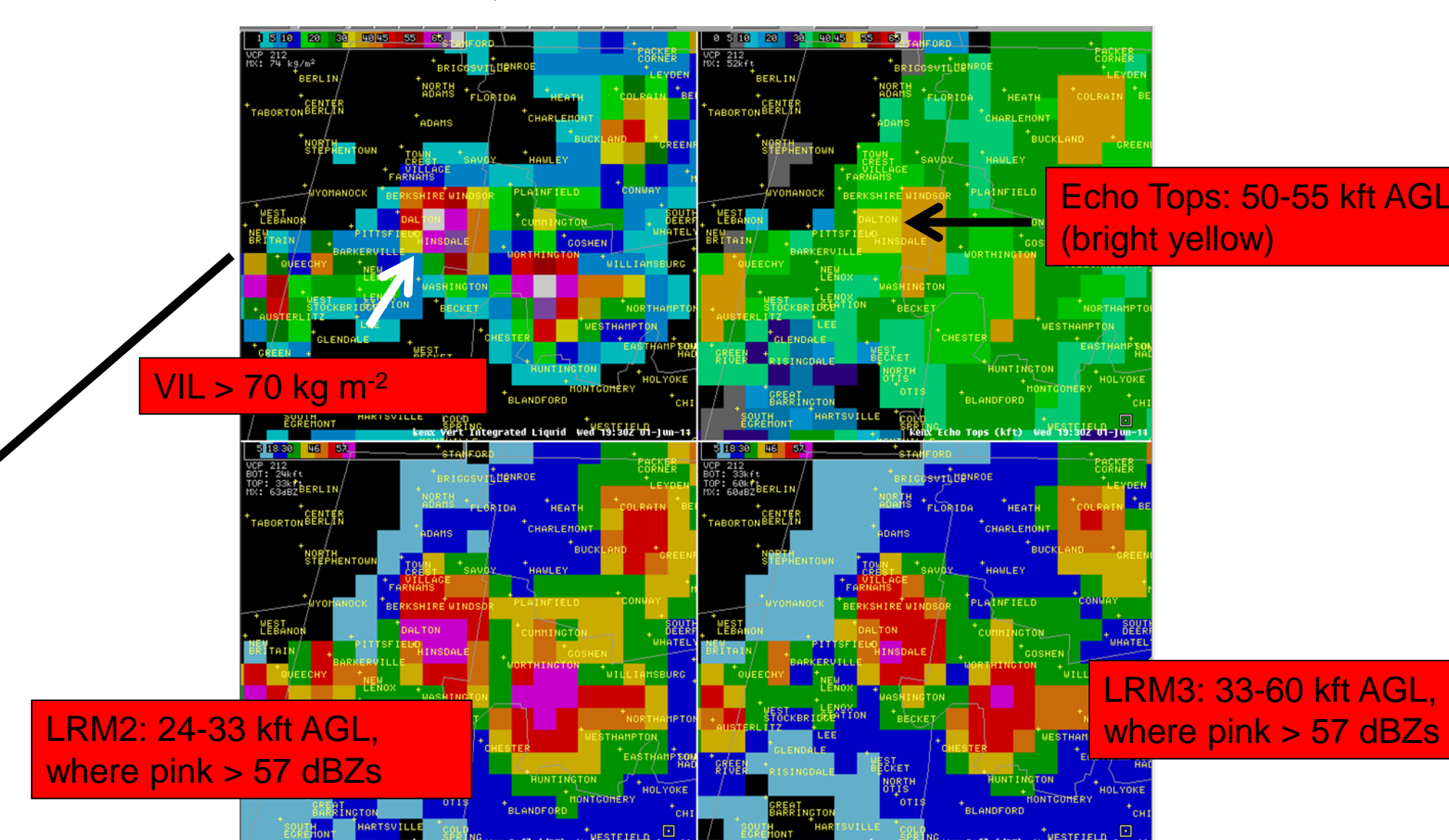
1858 UTC 0.5° Base REF and FSI: Shaftsbury, VT Hail Monster



-20°C height: 22.8 kft AGL

65 dBZ to 29 kft
60 dBZ to 33 kft
55 dBZ to 43 kft
50 dBZ to 45 kft

1930 UTC Windsor, MA 4" Hail Stones: Derived Products



VIL > 70 kg m⁻²

Echo Tops: 50-55 kft AGL (bright yellow)

LRM2: 24-33 kft AGL, where pink > 57 dBZs

LRM3: 33-60 kft AGL, where pink > 57 dBZs



1900 UTC 1 June 2011
3.25" Hail stone Shaftsbury, VT



1930 UTC 4" Hail Stones in Berkshires

Conclusions

- Abundance of instability coupled with deep shear allowed supercells to form producing historically large hail in the Northeast (also tornadoes in New England)
- An EML that originated about 5 days earlier in northern Mexico/western TX played a pivotal role in the hail monsters
- A strong cold front (strong surface/850 hPa dewpoint gradient) and a prefrontal surface trough were the key lifting mechanisms during the severe event
- Intense updrafts due to thick CAPE allowed 50/55/60/65 dBZ reflectivity cores to reach incredible heights for mammoth hail stones (up to 4" in the Berkshires)