P9.112 A Storm-Scale Analysis of the 29 May 2013 Tornado Event across East-Central New York

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Motivation

- EF2 Tornadoes in the Albany Forecast Area are rare (80% are EF0/EF1)
- CSTAR IV - V Goals (2010 – Present)

(1) To examine severe weather cases with application of the new (April 2012) dual polarization radar data (differential reflectivity, correlation coefficient, and specific differential phase)

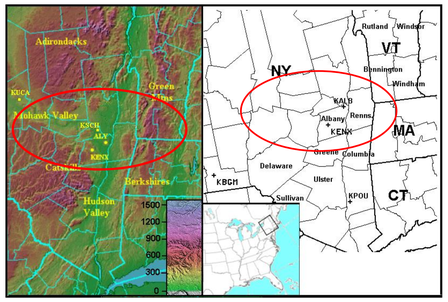
(2) Expand ALY Tornado V_r-R Shear Climatology from 1998-2000 in COMET partners project

CSTAR Grant #: NA01NWS4680002

Outline

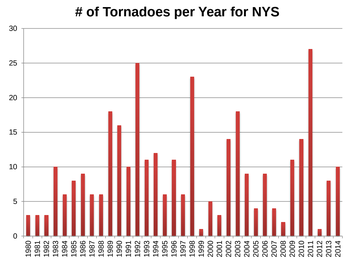
- Tornado Climatology
- Brief Synoptic Overview
- Mesoscale Analysis: SPC Rapid Refresh
- Review of Correlation Coefficient with Tornadic Debris Signatures
- Storm-scale Analysis with new V-R Shear Nomogram

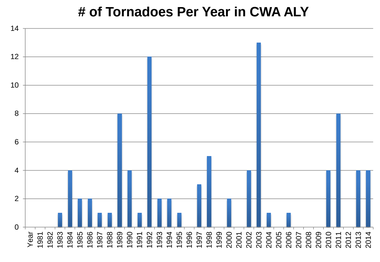
NWS at Albany Forecast Area

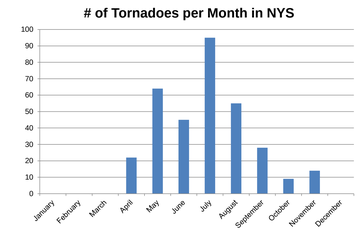


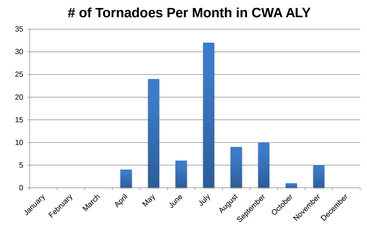
Area of focus is the Mohawk River Valley, Capital Region, Northern Catskills, Taconics, and Berkshires

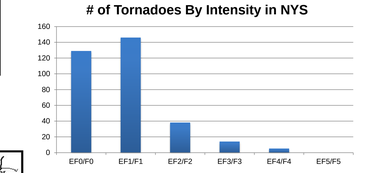
Tornado Climatology 1980-2014

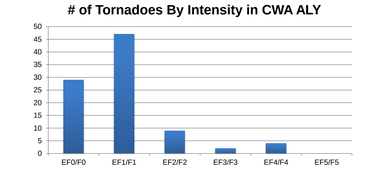


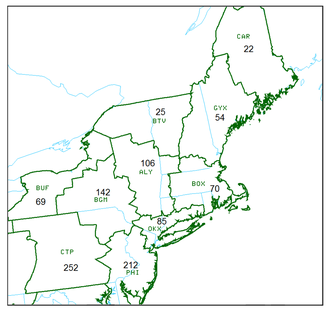


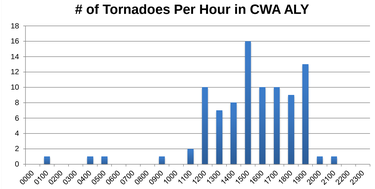








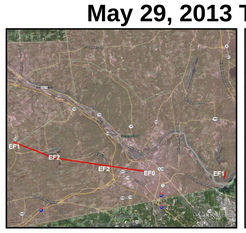




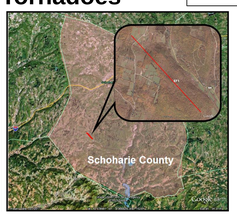
Number of Tornadoes by time in EST
Note: Most occur between 12:00-20:00 EST

1980-2012 Tornado Distribution by County Warning Area
Note: Numbers can be skewed since several reports from one tornado case are entered in separately in *StormData*

May 29, 2013 Tornadoes



EF1/EF2 tornado in Montgomery and Schenectady Counties & EF1 in Saratoga County

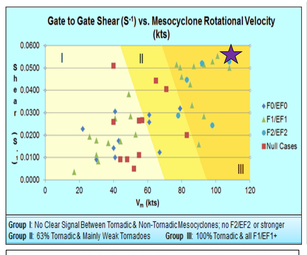


EF1 Tornado in mountainous Schoharie Co.

EF1 damage in Scotch Bush, Montgomery County, NY

EF2 damage in Mariaville, Schenectady County, NY

V-R Shear Nomogram
(CSTAR IV Research)



Nomogram: Gate to Gate Shear vs. Mesocyclone Rotational Velocity for 41 ALY Cases (2003-13)
★ V_m= 108 kts and S = 0.526 S^{-1} for Schenectady County EF2 Tornado

Tornadic Debris Signature (TDS) Review

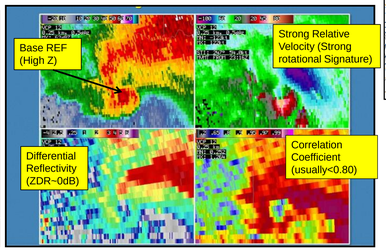
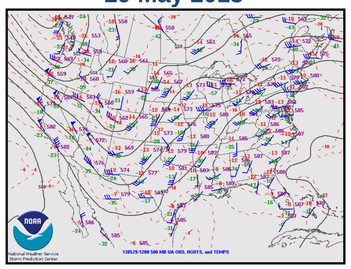


Image Courtesy of WDTB

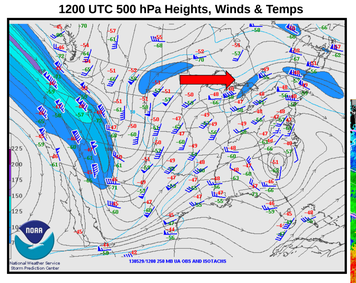
- TDS indicates debris being lofted such as shingles, siding, insulation, leaves and other debris
- The EF2 tornado on 29 May 2013 had an impressive TDS which is shown in the Storm-Scale Analysis

Synoptic Overview

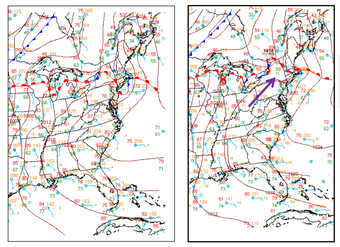
29 May 2013



1200 UTC 500 hPa Heights, Winds & Temps

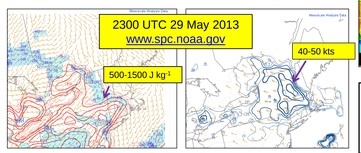


1200 UTC 250 hPa Heights, Isotachs & Temps

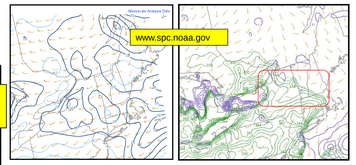


1800 UTC & 2100 UTC WPC SFC Analysis

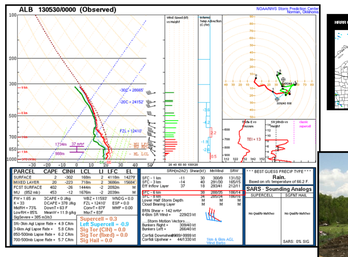
Mesoscale Analysis



RR SBCAPE (J kg^{-1}) & SBCIN (J kg^{-1}) **RR Effective Bulk Shear (kts)**



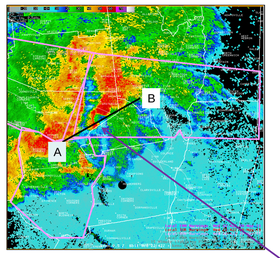
SFC-1 km Shear Vectors (kts) **SFC Theta-e (K) & Advection**

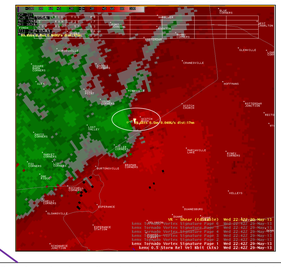


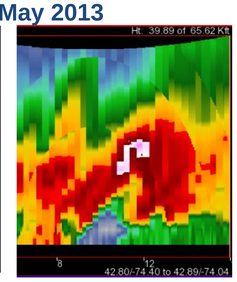
0000 UTC 30 May 2013 ALY Sounding

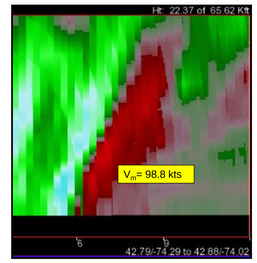
Storm-Scale Analysis

2242 UTC 29 May 2013



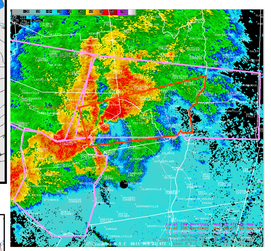


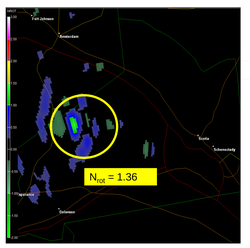




0.5° Base REF & SRM: Developing tornado/hook echo in reflectivity data and mesocyclonic velocity couplet with TVS (V_r = 39.6 kts over a distance 0.5 nm with S = 0.0406 s^{-1}). Line A – B is part of the cross-section through the hook echo . The BWER is shown in the RCS and the SRM cross-section shows the mesocyclone well.

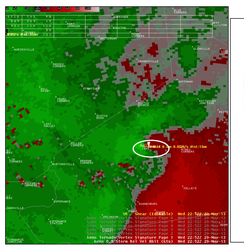
2247 UTC 29 May 2013

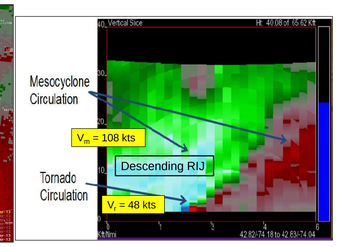




Tornado Warning issued at 2245 UTC. Classic Hook Echo with bow echo approaching. N_{rot} = 1.36 well above mean and median values (0.90; 0.81) for tornadoes in local study . GR2analyst Guide: N_{rot} > 1.0 (significant) > 2.5 (extreme)

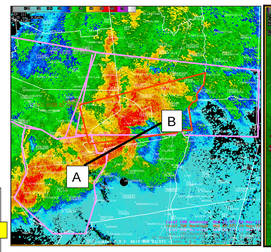
2252 UTC 29 May 2013

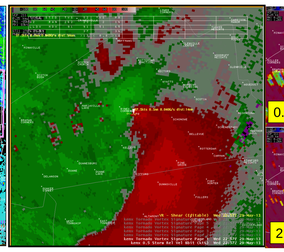


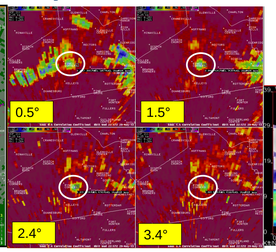


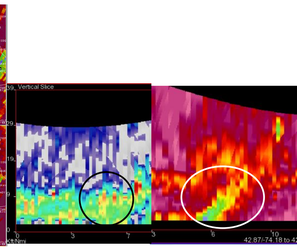
0.5° KENX SRM shows classic low-level mesocyclone with a TVS. V_r = 48 kts with S=0.0526s^{-1} at a distance of 15 nm from the KENX RDA, and a beam height of 1.5 kft AGL. The x-section shows a classic meso with a tornadic circulation with V_m=108 kts.

2257 UTC 29 May 2013





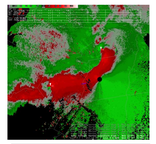




KENX 0.5˚Base REF and SRM: The orange polygon is the TOR Warning issued at 2245 UTC. The line A-B is the cross-section for the ZDR and CC images to the right. The SRM data continued to show an impressive tornado on the ground with a V_r = 38 kts at a distance of 14 nm from the RDA and S = 0.0406 s^{-1}

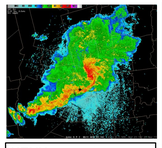
The 4 lowest tilts from the radar are shown with depressed Correlation Coefficient (CC) values to 6.2 kft AGL in the 3.4° elevation slice with a corresponding CC value = 0.685. The TDS shows up well through x-sections of the storm with the low-level ZDR at 0 to -0.3 dB, and the CC values below 0.8 up to around 8 kft AGL.

2257 UTC



2 tornadoes on the ground at the same time in the ALY CWA

2316 UTC



KENX radar shows MCS evolved into a line echo wave pattern with a book end vortex

2100 UTC HRRR captured bow echo moving across eastern NY fro 0000 UTC

Mariaville Lake EF2 damage (Photos from ALY Damage Survey Team)

Summary

- **3 tornadoes in the ALY forecast area (one long path EF2 tornado of 13 miles in Montgomery and Schenectady Counties)**
- **Moderate CAPE – High Shear pre-convective environment for supercells & bows**
- **Along strong low-level theta-e gradient, severe convection migrated along in the Mohawk River Valley, Capital Region into the Berkshires of Massachusetts**
- **Mini-squall line merged with a hook echo, and a bow echo (or wall of wind) formed**
- **Applied collaborative research from CSTAR for tornado warning decision (V_r – R Shear Study)**
- **First Dual Pol EF2 TDS in Eastern Region (debris ball up to 6-8 kft AGL)**
- **2100 UTC 29 May 2013 HRRR captured MCS and bow echo well**
- **Maximum sustained winds from the damage survey was 125 mph (EF2) with the Montgomery-Schenectady County Tornado**