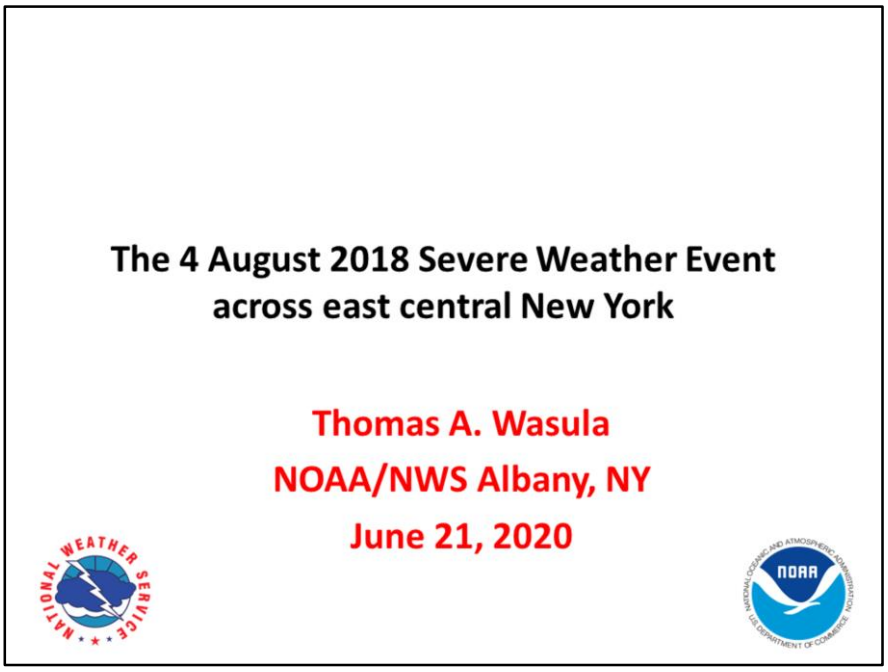
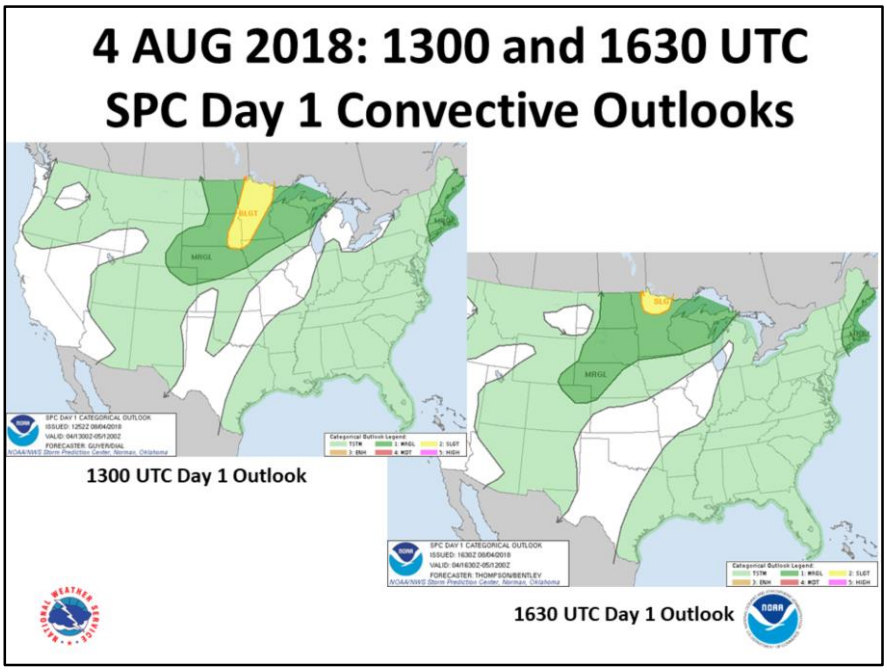
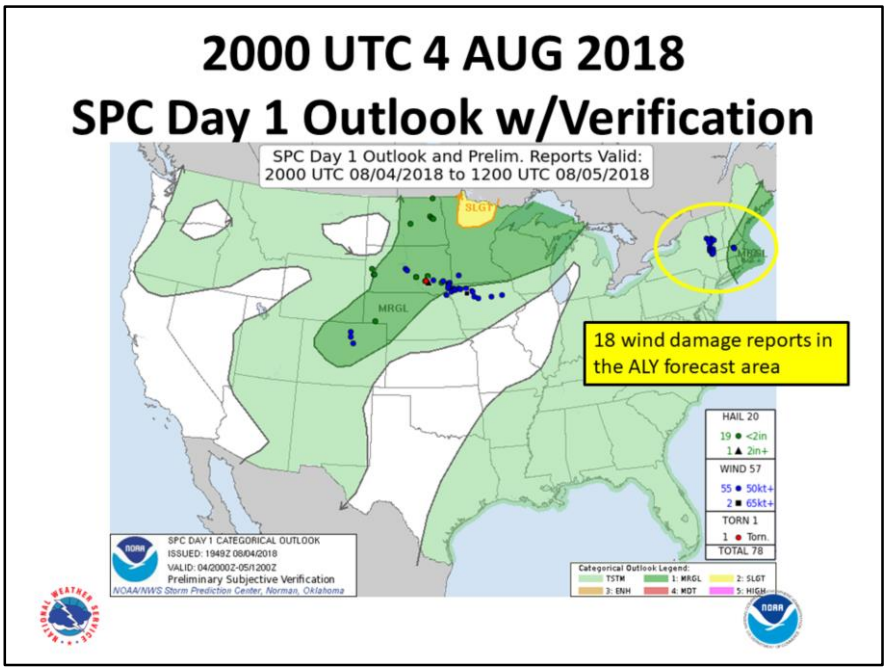


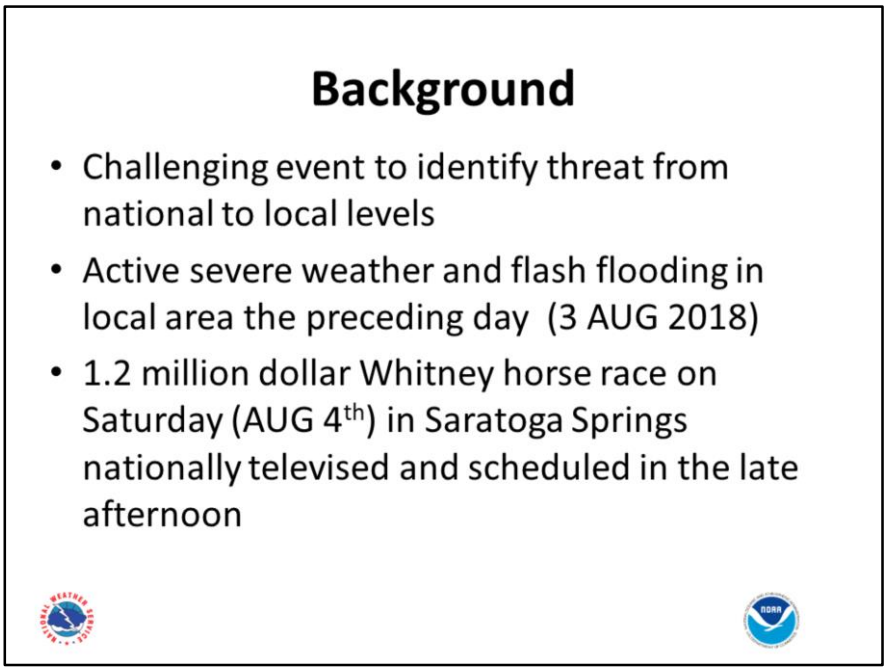
This is a severe weather case study that impacted the Albany Forecast area during the afternoon of 4 August 2018. I am Thomas Wasula, a meteorologist at the NWS at Albany. This a case study that I showed at the 44th Northeastern Storms Conference in March 2019, and also a slightly modified version at the Winter 2020 NYS Mesonet webinar series.



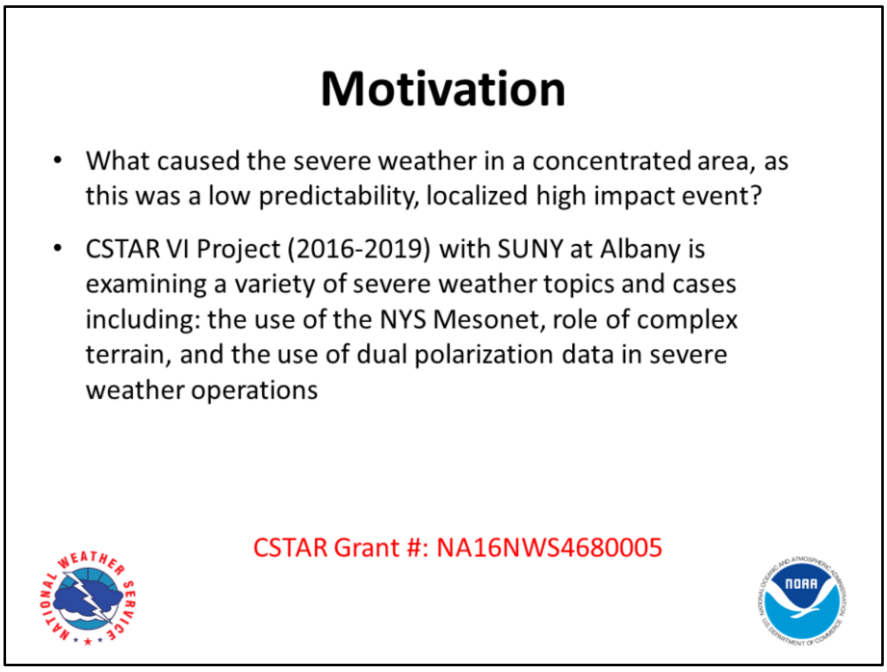
The morning SPC Day 1 Convective Outlook indicated mainly general thunderstorm activity for the majority of the WFO ALY forecast area, with a Marginal Risk grazing western New England. The Marginal Risk shifted eastward during the early afternoon (1630 UTC) across eastern New England.



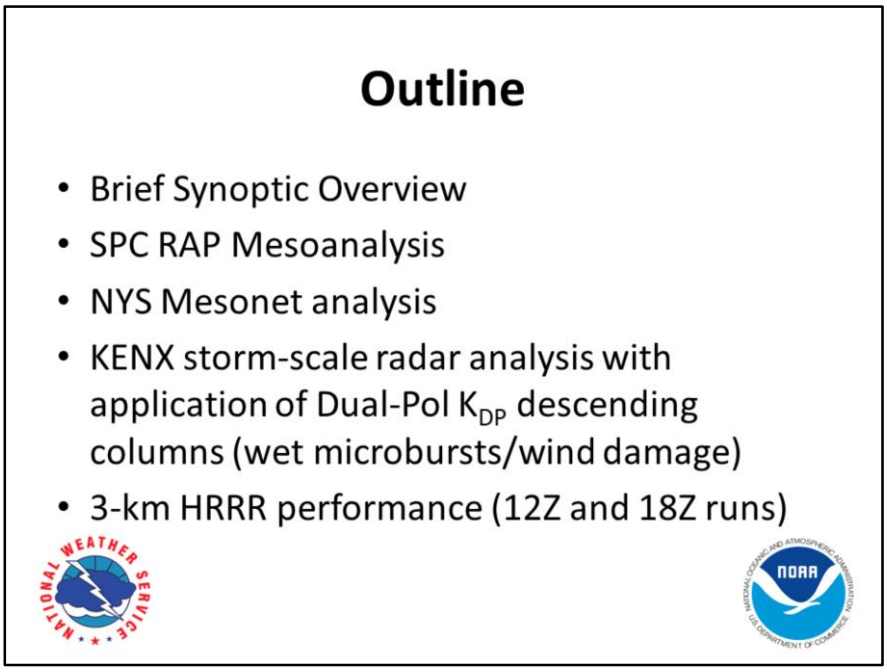
As you might suspect, some severe weather activity occurred west of the Marginal Risk area in eastern NY. A total of 18 wind damage reports occurred with a few winds damage reports and one later confirmed tornado across southern New England.



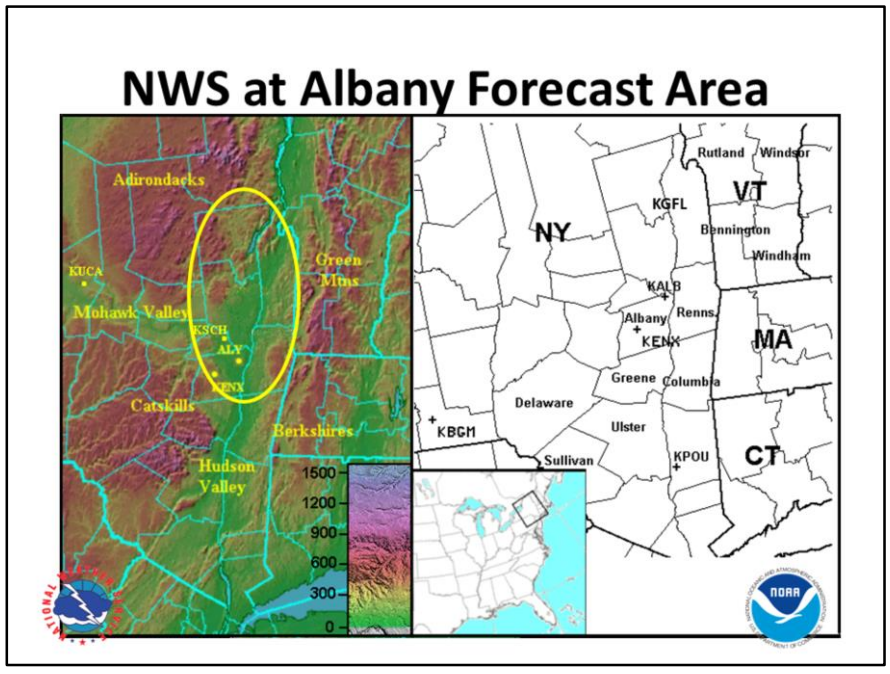
The event was challenging to forecast in advance from the national to local level. Some of the situational awareness may have dampened due to the minor severe and flash flooding event the preceding day. The Flash Flood Watch was actually canceled in the morning, as the weak cold front slid eastward, and the deeper moisture exited into New England. At the time, it was not known that the heavily attended Whitney horse race at the Saratoga Springs Race Track was going to be nationally televised in the late afternoon (5-6 pm). A significant societal impact would occur with around 40,000 people in attendance due to convection.



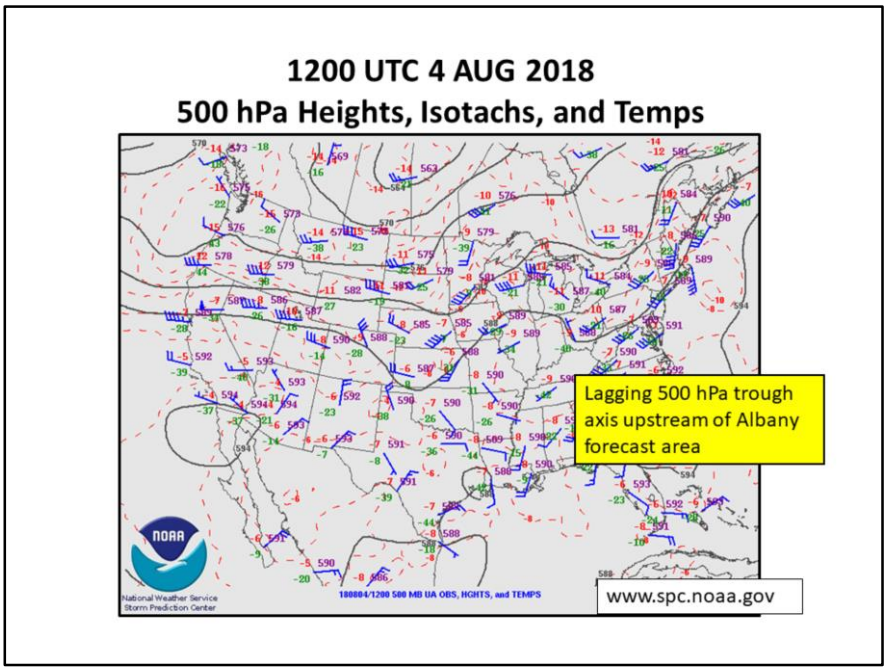
The goal of this case study presentation is try to understand why a localized low predictability, high impact occurred. Some CSTAR V-VI research guidance will be utilized such as utilizing some of the NYS Mesonet observations, examining the role of complex terrain and the use of dual polarization datasets in severe weather operations.



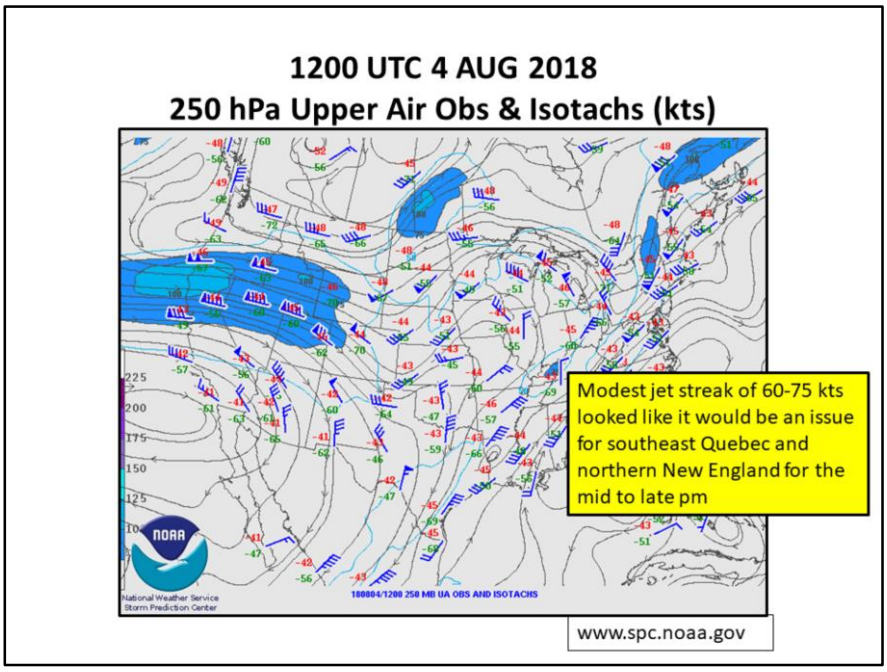
The outline is shown in this slide with a forecast funnel approach that will be examined from the synoptic-scale, the mesoscale, and to the radar or storm-scale. A special emphasis will be on the storm-scale analysis applying new research by Brian Frugis at the WFO at ALY where descending KDP or specific differential reflectivity columns can be used to forecast wet microbursts and subsequent wind damage. Also, the performance of some of the 3-km HIRES CAMS will be reviewed to assess their performance in this event The 3-km HRRR and NAMnest will be looked at the most.



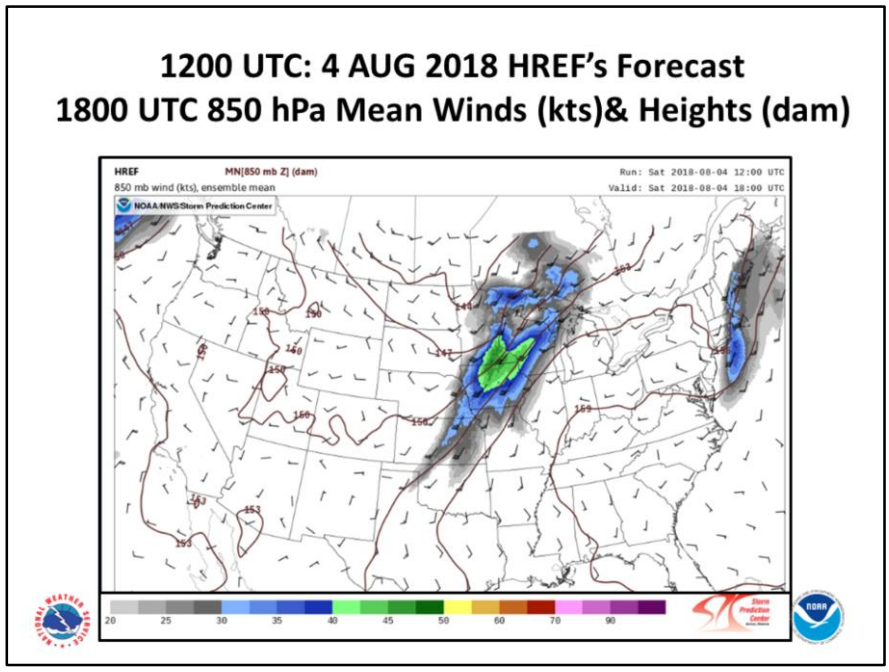
The WFO ALY forecast area is shown on these two maps. On the left side is a topographical map nicely showing the terrain delineating the Mohawk and Hudson River Valleys from the Adirondacks, southern Green Mountains, Berkshires, Litchfield Hills, Taconics and the Catskills. The WFO ALY forecast area covers eastern NY and western New England including southern VT, the Berkshires of western MA, and Litchfield County in northwest Connecticut. The focus area for this case study will be east of the Adirondacks in the Upper Hudson Valley, Lake George Region southward into Albany and the Capital Region.



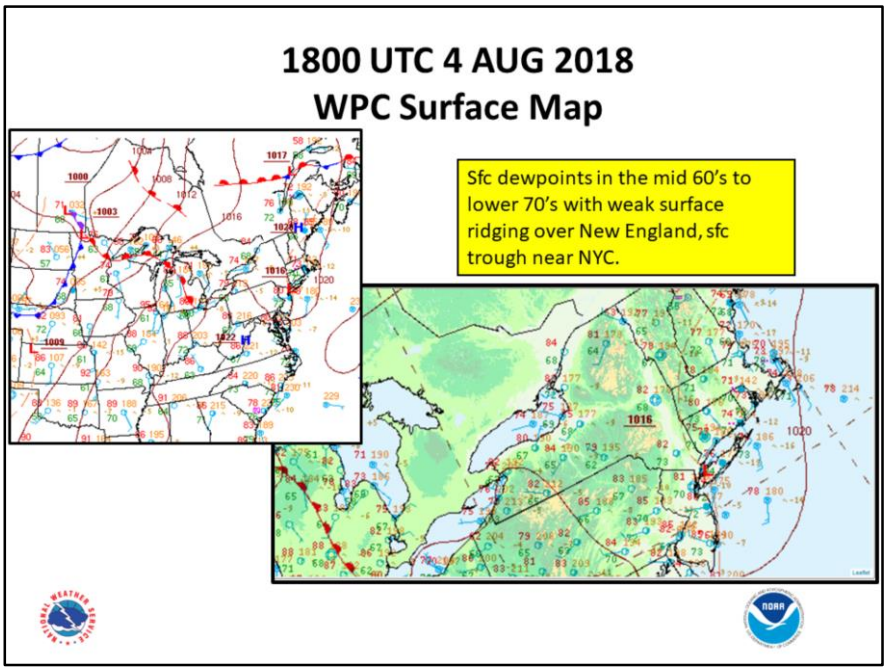
The 500 hPa pattern at 1200 UTC 4 AUG 2018 showed a short-wave moving across southern NY into western New England. The lagging 500 hPa trough axis remained upstream across southeast Canada, western NY into the OH Valley. The better jet dynamics were shifting downstream of Albany with weak synoptic forcing implied at 500 hPa .



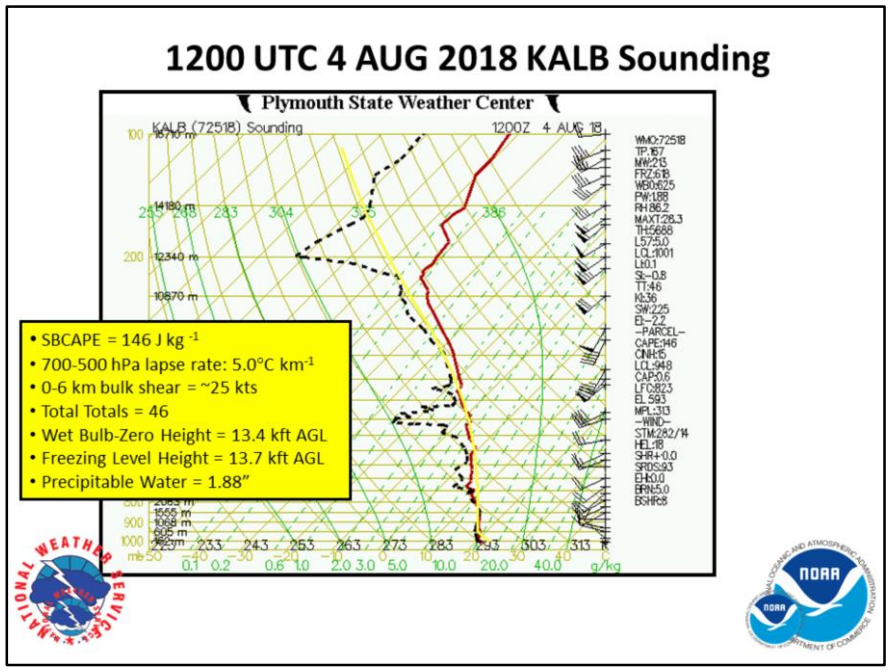
At 250 hPa, a weak dual jet structure was in place, with a modest equatorward jet streak of 60-75 kts moving north of the Capital Region in eastern NY. The right front entrance region of this jet streak appeared it would be a focus area for some convection, possibly isolated severe convection across southeast Quebec and northern New England in the afternoon. The better jet dynamics aloft were forecast to move away from the forecast area.



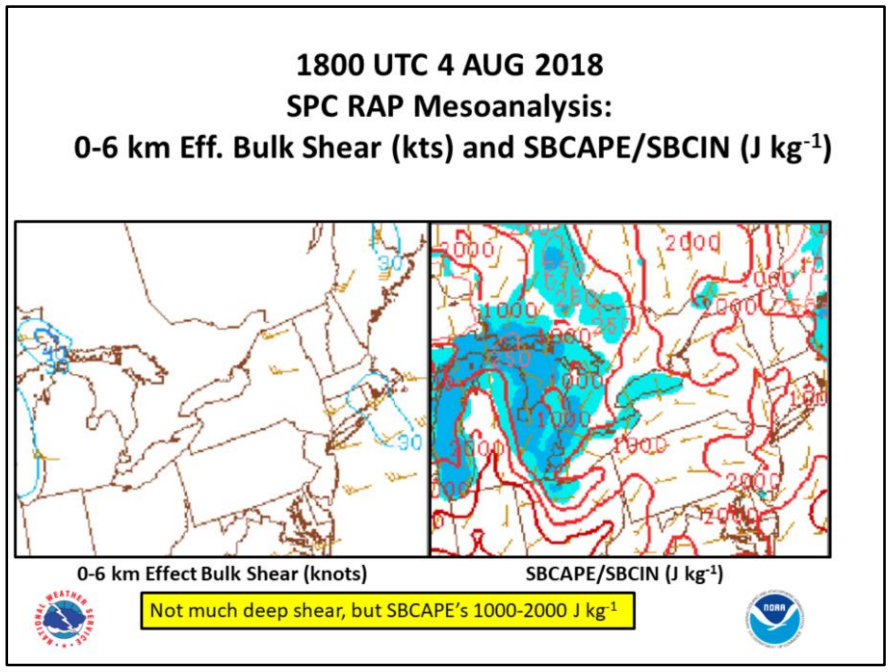
The 1200 UTC 4 AUG 2018 HREFs 850 hPa mean heights and winds forecasted for 1800 UTC that afternoon showed the better low-level jet and forcing moving along and off the eastern New England Coast. There was a weak 850 hPa shallow trough hinted at just east of the Hudson River Valley for the early pm.



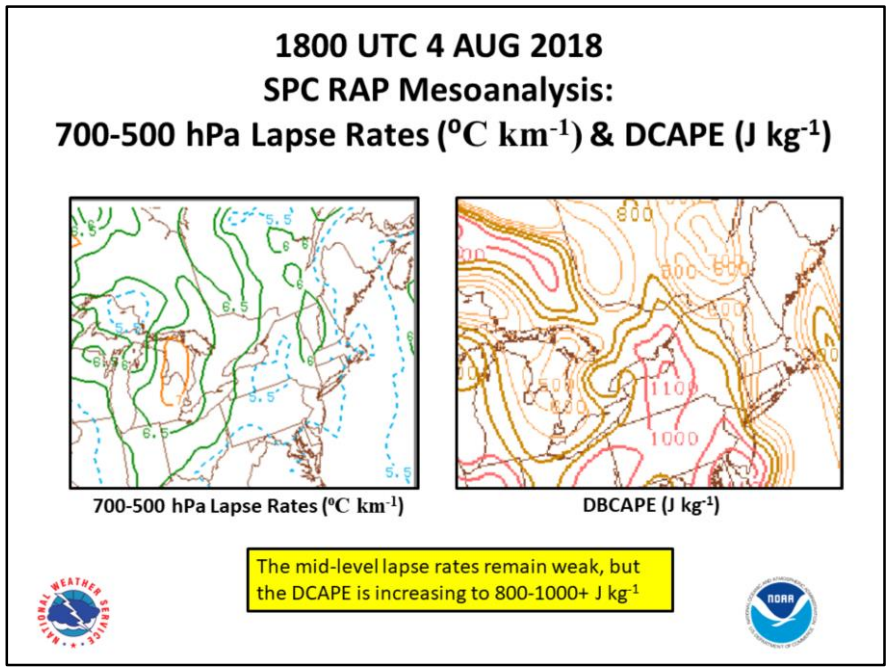
At 1800 UTC 4 AUG 2018, a weak surface anticyclone was over northern New England, but a surface low or trough continued to be over NYC. Surface dew points never really lower with mid 60s to lower 70's over eastern NY and western New England.



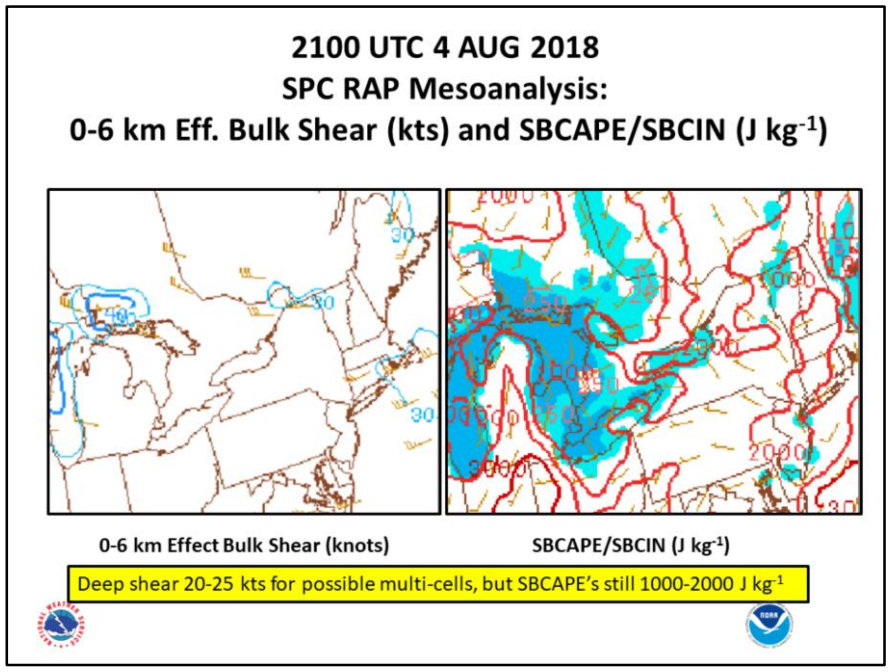
The 1200 UTC 4 AUG 2018 KALB sounding was very moist, with a tall and skinny signature. Shallow cool advection can be seen in the boundary layer, but then the flow backs in the lower troposphere with southwesterly flow aloft. The precipitable water values remained high at 1.88”. The freezing level relatively high at 13.7 kft AGL. The SBCAPE was low at 146 J/kg, and the deeper shear was weak at around 25 knots. The mid level lapse rates were weak too.



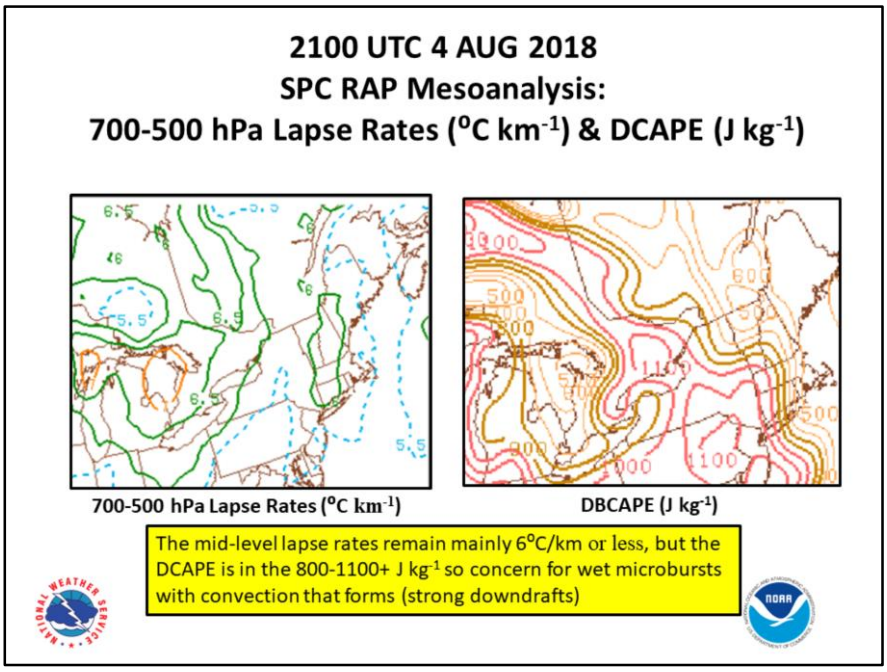
1800 UTC 4 AUG 2018 SPC RAP Mesoanalysis showed very little 0-6 km Effective Bulk Shear (kts) with around 20 knots. The SBCAPE's increased into the 1000-2000 J/kg range with some heating and the high dewpoints in place. There was very little SBCIN (J/kg) by 1800 UTC.



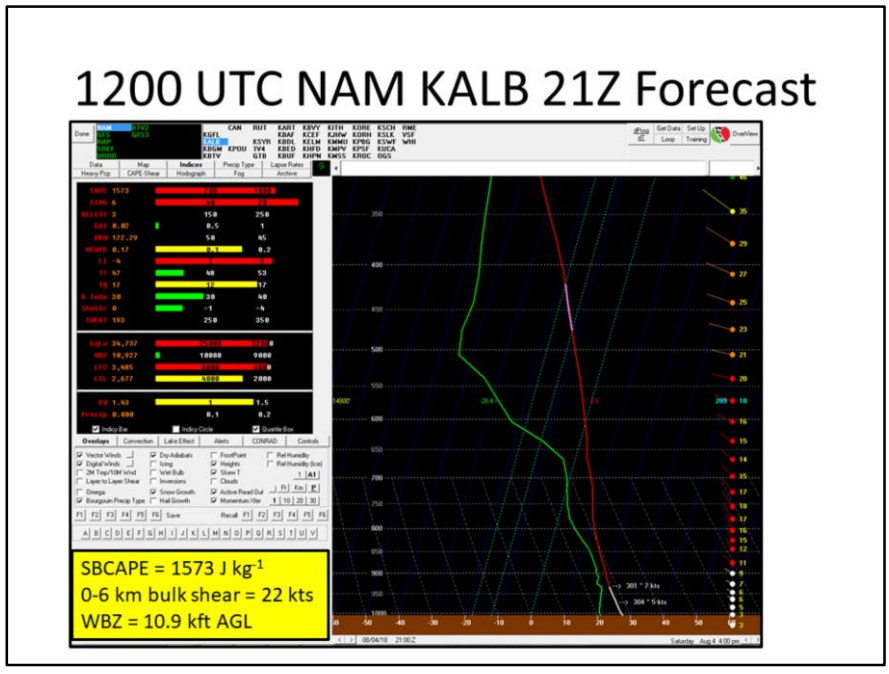
1800 UTC 4 AUG 2018 SPC RAP Mesoanalysis indicated mid-level lapse rates remained weak with values of 5.5-6°C/km. However, the DCAPE values were about 700-1100 J/kg along the western New England to eastern NY border. High values of DCAPE are an indicator of stronger downdrafts and damaging winds with any convection that develops.



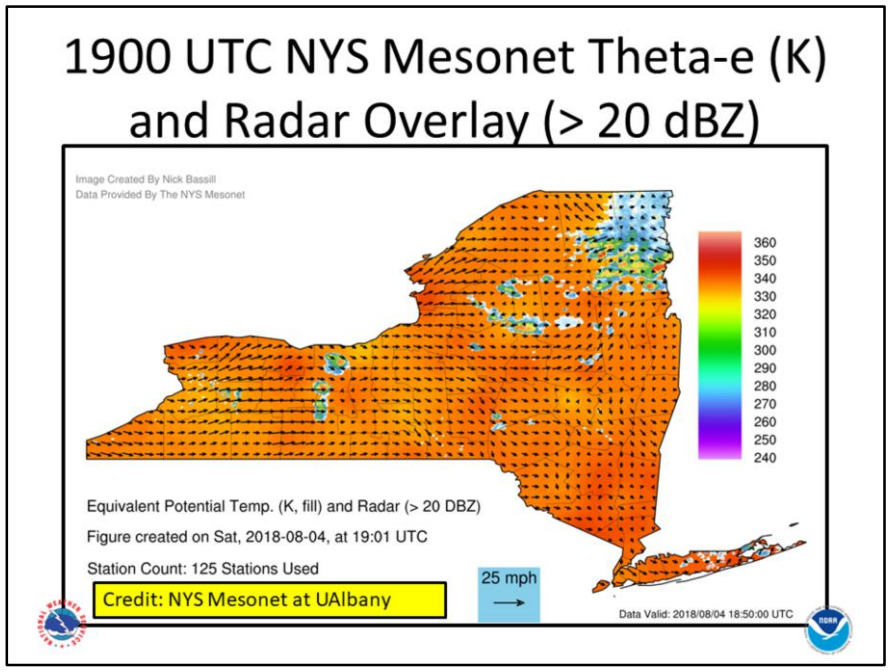
2100 UTC 4 AUG 2018 SPC RAP Mesoanalysis showed very little 0-6 km Effective Bulk Shear (kts) with 20-25 knots. The greatest shear was up along the NY-VT Canadian border. The SBCAPE's continued to be in the 1000-2000 J/kg range. There was some SBCIN over northern VT, the Champlain Valley, and the Lake George Region.



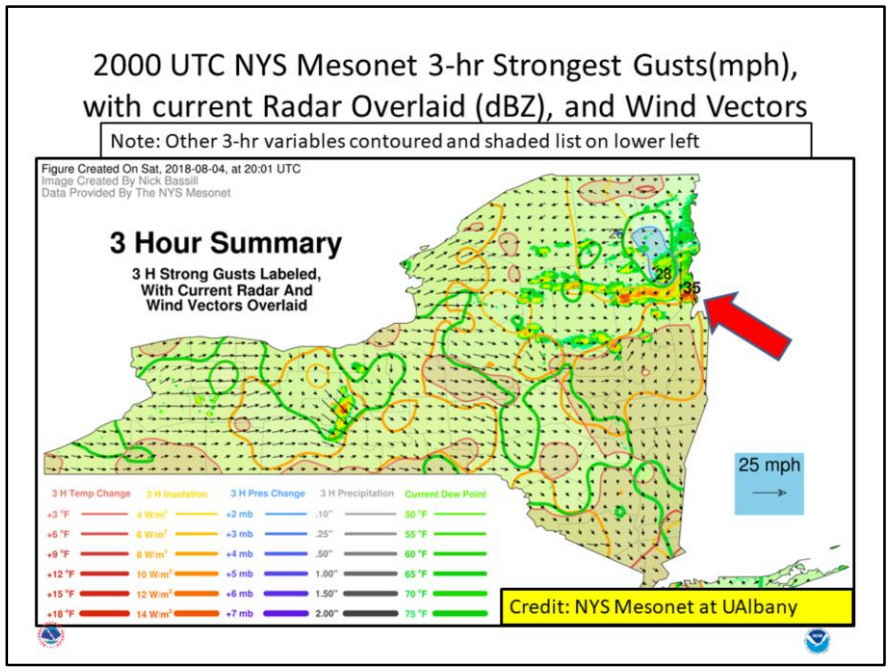
The 2100 UTC 4 AUG 2018 mid-level lapse rates remained mainly 6°C/km or less but the DCAPE values increased to 800-1100+ J/kg with a strong gradient of DCAPE oriented along the Mohawk Valley and the Lake George Saratoga Region. These high values of DCAPE increased the concern for wet microbursts with any convection that formed.



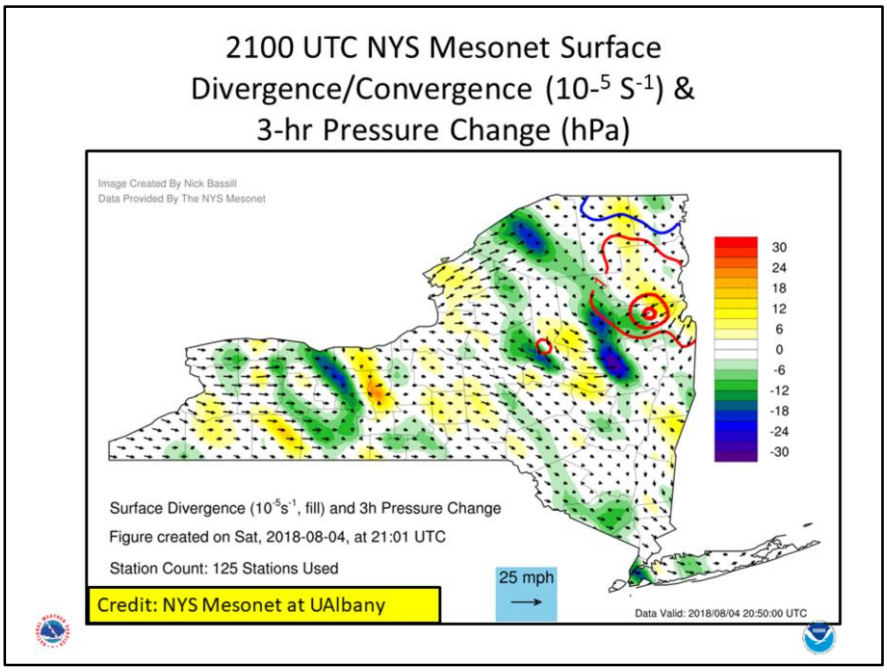
A 1200 UTC 4 AUG 2018, BUFKIT NAM model sounding for KALB at 2100 UTC continued to show moderate CAPE with an SBCAPE value of 1573 J/kg and fairly weak deep shear with 0-6 km bulk shear of 22 knots. Wet bulb zero heights were lower at 10.9 kft compared to the observations sounding. Some multi-cells were possible if convection developed.



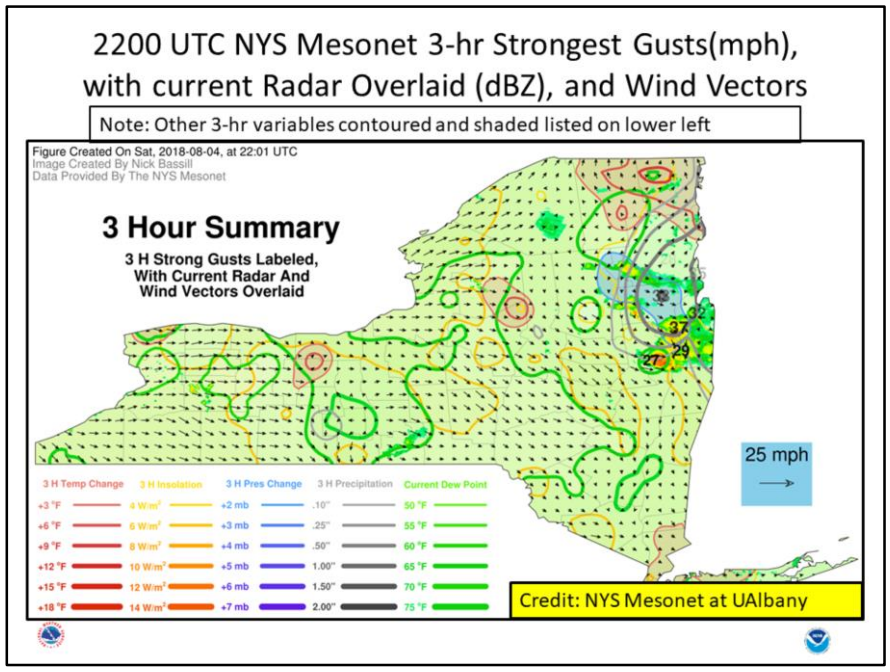
The 1900 UTC NYS Mesonet showed high theta-e values over NYS in the 330-340 K range. Convection fired over southern Quebec, and shifted south or southeast into northern NY and the Saint Lawrence River Valley. Some of these cells were getting close to the northern reaches of the Lake George Region.



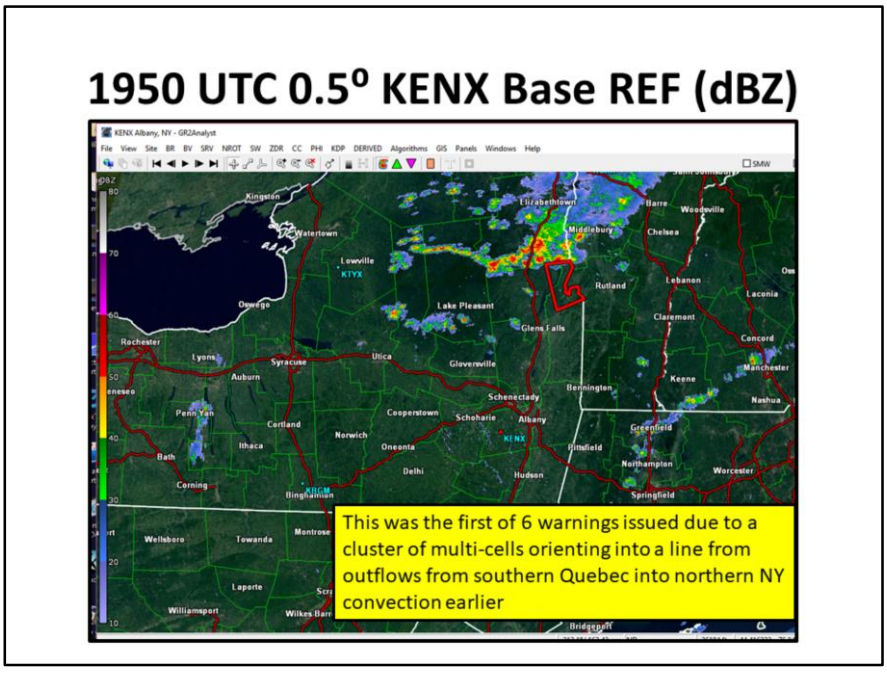
The 2000 UTC 4 AUG NYS Mesonet 3-hour wind gusts, wind vectors, dew points; 3-hr temp, insolation, precipitation, pressure change and radar returns overlayed showed the cold pool of the convection pushing into the Lake George Region. A wind gust of 35 mph occurred at Ticonderoga, and 28 mph at North Hudson. Some pressure rises were occurring in the wake of convection moving southward towards the Lake George Region.



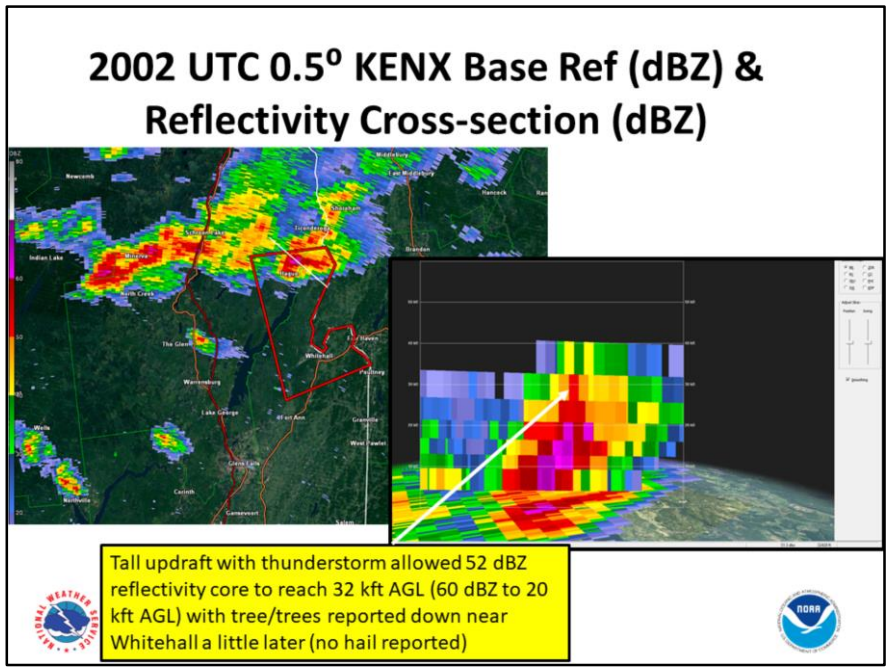
The 2100 UTC 4 AUG 2018 NYS Mesonet Divergence/Convergence and 3-hr MSLP pressure overlay showed low-level convergence increasing (cool colors) along the eastern spine of the Adirondacks down the Hudson River Valley. MSLP pressure rises of 1-3 hPa/3 hours were occurring over northern Warren County and near Lake George, as strong to severe convection pressed southward.



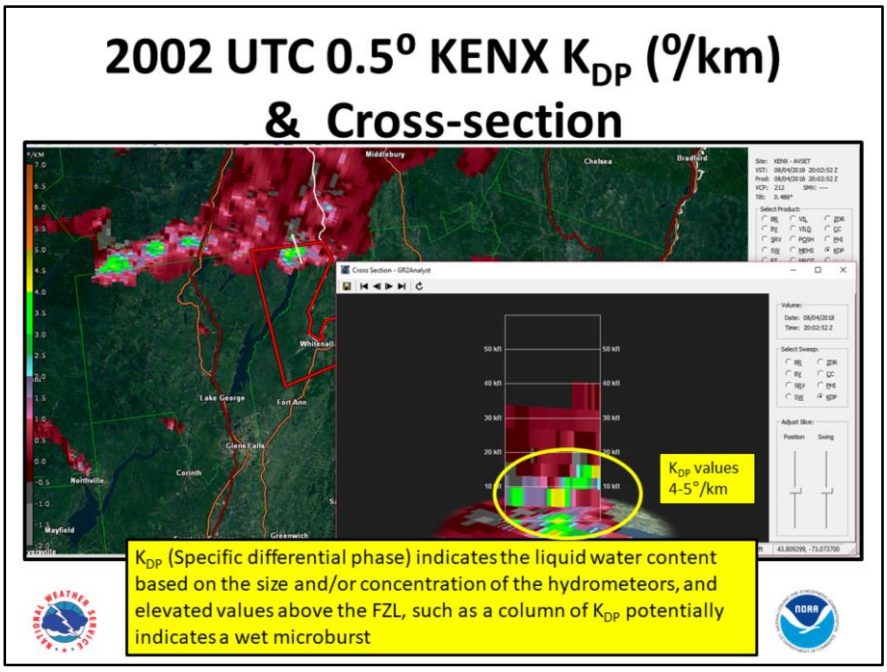
The 2200 UTC 4 AUG NYS Mesonet 3-hour wind gusts, wind vectors, dew points; 3-hr temp, insolation, precipitation, pressure change overlayed on radar echoes showed the cold pool of the convection pushing into the Capital Region A wind gust of 37 mph occurred at Glens Falls, 32 mph at Whitehall, and 29 mph at Schuylerville. Some pressure rises were occurring in the wake of convection across the Lake George Region pushing southward.



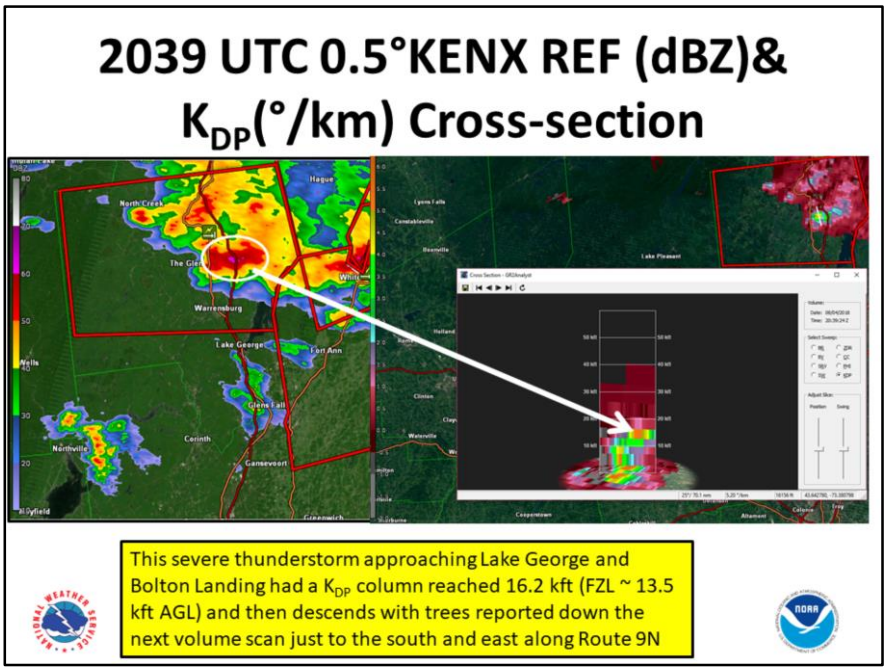
A cluster of multi-cells organized into a line across the southern Adirondacks and the Lake George Saratoga Region at 1950 UTC 4 AUG 2018. These storms fired along outflow boundaries from convection in southern Quebec earlier in the day that moves into northern NY. There were no severe thunderstorms until this first warning was issued for northeast Warren and northern Washington Counties.



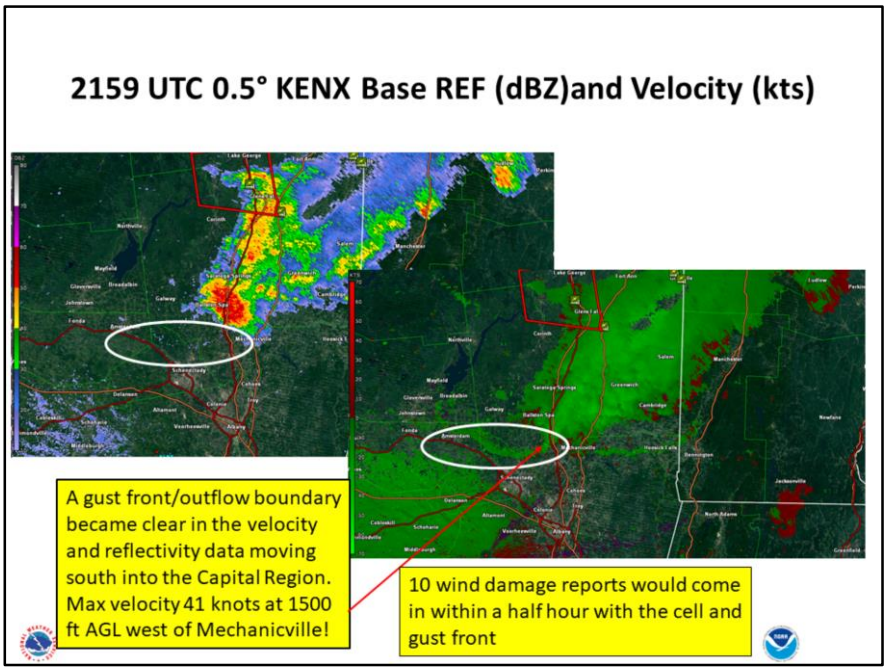
A severe thunderstorm moved into northern Washington County at 2002 UTC. An updraft was tall enough for a 52 dBZ reflectivity core to reach 32, 000 ft AGL and 60 dBZ to 20,000 ft AGL. A severe thunderstorm warning was in place, and tree/trees were reported down near Whitehall. There was no hail reported with this cell.



At 2002 UTC 4 AUG 2018, the K_{DP} or Specific Differential Phase had values of 4-5°/km reach to about 15,000 ft AGL which is just above the freezing level (FZL). K_{DP} indicates the liquid water content based on the size and/or concentration of the hydrometeors. High K_{DP} values can also be an indicator of melting hailstones. These values of K_{DP} or this K_{DP} column extended above the FZL of 13,700 ft AGL and then descended indicating a potential wet microburst.

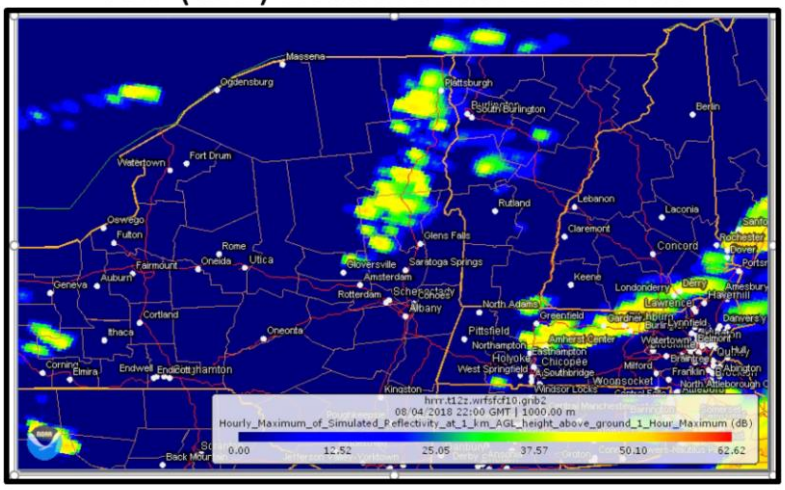


At 2039 UTC, the convection showed some back building, as strong to severe thunderstorms on the western flank of the cluster or evolving line approached the village of Lake George and Bolton Landing. The severe thunderstorm had a K_{DP} column reach 16,200 ft AGL (FZL ~ 13.5 kft AGL) which is well shown in the cross-section (values of 5-7°/km) and then descends quickly with trees reported down the next volume scan just to the south and east along Route 9N in the Lake George area.

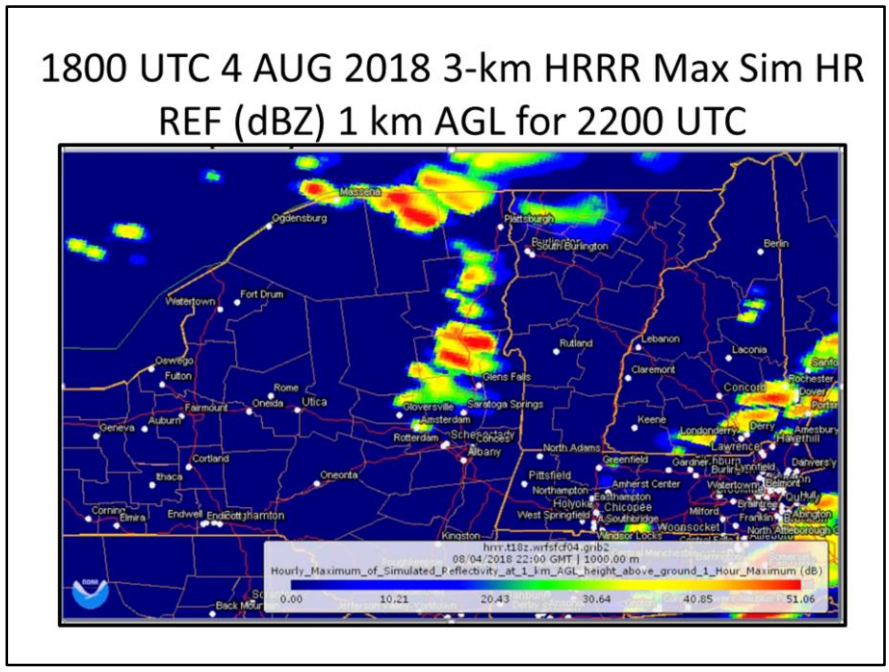


A impressive gust front or outflow boundary move quickly southward of a severe thunderstorm over the Saratoga Springs and Ballston Spa area. This outflow boundary would produce fairly widespread wind damage across the Capital Region. At 2159 UTC it became very clear in the reflectivity and velocity data. The max velocity was 41 knots at 1500 ft AGL west of Mechanicville in the right image. 10 wind damage reports would occur within a half an hour with the gust front/outflow boundary. The warning decision team was issuing severe thunderstorm warnings off the gust front in WarnGen with little to no cloud to ground lightning. It was a good move to use this option in WarnGen.

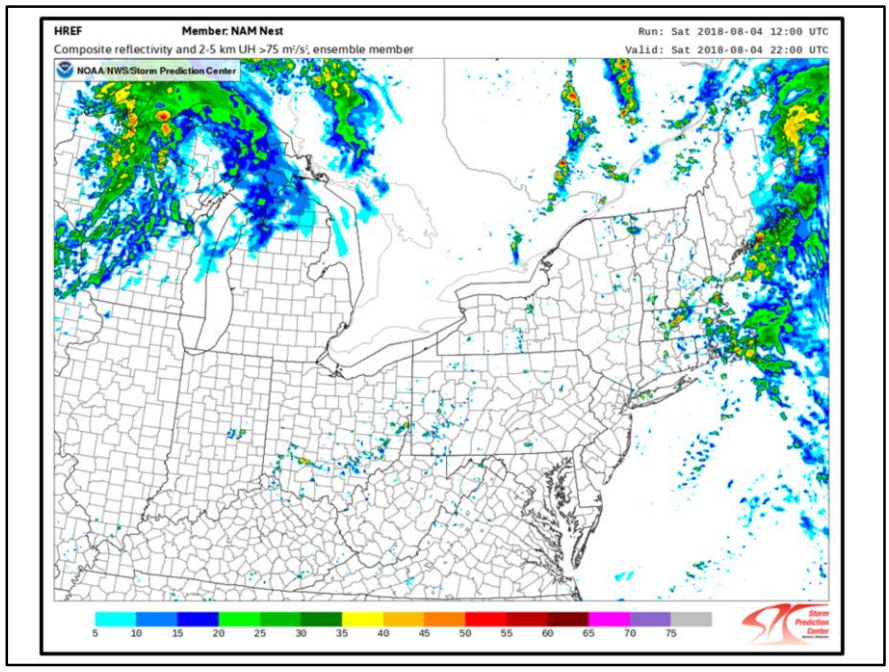
1200 UTC 4 AUG 2018 3-km HRRR Max Sim HR REF (dBZ) 1 km AGL for 2200 UTC



This is a snapshot from the 1200 UTC 4 AUG 2018 3-km HRRR Maximum Simulated High Resolution Reflectivity (dBZ) at 1 km AGL. The loop can not be shown, but at approximately 2200 UTC, we can see the HRRR had a pretty good clue where the convection would be around 2200 UTC. The maximum reflectivities of 40-50+ dBZ were over the eastern Adirondacks into the Lake George-Northern Saratoga Region and extended northward into the Champlain Valley.

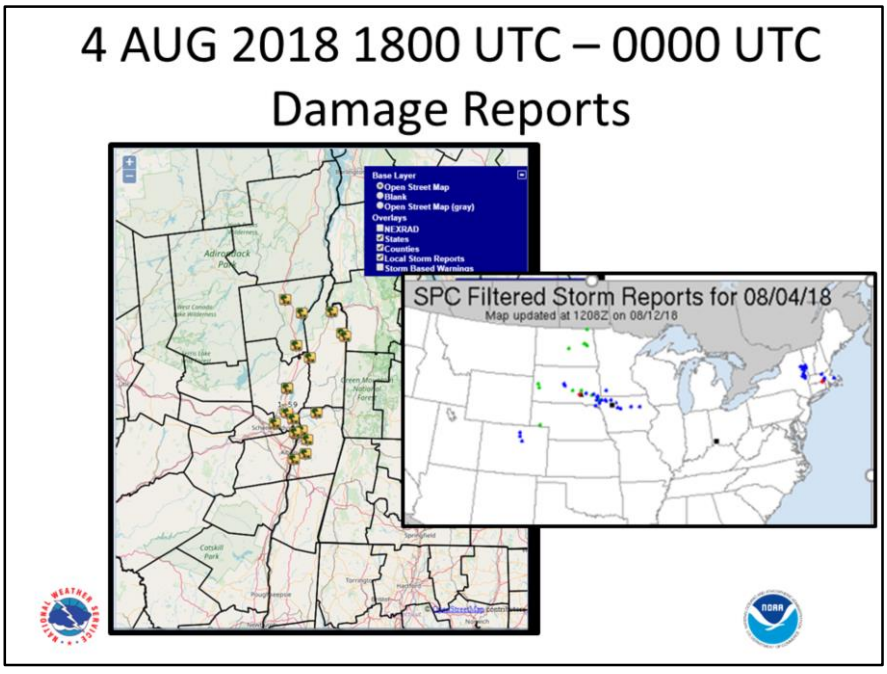


This is a snapshot from the 1800 UTC 4 AUG 2018 3-km HRRR Maximum Simulated High Resolution Reflectivity (dBZ) at 1 km AGL. The loop can not be shown, but at approximately 2200 UTC, we can see the HRRR had a pretty good clue where the convection would be around 2200 UTC. The maximum reflectivities of 40-50+ dBZ were over the Lake George-Northern Saratoga Region dipping southward to the Capital Region which was really close to what happened.

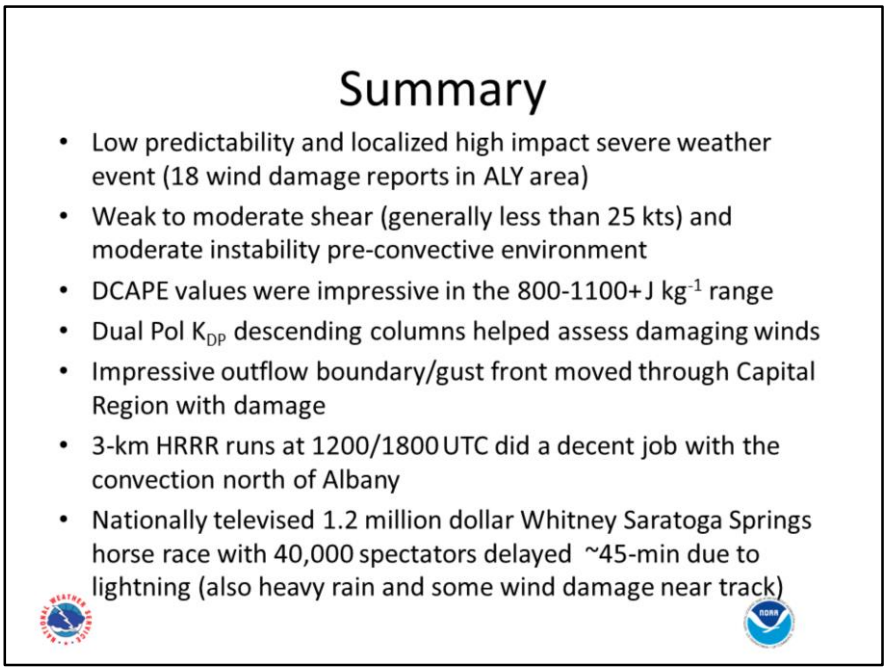


The 3-km 12Z NAM Nest Composite Reflectivity forecast on 4 AUG 2018 (loop could not be shown) for the afternoon showed very little convective activity over the southern Adirondacks, Lake George Region into the Capital Region. A snapshot forecasted at 22 UTC showed a few showers over southern VT and west/northwest of Glens Falls in the Upper Hudson Valley and the Lake George Region. The 3-km NAM Nest poorly performed on this event, and the forecast thinking likely relied on it too much.

I was the 7-4 pm meteorologist on shift that Saturday (coming off a week of leave), and I was able to go home on time for my sons 10th birthday party. I was going to be flying out to Kansas City, MO for a Field Operations Course for Lead Meteorologists the next day. A wind gust of around 50 mph from the outflow boundary/gust front knocked over our basketball hoop around 6 pm. Good thing I did not park my car under it (and Yoda did not knock it over with a force push)! This is the only time wind gusts have blown it over!



18 wind damage reports occurred with this low predictability and localized high impact event across the Lake George Saratoga Region, Upper Hudson Valley and the Capital Region. The majority of the events were from the gust front/outflow boundary.



Challenging event with general thunderstorms forecasted across the Albany forecast area. A classic low predictability and high impact severe event with those 18 wind damage reports. The pre-convective environment had moderate amounts of instability and weak to moderate shear (mainly less than 25 knots). The DCAPE values were impressive in the 800-1100+ J/kg range. Descending K_{DP} columns helped warning decision makers assess the damaging wind threat for some of the severe thunderstorm warnings. An impressive outflow boundary or gust front move southward through the Capital Region with several wind damage reports. The 3-km HRRR runs at 1200 UTC and 1800 UTC did a good job with the strong to severe convection north of Albany. The 3-km NAM Nest did not do as well. This localized severe weather event had a significant societal impact on the nationally televised 1.2 million Whitney Saratoga Springs horse race with ~40,000 spectators. The race was delayed around 45 minutes due to lightning and also heavy rain with some wind damage close to the track!

Acknowledgements

- Mike Evans ALY SOO, and Israel Jirak SPC SOO for providing me the HREFs model runs for this case
- The University at Utah 3-km HRRR website:

http://home.chpc.utah.edu/~u0553130/Brian_Blaylock/cgi-bin/hrrr_download.cgi

- Christina Speciale for help getting archived BUFKIT data
- Dr. Alicia Wasula for NOAA Toolkit assistance

Many thanks to the following individuals listed on this slide!