The 16 July 2024 Significant Severe and Tornadic Event across New York and New England
Part I: Synoptic and Mesoscale Overview

Thomas A. Wasula and Neil A. Stuart
NOAA/NWS Albany, NY

NROW XXV
November 13-15, 2024

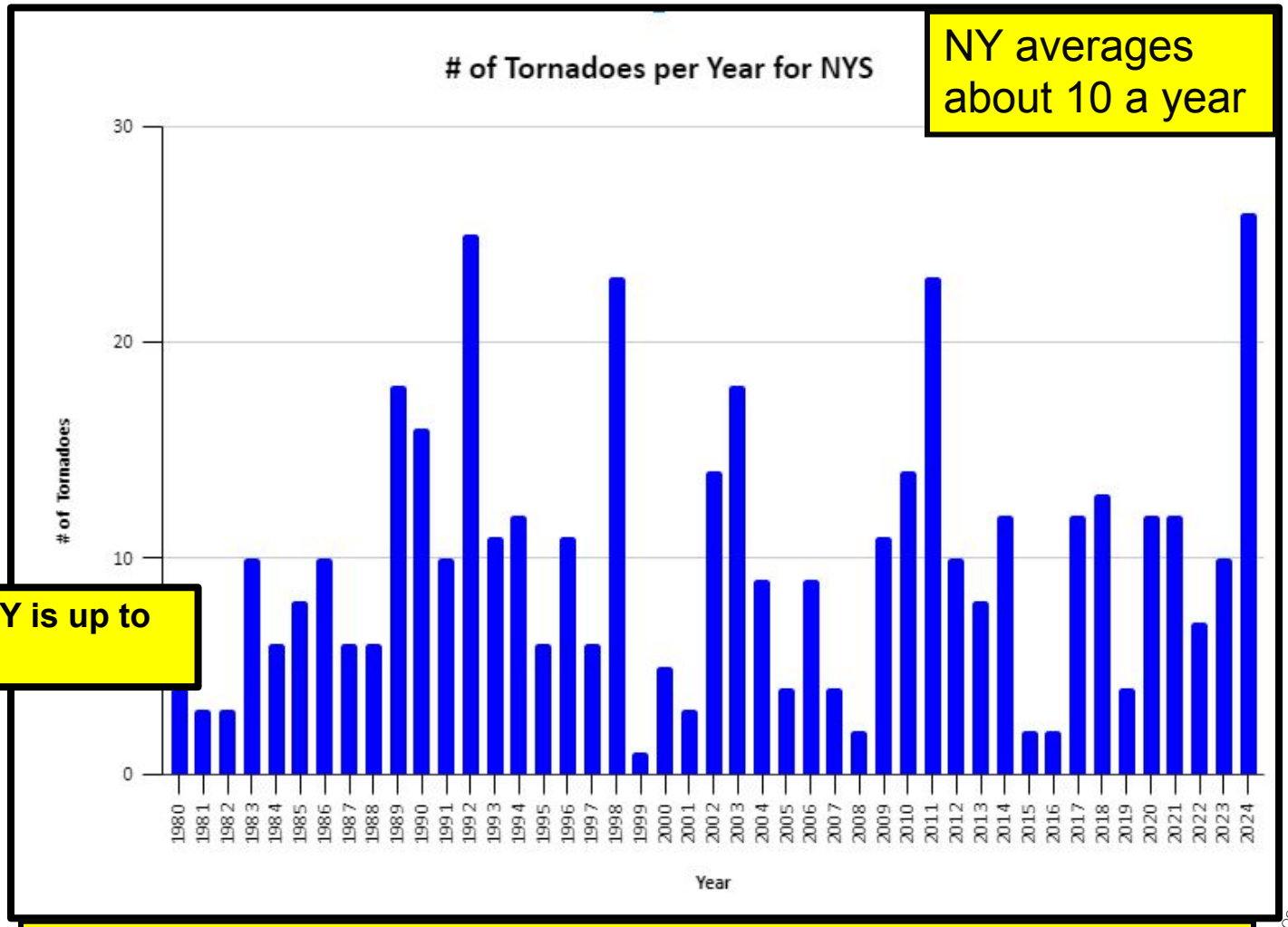
Motivation

- Widespread severe event occurred across upstate NY into New England (tornadoes, microbursts, widespread wind damage)
- 11 tornadoes occurred in NY occurred on this day. The climatology of tornadoes in NY from 1980-Jul 2024 ~ 10/year. 8 occurred in the WFO ALY County Warning Area (which averages 3/year)
- **Key question**: What caused the tornadoes and widespread wind damage on 16 Jul 2024 and what was the convective environment? Mesoscale Convective Vortex (MCV) presence

Outline

- Review New York & WFO ALY Tornado Climatology
- Synoptic Overview
- Sounding & Mesoscale Analysis (SPC Meso-analysis data (Rapid Refresh))
- NYS Mesonet applications during event
- Brief application to past CSTAR work

1980 - JUL 2024 Tornadoes Annually in NYS

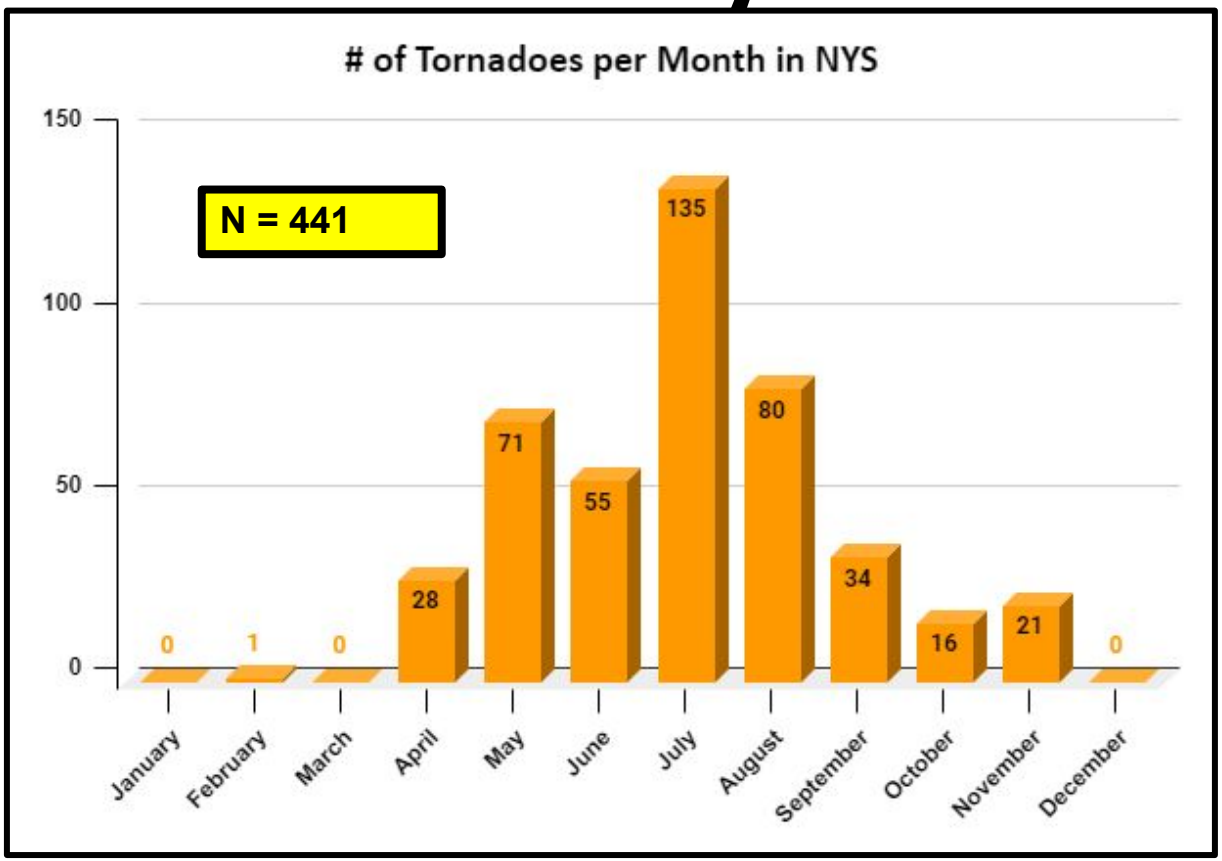


NY averages about 10 a year

Unofficially NY is up to 32 in 2024!!!

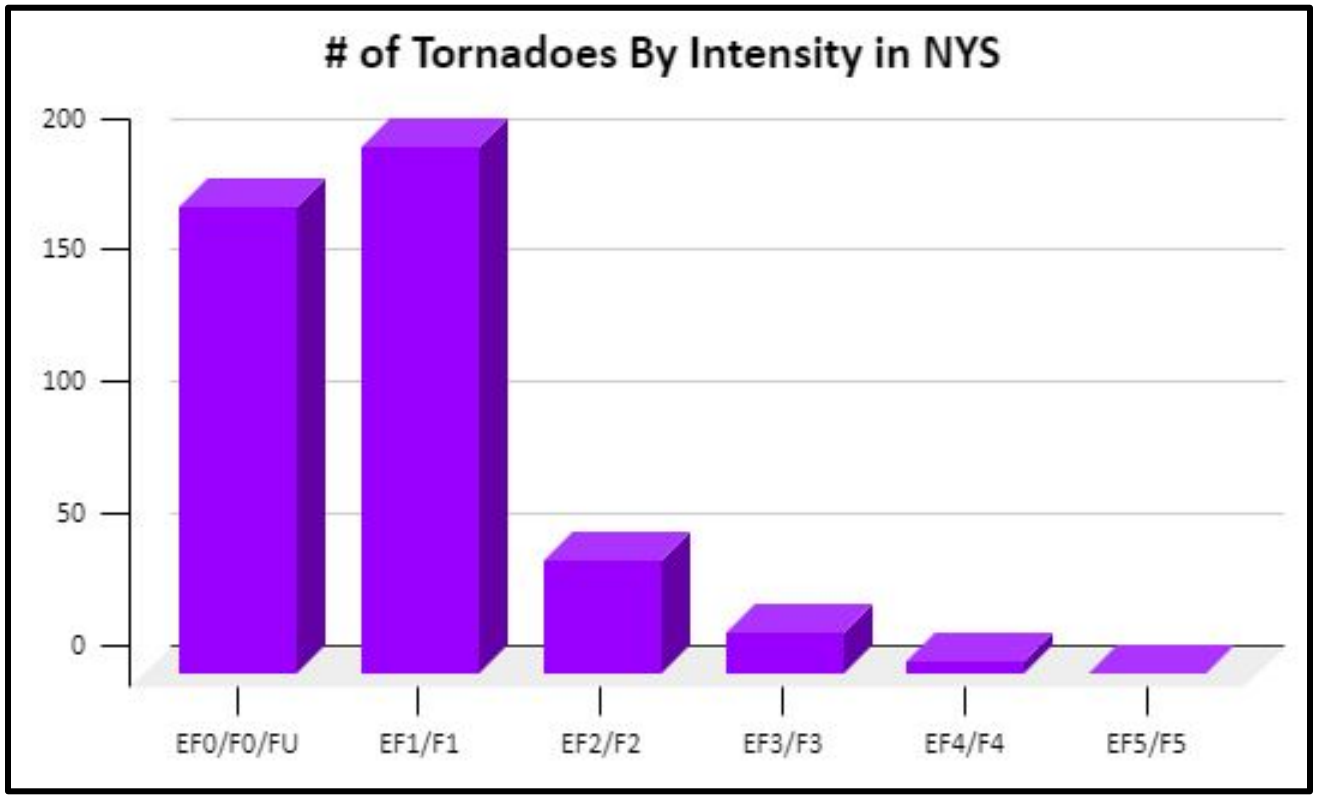
- **NYS average 10 reports/year (n=441 on chart)**
- **Numbers can be slightly skewed, since several reports from one tornado can be entered in NCEI Storm Data**

1980 - JUL 2024 NYS Tornadoes by Month



Peak in summer (July and August). 77% (341/441) tornado events in May to August. (Source: NCEI)

1980 - JUL 2024 NYS Tornadoes by EF-scale Intensity/Strength

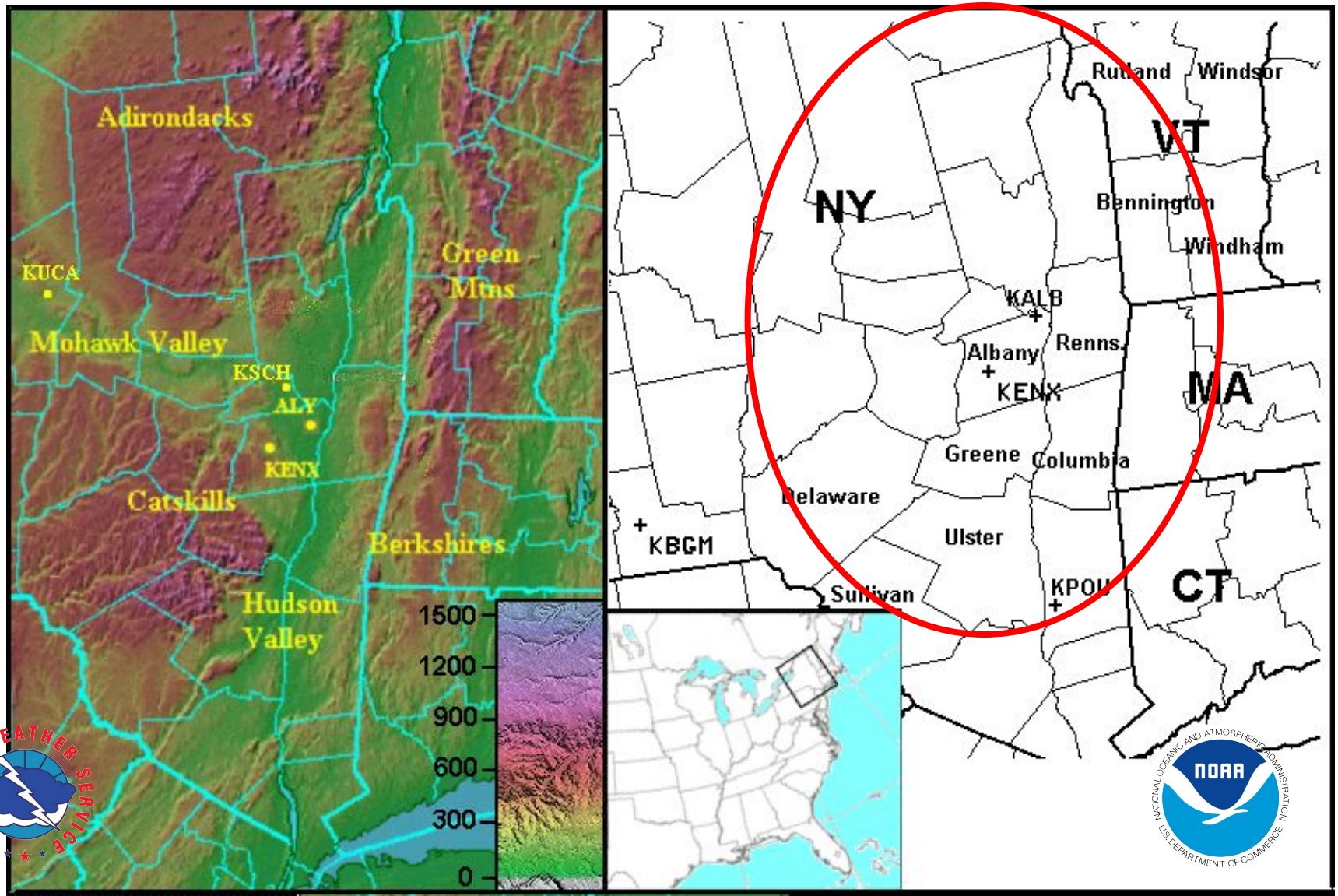


N=441 tornado events

~85% are EF0/F0 and EF1/F1!!!

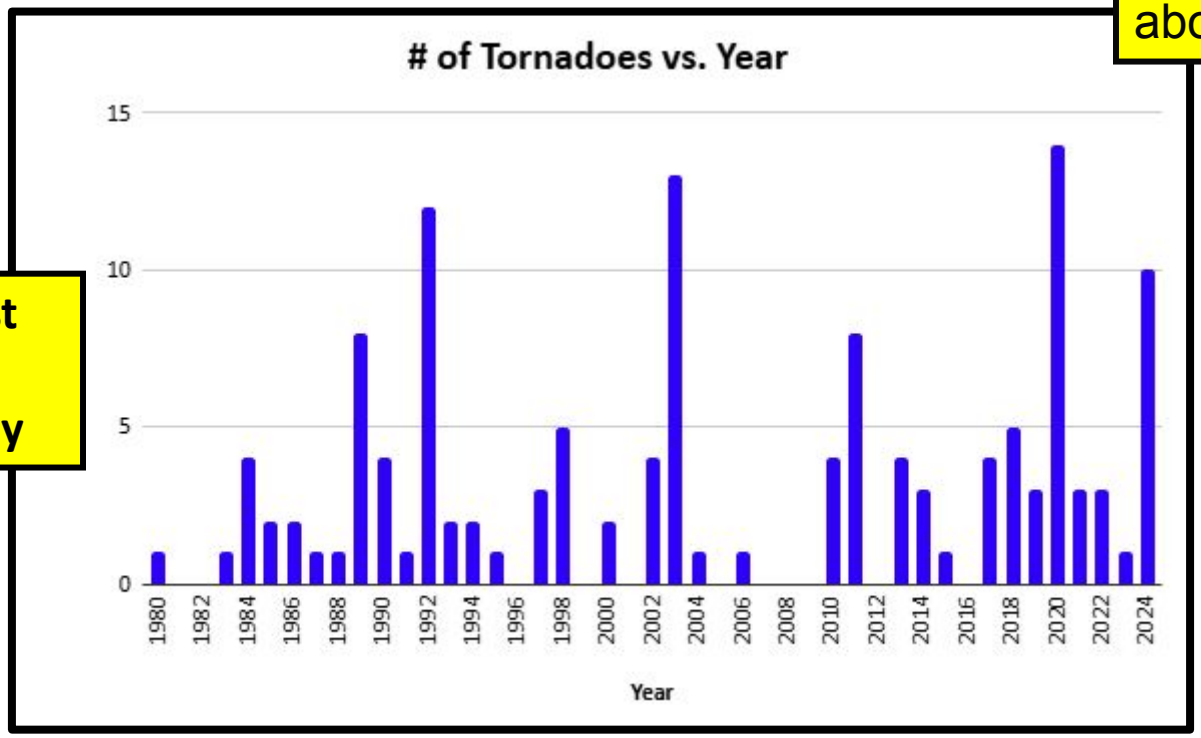
***~ 5% are EF3/F3 or greater

NWS at Albany Forecast Area



1980 - JUL 2024 Tornadoes Annually in WFO at ALY CWA

NY averages about 10 a year

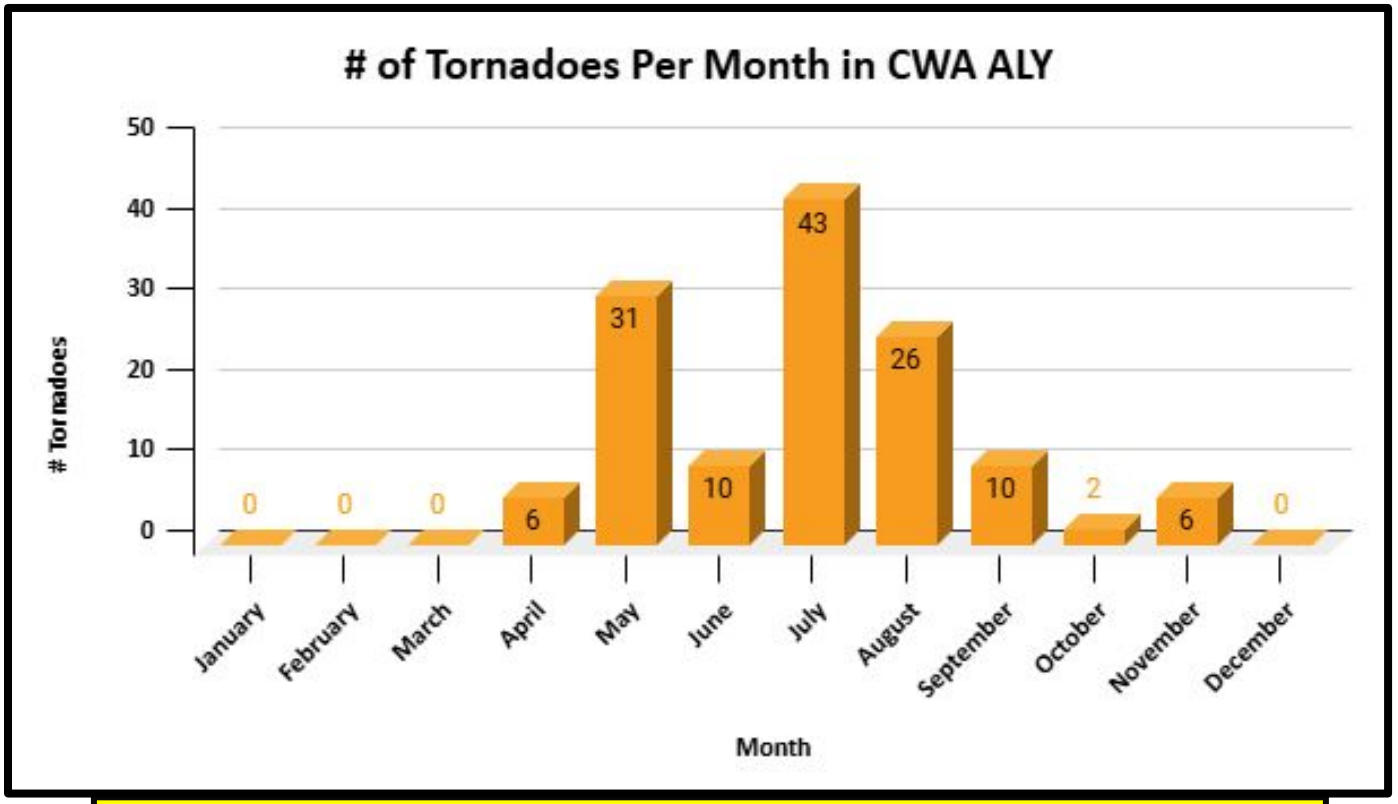


WFO ALY forecast area had 2 EF0's and 7 EF1's in July

- **ALY CWA average 3 reports/year (n=134 on chart)**
- **Numbers can be skewed, since several reports from one tornado are entered in *StormData* separately (i.e. 2003)**

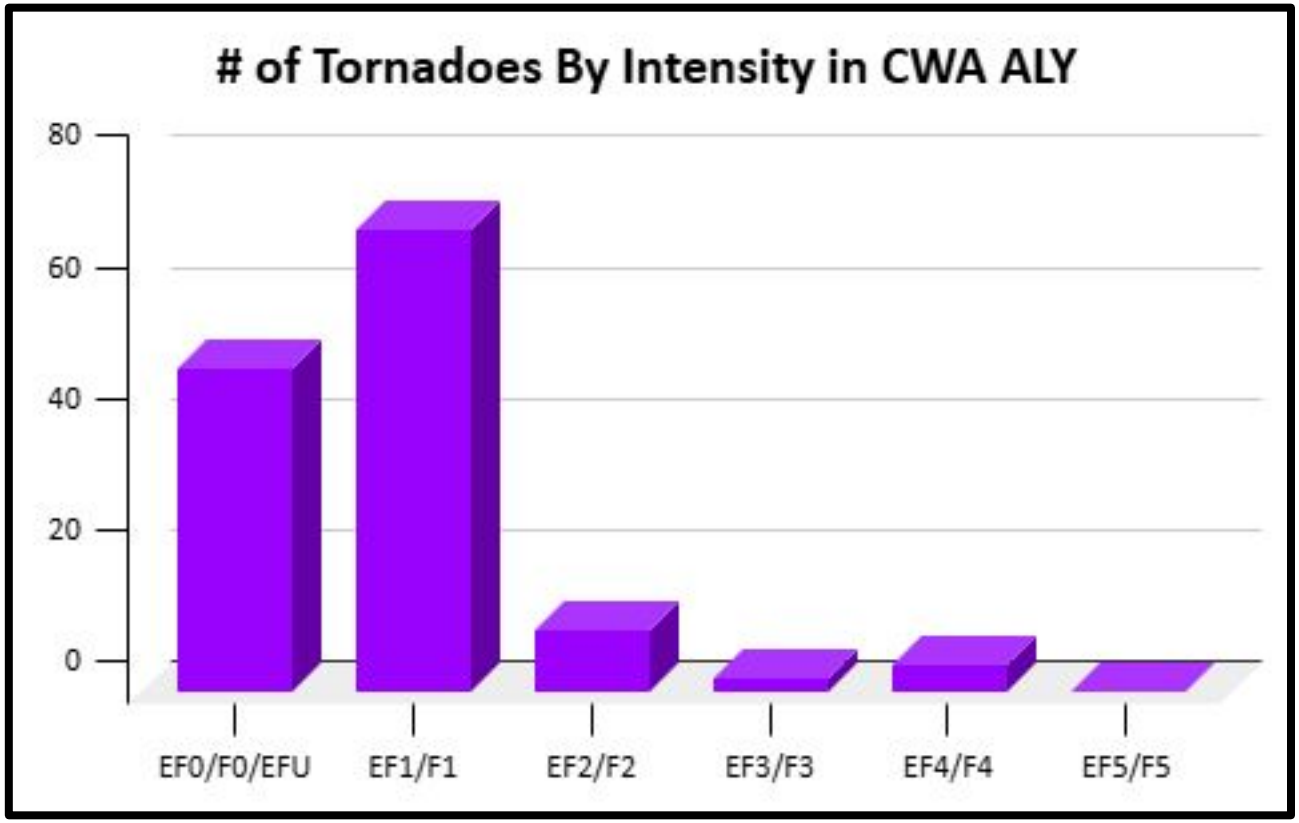
1980 - JUL 2024 ALY CWA Tornadoes by Month

(N = 134 tornado events)



Peak in late Spring into Summer (May and July maxima's). A significant increase in August cases (3) 2019 and 2020 (11) with 14 tornadoes!

1980 - JUL 2024 ALY CWA Tornadoes by EF-scale Intensity/Strength

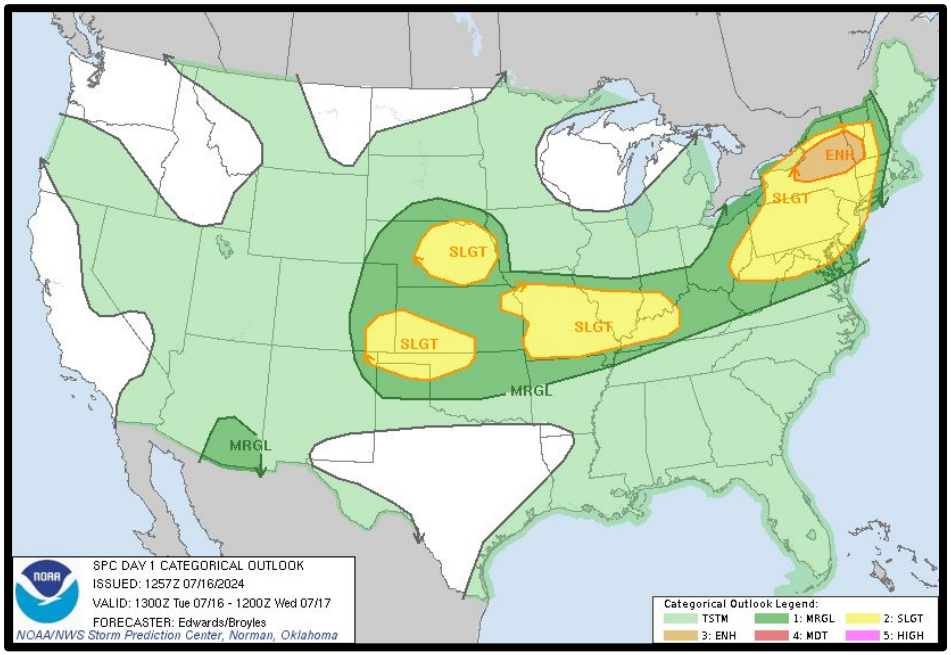


N=134 tornado events

~89% are EF0/F0 and EF1/F1!!!

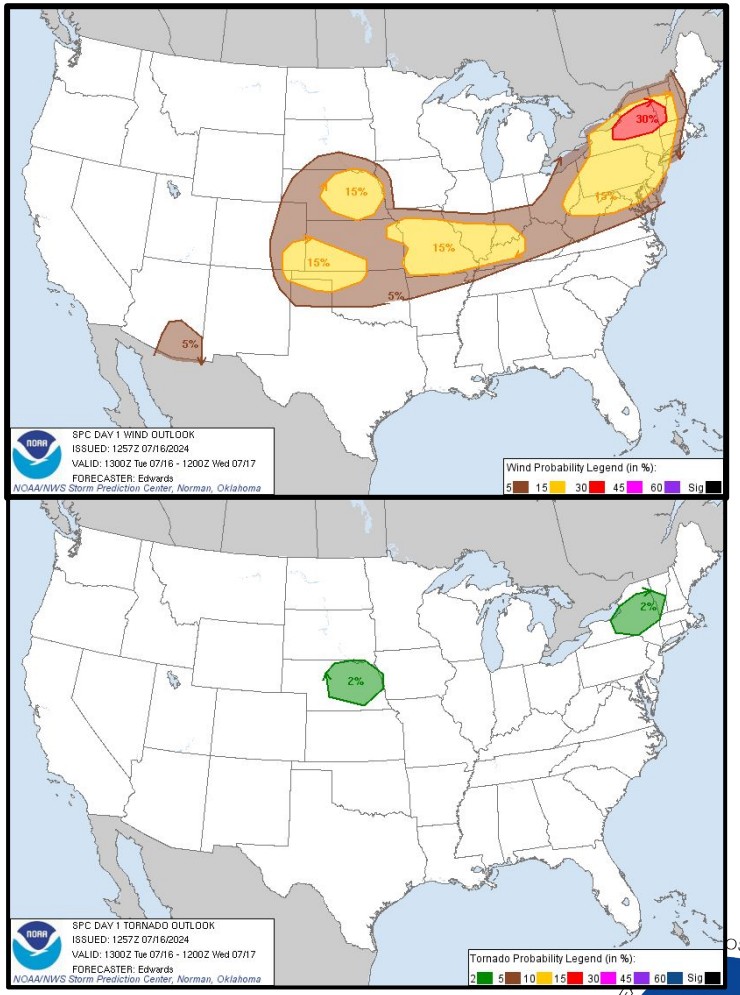
***~ 4% are EF3/F3 or greater

SPC Day 1 Outlooks: 16 JUL 2024



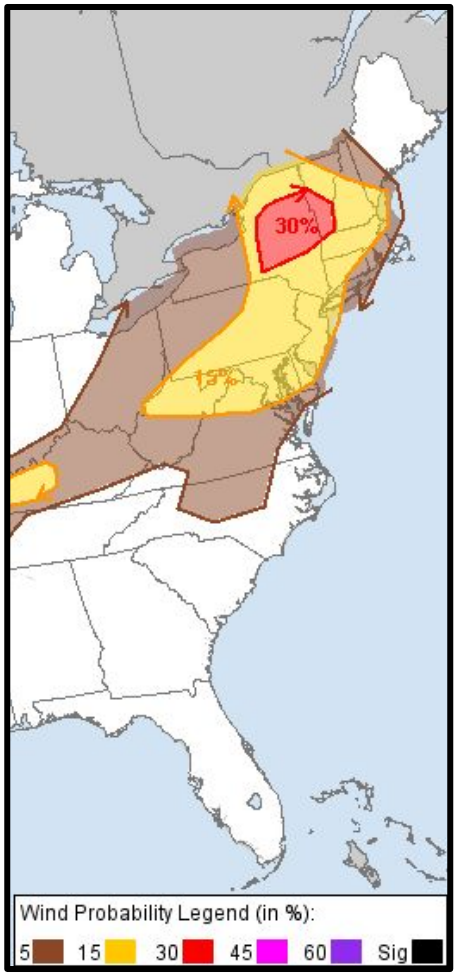
1300 UTC: Day 1

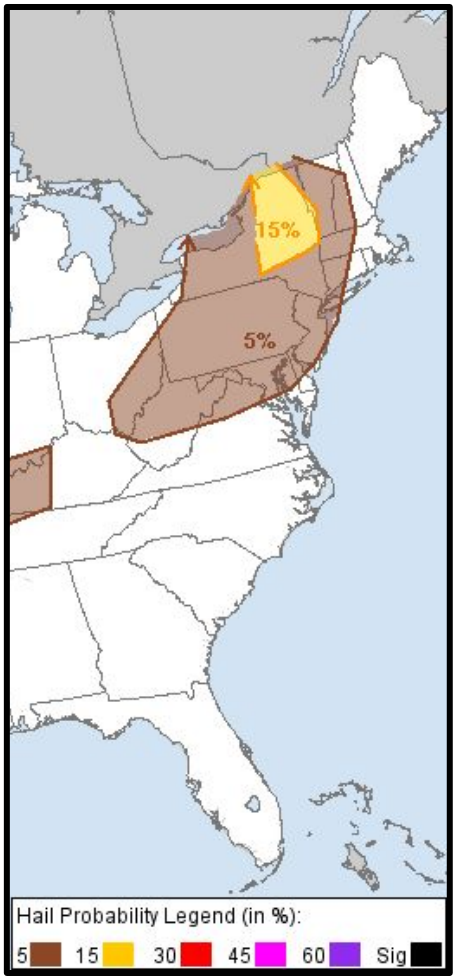
Note: Slight Risk area highlighted well in previous Day 2 Outlook for the Northeast



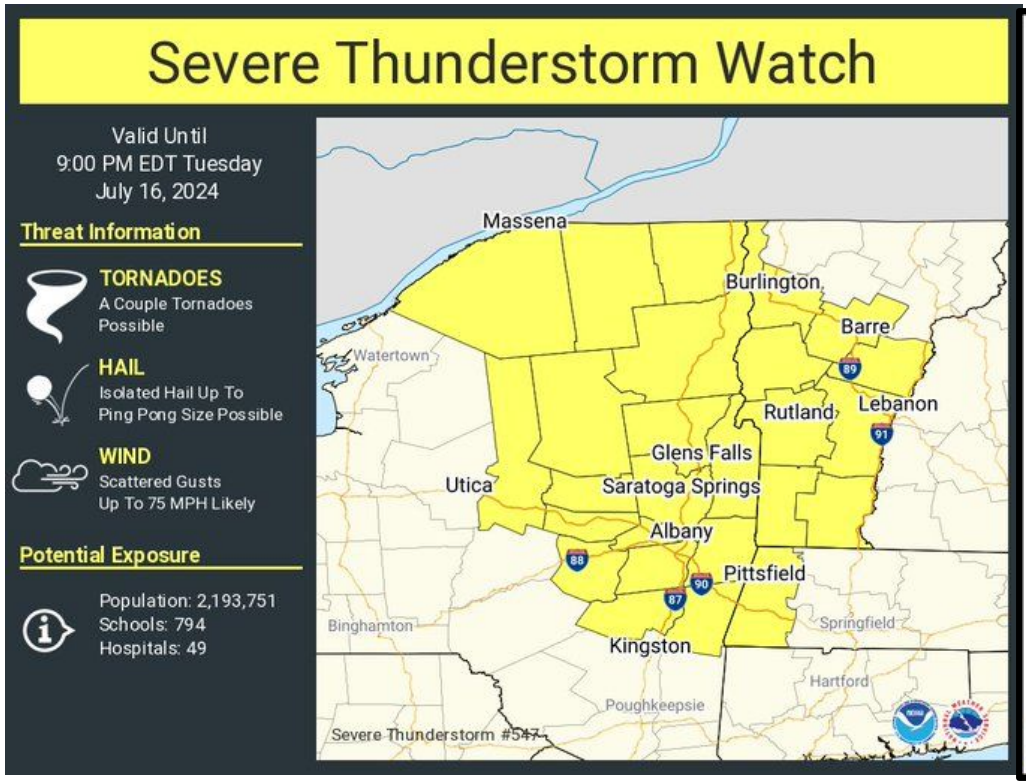
1300 UTC: Day 1 Wind and Tornado Probabilities

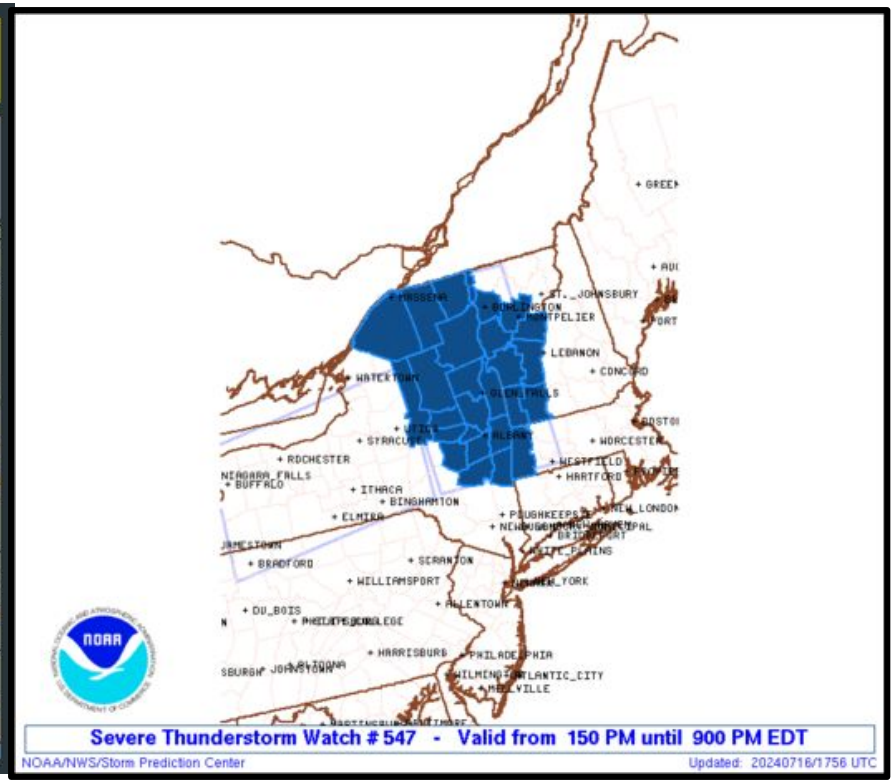
SPC Day 1 Severe Probability Outlooks: 2000 UTC 16 JUL 2024





1750 UTC: Severe Thunderstorm Watch Issued

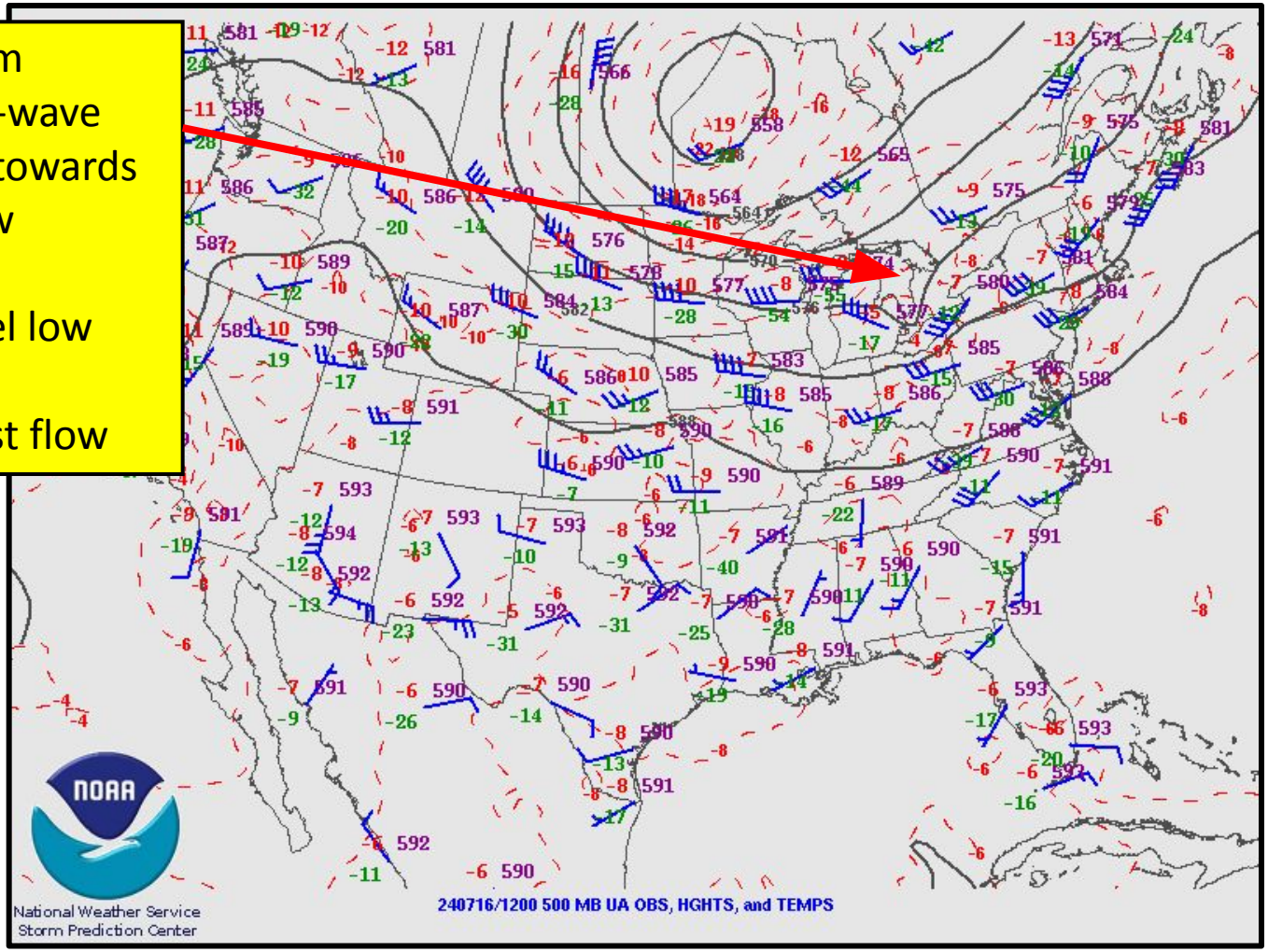




WFO ALY was flexible either way with a Tornado or Severe Thunderstorm Watch. Based on collab with SPC, WFO BTV and BGM, severe thunderstorms with damaging winds were main threat with isolated tornado or two!

1200 UTC 16 JUL 2024
500 hPa Heights, Isotachs, and Temps

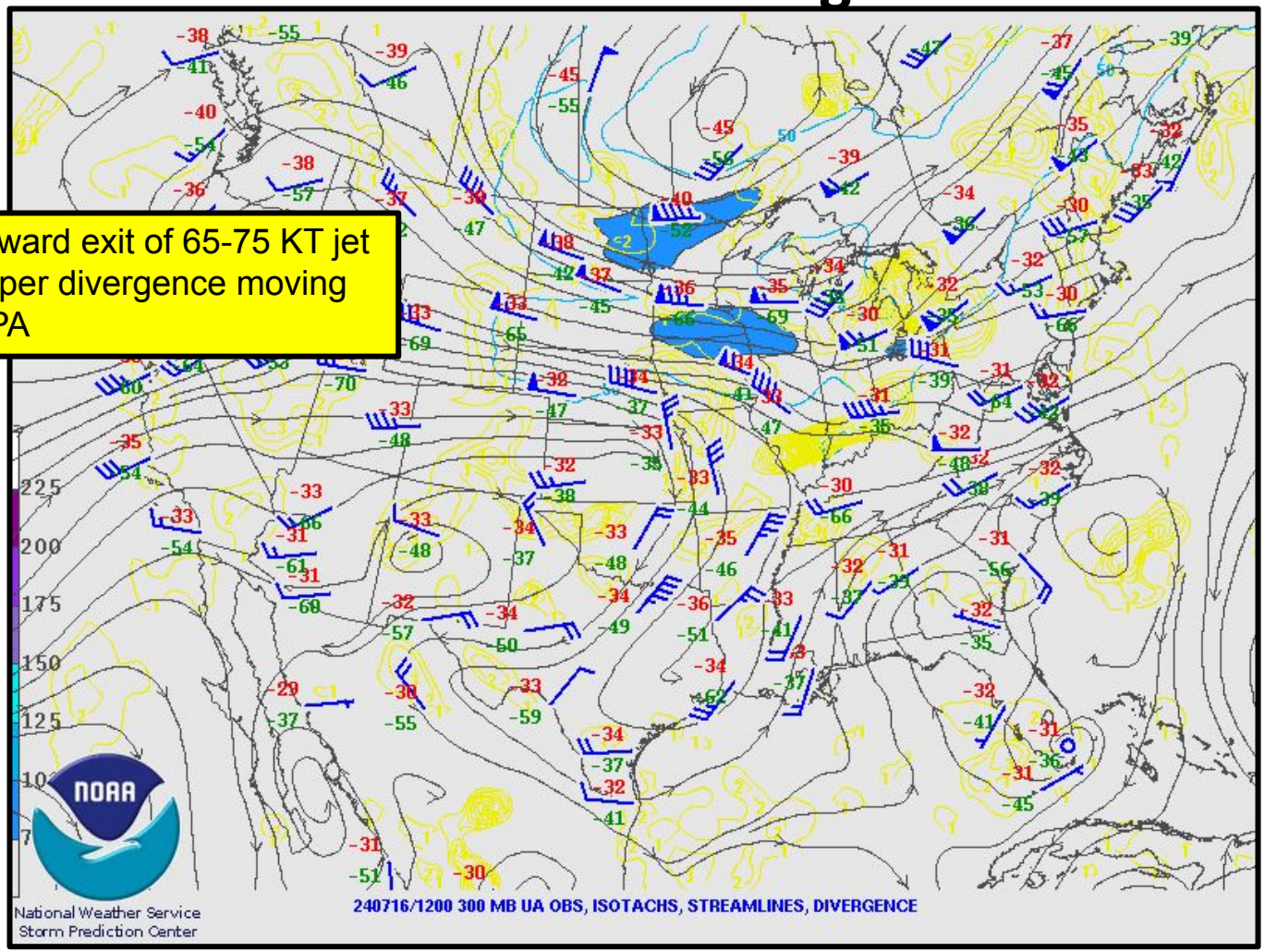
Strong upstream mid-level short-wave (MCV) moving towards the NY and New England.
Closed mid level low over Ontario.
West/southwest flow 40-45 KT.



www.spc.noaa.gov

1200 UTC 16 JUL 2024
300 hPa Upper Observations, Streamlines, Isotachs and Divergence

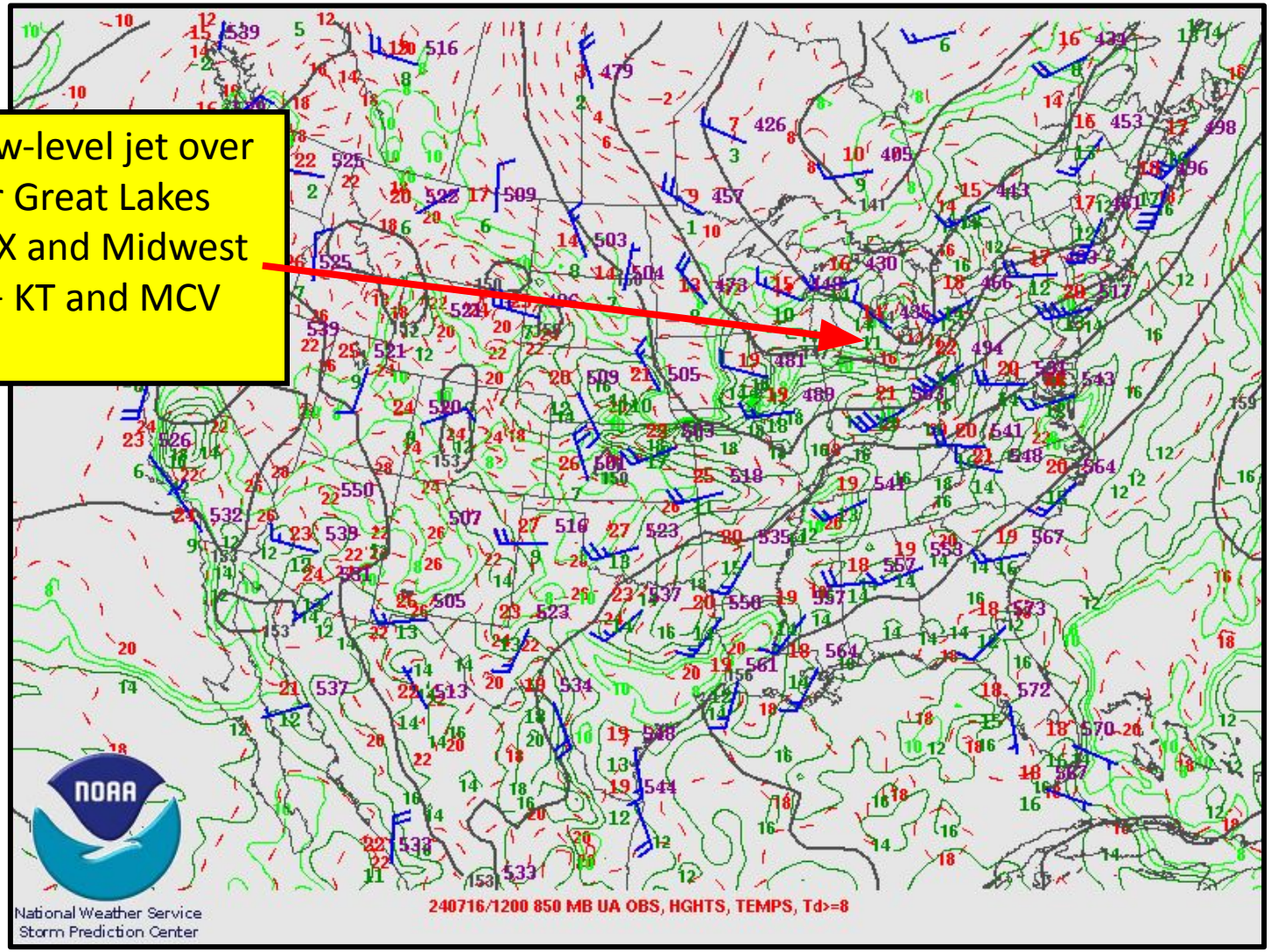
Left front/poleward exit of 65-75 KT jet streak with upper divergence moving over NY and PA



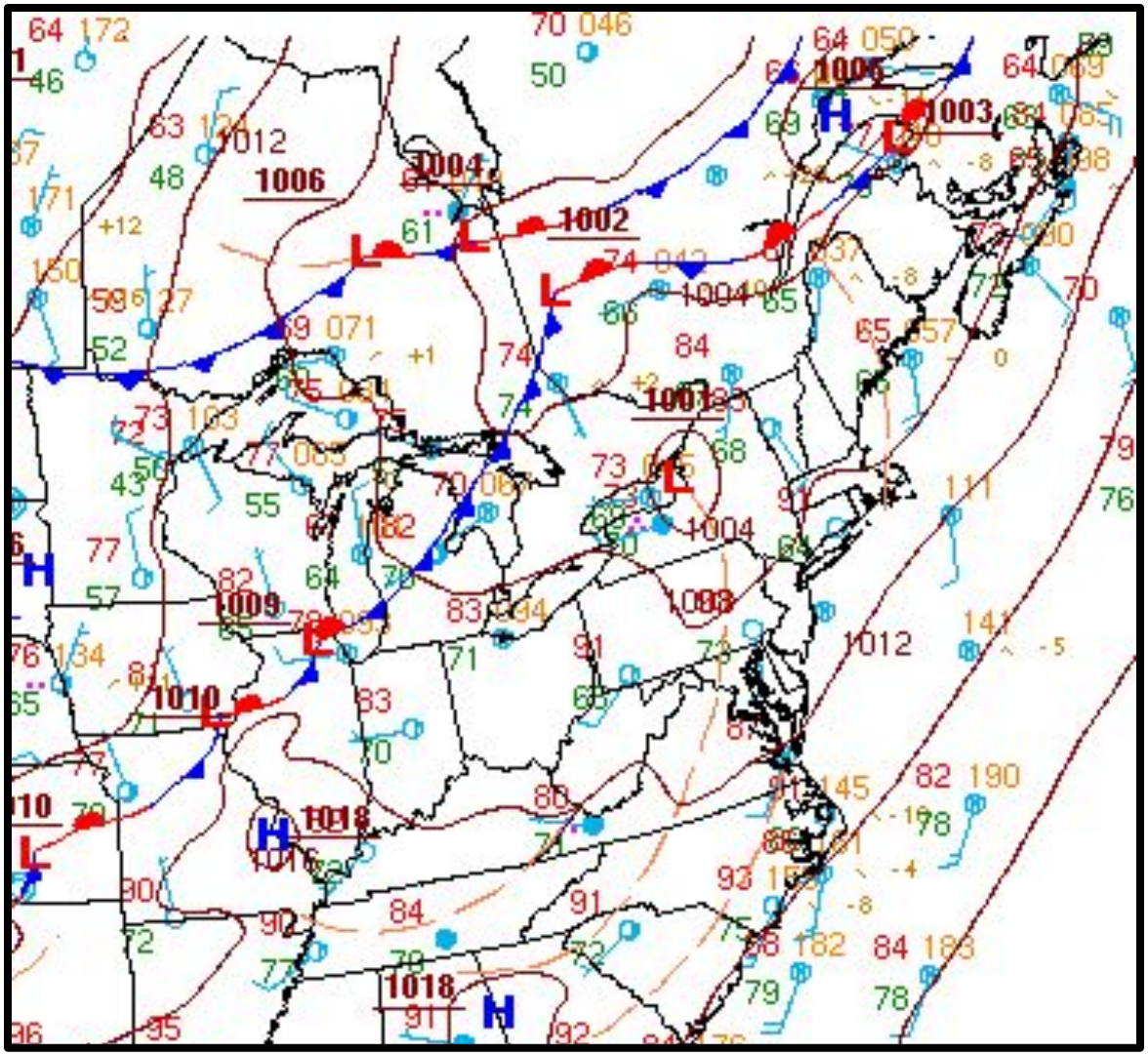
www.spc.noaa.gov

1200 UTC 16 JUL 20204
850 hPa Heights, Isotachs, Temps, & Td's

Strong low-level jet over the lower Great Lakes near KDTX and Midwest of 30-35+ KT and MCV present.



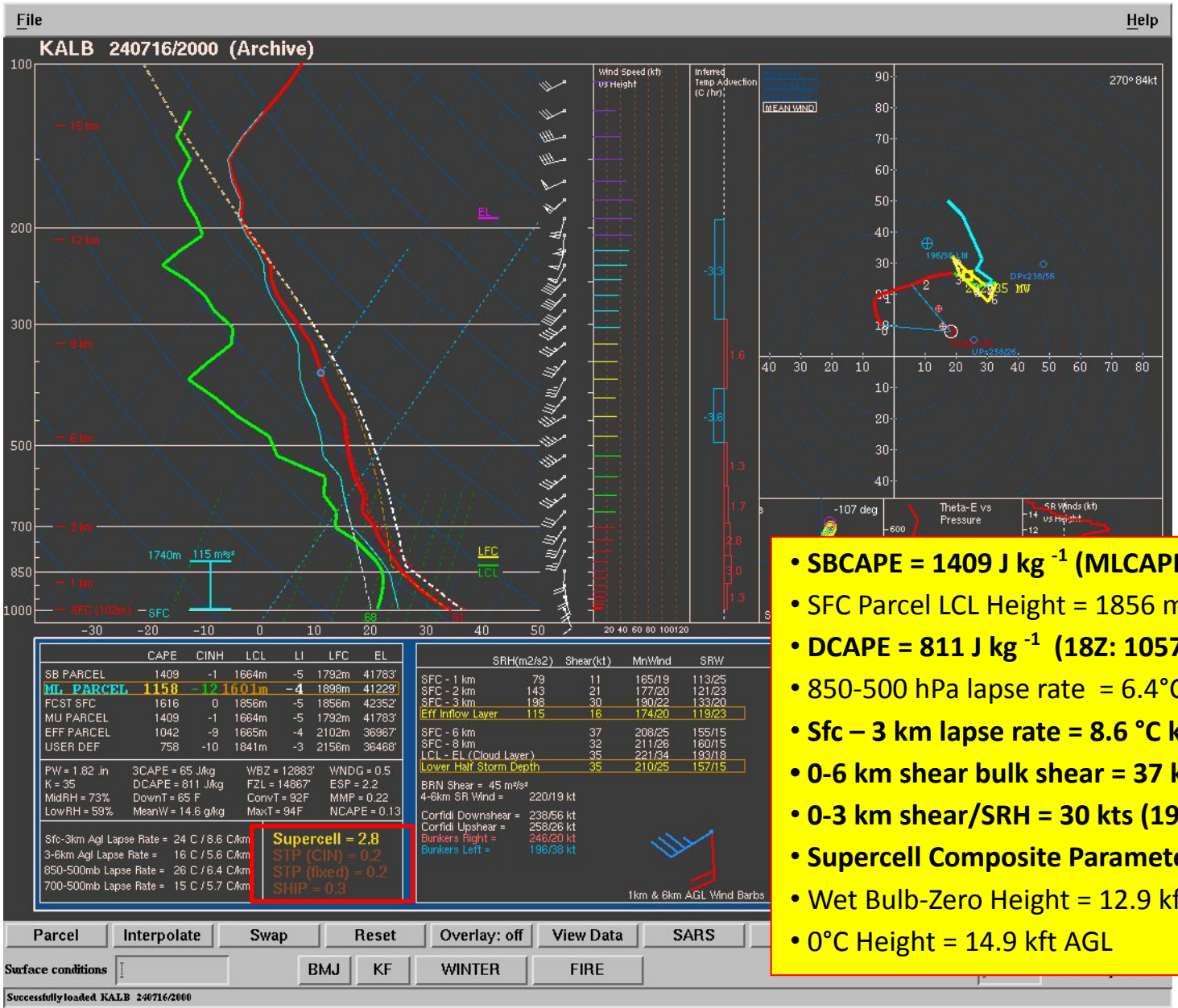
1800 UTC 16 JUL 2024
Surface Map



1800 UTC KSYR RAP Sounding

- **SBCAPE = 2972 J kg $^{-1}$ (MLCAPE 2211 J/kg)**
- SFC Parcel LCL Height = 1566 m (5,136 ft)
- **DCAPE = 885 J kg $^{-1}$**
- **850-500 hPa lapse rate = 6.7°C km^{-1}**
- **Sfc – 3 km lapse rate = 8.5 °C km^{-1}**
- **0-6 km shear/eff shear = 51 kts**
- **0-3 km shear/SRH = 35 kts (211 m^2/s^2)**
- **Supercell Composite Parameter = 8.2**
- Wet Bulb-Zero Height = 12.3 kft AGL
- 0°C Height = 13.6 kft AGL

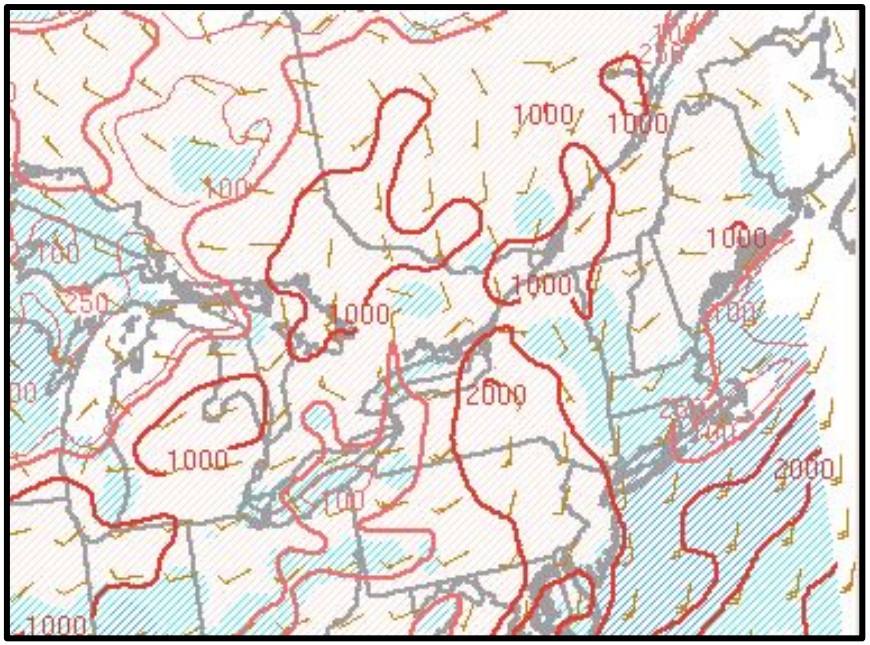
2000 UTC KALB RAP Sounding

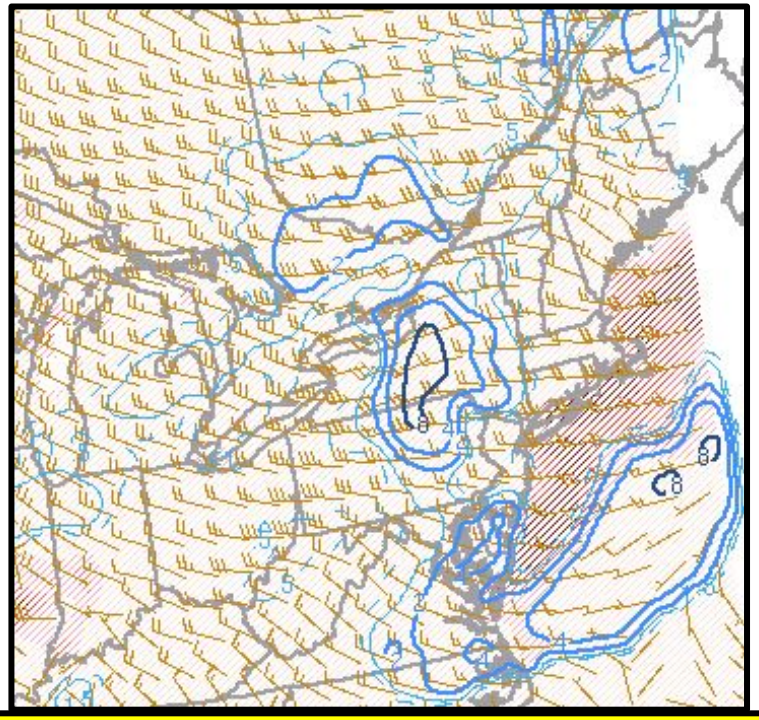


- **SBCAPE = 1409 J kg $^{-1}$ (MLCAPE 1158 J/kg)**
- SFC Parcel LCL Height = 1856 m (6,088 ft)
- **DCAPE = 811 J kg $^{-1}$ (18Z: 1057 J kg $^{-1}$)**
- 850-500 hPa lapse rate = 6.4°C km^{-1}
- **Sfc – 3 km lapse rate = 8.6 °C km^{-1}**
- **0-6 km shear bulk shear = 37 kts**
- **0-3 km shear/SRH = 30 kts (198 m^2/s^2)**
- **Supercell Composite Parameter = 2.8**
- Wet Bulb-Zero Height = 12.9 kft AGL
- 0°C Height = 14.9 kft AGL

1800 UTC 16 JUL 2024

RAP MLCAPE/MLCIN/Eff Shear & Supercell Comp. Parameter



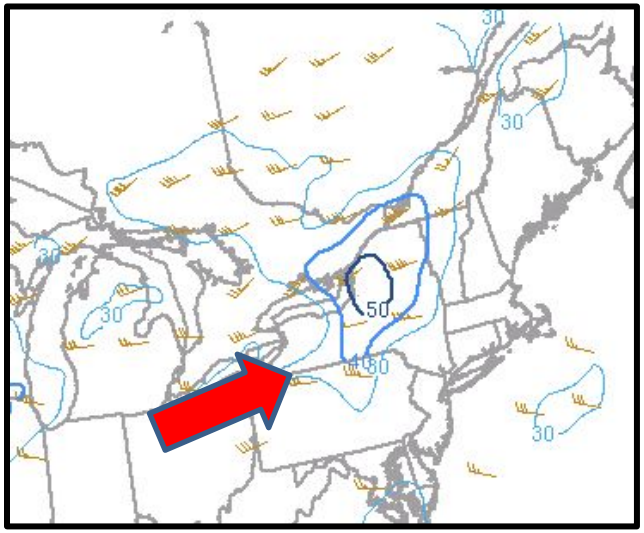


Best MLCAPE 1000-2000 J/kg Hudson River Valley westward with 35-50 kts of effective shear

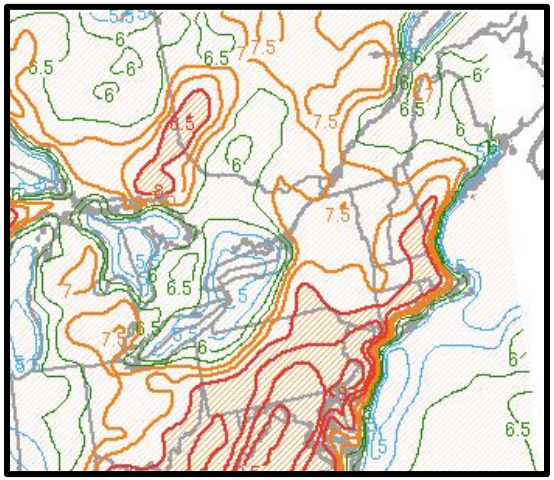
Supercell Composite parameter 2-8 over central NY/PA to eastern NY with Bunker Storm Motion vectors overlayed

www.spc.noaa.gov

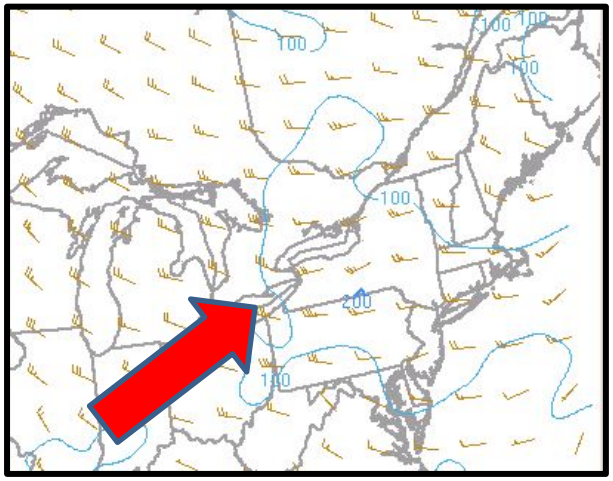
1800 UTC 16 JUL 2024 Effective Bulk Shear (KT), 0-3 km lapse rates (°C/km) & 0-3 km SRH (m^2/s^2)



Effective Bulk Shear (kts) was 35-50+ kts

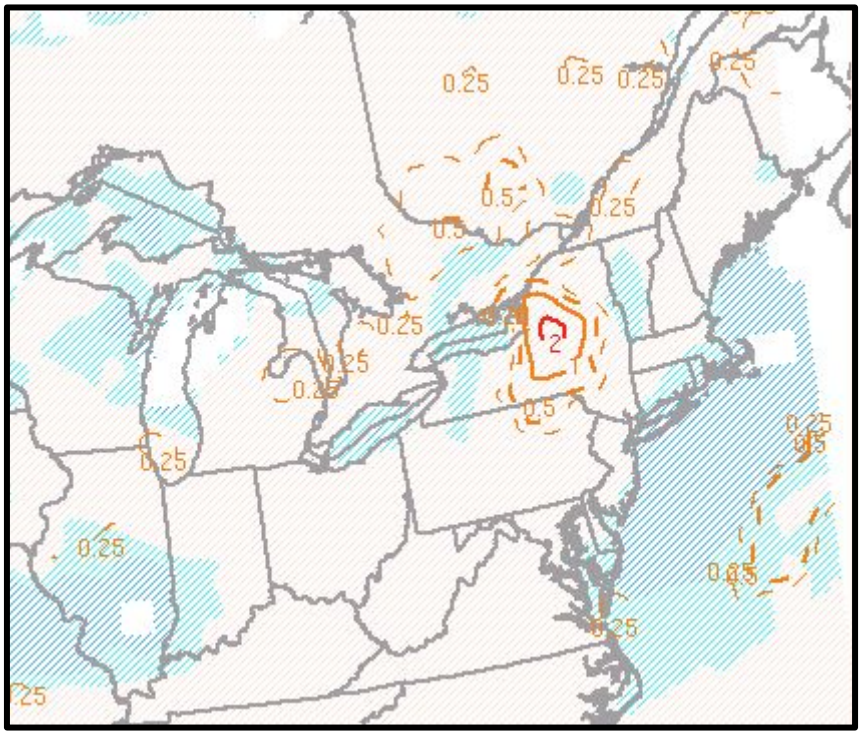


0-3 km Low-Level Lapse Rates (°C/km) were 7.5-9 ° C/km



0-3 km SRH values 100-200 m^2/s^2 across NY into western New England with storm motions of 25-35 kts

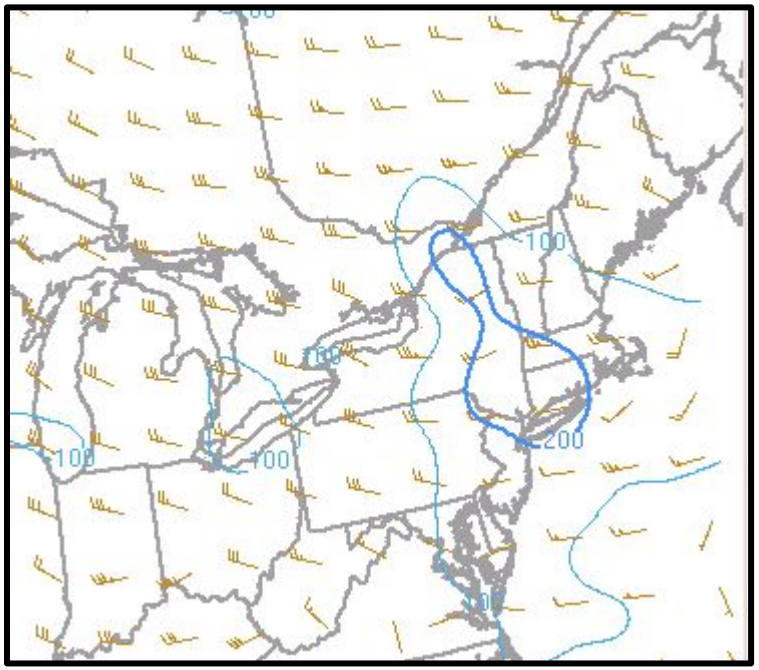
1900 UTC 16 JUL 2024
Sig Tor Parameter

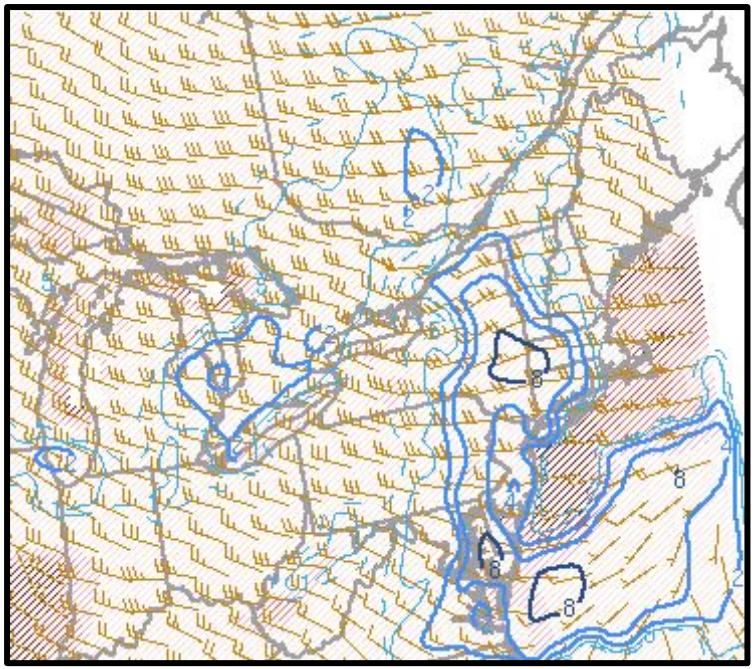


SigTornado Parameter 1-2+ over central NY towards the Adirondack Park

* EF2 Tornado in Rome, NY!!!

2100 UTC 16 JUL 2024
0-3 km SRH (m^2/s^2) and SCP



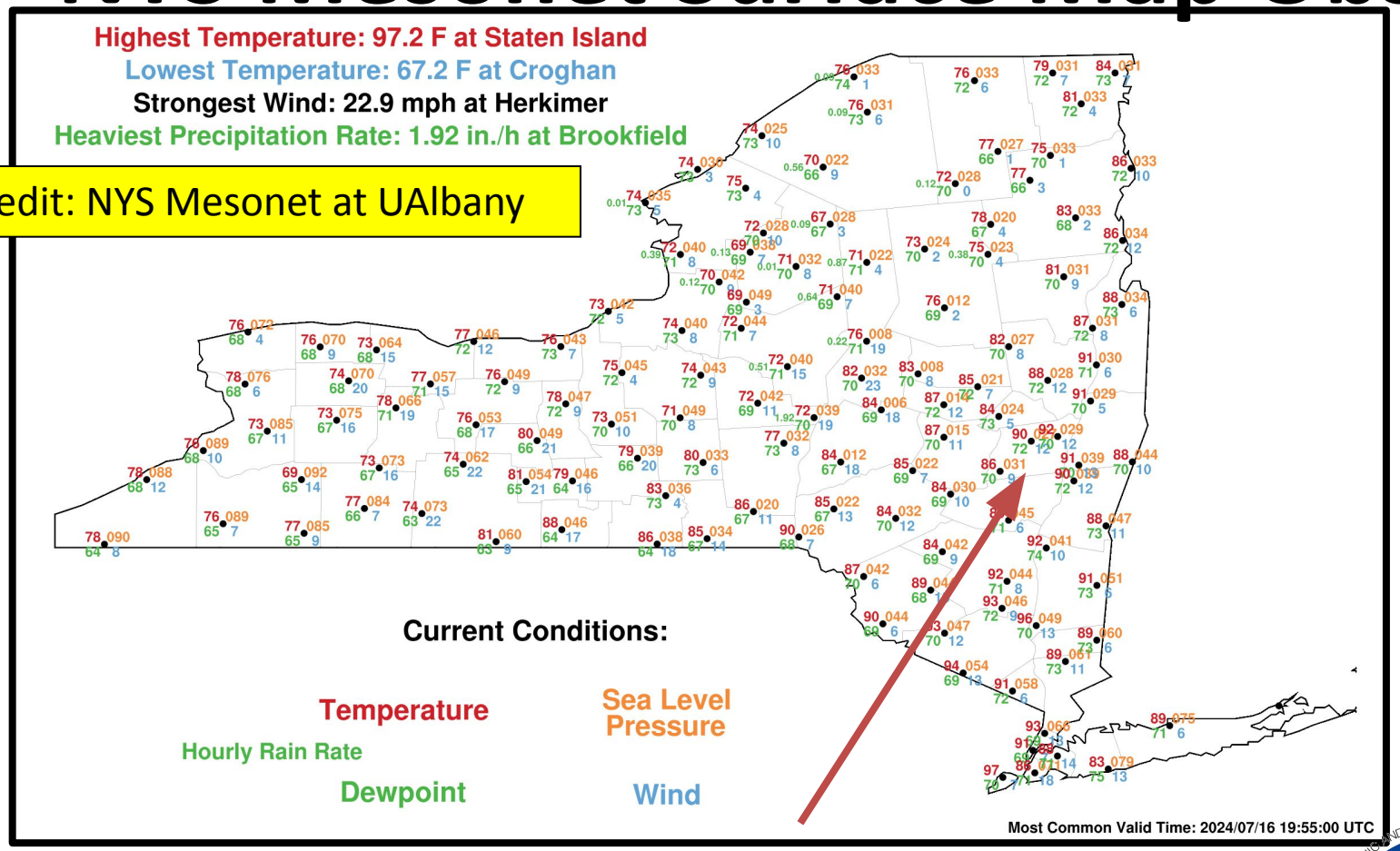


0-3km SRH values 200+ m^2/s^2 across eastern NY into western New England with storm motions of 25-35 kts

Supercell Composite Parameters(SCP) 4-8. Supercells/Rotating cells likely.

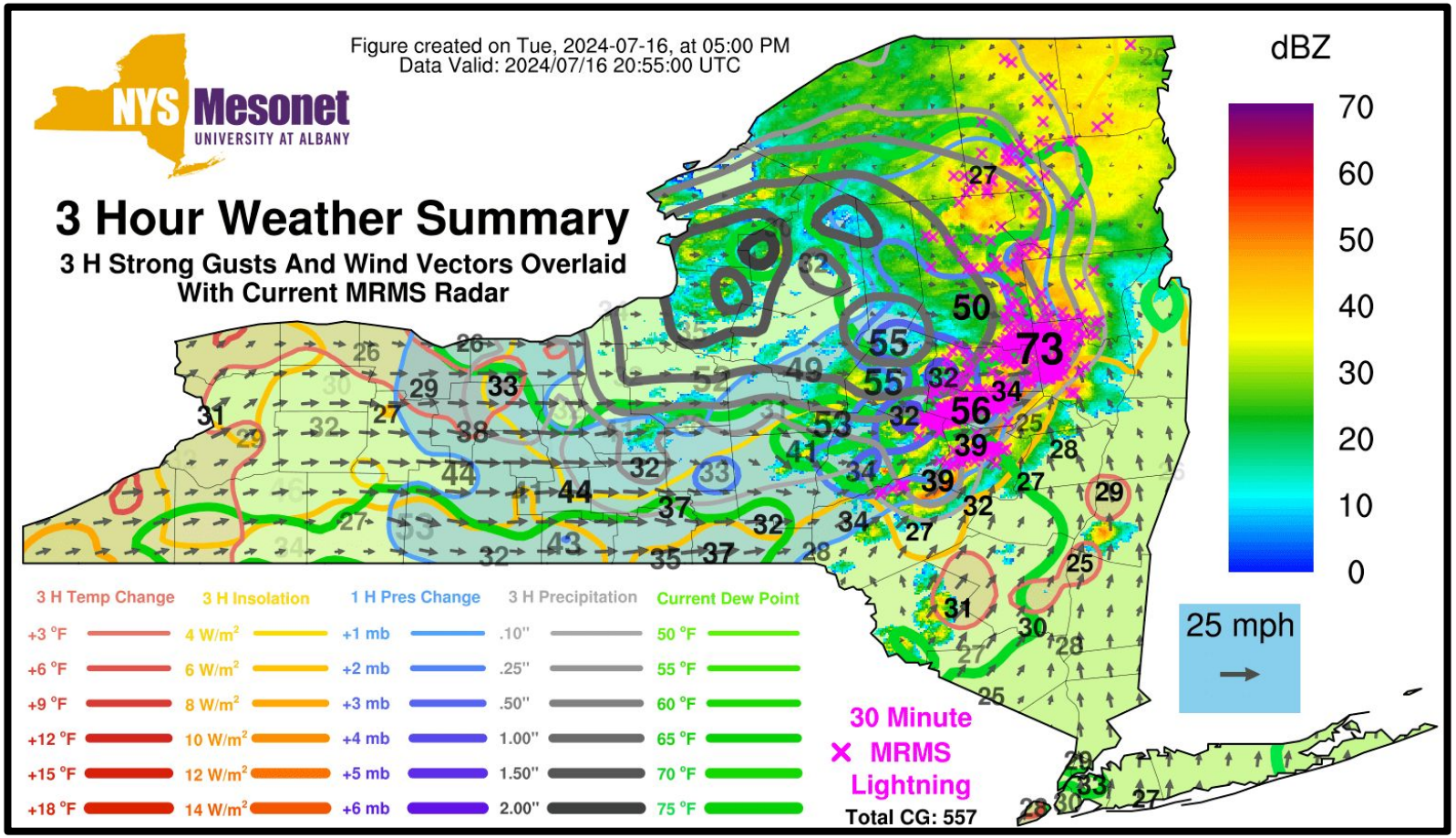
2000 UTC 16 JUL 2024

NYS Mesonet Surface Map Obs

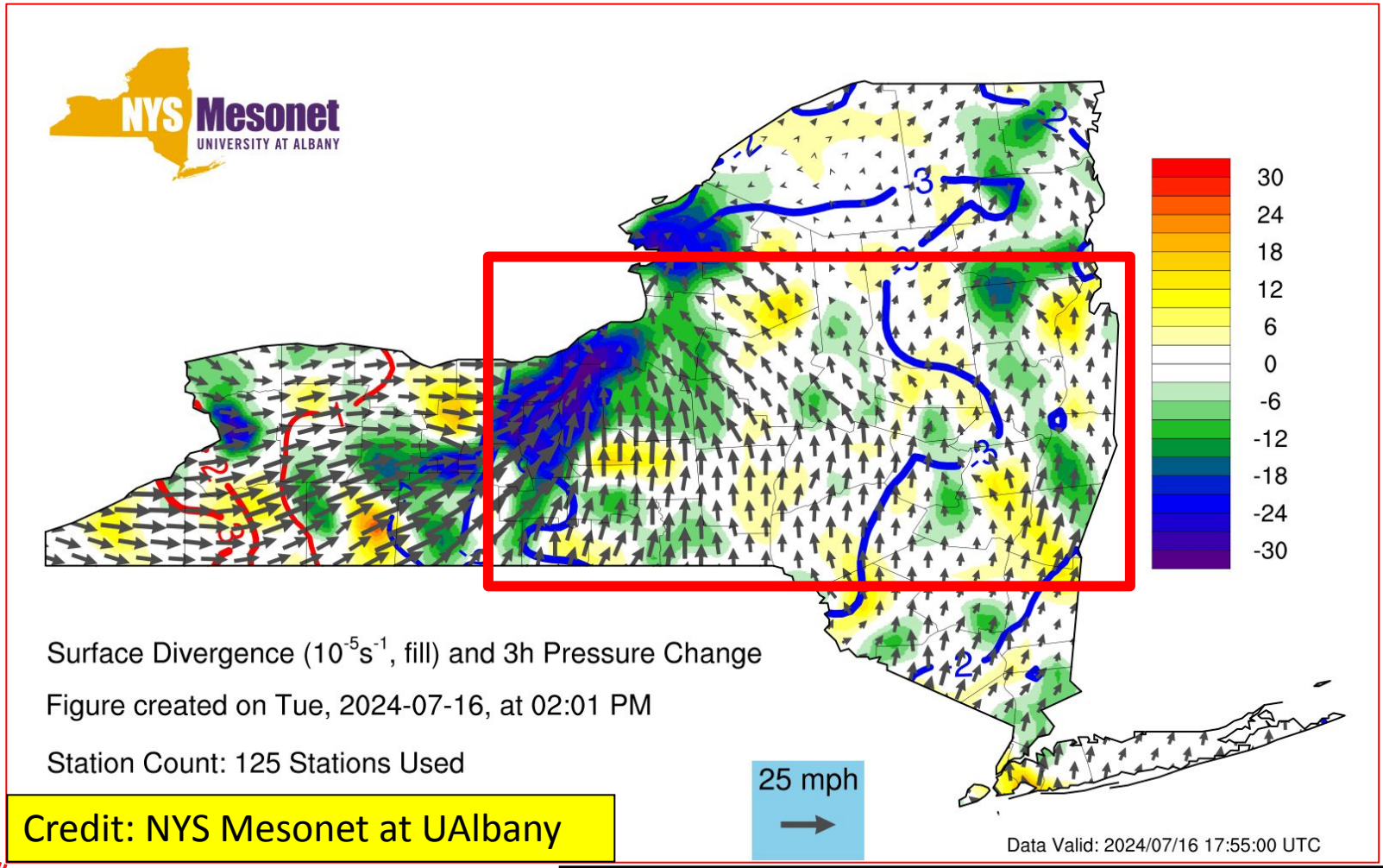


Note: Surface dew points in the upper 60s to lower 70s across central and eastern NY with max temps in the upper 80s to lower/mid 90s

2100 UTC: 3-Hour Weather Summary (Wind Gusts, Wind vectors, MRMS radar & LTG Overlaid)



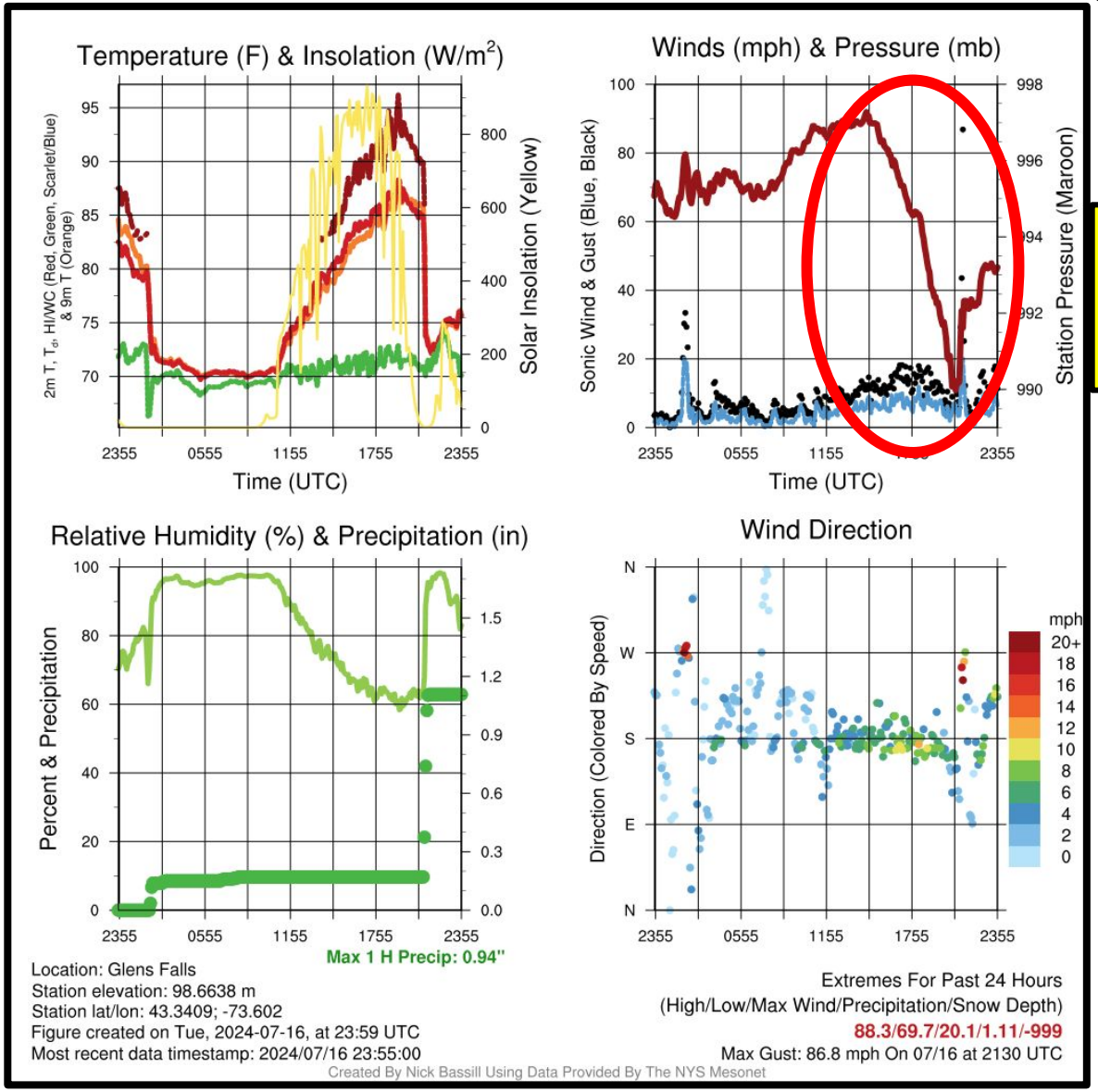
18-22 UTC 16 JUL 2024 NYS Mesonet Surface Con/Div and 3-hr Pressure Change Loop



Credit: NYS Mesonet at UAlbany

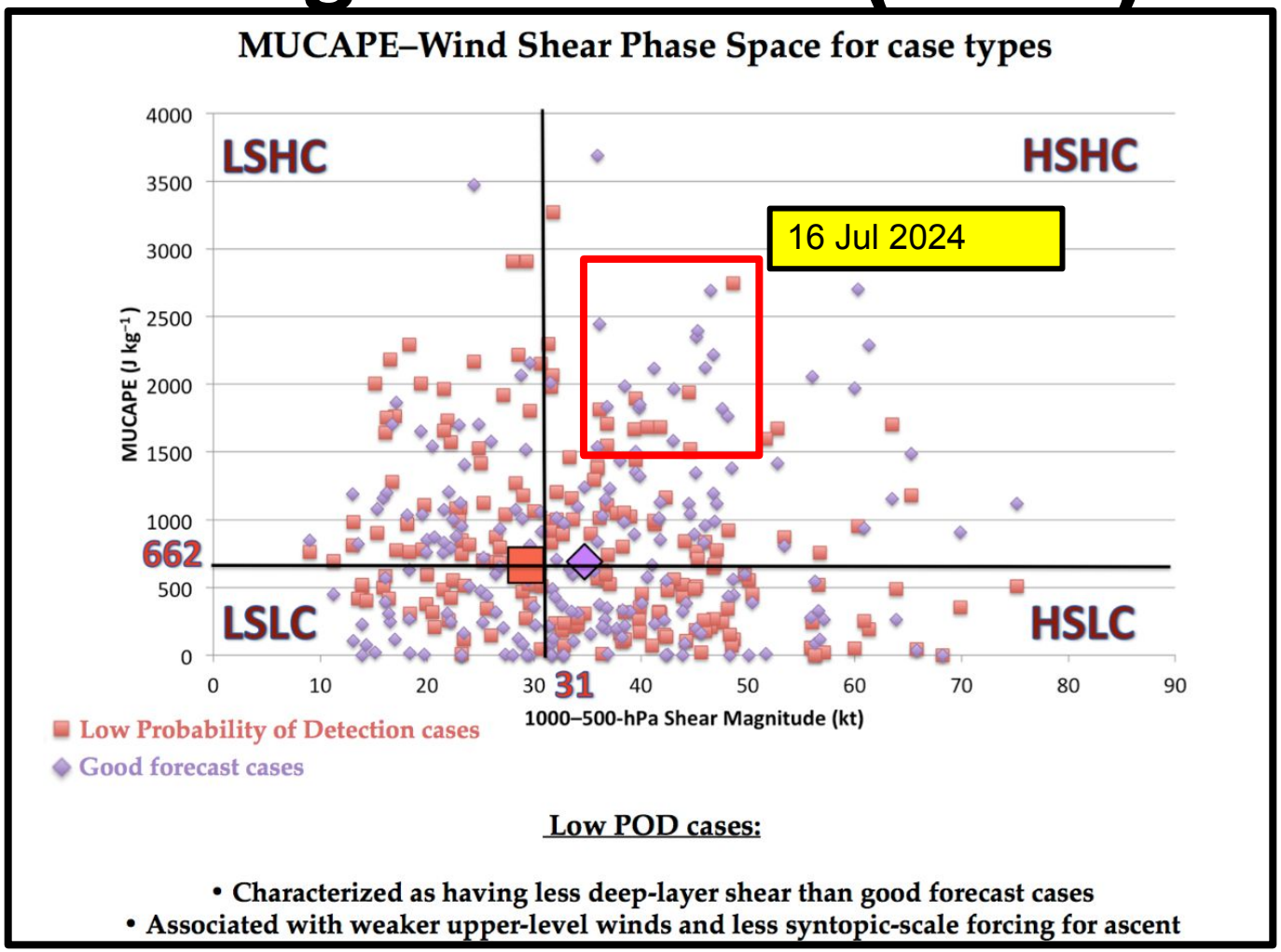
Area of low-level convergence with 3-hr pressure fall with MCV around 2000-2200 UTC.

NYS Mesonet Glens Falls Meteogram



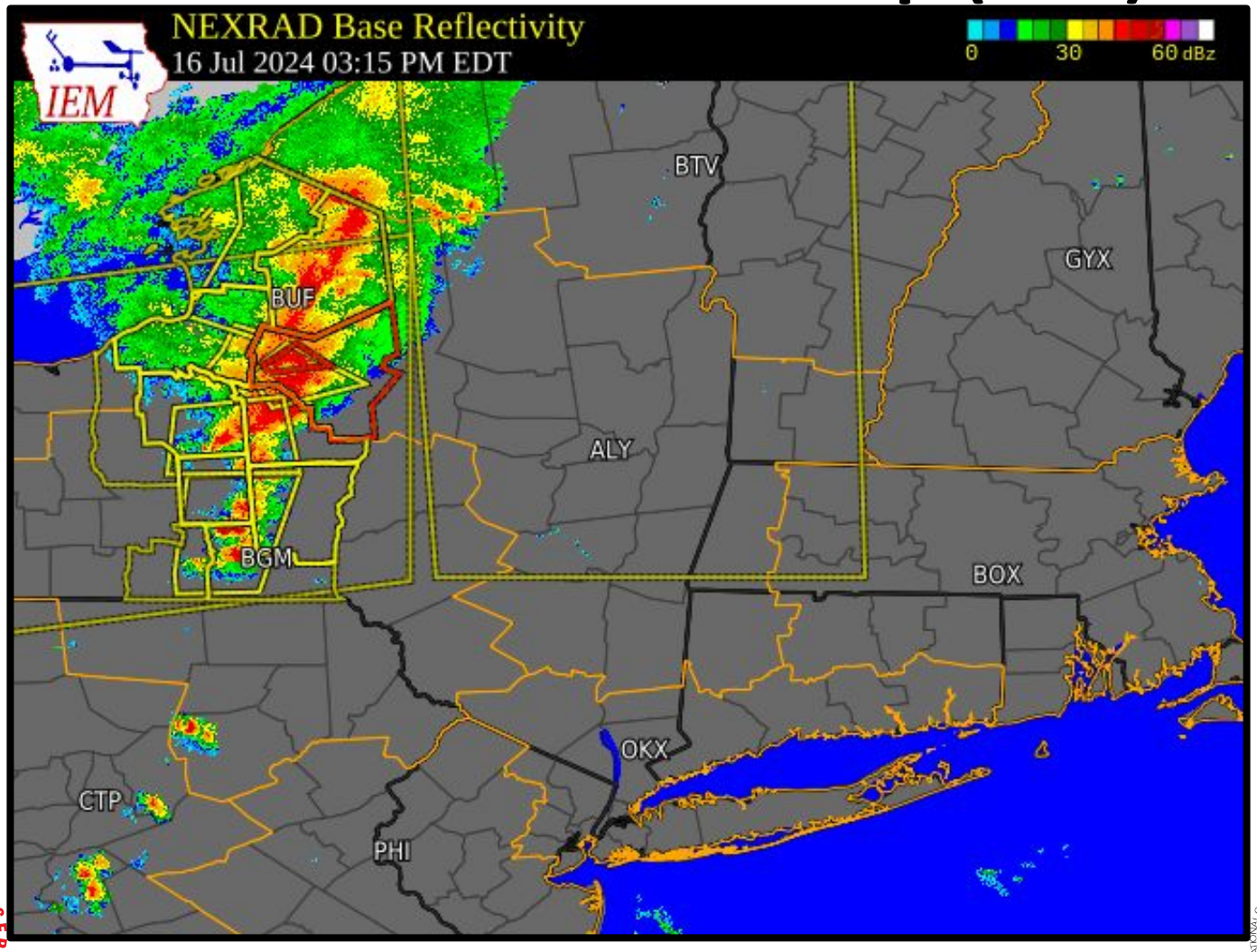
* Rapid pressure fall-rise with severe convection and 87 mph gust

Vaughan CSTAR (2015)

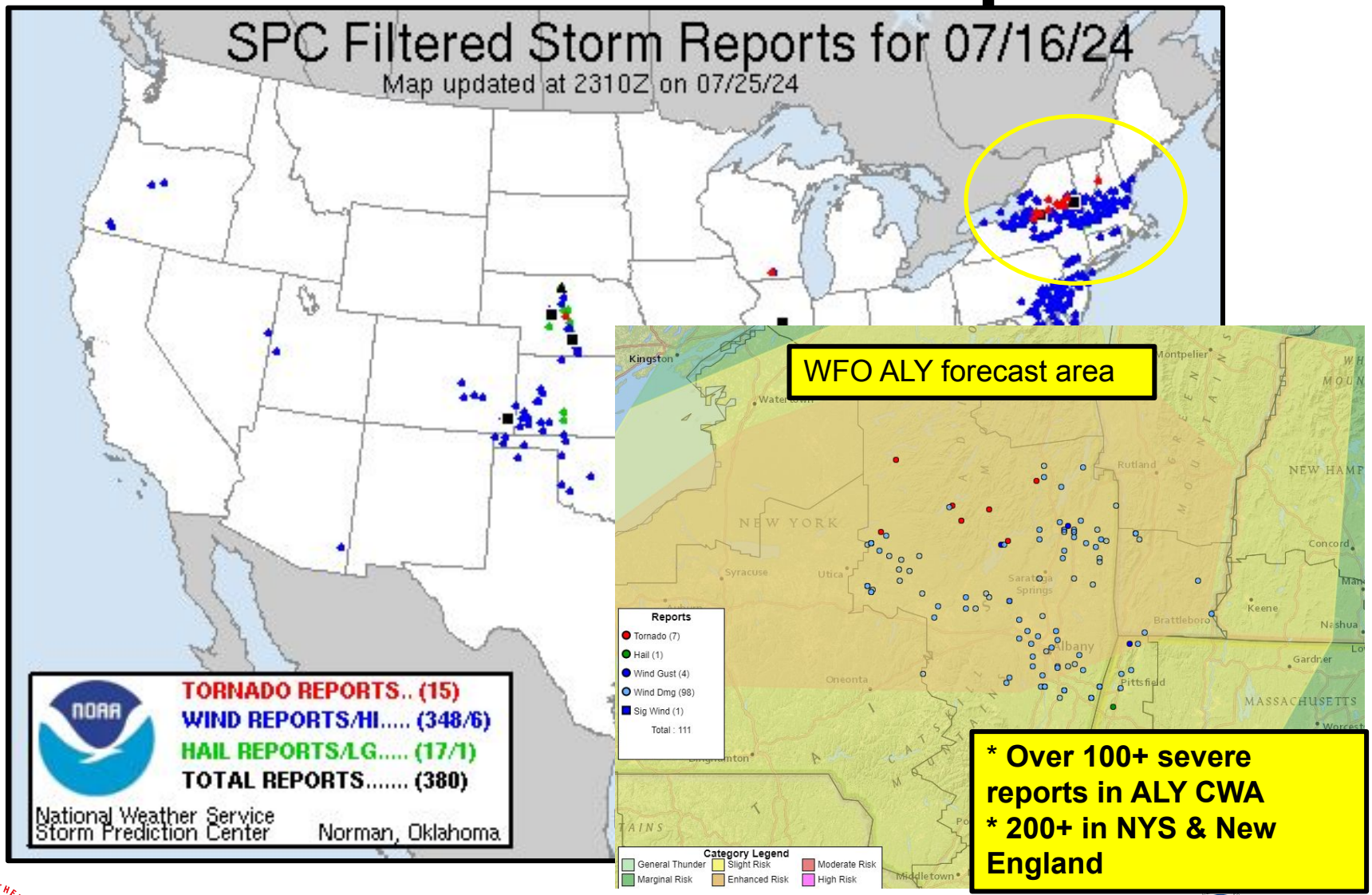


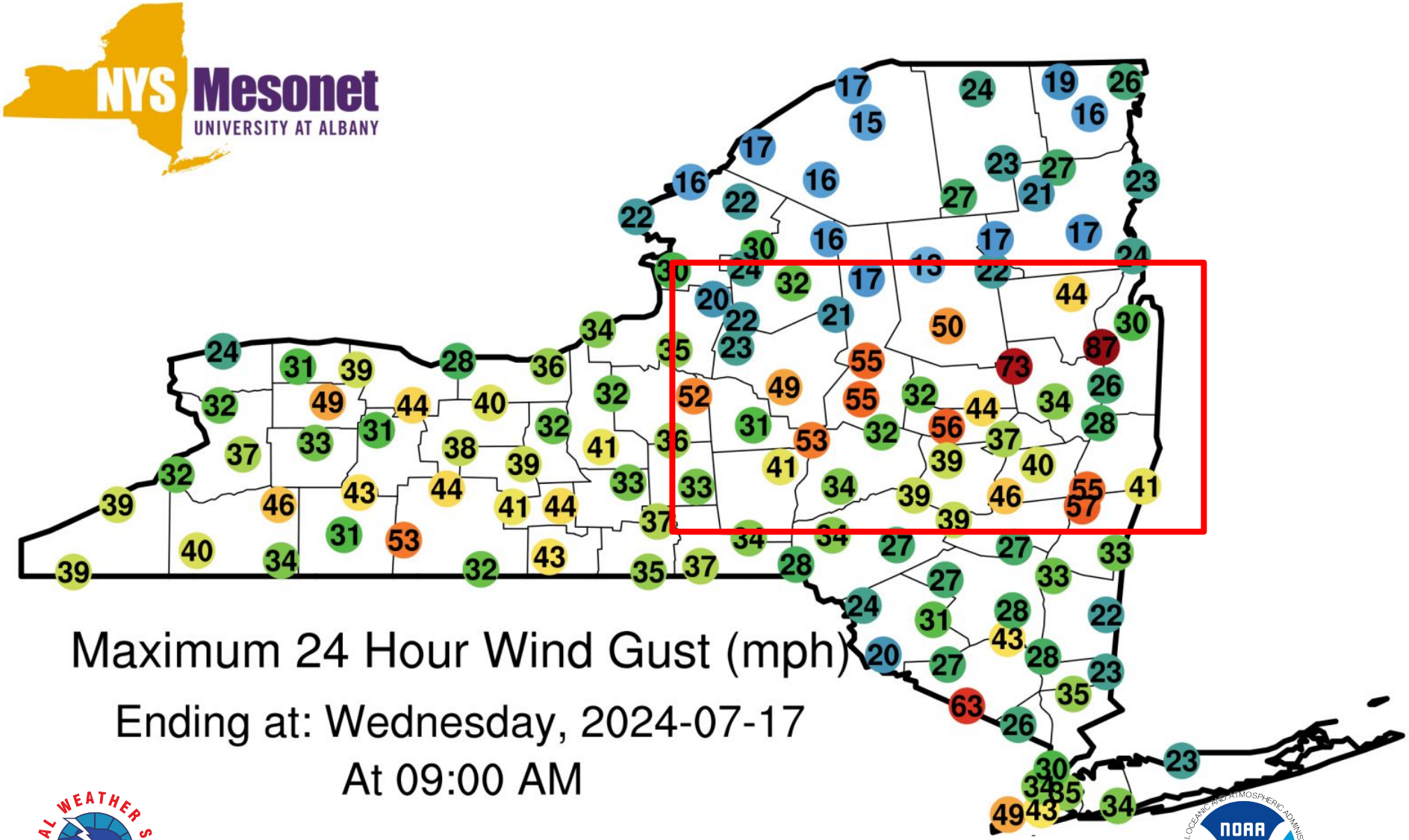
Matthew Vaughan Thesis: “An Analysis of High-Impact, Low-Predictive Skill Severe Weather in the Northeast US”

1915-0000 UTC Regional Mosaic Base REF loop (dBZ)



16 JUL 2024 Storm Reports




NYS Mesonet
UNIVERSITY AT ALBANY
Maximum 24 Hour Wind Gust (mph)
Ending at: Wednesday, 2024-07-17
At 09:00 AM
NATIONAL WEATHER SERVICE
NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Preliminary Results

- Anomalous severe event where 11 tornadoes occurred in NYS (8 in ALY CWA (7 EF1's and 1 EF0)) along with a couple microbursts and 100+ wind damage reports in ALY CWA
- MCV moved into favorable upper-level dynamics and pre-convective environment across NY into western New England
- Moderate-High instability & high shear/helicity environment (effective bulk shear 35-45+ kts) supported MCV -> MCS for supercells, tornadoes and widespread wind damage threat
- Inverted-V profile in soundings with steep low-level lapse rates and high DCAPE hinted at widespread wind damage
- NYS Mesonet data & graphics help the situational awareness throughout the eve t, wind gusts, etc.)