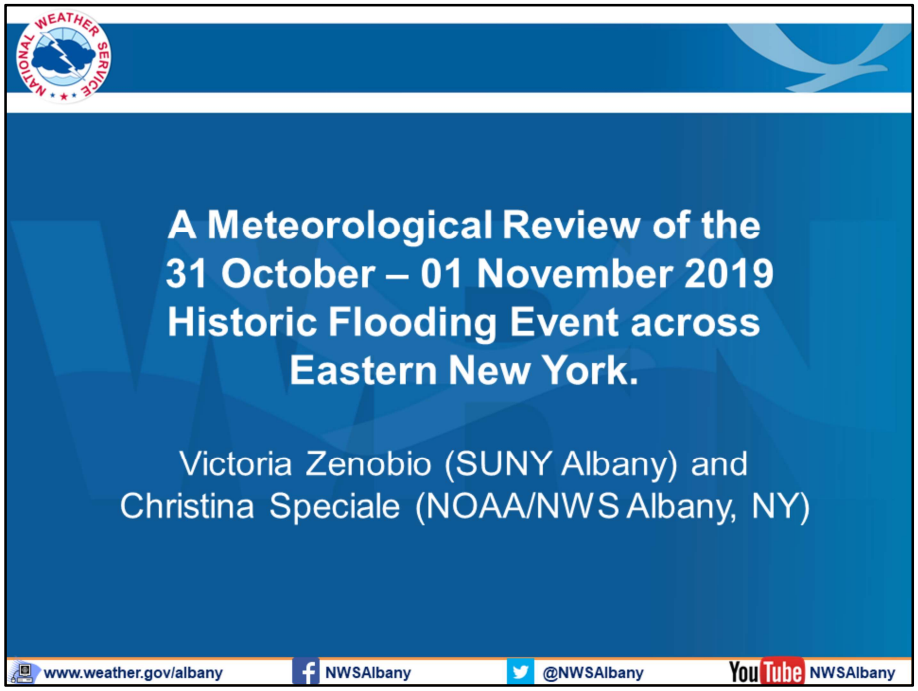
A Meteorological Review of the
31 October – 01 November 2019
Historic Flooding Event across
Eastern New York.
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Christina Speciale (NOAA/NWS Albany, NY)
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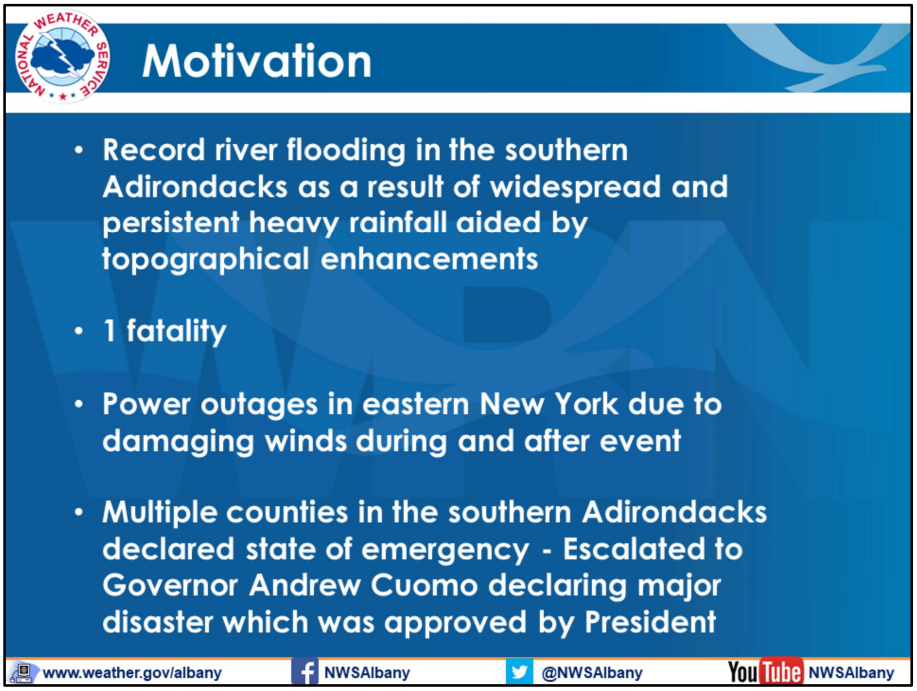
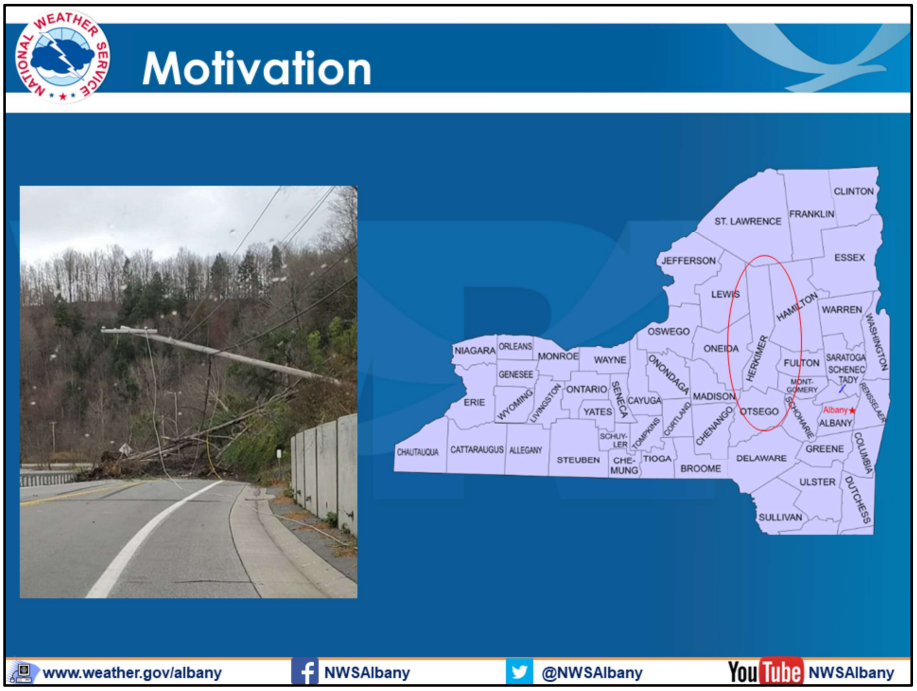


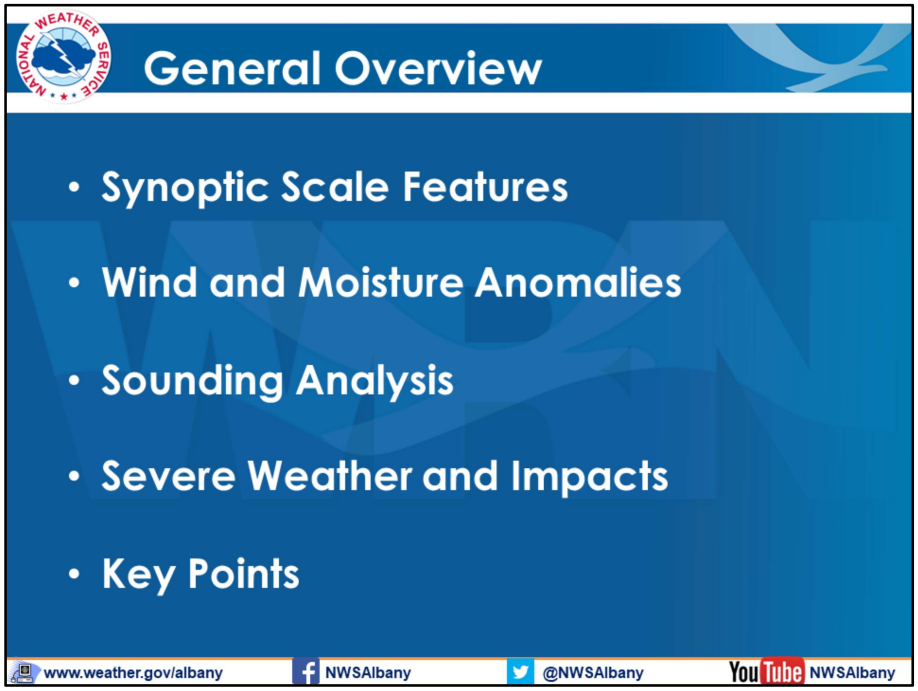
- Long duration of this rain from this event led to multiple river gauges across the southern Adirondacks to reach record breaking crest levels
- Topography of the southern Adirondacks along with orientation of the winds aided in enhanced lift.
- Unfortunately there was one fatality
- Widespread power outages due to severe winds during and after the event.
- Severity of flood damage led to Governor Andrew Cuomo declaring state of emergencies in multiple counties



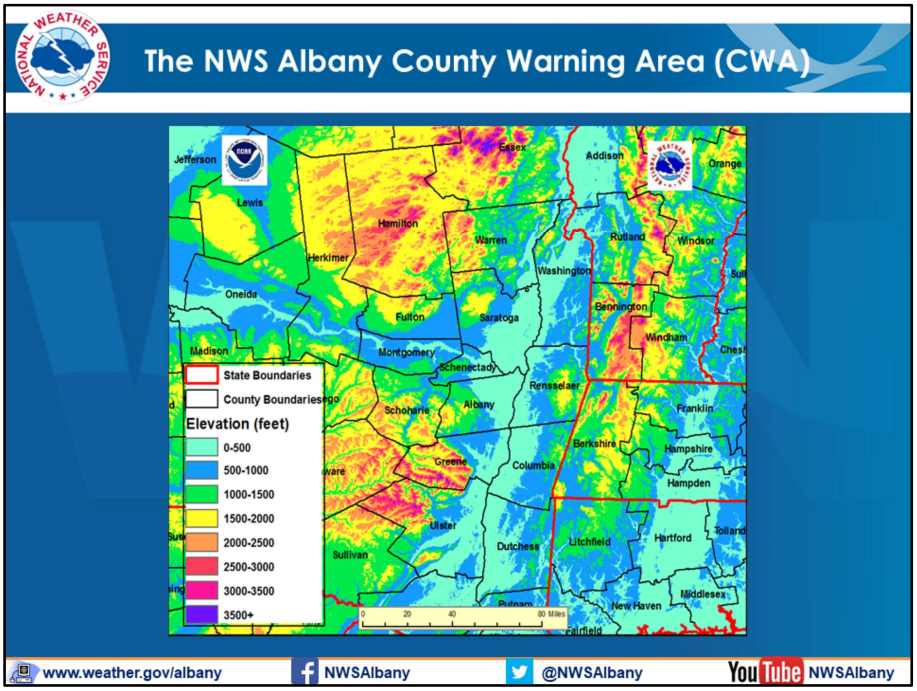
- Herkimer county on Route 28 is an example of downed trees and power lines that occurred through much of eastern New York resulting in multiple power (approximately 92,000 power outages across the state)

- In Fulton County the rising waters of the East Canada Creek spill into the village of Dolgeville.
- Approximately 344 dwellings were damaged and Red Cross stepped in to house those displaced

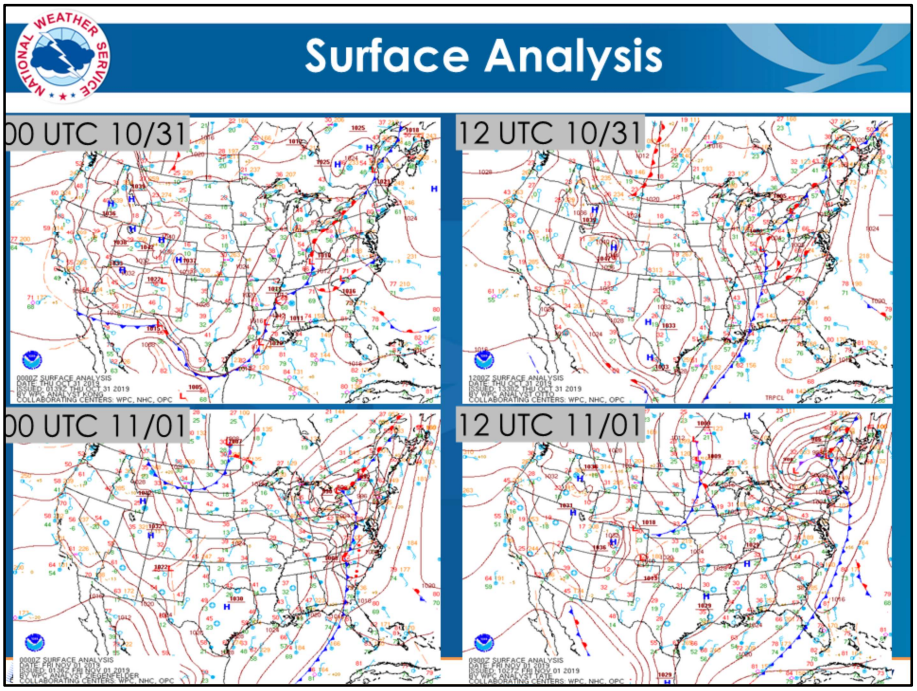
- Lake Desolation Road in Saratoga county shows the extent of the damage done to roadways



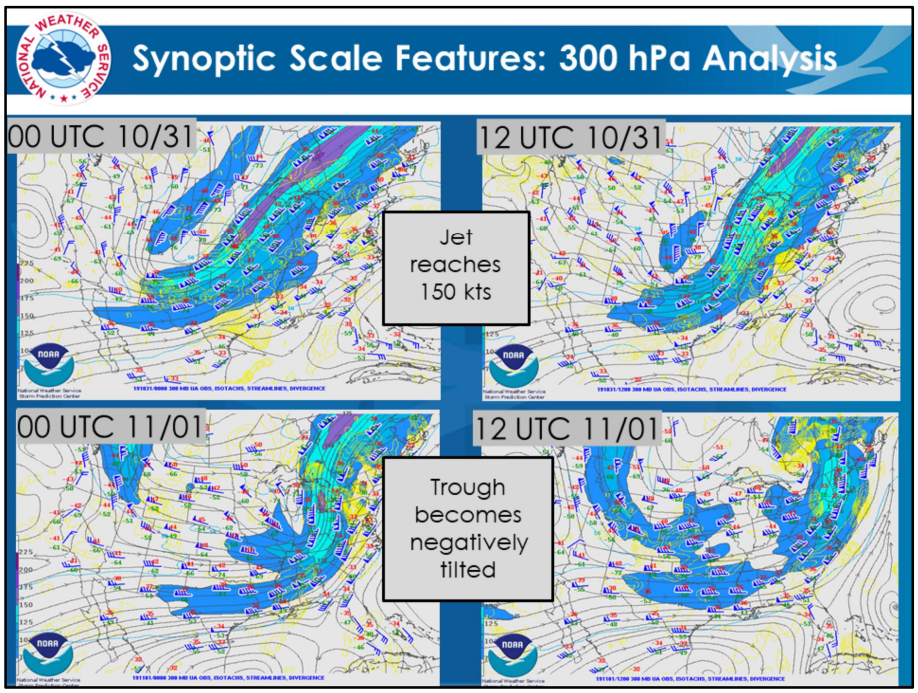
- Discussion on upper air maps and synoptic features
- Discuss the impressive wind and moisture anomalies
- Review soundings from ALY
- Talk about the severe weather that occurred and how it affected people in multiple communities
- Lastly, finish off with the key points



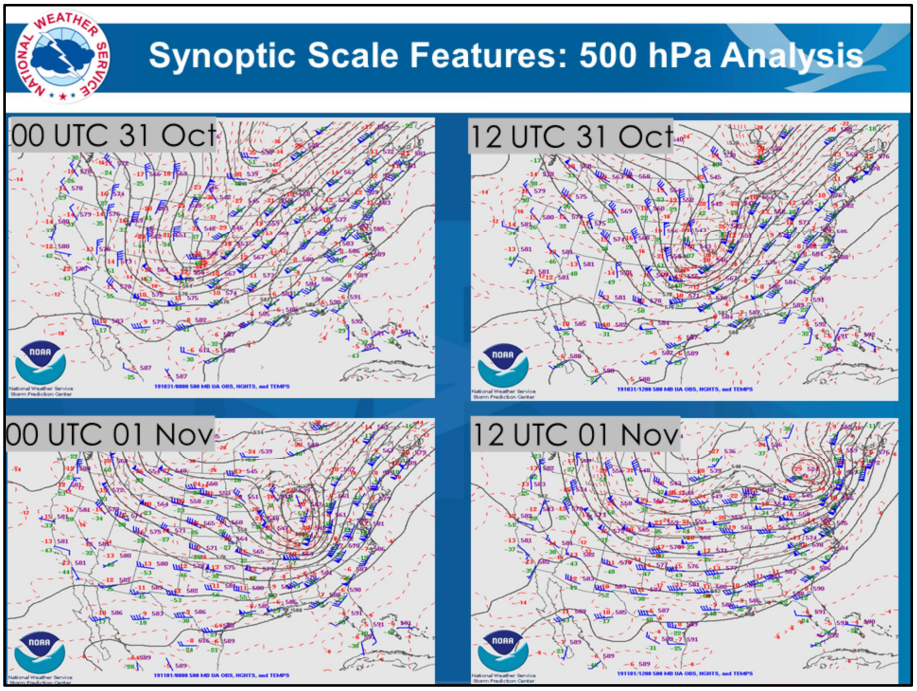
- This is the County Warning Area (CWA) for the National Weather Service office in Albany, NY
- Southern Adirondacks topography will play a role in rainfall amounts in this area



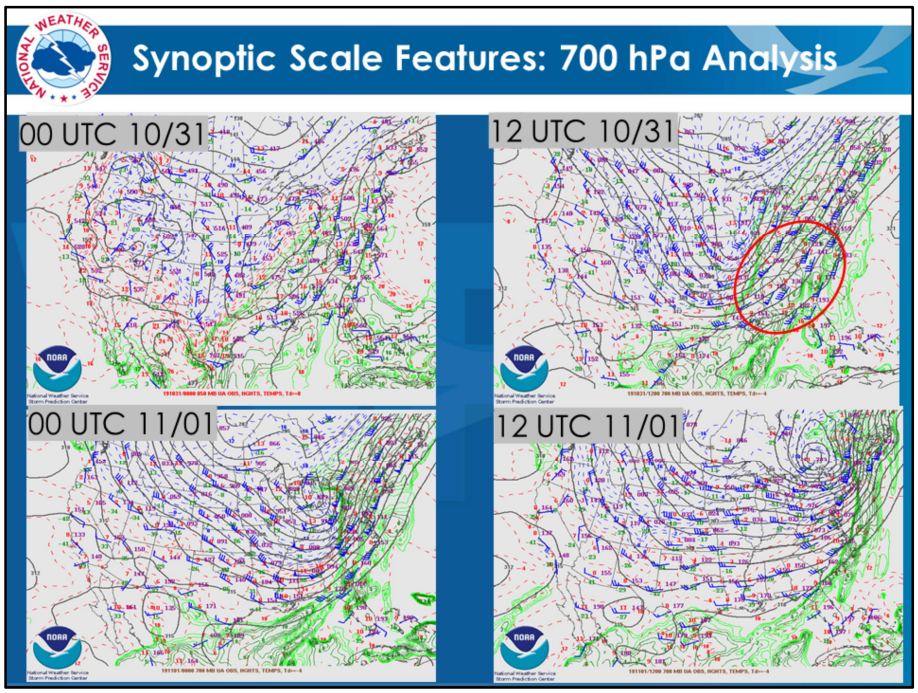
- Low pressure system developed over the Ohio Valley at 00 UTC (1010 hPa)
- The Northeast was in the warm sector which resulted in record breaking warm temperatures in some locations
- 00 UTC 1 Nov, cold front approached the NWS Albany CWA as the low intensified to 992 hPa
- At 12 UTC 01 Nov, the low became occluded as the low matured and strengthened to 988hPa



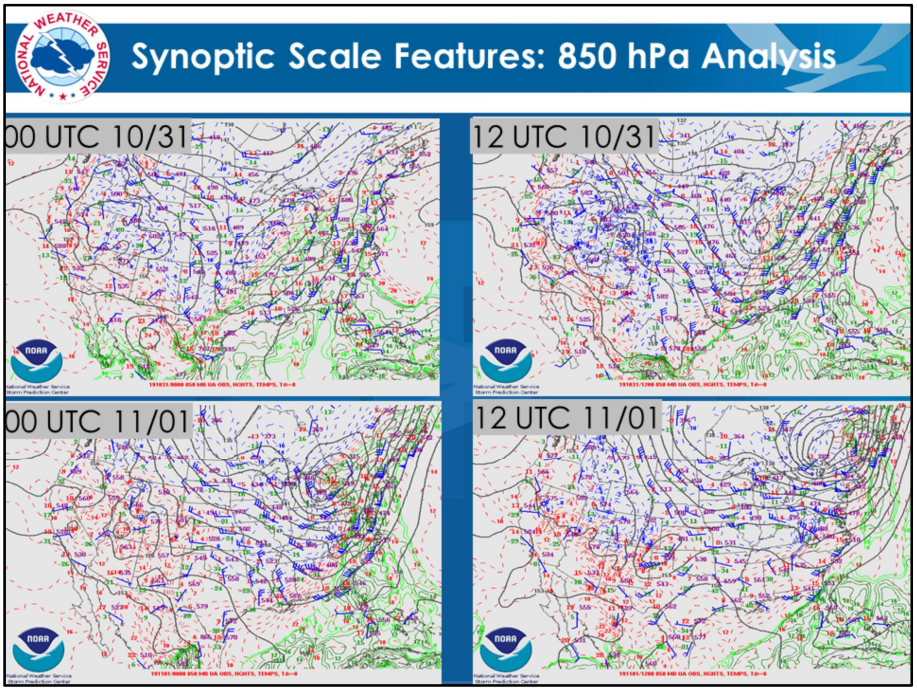
- 00 UTC 31 Oct, a jet streak over eastern Canada reached up to150 knots
- Trough becomes negatively tilted by 00 UTC 01 Nov.
- Second jet streak developed over the Ohio Valley
- Coupling of the two jet streaks produced enhanced lift over the Saint Lawrence River Valley which coincided with the developing surface low



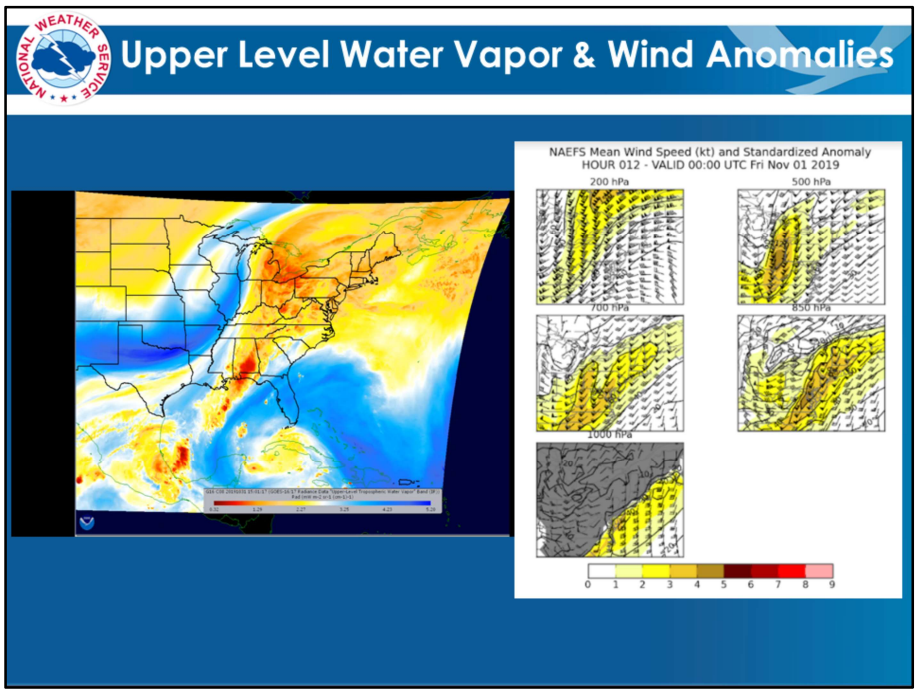
- Positively tilted trough at 00 UTC 31 Oct
- Low closed off up to 500hPA by 12 UTC 31 Oct with the trough becoming neutrally tilted. This indicates that the cyclone is intensifying
- Southwesterly winds downstream of the trough strengthened and pumped very warm and moist air into the Northeast
- 00 UTC 01 Nov, trough becomes negatively tilted and closed off as it traveled into the Ohio valley. As a result, New York became positioned in an area of robust cyclonic vorticity advection
- 12 UTC 01 Nov, the closed low tracked along the Saint Lawrence River Valley. Climatologically, when storms track along the Saint Lawrence River, areas in the NWS Albany CWA experience very strong winds.



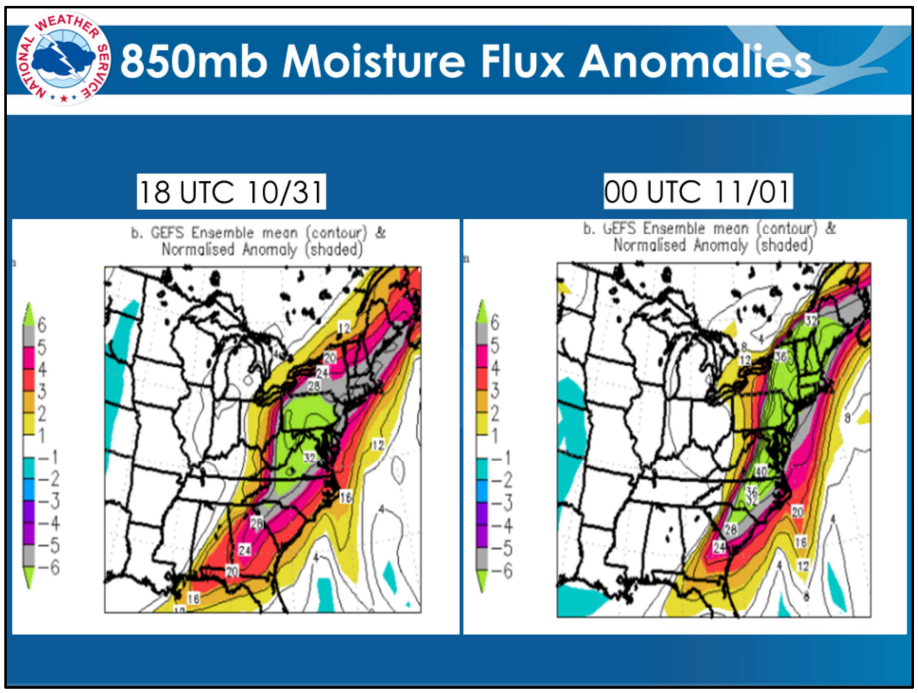
- Trough digs trough digs longitudinally towards the Gulf of Mexico at 12 UTC 31 Oct
- Strong southwesterly flow allows Gulf moisture to be advected towards New York



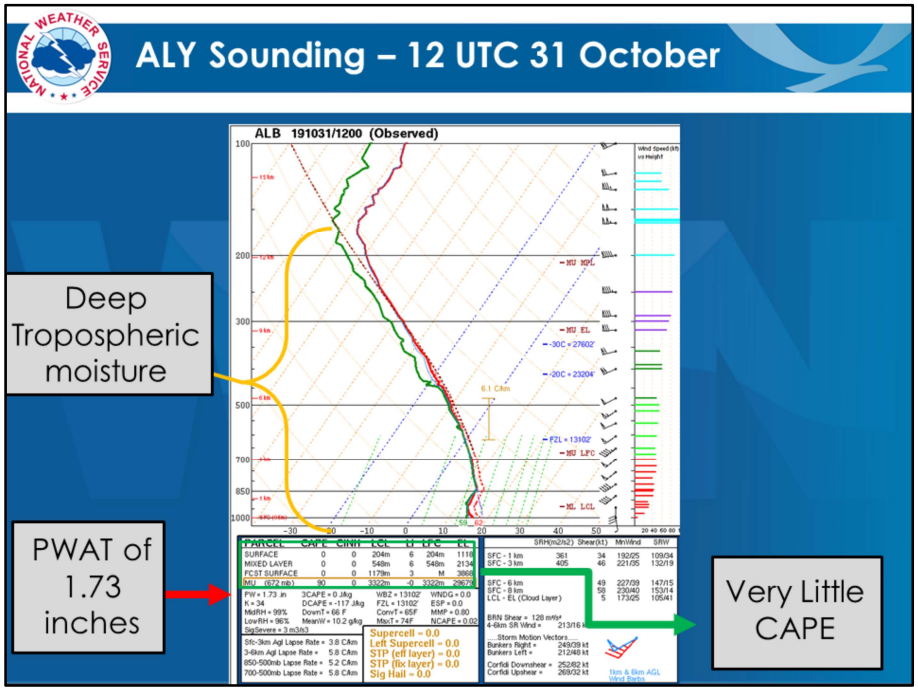
- As the trough amplified and closed off, warm air advection strengthens significantly between 12 UTC 31 Oct and 00 UTC 01 Nov and provided strong forcing for ascent
- 850 hPa jet within the warm sector impressively strengthened to 60-80 knots at 00 UTC 01 Nov and became directed towards the Northeast. This allowed very warm and moist air from the Gulf of Mexico to be pump into the Northeast
- New York was still in the warm sector on 31 Oct where Albany reached a recorded high of 75.



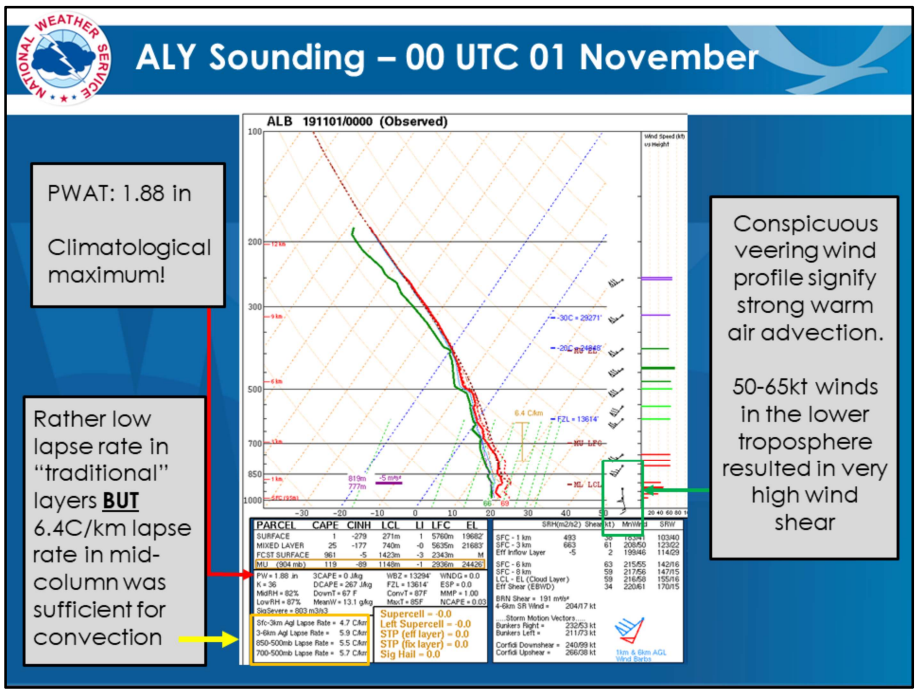
- Water Vapor loop shows significant amount of moisture present in the upper levels ahead of the cold front.
- Based on the GEFS, PWAT values reached 3 standard deviations above normal on at 12 UTC 31 Oct and increase to 4 standard deviations above normal by 00 UTC 01 Nov.
- Very anomalously strong upper and mid-tropospheric winds (4-5 standard deviations above normal) aided in this advection



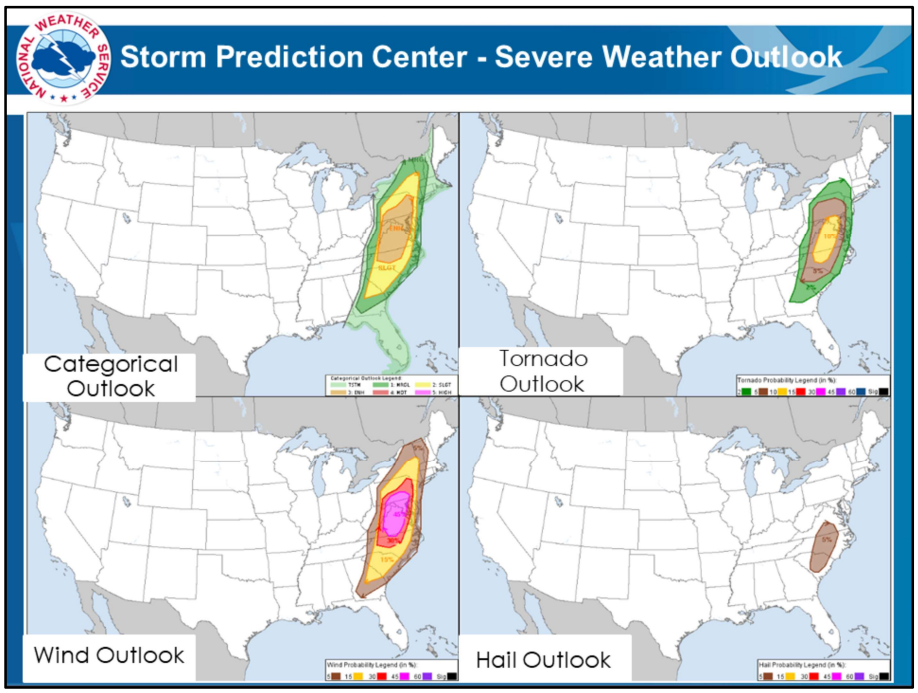
- Impressive 850hPa winds transported an abundant of moisture from the Gulf of Mexico into the Northeast
- At 18 UTC 31 Oct, the moisture flux anomalies ranged 4-5 standard deviations above normal before quickly exceeding 6 standard deviations above normal ahead of the approaching cold front by 00 UTC 01 Nov



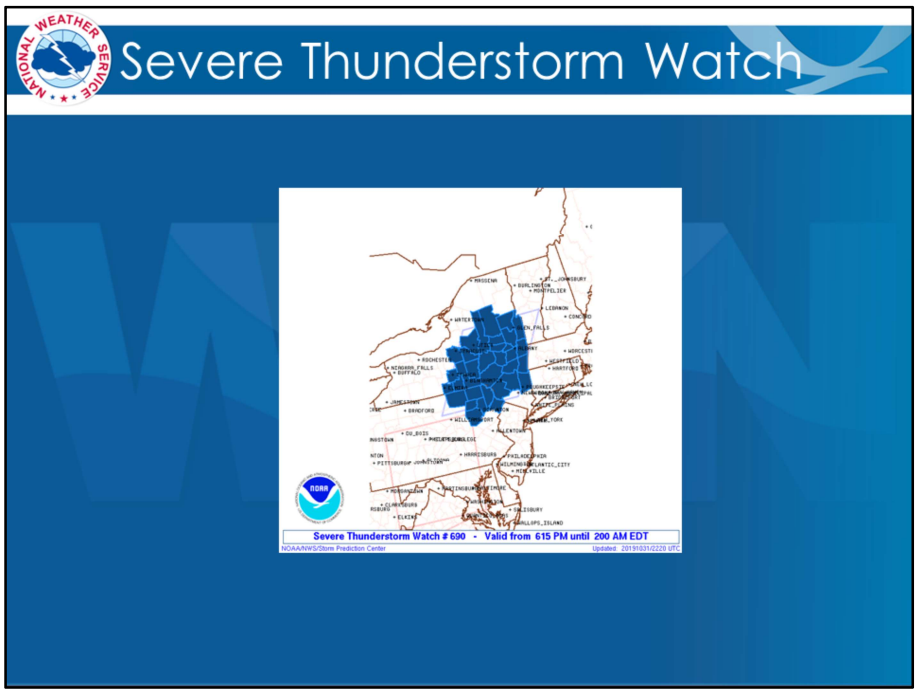
- ALY Sounding 12 UTC 31 Oct. Tall skinny cape profile. Most unstable cape is only 90 J/kg showing limited instability was present
- Albany is in the warm sector
- First glance, we see deep tropospheric moisture was present which is represented by a PWAT value of 1.73 inches (unusually high for this time of year).



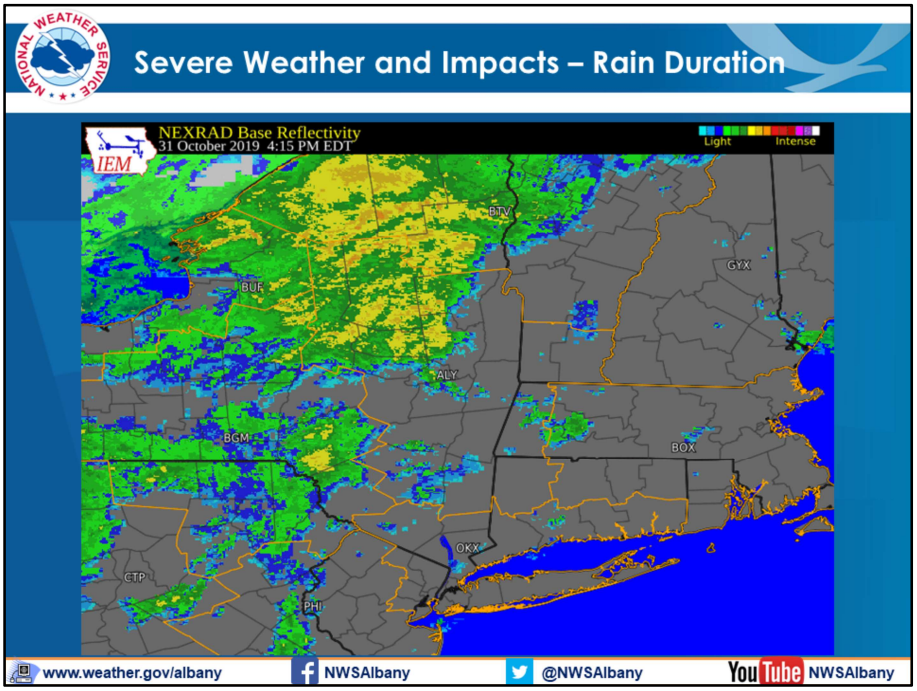
- Sounding taken just before the passage of the cold front
- Veering wind profile indictive of strong warm air advection
- Dew point increase to mid 60's
- Strong speed and directional wind shear in lower troposphere but low cape which is why this was a high shear / low cape environment
- Low lapse rates in 700-500hP and 850-700hPa layer may limit convection, but 6.4 C/km was more than sufficient for thunderstorm development in the presence of the approaching cold front
- PWAT value of 1.88 inch (very unusual for late October)
- Warm cloud depth is 13,000 ft – Signifies a warm/moist environment and alerts forecasters that the environment is favorable for flooding



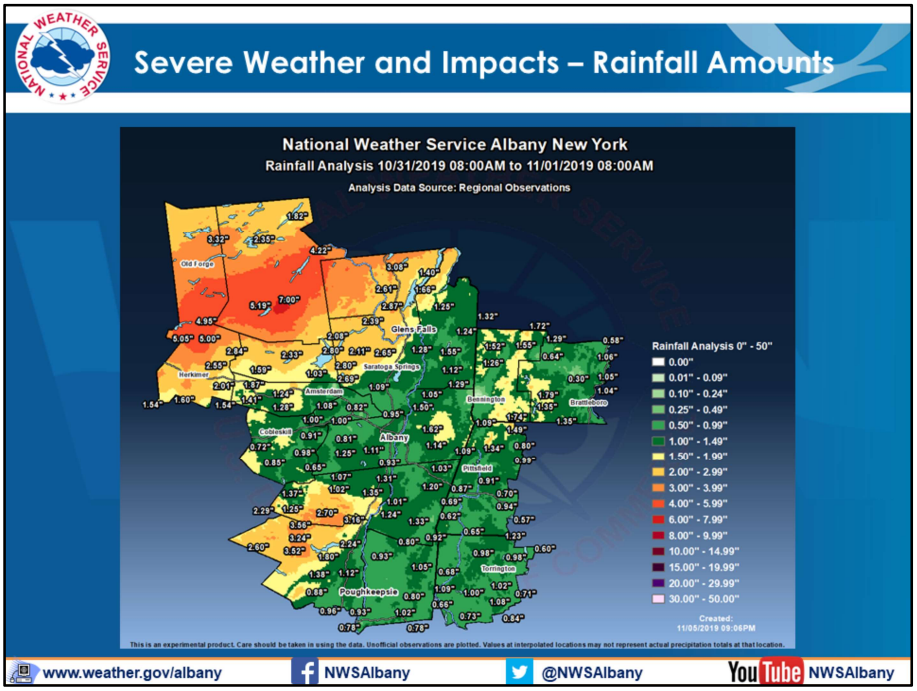
- Storm Prediction Center Severe Weather Outlook issued 1956 UTC on 31 Oct, valid from 2000 UTC 31 Oct to 12UTC 01 Nov
- Severe weather outlook – Enhanced Risk in the mid-Atlantic with slight risk in Southern NY and parts of the Adirondacks
- Tornado outlook – 2% risk
- Severe Wind Hazard – 15% with a region of 30-45% in the mid-Atlantic due to the highly anomalous wind profiles from this set-up



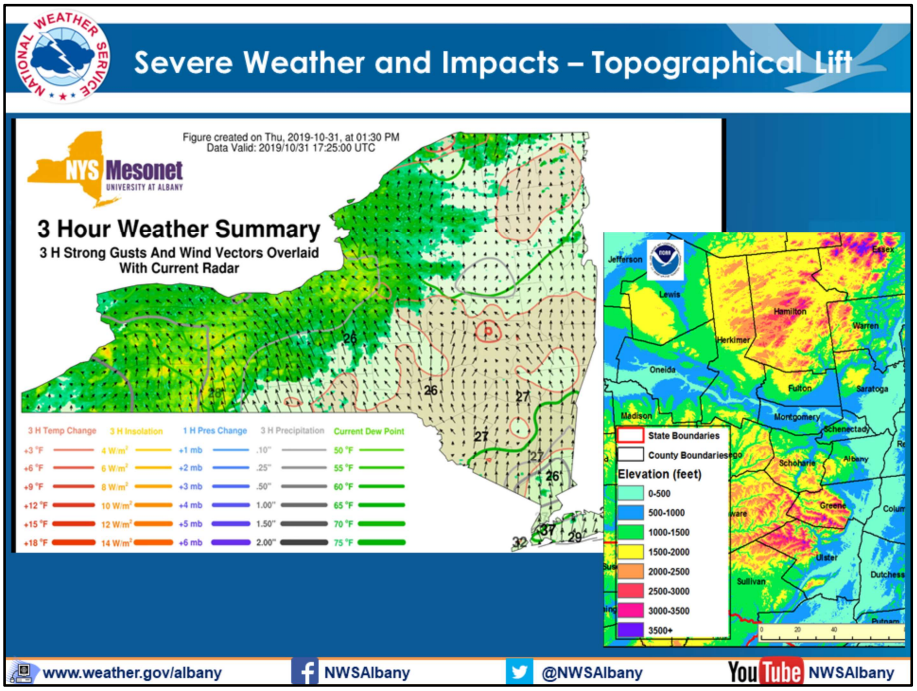
- Storm Prediction Center issued a Severe Thunderstorm Watch at 6:15PM 31 October as the cold front advanced into the Northeast



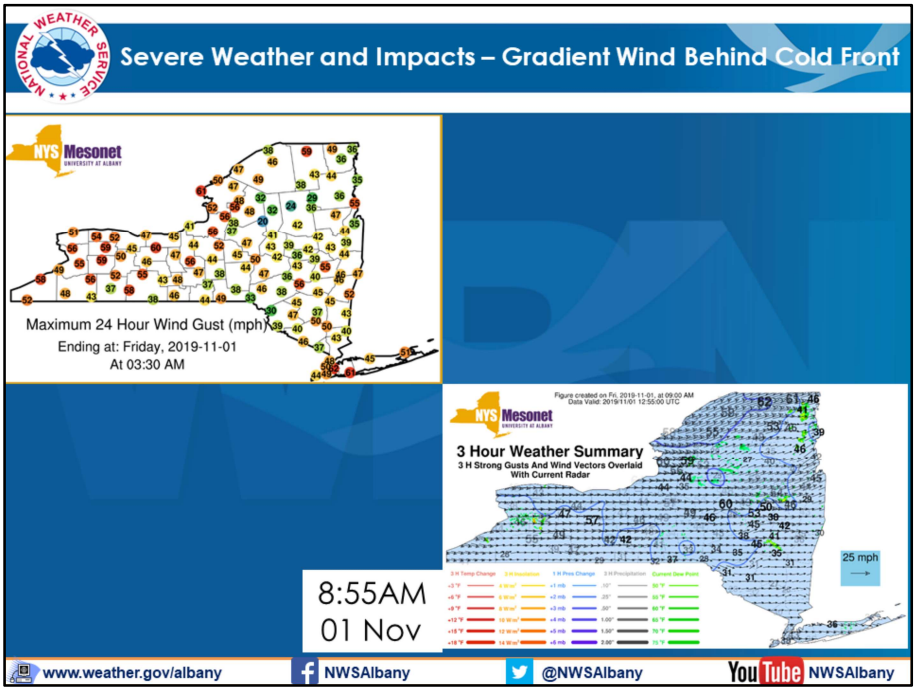
- After discussing the features of the event, lets take a look at the radar to see what occurred
- First round of precipitation in the Adirondacks began around 04 UTC and ended around 12 UTC 31 Oct (not shown)
- Bulk of precipitation associated with the leading edge of the cold front began around 18 UTC 31 Oct producing moderate to heavy rainfall
- Strong line of strong to severe thunderstorms moved through area between 01 and 04 UTC 01 Nov
- 08 UTC 01 Nov, precipitation exits the NWS Albany CWA



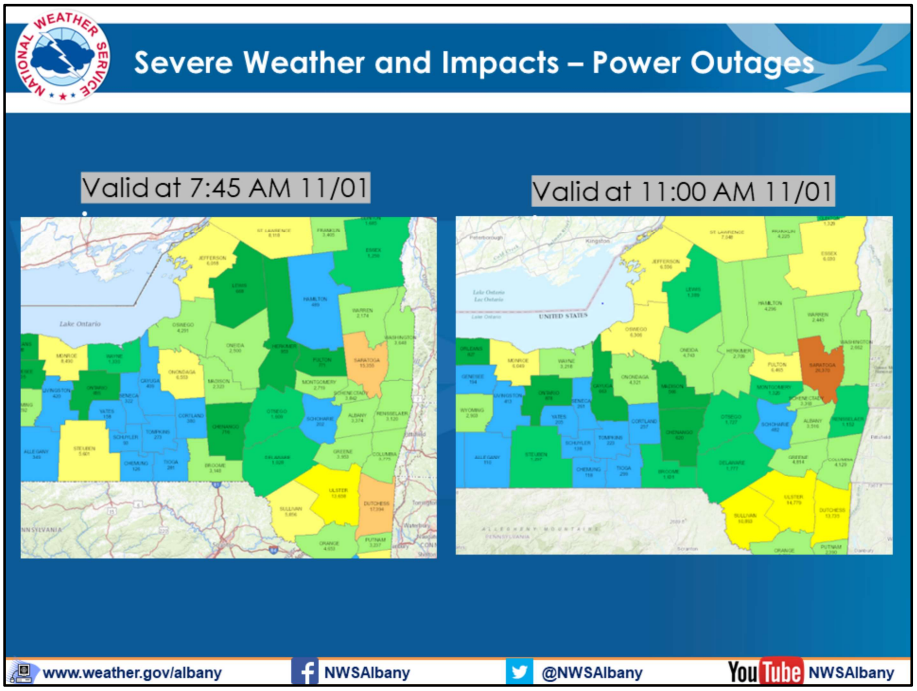
- Overall, we can see majority of the heavy rainfall occurred in higher terrain areas including the southern Adirondacks and the Catskill Mountains due to topographical enhancements
- The Southern Adirondacks received rainfall amounts between 2 and 5 inches with a local maximum of 7 inches in southern Hamilton County (elevation 1.5-2.5kft) where the southwesterly winds aligned perpendicular to the south facing slopes and thus led to very favorable forcing for ascent lift.



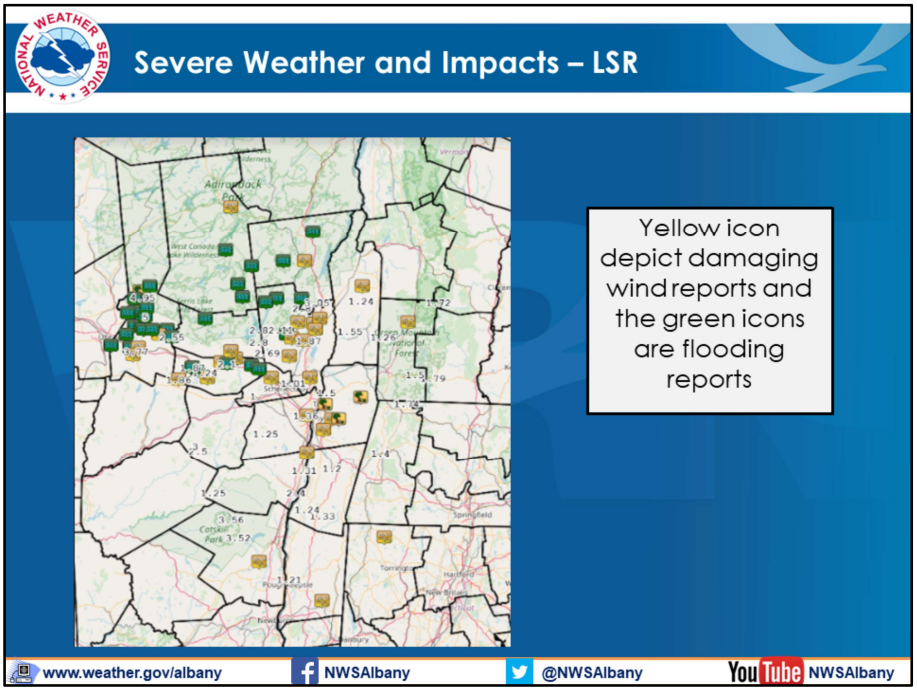
- Tight pressure gradient developed ahead of intensifying cyclone (which deepened to sub-990hPA) resulted in strong synoptically driven winds with surface wind gusts reaching 30-50mph before the cold front/thunderstorms even arrived.
- Anomalously strong kinematics in place throughout the troposphere and sufficient instability ahead of the cold front allowed convection to mix strong winds aloft down to the surface resulting in additional damaging winds reports.



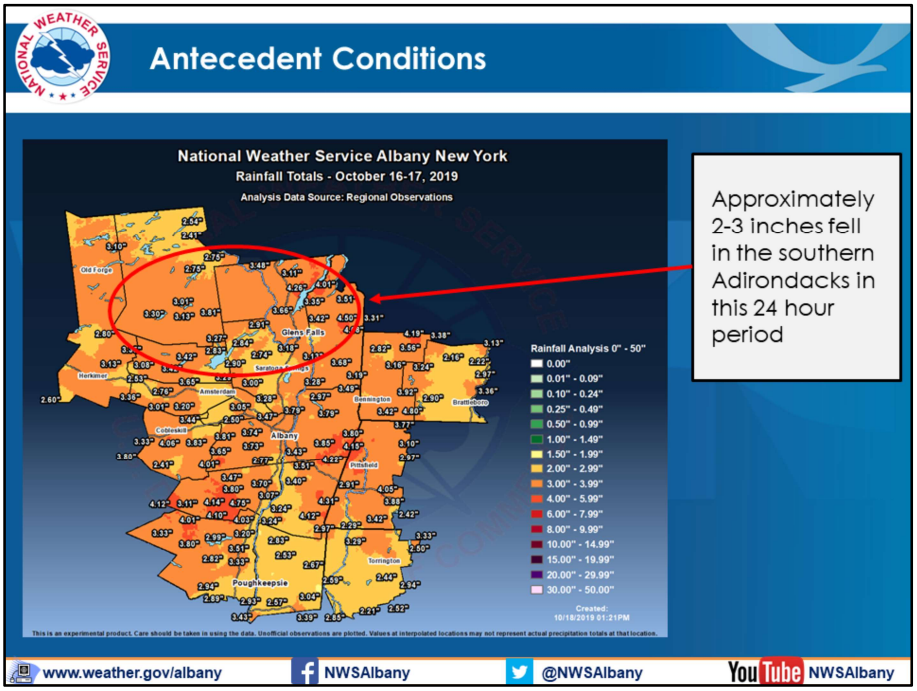
- On the top left, we see maximum wind gust map which represents the peak wind gusts at every mesonet site from this event including the synoptically and convectively driven winds. Notice widespread wind gusts between 40 and 55mph throughout eastern NY
- On the bottom right, we see that strong winds continued into the following day on 01 November due strong cold air advection in the wake of the deepening low. Wind gusts 40-60mph hampered both flooding and power restoration recovery efforts



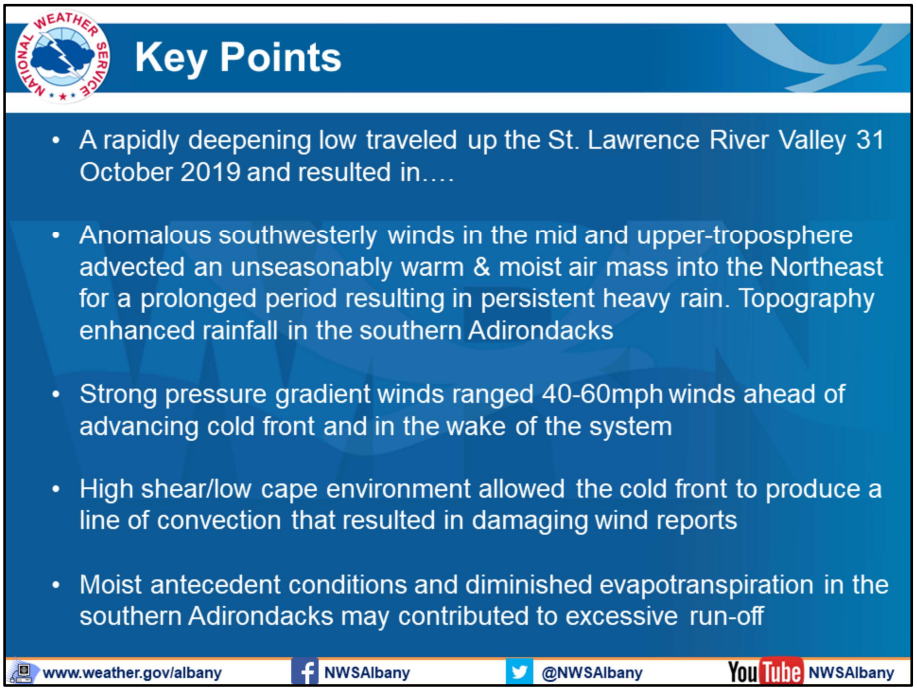
- Power outages in some eastern NY counties featured over 10k outages by 7:45AM 01 November.
- Just 3 hours later, power outages increased as continued strong winds in the wake of the departing system likely caused trees/branches that were already weakened from 31 October to fall



- This LSR shows the locations at which damaging winds were reported along with flooding river waters.
- NWS Albany coordinated with the Herkimer County Emergency Manager to issue a Flash Flood Emergency at 03:10 UTC 01 November after learning of the high number of flooding reports and water rescue operations.
- Wind reports are not necessarily where the heaviest rainfall occurred



- Preexisting conditions: From Oct 16-17, 2019, 2-3 inches of rain fell in Southern Adirondacks.
- Soil in this region was previously moistened ahead of the 31 October 2019 heavy rain event.
- The growing season in the southern Adirondacks ended October 5, 2019 which suggests that vegetation may have become dormant and thus may have resulted in excessive runoff during the Halloween 2019 event


Key Points
• A rapidly deepening low traveled up the St. Lawrence River Valley 31 October 2019 and resulted in….
• Anomalous southwesterly winds in the mid and upper-troposphere advected an unseasonably warm & moist air mass into the Northeast for a prolonged period resulting in persistent heavy rain. Topography enhanced rainfall in the southern Adirondacks
• Strong pressure gradient winds ranged 40-60mph winds ahead of advancing cold front and in the wake of the system
• High shear/low cape environment allowed the cold front to produce a line of convection that resulted in damaging wind reports
• Moist antecedent conditions and diminished evapotranspiration in the southern Adirondacks may contributed to excessive run-off
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