P1.30 A STORM-SCALE ANALYSIS OF THE 29 MAY 2012 NULL TORNADO WATCH 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 topics including: a local Albany 1" hail study, tornado climatology and Vr-shear study, pre-frontal troughs, and the use of dual polarization data in severe weather operations

- This case will be analyzed from a multi-scale approach with an emphasis on the storm-scale to address:

(1) What caused the copious large hail reports ?

(2) Why anomalously large hail occurred and a lack of tornadoes ???

CSTAR Grant #: NA01NWS4680002

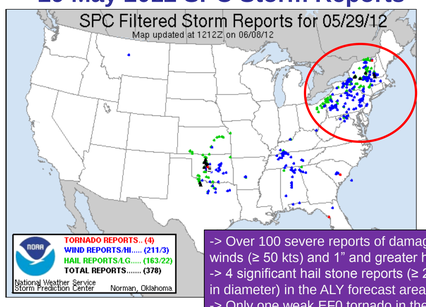
Outline

- Brief synoptic and mesoscale overview (SPC Mesoanalysis data (Rapid Refresh))
- Review and application of WFO at ALY 1" hail study results
- Review of traditional and legacy radar products
- "Large Hail" Analysis with Dual Pol data (utilizing base reflectivity (REF), differential reflectivity (ZDR), Specific Differential Phase (KDP), and Correlation Coefficient (CC))

Background

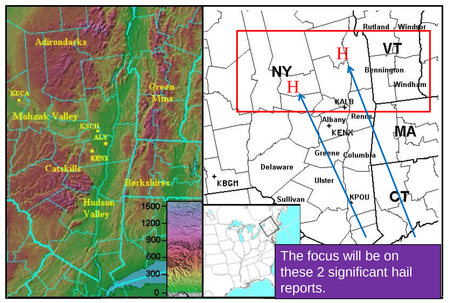
- Albany radar (KENX) Dual Pol installation completed 23-27 April 2012
- A widespread severe weather outbreak occurred 29 May 2012 in the Northeast
- 29 May 2012 event accounted for nearly half (30 out of 66) of the severe hail reports in the WFO ALY area May-Sept 2012
- An Elevated Mixed Layer (EML) was present over NY and New England
- 2nd largest hail stone (3.5" in diameter) all-time in NY measured in Bolton in Warren County (Lake George Area)

29 May 2012 SPC Storm Reports



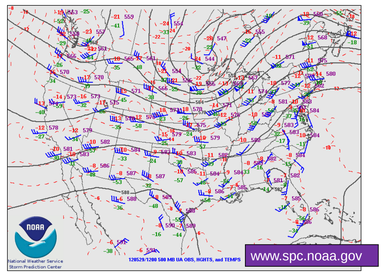
-> Over 100 severe reports of damaging winds (≥ 50 kts) and 1" and greater hail
-> 4 significant hail stone reports (≥ 2" in diameter) in the ALY forecast area
-> Only one weak EF0 tornado in the Northeast Kingdom of Vermont

WFO at ALY Forecast Area

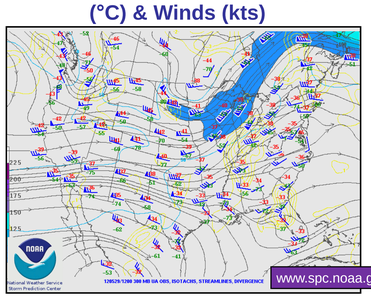


The focus will be on these 2 significant hail reports.

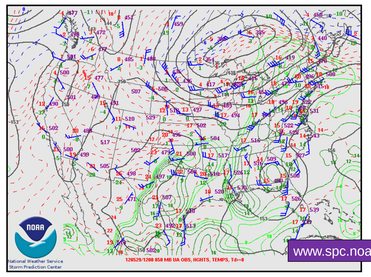
1200 UTC 29 May 2012 Upper Air Analysis



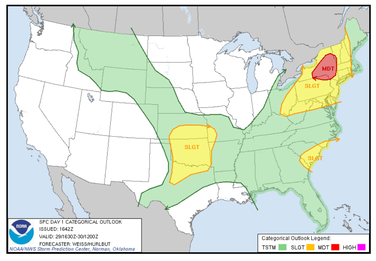
500 hPa Heights (dam), Temps (°C) & Winds (kts)



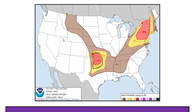
300 hPa Heights (dam), Streamlines & Divergence ($10^{-5}s^{-1}$)



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

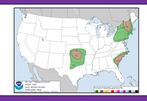


1642 UTC: SPC DAY 1 OUTLOOK



1642 UTC Hail Probabilities

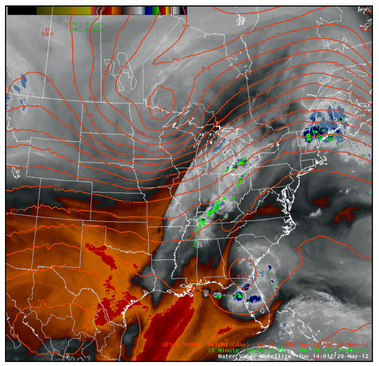
1642 UTC Wind Probabilities



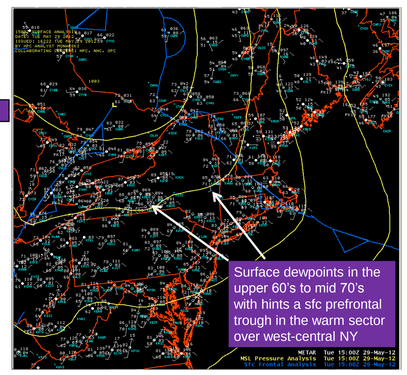
1642 UTC Tornado

1630 UTC Tornado Watch

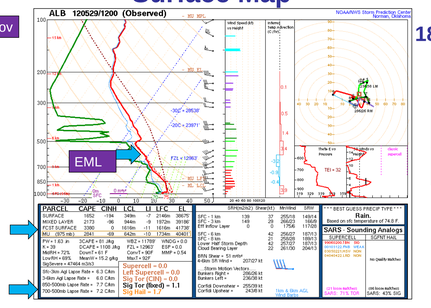
Satellite, Surface, Sounding, & Meso-analysis



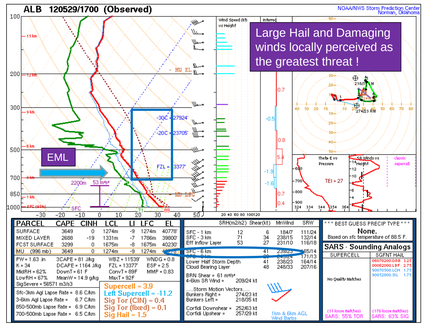
1400 UTC 29 May 2012 Water Vapor, GFS 500 hPa Heights, and LTG



1500 UTC 29 May 2012 Surface Map



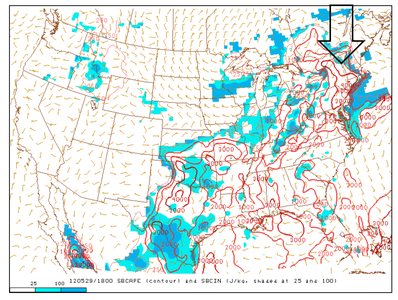
1200 UTC KALB Sounding



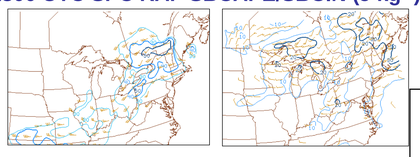
1700 UTC KALB Sounding

- SBCAPE/MUCAPE = 3649 J kg $^{-1}$
- Steep mid-level lapse rates due to EML (~7°C km^{-1})
- 0-6 km shear = 41 kts (supercells organizing into a line)
- Wet Bulb-Zero Height = 11.5 kft AGL
- 0°C Height = 13.4 kft AGL, -20°C Height = 23.7 kft AGL, -30°C = 27.9 kft AGL
- DCAPE = 1164 J kg^{-1}

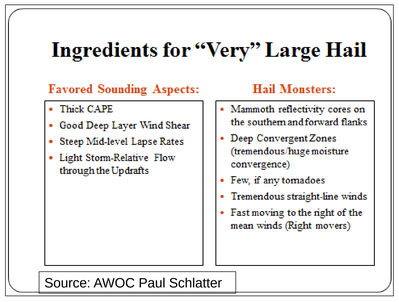
Key 1700 UTC Sounding Parameters

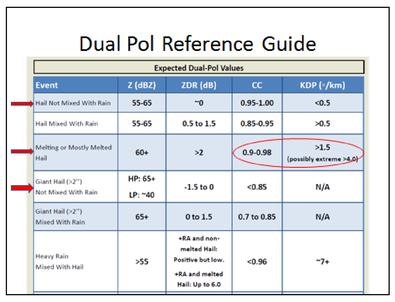


1800 UTC SPC RAP SBCAPE/SBCIN (J kg^{-1})



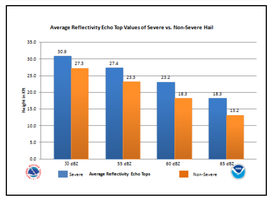
1800 UTC SPC RAP 0-6 km Bulk Shear (kts) & 0-1 km Shear vectors (kts)

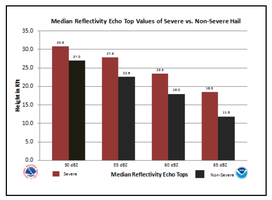


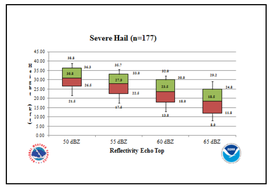


WFO at Albany 1" Hail Study

- Storms producing nearly 400 hail reports from 2005-2010 across the Albany CWA were examined to find ways to warn on the new threshold for severe hail
  - Hail reports were as small as 0.25" to as large as 2.60"
- An ER Tech Attachment was published on this study by Brian Frugis and Tom Wasula in August 2011
  - Can be accessed at this link: http://www.erh.noaa.gov/er/hq/ssd/erps/ta/ta-list.html





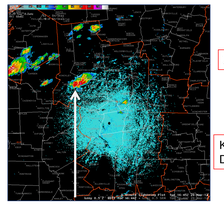


Box and Whisker Plot Highlights

- Boxes are rather symmetrical
  - Suggests data is well-distributed
- Median values are close to average values
  - Suggests that either average or median values are a good mid-point for severe data
- 25% quartile value can be used as a lower-bound as a "caution level" for warning purposes
- 75% quartile value can be used as a "really should have it out if at or above" level

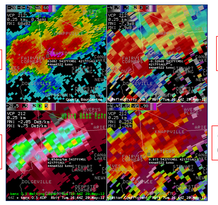
May 29, 2012: Bolton 3.5" hail stones in Lake George, Warren County

Storm-Scale Analysis



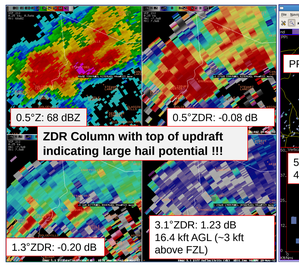
Z: 60-68 dBZ

KDP: 0.9-4+ Deg km^{-1}

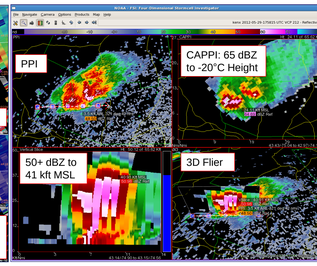


1644 UTC 0.5° KENX Base REF

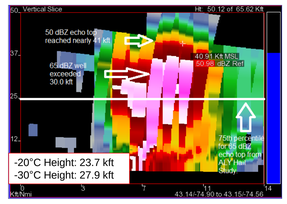
1644 UTC 0.5° KENX 4-panel Z(dBZ), ZDR(dB), KDP(deg km^{-1}) and CC



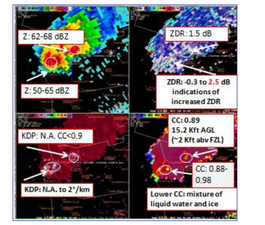
1644 UTC: Z(dBZ) and ZDR(dB)



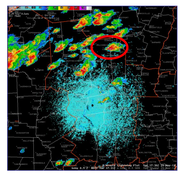
1649 UTC FSI Stratford Baseball Hail



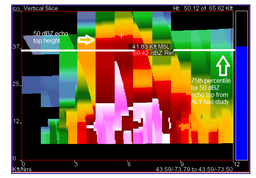
1649 UTC FSI Cross-section: 2.75" Hail in Stratford, Fulton Co.



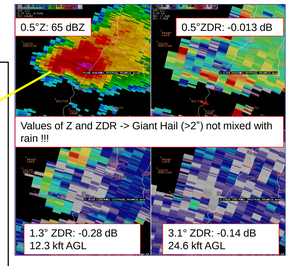
1649 UTC 3.1° Dual Pol Data



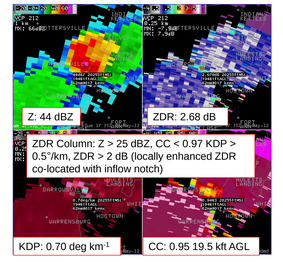
1731 UTC KENX 0.5° Base REF



1731 UTC FSI Cross-section of Bolton (Lake George) Hail Monster



1735 UTC: Z (dBZ) & ZDR (dB)



1735 UTC: 2.4° Bolton ZDR Column

Conclusions

- Abundance of instability coupled with ample deep shear allowed supercells to form. Lack of strong low-level wind shear (0-1 km) inhibited widespread tornadoes from developing
- An EML played a significant role for large hailstorms
- 1" hail study results used with traditional legacy and dual pol radar products helped forecasters issue "high confidence" warnings
- "Hail Monster" type hail cores indicated by FSI analysis (i.e. 3.5" hail stones in Bolton)
- Dual Pol data very helpful in storm-scale analysis. ZDR columns very useful for updraft strength analysis, hail growth and determination.