August 12, 2021 Severe Thunderstorms in Albany, NY

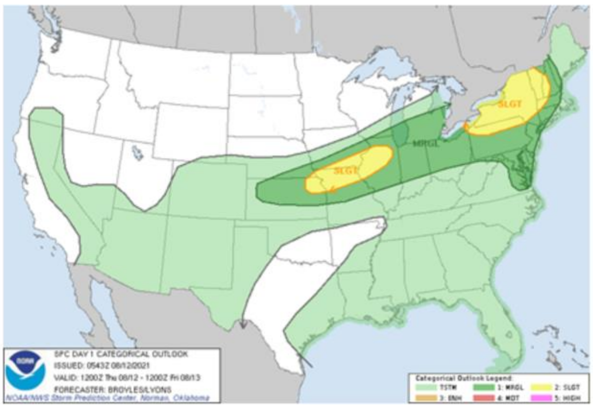
Ryan Schwimer
SUNY Albany

Outline

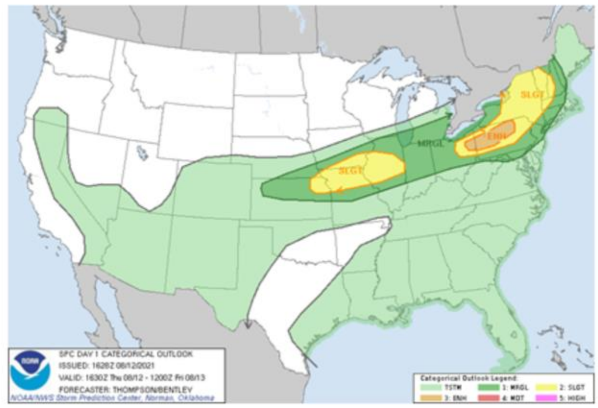
- Large-scale pattern
- Mesoscale pattern
- Backbuilding storms in the Hudson Valley
- Observed soundings
- Observed radar
- Conclusion

August 12, 2021: 1200 UTC and 1630 UTC Day 1 Convective Outlooks

At 1200 UTC on the 12th, there were two slight risk areas for severe thunderstorms. Albany, NY is in

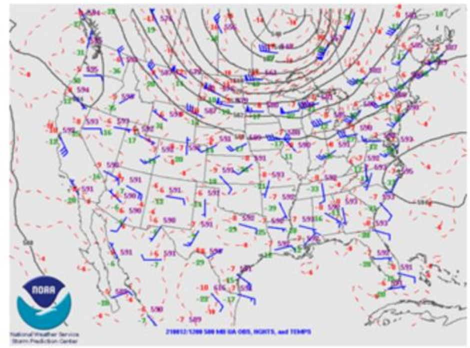


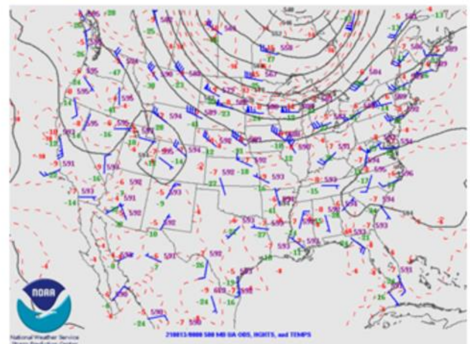
At 1630 UTC, an enhanced risk area was added to the forecast over western Pennsylvania.



500 MB Upper Air OBS, Heights, and Temperatures

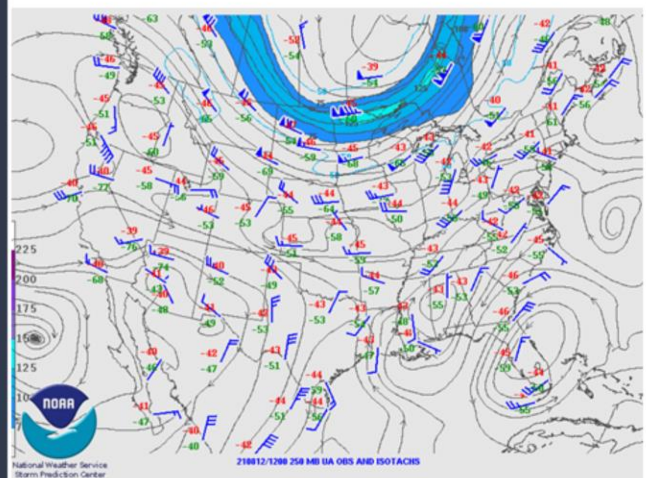
An upper-level trough was moving eastward across southern Canada, with a Bermuda high off the mid-Atlantic coast.





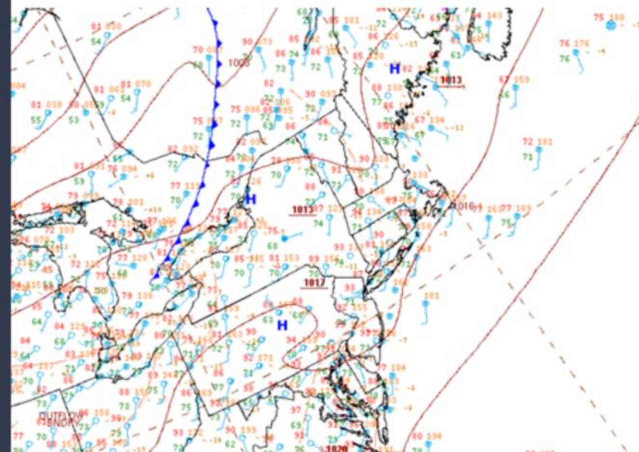
250 MB Upper Air OBS and Isotachs

At 1200 UTC, the upper level jet streak at the base of the trough was associated with speeds up to 125 knots. Albany, NY had upper level southwesterly wind speeds of 25 knots.



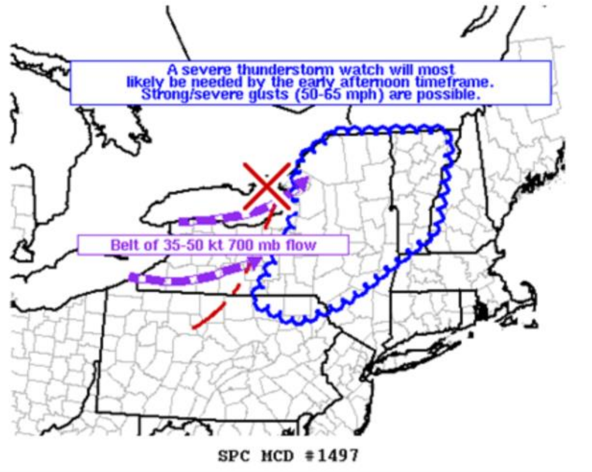
1800 UTC Surface Analysis Map of Albany, NY

A surface cold front was moving eastward across the eastern Great Lakes at 18 UTC. The airmass ahead of the front was very warm and humid. Albany reported a temperature of 87 °F and a dewpoint of 74 °F.



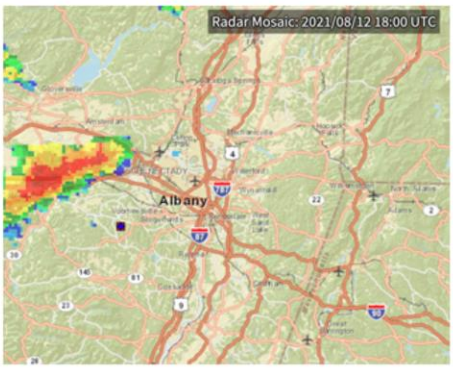
August 12, 2021 SPC Mesoscale Discussion

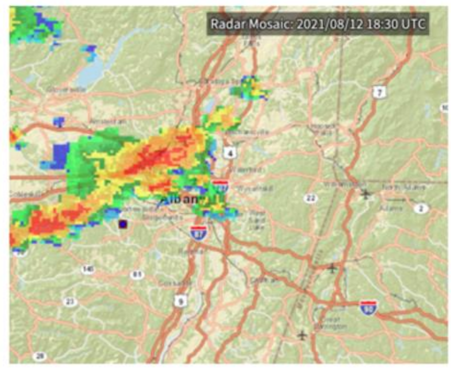
The SPC Mesoscale Discussion indicated that a severe thunderstorm watch would most likely be needed over most of New York and Vermont. Features highlighted by the discussion included a belt of 35 to 50 kt winds at 700 mb. The dashed red line is the cold front, and the red 'X' denoted a mesoscale convective vortex over northeastern Lake Ontario.



1800 UTC and 1830 UTC Observed Radar

A short line of storms moved eastward toward New York's Capital District from 1800 UTC to 1830 UTC. The storms would evolve as they moved across the Hudson Valley through 2100 UTC.





CSTAR-funded research by U Albany graduate student Matt Stutstrim has shown that storms often evolve upon reaching the Hudson Valley.

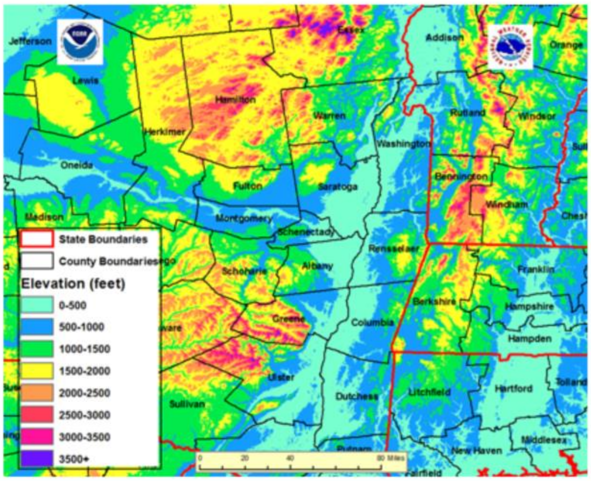
Matt Stutstrim lists the necessary physical mechanisms and variables for predicting backbuilding of storms that reach the Hudson Valley.

A cold pool is formed within the Hudson Valley by convection while the terrain channels moist air northward towards this cold pool. This moist air gets lifted by the convergence to form new cells.

Conclusion

- Physical mechanism for back building:
  - Discrete convection creates cold pool in Hudson Valley
  - Terrain channeled flow advects moist surface air towards cold pool
  - Surface convergence lifts moist air over gust front to initiate new cells
  - New cells mature and reinforce cold pool with evaporatively cooled air
- Important variables for predicting back-building convection vs. discrete convection with no back-building:
  - 2-m dew point depression
  - SBCAPE
  - Mid-tropospheric dew points
  - Mid-tropospheric wind speed

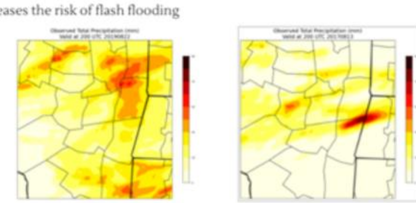
Hudson Valley convection research



- A subset of storms that reach the Hudson Valley will exhibit back-building. Precipitation patterns associated with these storms are shown below. Note Isolated maxima of heavy rain that develops over the Hudson Valley in these cases.

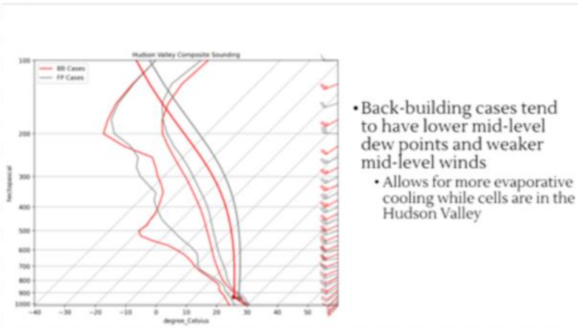
Motivation

- Back-building Mesoscale Convective Systems (MCS) represent 20% of extreme raining producing MCS's in the Great Plains region (Schumacher 2005)
- Back-building convection in the Hudson Valley tends to create localized rainfall maxima
  - Increases the risk of flash flooding

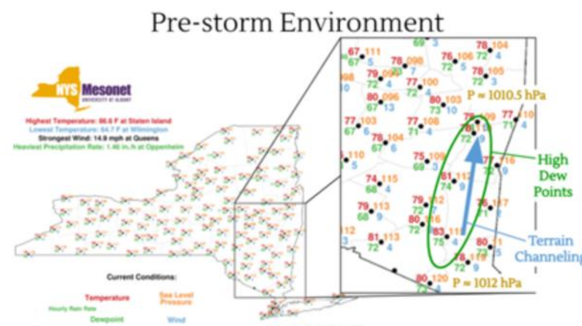


A Look At Backbuilding Environments

Backbuilding occurs with higher to mid-level dew points and weak mid-level winds than non-back building cases, which allows for an intensified cold pool.

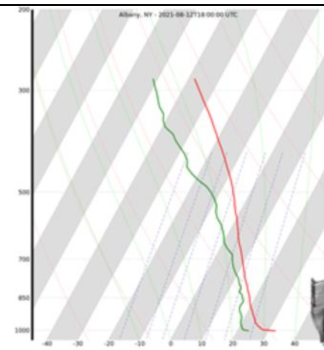


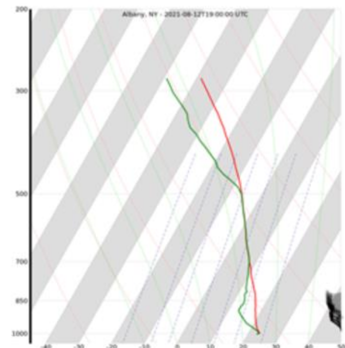
This map shows the terrain channeling moist air through the Hudson Valley towards the Albany area.



1800 UTC and 1900 UTC Observed Soundings at Albany (New York Mesonet)

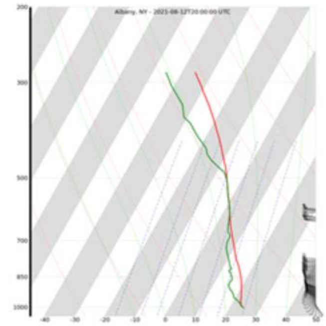
The 1800 UTC and 1900 UTC profilers at Albany sounding indicated a moist, unstable atmosphere with mid-level flow from 20 to 30

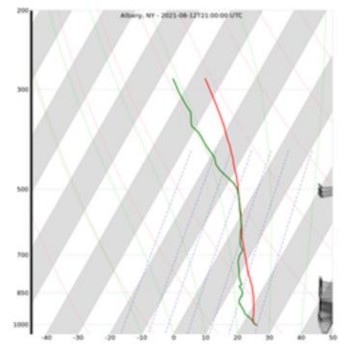




2000 UTC and 2100 UTC Observed Soundings

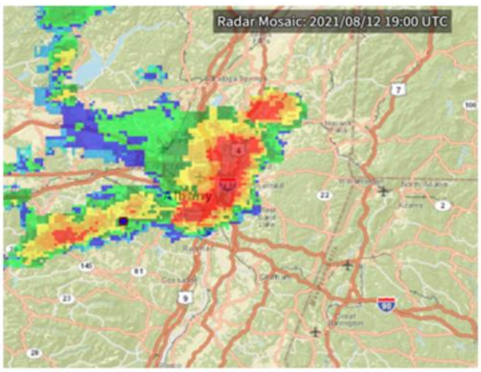
Strong veering in the low-level wind profile can be seen on the 2000 UTC sounding. This pattern appears to weaken at 2100 UTC sounding.



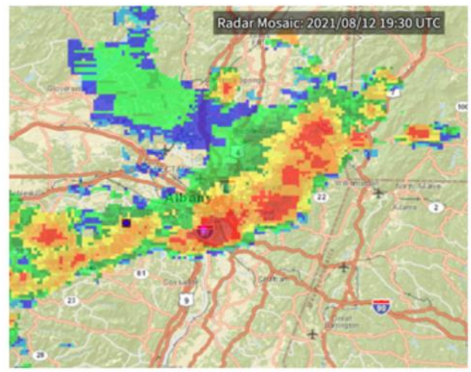


1900 UTC and 1930 UTC Observed Radar

Storms moved into the Hudson Valley by 1900 UTC. A strong bow-echo was observed near and just north of Albany.

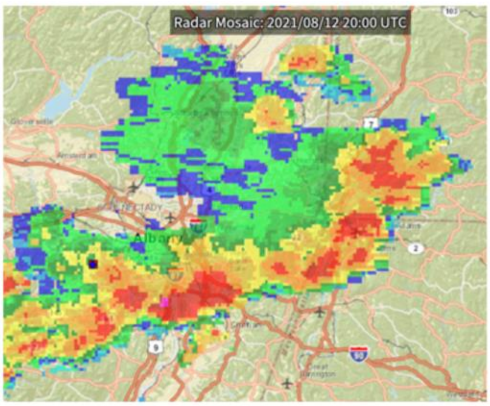


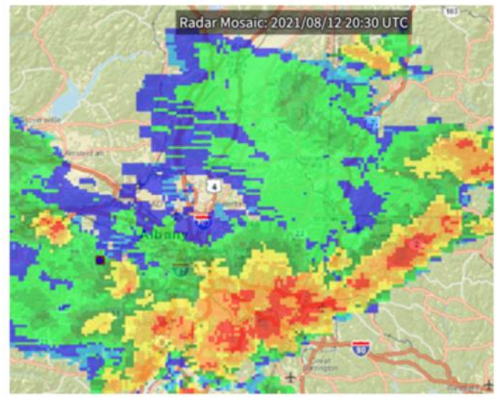
New storms can be seen developing south of Albany by 1930 UTC. This may have been caused by the mechanism described by Stutsrim.



2000 UTC and 2030 UTC Observed Radar

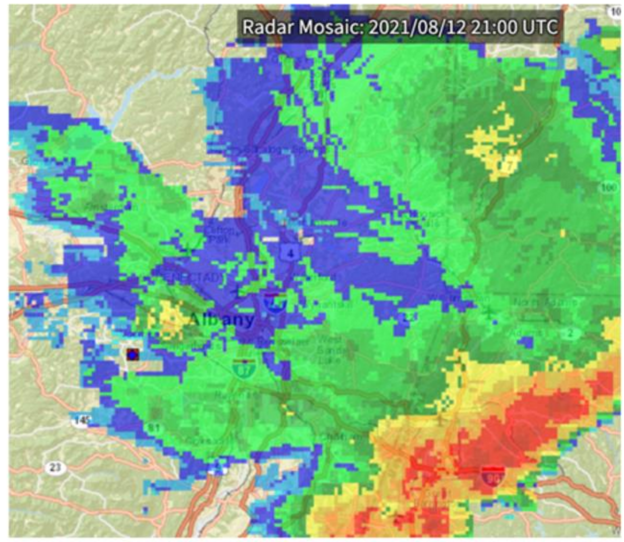
The northern portion of the line was progressive and moved into southern Vermont. Meanwhile, storms farther south exhibited backbuilding and training, prolonging the heavy rain in that area.





2100 UTC Observed Radar

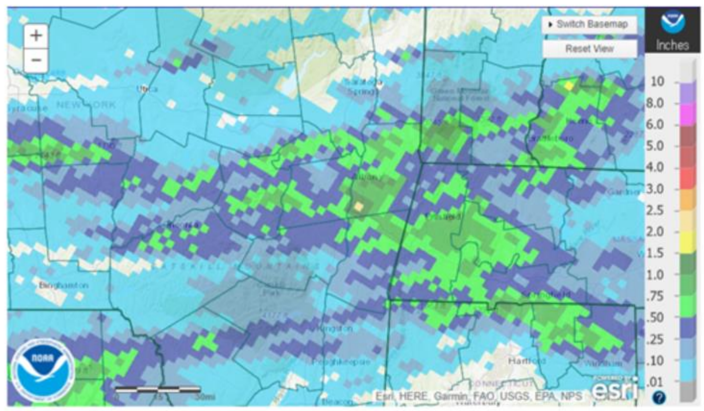
By 2100 UTC, the storms are moving southeast of the Capital



Estimated precipitation

- A maximum of precipitation occurred south-southeast of Albany in the area where the storms were exhibiting back-building and training. Meanwhile, less rainfall was observed just to the west of that area.

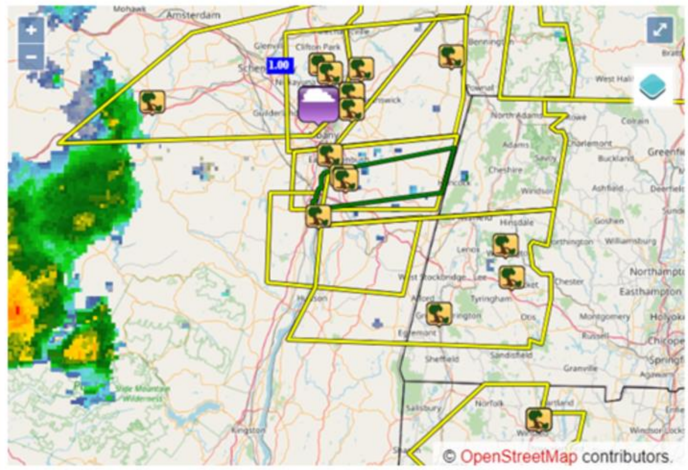
Estimated quantitative precipitation from the northeast River Forecast Center



High impact weather

- Several reports of wind damage occurred north of Albany in association with the bow echo portion of the storm. To the south, a flood advisory was issued (shown by the green box) where storms were back-building.

Severe weather reports, warnings and advisories issued by the National Weather Service in Albany.



Conclusion

Strong to severe thunderstorms moved east across eastern New York and western New England on August 12th, 2021. The large-scale environment featured modest large-scale forcing with the main mid-to-upper level trough and jet well to the north of our area. A convective complex developed over the Hudson Valley near Albany ahead of an approaching cold front in a warm and very moist atmosphere. The northern portion of the complex featured a bow echo with damaging winds. Farther south, the storms appeared to develop backbuilding characteristics. Heavy rain occurred in that area, but no significant flooding was reported.