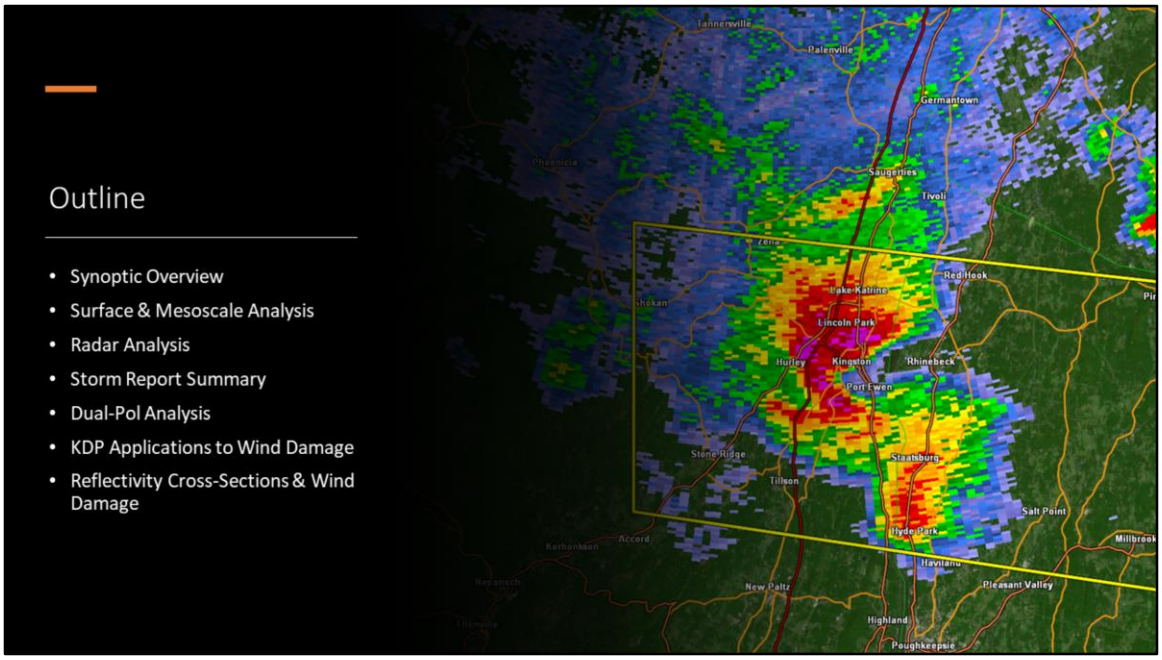
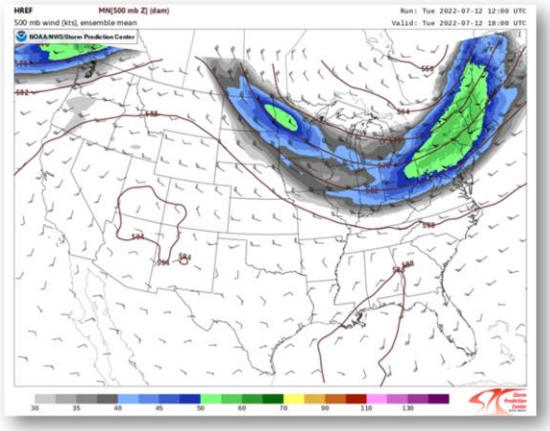
This presentation will be all about an isolated severe thunderstorm on July 13, 2022 that producing a damaging downburst, brief tornado and hail across Ulster County, New York.



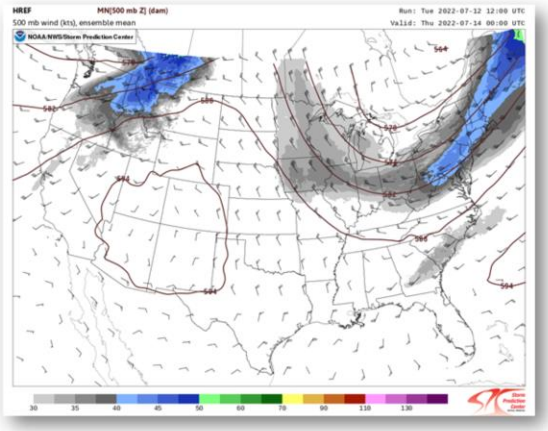
Here is the outline for what we will be discussed in the presentation.

HREF Ensemble Mean 500 mb Winds/Heights

Int 12z 7/12 Valid 18Z 7/12



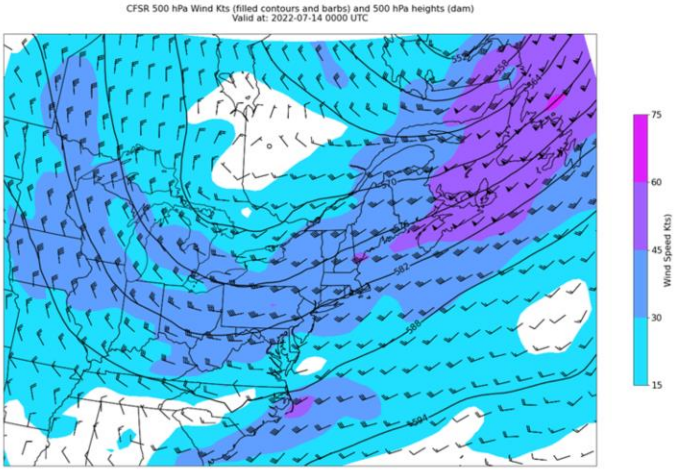
Int 12z 7/12 Valid 00Z 7/14



These maps show forecasted 500 hpa winds and heights from the 12z HREF from July 12, 2022. The first map shows winds and heights from 18z on July 12th, when a more significant severe outbreak was expected. The second map is for 00z on July 14th, which is around the time when the isolated severe storm occurred. While you can see the strong winds aloft on the first time over the Northeast, you can also see the secondary max moving across the Upper Midwest, which is eventually what moved overhead for the isolated event.

500 mb Winds/Heights

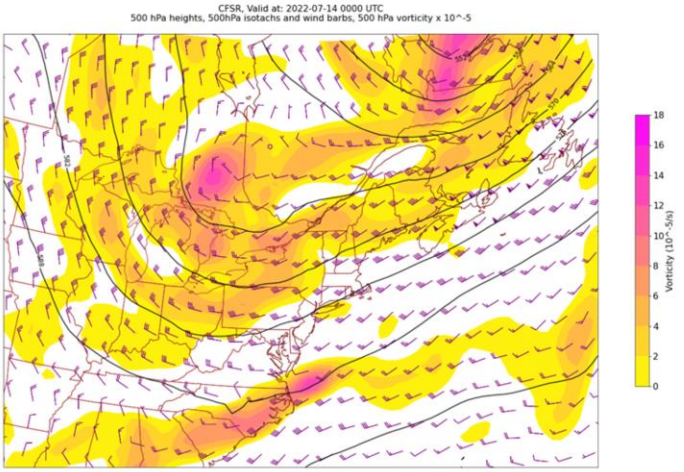
- Initial shortwave associated with July 12th outbreak exits into Canadian Maritimes
- Secondary shortwave moves into eastern Great Lakes
- 500 mb flow > 30 Kts out of SW over southeastern NY State
- Relatively strong mid-level flow for mid July



This is a close up look of 500 hpa winds/heights, valid at 00z on July 14th . The shortave trough axis is just west of the the area, with decent flow at 500 hpa exceeding 30 kts.

500 mb Vorticity/Height

- Vorticity max over Great Lakes associated with shortwave
- Curvature vorticity under upper-level trough axis with shear vorticity wrapping around the southern edge of the shortwave
- Some positive vorticity advection over central and eastern NY State as winds cross from higher to lower vorticity
- Provides some weak forcing despite the lack of a strong surface boundary

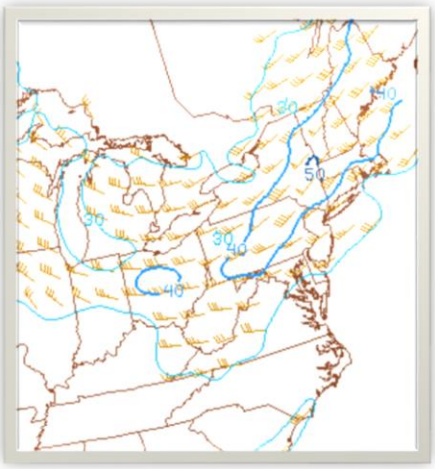


Here is a look at 500 hpa vorticity/heights for 00z on July 14th. Notice the positive vorticity advection in place over the Northeast within the cyclonic flow.

0-6Km Shear Vector

- SPC Mesoscale analysis at 00z shows 0-6 Km shear vectors out of the SW at a magnitude of >40ks over southeastern NY State
- This shear is driven almost exclusively by the 500 mb wind due to very weak surface winds
- Despite the lack of any large scale forcing, this is enough for storm organization assuming any convection manages to form

0-6Km Shear Valid 00z 7/14



This shows 0-6 km bulk shear vectors for 00z on July 14th from the SPC Mesoanalysis. Values are exceeding 40+ kts over the area, which is more than sufficient for severe storms.

Surface Analysis

18Z July 12th

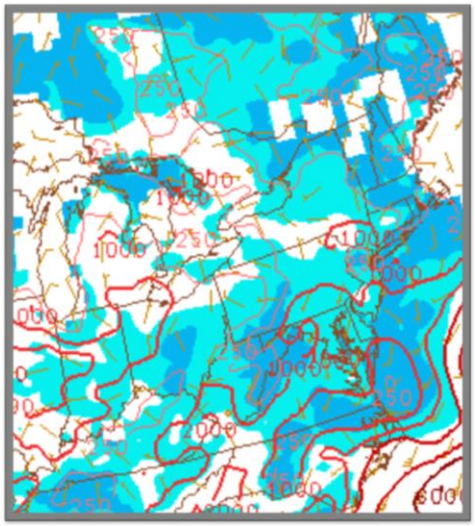
21Z July 13th

Here is a surface analysis for both 18z and 21z on July 13th. A weak surface boundary approaching is stalling out close to the area. Overall, the surface forcing is rather weak and diffuse.

Surface Based CAPE

- SPC Mesoscale analysis at 00z shows SB CAPE around 1000 J/Kg
- CAPE values within the Hudson Valley were likely slightly over 1000 J/kg and were higher than mesoscale models had forecast
- Supported by rapid surface heating under clear skies, along with surface dewpoints in the low 60s
- Boundary layer was well mixed with steepening low level lapse rates, along with upper trough cooling the column above

SB CAPE 00z July 14th

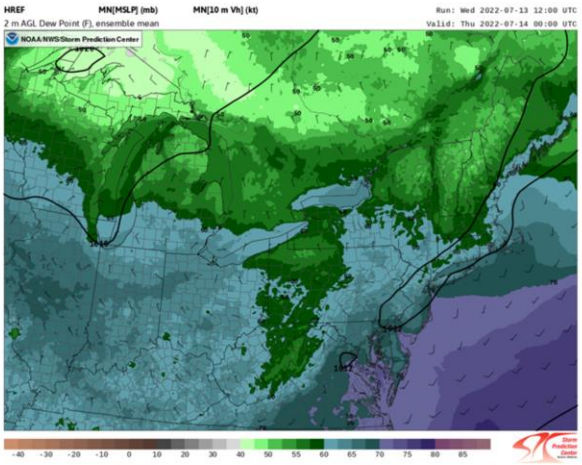


SPC Mesoanalysis shows CAPE values around 500-1000 J/kg on July 14th at 00z over eastern and southern New York. The values on the SPC mesoanalysis may actually have been a little underdone.

Surface Dewpoints

- HREF ensemble predicted surface dewpoints climbing into the low 60s within the Hudson Valley by the evening
- Relatively weak low-level flow behind previous mid-latitude cyclone
- Some weak southerly flow was observed in the evening just ahead of the supercell, possibly enhanced by north/south orientation of the Hudson Valley

HREF Ensemble Td Int 12z 7/13, Valid 00z 7/14

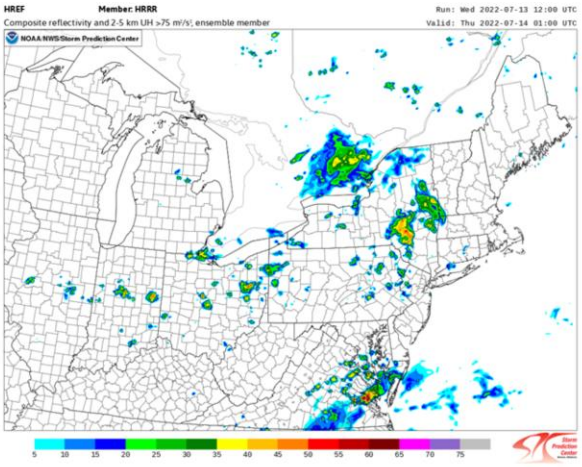


Surface dewpoints for 00z July 14th, as predicted by the 12z HREF, shows values in the 60s.

Simulated Radar

- HRRR 12z run initiated scattered convection under broad region of forcing just east of the shortwave trough
- Convection assisted by modest surface heating and modest surface-based CAPE
- No large-scale organization due to lack of any notable fronts or surface boundaries
- Still potential for some organization thanks to >40 kts mid-level flow

HRRR Reflectivity Int 12z 7/13, Valid 00z 7/14



Here is the simulated radar imagery from the 12z HRRR. Activity looks disorganized and isolated in coverage, but convection was expected to develop and be around eastern New York for late in the day.

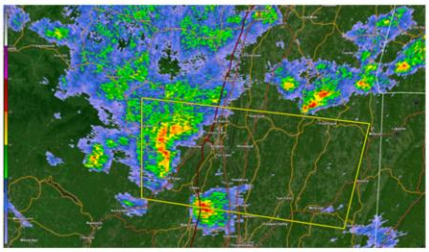
July 13th SPC Outlook & Storm Reports

- SPC Day 1 Convective Outlook shows a general thunderstorm risk
- Storm Reports are sparse as expected, however a few wind reports are seen associated with stronger storms that developed on the southeastern flank of the upper trough
- Several wind reports and a tornado report are associated with the evening supercell within Ulster County NY

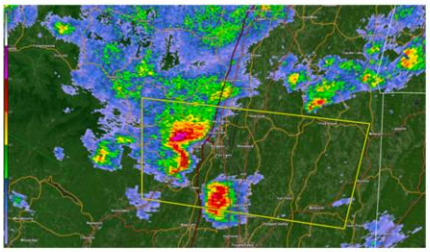
Here are the severe weather reports from July 13th. Notice the cluster of reports around the Kingston area; these were all associated with the isolated severe storm. Notice that the area is only outlooked for general thunderstorms, not even marginal.

Reflectivity

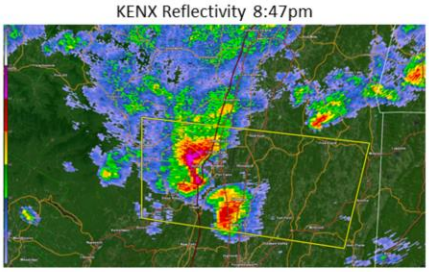
KENX Reflectivity 8:38pm



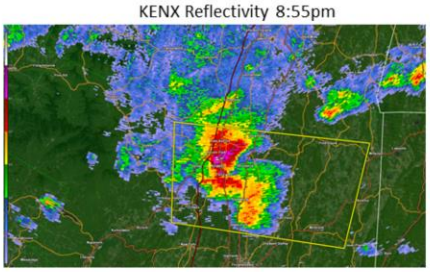
KENX Reflectivity 8:42pm



KENX Reflectivity 8:47pm



KENX Reflectivity 8:55pm



This is a 4 panel of 0.5 degree reflectivity from the evening hours between 8:38 pm and 8:55 pm. You can see the strong storm heading eastward as it heads across the Catskills into the mid Hudson Valley. The strong appears to strengthen, although some of this could be due to beam blockage over the high terrain. A Severe Thunderstorm Warning that was in effect was also displayed over the radar imagery.

Storm Report Hurley EF-1 Tornado

Tornado Report 8:49pm EDT

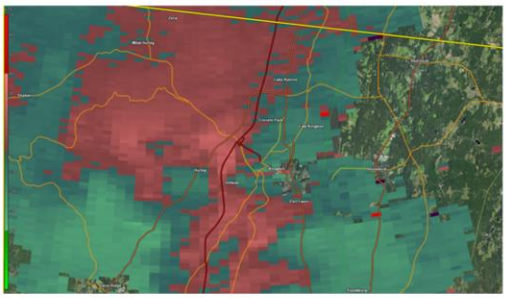
1 NNE HURLEY Tornado Report

County, State: ULSTER, NY
(marker location is approximate)
Lat.: 41.93, **Lon.:** -74.05
Time: 2022-07-14 00:49 UTC
EF-Scale: Unknown

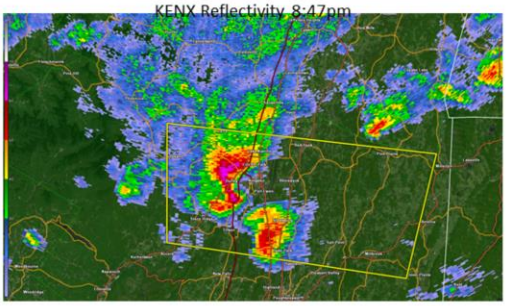
AN EF-1 TORNADO TOUCHED DOWN NEAR HURLEY AVENUE (ROUTE 29) BETWEEN DAVIS STREET AND HILLSIDE DRIVE. THE TORNADO MOVED SOUTHEAST TO JUST WEST OF THE NY STATE THRUWAY CRO (ALY)

- Brief tornado touched down at 8:49 pm and dissipated at 8:51 pm
- Path length was ½ mile with a max width of 300 yards
- EF-1 with 90 mph winds

KENX Velocity 8:47pm



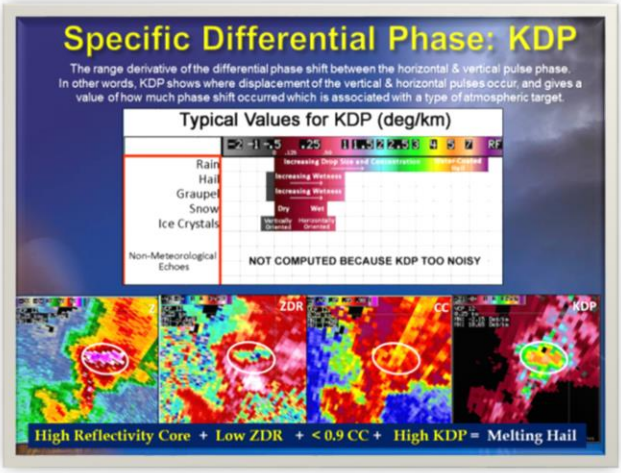
KENX Reflectivity 8:47pm



This is the info regarding the brief tornado that occurred. You can see some rotation within the 0.5 degree KENX velocity, although it's still difficult to see a tight couplet. The reflectivity was impressive at this time. The tornado only last two minutes, but did produce damage in the Hurley area.

KDP Applications

- Differential phase shift shows the difference in phase shift of the horizontal and vertical pulses as they interact with a target
- KDP shows the change in differential phase shift
- High KDP values indicate greater phase shift in the horizontal, and thus indicate where heavy rain is occurring



https://www.weather.gov/media/erh/ta2020-04.pdf

Here is some background regarding Specific Differential Phase (KDP), which was a useful dual-pol radar parameter with this case.

Storm Survey Macroburst

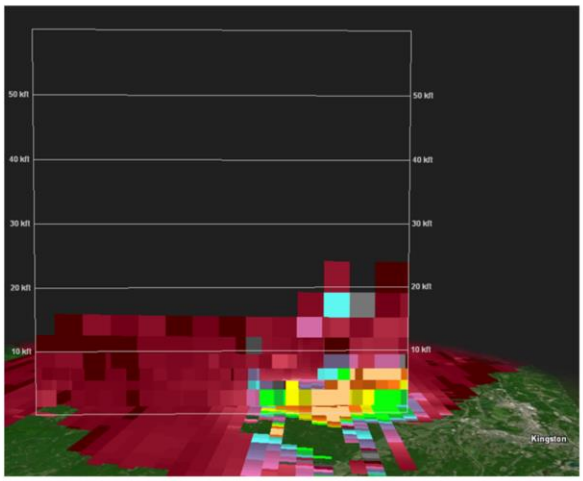
Date	July, 13, 2022
Time (Local)	8:37 to 8:47 pm EDT
Est. Peak Winds	90 mph
Path Length	4.0 miles
Max Width	1.0 miles
Injuries/Deaths	0/0

Summary:

NWS Albany Survey Team confirmed a Macroburst that began about 9 miles west of Kingston and ended about 5 miles southwest of Kingston in Ulster County. Wide swaths of downed trees were noted along Lapla Road (and connecting roads) across the hill the road crosses. At least 2 trees fell on cars along Lapla Road. Wind damage consisting of broken, snapped and uprooted trees continued southeast across U.S. Route 209.

- High KDP values suspended aloft at 8:33pm fall to surface by 8:42pm along Macroburst path just west of Kingston and Hurley.
- Indicative of heavy precip core plunging to surface, Wet Microburst/Macroburst

KDP Cross-Section 8:42pm
Approx 2 miles west of Hurley

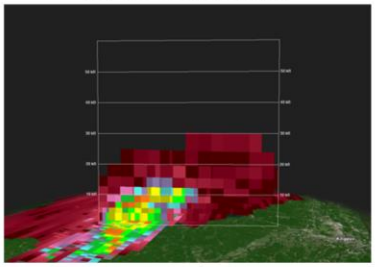


A macoburst occurred at 8:42 pm. High values of KDP can be seen aloft as early as 8:33 pm. As these high values (indicative of heavy precip/hail) crashed towards the surface, a macroburst occurred in the Kingston area. Many trees were damaged.

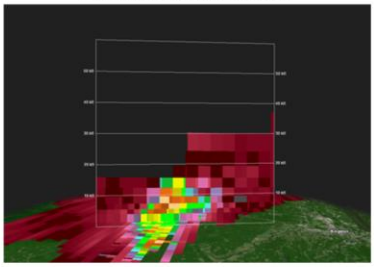
KDP Collapse Sequence

- Sequence of scans from KENX between 8:29pm and 8:42pm show high KDP values suspended aloft crashing down to the surface west of Hurley.
- Ending of this sequence corresponds to timing and location of Macroburst
- High KDP core collapsing shows the descent of very heavy precip toward the ground

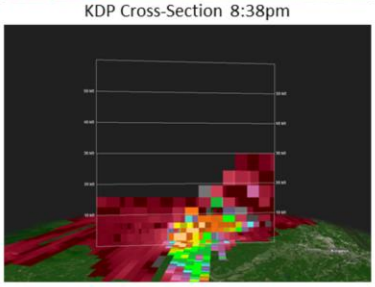
KDP Cross-Section 8:29pm



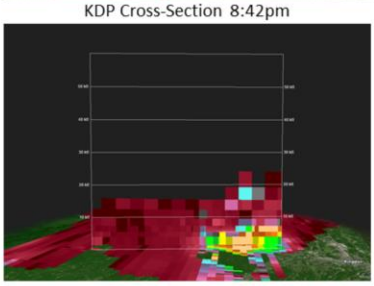
KDP Cross-Section 8:33pm



KDP Cross-Section 8:38pm



KDP Cross-Section 8:42pm



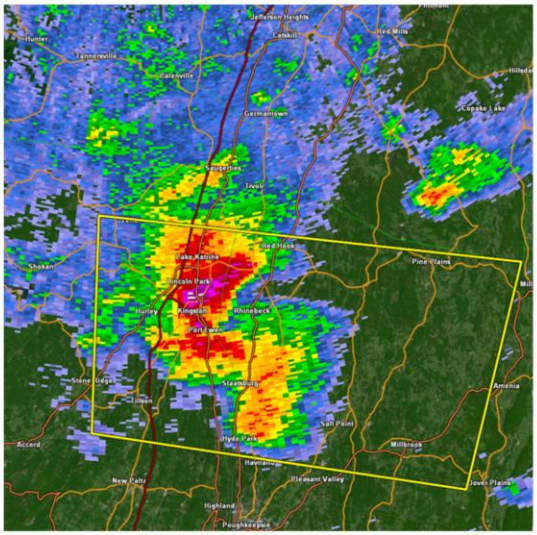
Here are some more cross-sections of KDP from 8:29 pm to 8:42 pm. You can see the high values suspended aloft that descended towards the surface towards 8:42 pm.

Storm Reports
Wind Damage

0848 PM 07/13/2022	TSTM WND DMG	1 NNE HURLEY ULSTER	NY	41.93N 74.05W SOCIAL MEDIA	
	TREE ON HOUSE				
0850 PM 07/13/2022	TSTM WND DMG	1 ENE HURLEY ULSTER	NY	41.92N 74.03W SOCIAL MEDIA	
	PROPANE TANK STUCK BY TREE, TANK LEAKING, LYNETTE BLVD				
0850 PM 07/13/2022	TSTM WND DMG	1 NE HURLEY ULSTER	NY	41.93N 74.04W SOCIAL MEDIA	
	TREE ON TRAILER (SPRING LAKE)				
0855 PM 07/13/2022	TSTM WND DMG	1 SSE PORT EWEN ULSTER	NY	41.89N 73.97W SOCIAL MEDIA	
	TREE AND WIRES DOWN BROADWAY				

- Reflectivity shows returns of up to 70 dBZ at the time severe wind damage occurred within the Kingston area
- This indicates heavy precip likely mixed with hail

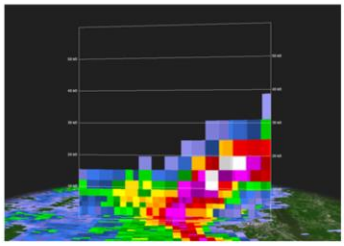
KENX Reflectivity 8:55pm EDT



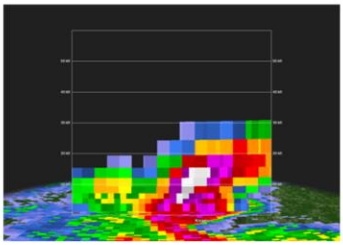
Here is a summary of wind damage reports. The 0.5 degree reflectivity radar imagery showed up to 70 dbZ around 8:55 pm.

Reflectivity Sequence

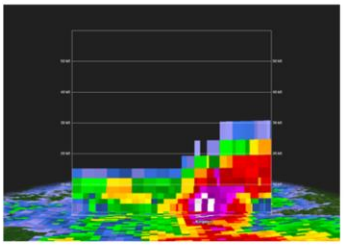
- Similar to KDP, high Reflectivity values can be seen suspended aloft prior to severe winds in Kingston
- High Reflectivity values > 70 dBZ are suspended aloft at 8:47pm when the storm is just west of Kingston, and rapidly descend through 8:55pm, corresponding to the timing of wind reports
- The tilted updraft of the supercell is also evident in these panels
- High Reflectivity aloft also indicates hail suspended by the updraft



Reflectivity Cross-Section 8:47pm



Reflectivity Cross-Section 8:51pm



Reflectivity Cross-Section 8:55pm

A few cross-sections of reflectivity are shown here from 8:47 through 8:55 pm. Notice the very high values and the tilted updraft, showing the strong shear in place. Some of these high values were due to hail suspended aloft as well.

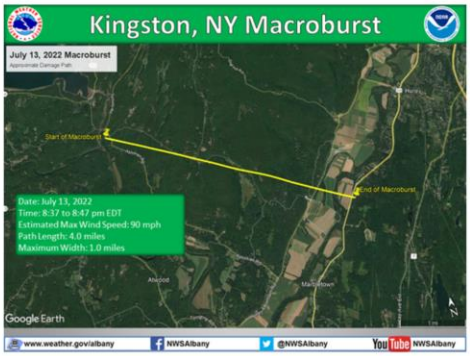
Conclusions

- An isolated thunderstorm was able to acquire a rotating updraft and become a Supercell despite being in a marginal environment characterized by a lack of large-scale forcing mechanisms and the presence weak low-level flow
- The presence of an upper-level shortwave provided weak forcing, which was able to produce isolated thunderstorms
- Higher than expected surface-based CAPE (approx 1000 J/kg) within the Hudson Valley and the presence of > 40 Kts of vertical wind shear was sufficient to maintain this Supercell for several hours
- Descending values of high Reflectivity and Dual-Pol products like KDP showed a correlation with the timing and locations of the greatest wind damage

Some conclusions are listed above.

Conclusions

- This supercell produced 2 significant events in the form of an EF-1 tornado, and a macroburst with 90 mph straight line winds
- Evidence that large scale forcing is not always necessary for severe weather and damaging storms can still occur if cells tap into available instability and shear



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A few more conclusions are listed here. Overall, it was an impressive isolated severe event that occurred within a day only outlooked for general thunderstorms. Just enough shear, forcing and instability was available to produce a damaging event.


July 13, 8:36 pm
July 13, 8:38 pm
July 13, 8:38 pm
July 13, 8:44 pm