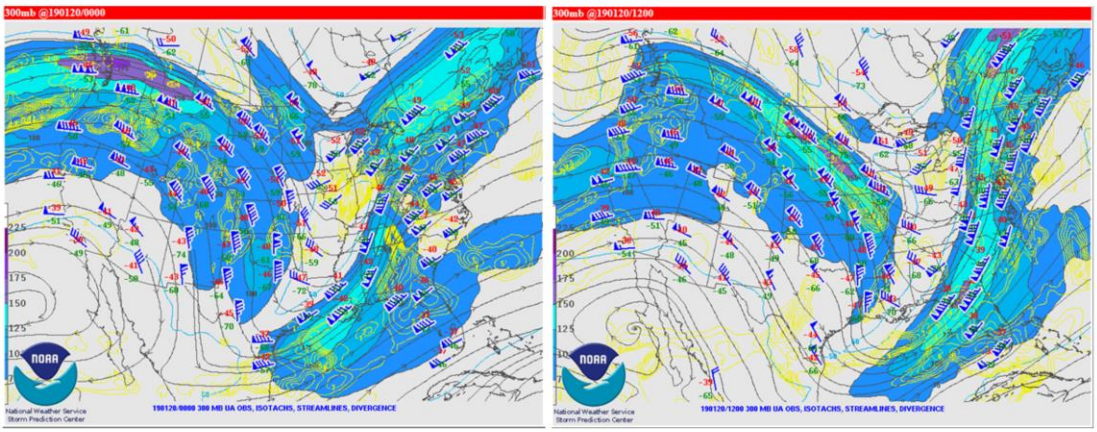
The January 19-20 2019 winter storm

Mike Evans

Outline

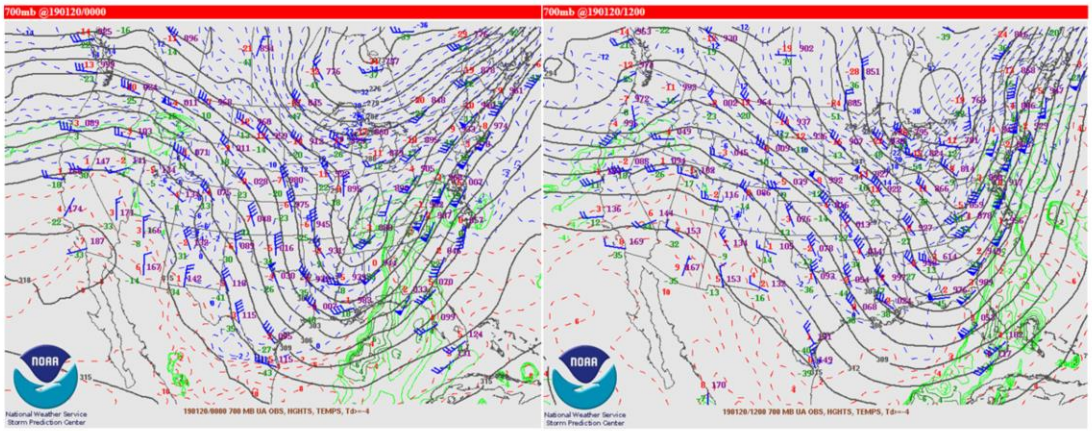
- Large-scale pattern
- Meso-analysis
- High resolution models
- Observations
- Summary / Conclusion

300 mb heights and wind



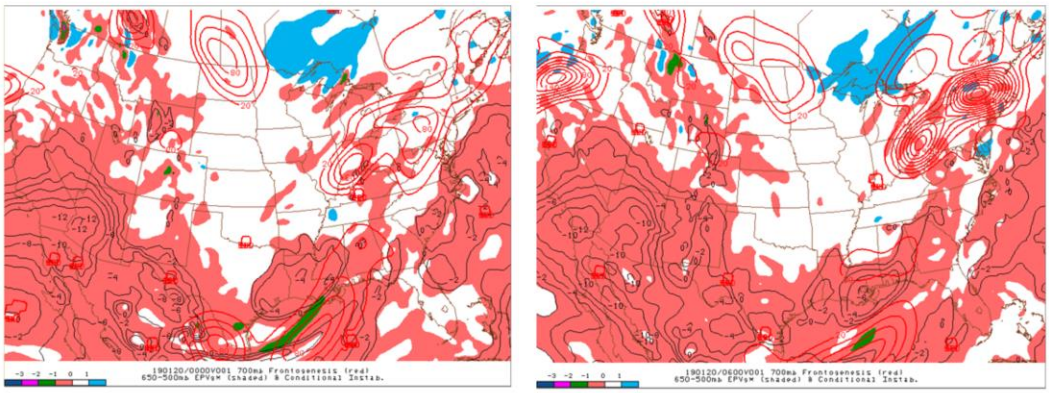
A full-amplitude upper-level trough moved east from the Great Lakes toward the east coast from January 19th to the 20th.

700 mb heights, temperature and wind



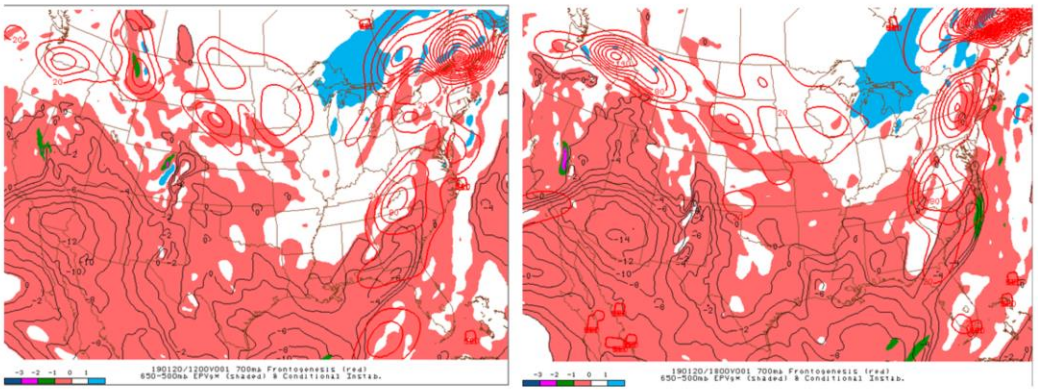
A trough at 700 mb became more open as it moved east from the Ohio Valley toward the east coast, while the primary closed low developed with another shortwave digging southeast from central Canada toward southern Quebec. Frontogenesis was implied over Pennsylvania, New York and New England as strongly confluent southwesterly flow developed between the southern and northern branches of the flow, across a moderately strong temperature gradient.

700 mb frontogenesis and 750-500 mb EPV 00z and 06z Jan 20



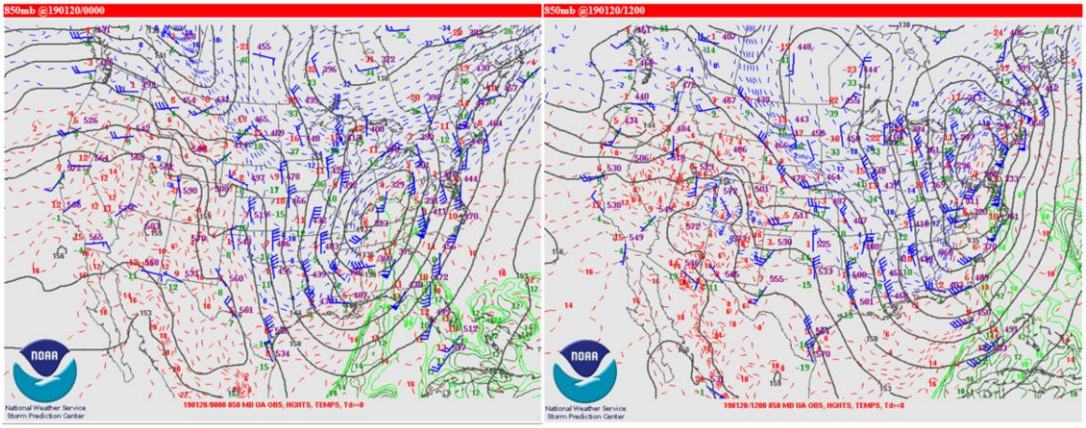
Lower-to-mid-level frontogenesis intensified as it moved northeast up the Ohio Valley toward the northeast early on the 20th, maximizing over eastern New York and New England during the early morning hours.

700 mb frontogenesis and 650-500 mb EPV 12z and 18z Jan 20



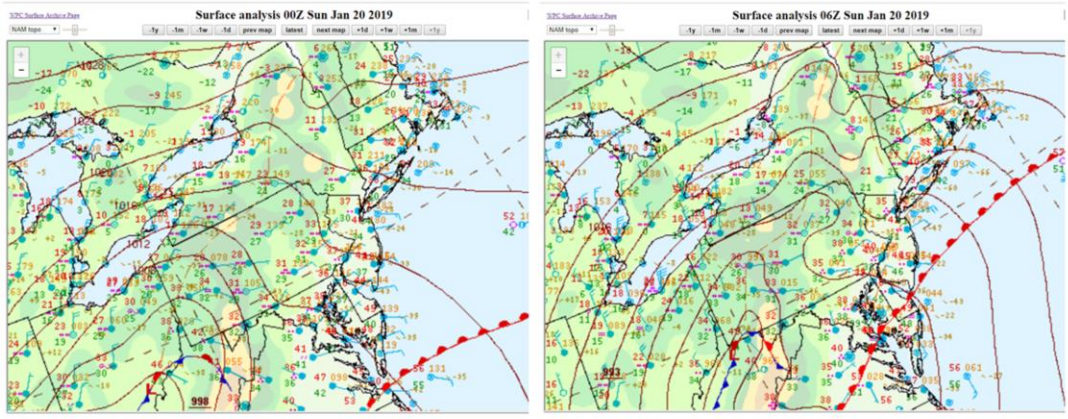
The frontogenesis continued move northeast across northern New England early on the 20th. By afternoon on the 20th, the strongest frontogenesis was north of New England, however a secondary, weaker area of frontogenesis could be seen over New York and Pennsylvania on the west side of the system as it pulled off to the east.

850 mb heights, temperature and wind



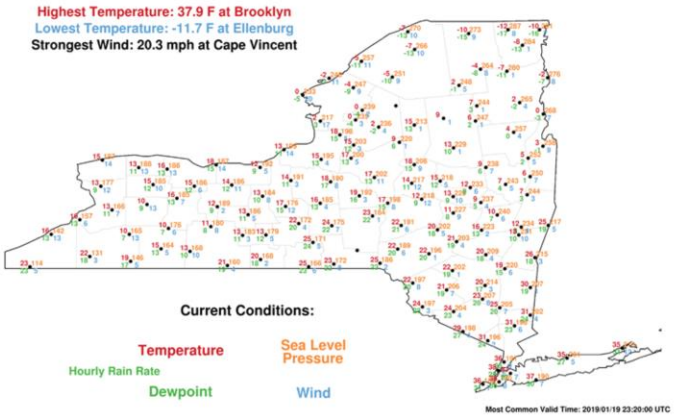
The 850 mb closed low tracked up the Ohio Valley toward Pennsylvania. 45 to 60 kt south-southeasterly flow was analyzed on the east side of the closed low over the northeast CONUS by early on the 20th. The north-south thermal gradient was quite strong, with -10 C analyzed over the Adirondacks at 12z on the 20th, and +5 C over southern New England.

Surface analysis



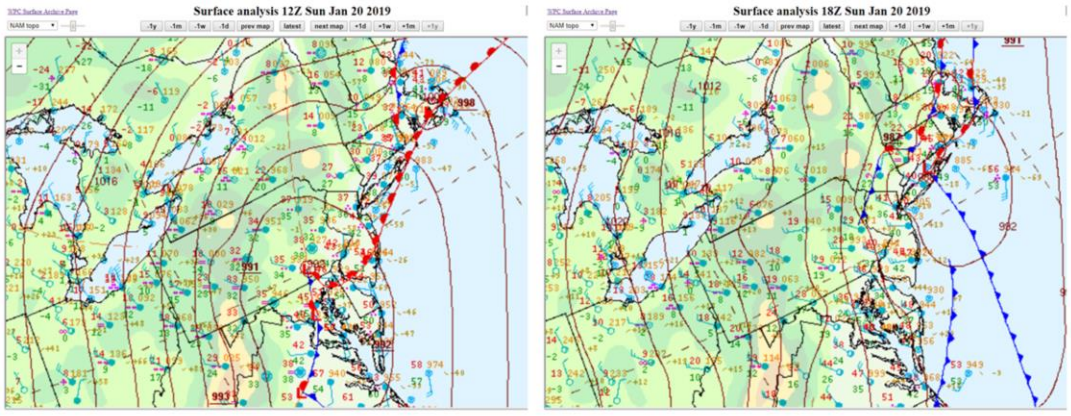
At the surface, low pressure tracked northeast up the Ohio Valley during the evening on the 19th then began to re-form along the northern mid-Atlantic coast during the early morning hours on the 20th. The air mass over northern New York and New England was very cold on the northern side of this system, with temperatures below zero F across the northern Adirondacks at 00z on the 20th.

Temperatures from the NY Mesonet – 00z Jan 20



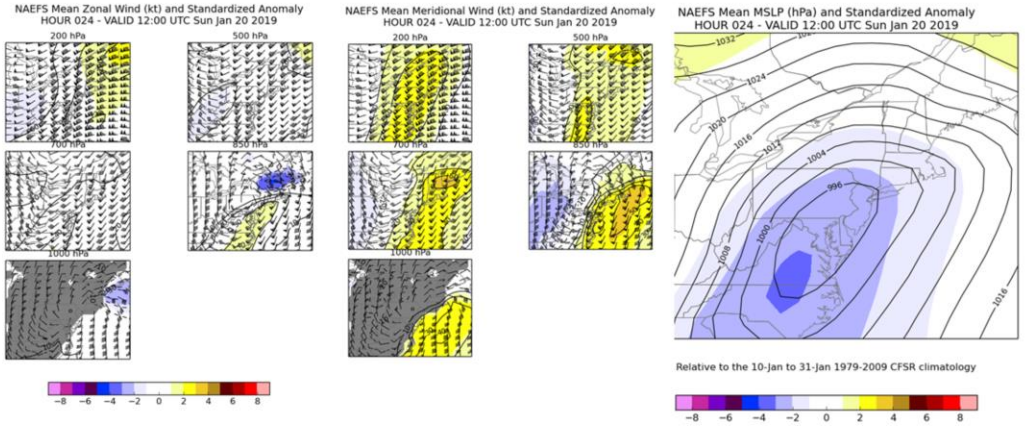
Characteristics of the temperature field during the evening on the 19th can be seen from this plot from the New York State Mesonet. Temperatures were as low as -12 F near the Canadian border in northeast NY, with 30s over New York City. The cold air was being funneled down the upper Hudson Valley during the evening, with single digits as far south as the Albany area. Model forecast temperatures and MOS guidance were several degrees too warm with this cold air wedge as it worked southward down the Hudson Valley.

Surface analysis



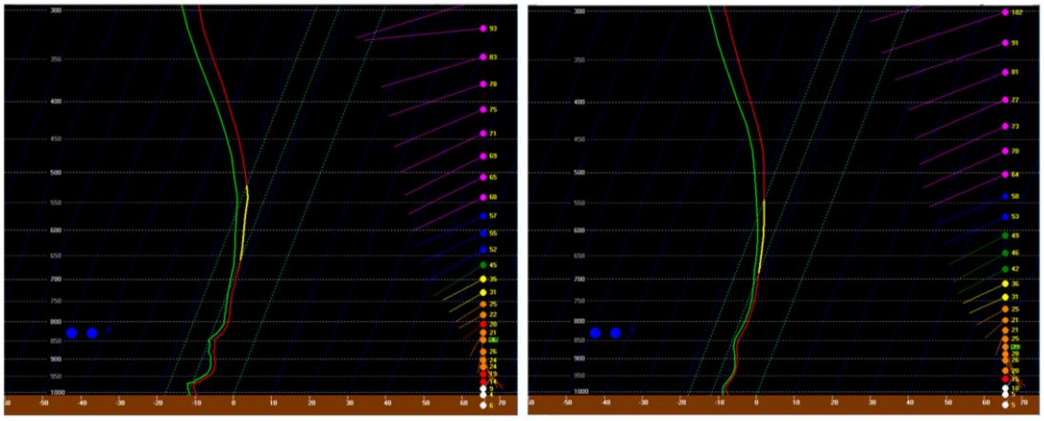
By the morning on the 20th, surface low pressure had re-developed along the northern mid-Atlantic coast, tracking northeast to southern New England during the afternoon.

Anomalies – valid at 12z January 20



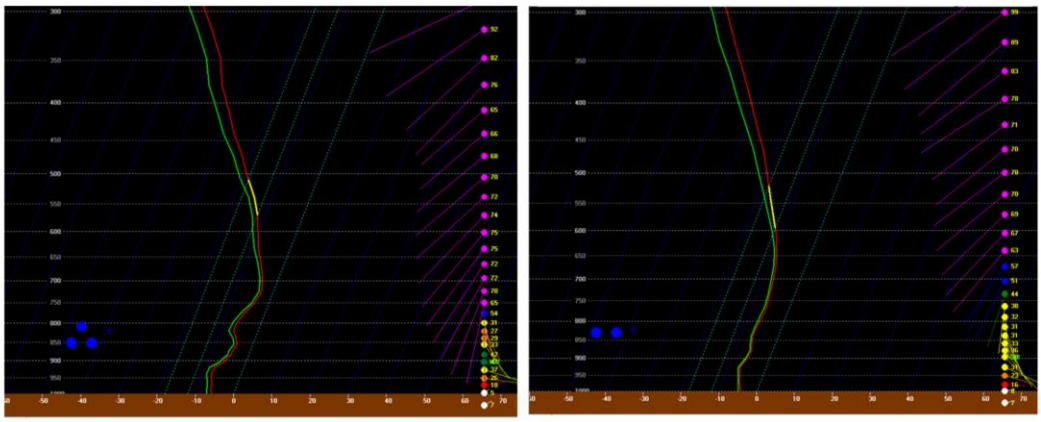
Features to note at 12z on the 20th in the anomaly fields included an anomalously strong 200 mb jet over the Canadian Maritimes, and an anomalously strong easterly flow at 850 mb over New York and New England.

NAM vs GFS forecast sounding valid 00z Jan 20



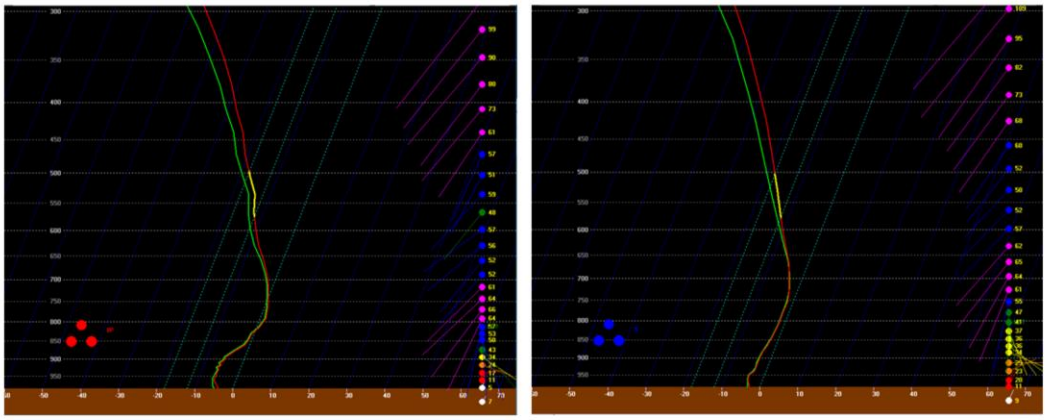
As was the case for most of the winter events during the 2018-2019 season, warm air aloft would result in precipitation type issues for eastern New York and western England. At the onset of the storm, at 00z on the 20th, the NAM (left) and GFS (right) forecast similar temperature profiles well below freezing. The NAM appeared to be a little colder in the boundary layer, although neither model was cold enough

NAM vs GFS forecast sounding valid 06z Jan 20



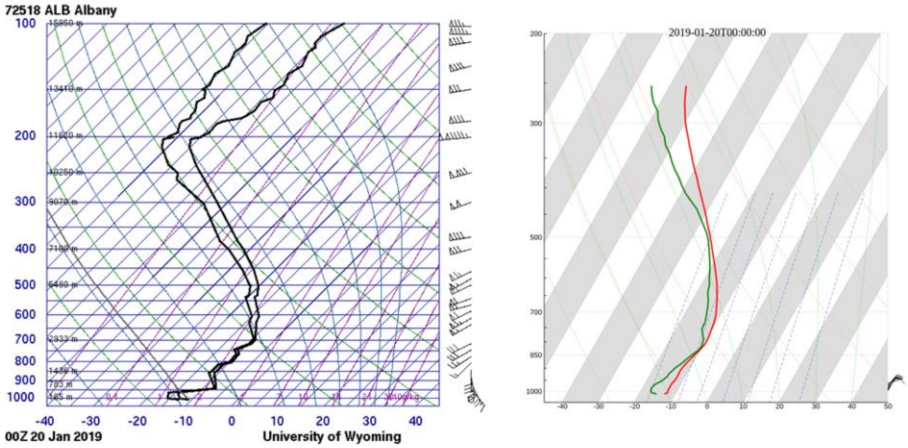
At 06z, the NAM (left) was beginning to show a slightly warmer forecast temperature above 800 mb, along with slightly stronger easterly winds from 900 to 800 mb, slightly greater than 40 kts.

NAM vs GFS forecast sounding valid 12z Jan 20



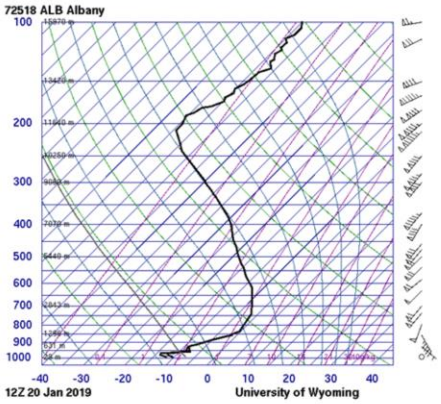
At 12z on the 20th, the NAM was forecasting a warm nose aloft slightly above freezing while the GFS was colder. Subsequent observations indicated that the NAM was more accurate. This has become a common model bias during the past few years, as the NAM is typically warmer and more accurate with warm noses aloft during patterns featuring strong warm advection.

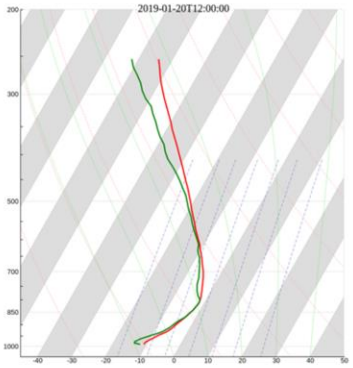
00z observed sounding and the profiler at ALB



The 00z sounding at profiler from the New York meso-net were both indicating very cold conditions at Albany at 00z, with the maximum temperature within the profile around -10 C. Both soundings picked up the shallow, very cold layer near the ground with temperatures around -12 C.

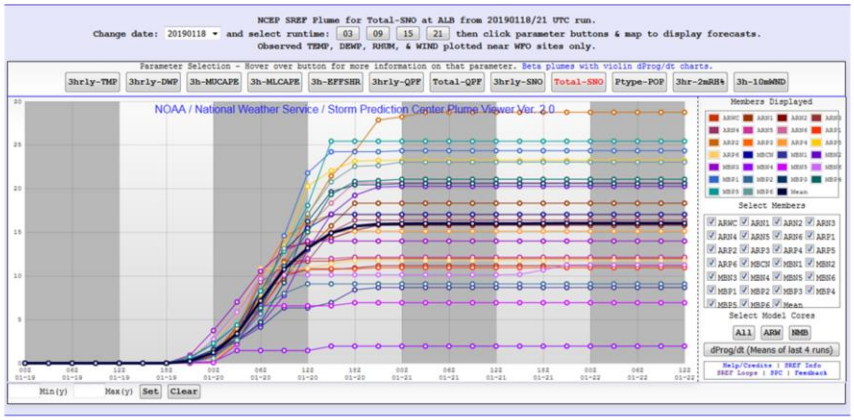
Observed sounding and profiler at ALB – 12 UTC January 20





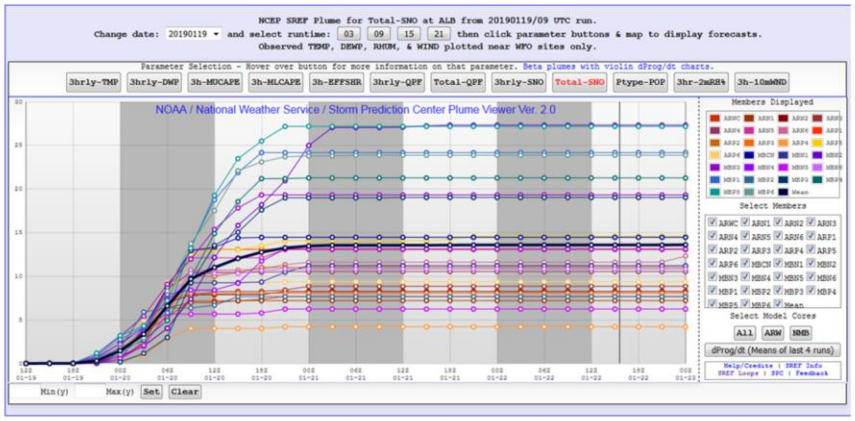
The observed sounding at 12z indicated a warm layer between 800 and 700 mb, with a maximum temperature around +2 C. The profiler appeared to smooth out the warm layer, indicating a maximum temperature of around -2 C. Observations from around the area at this time indicated that sleet was mixing with the snow, indicating that at least a portion of the profile was above freezing.

SREF snowfall at ALB run at 21z Jan 18



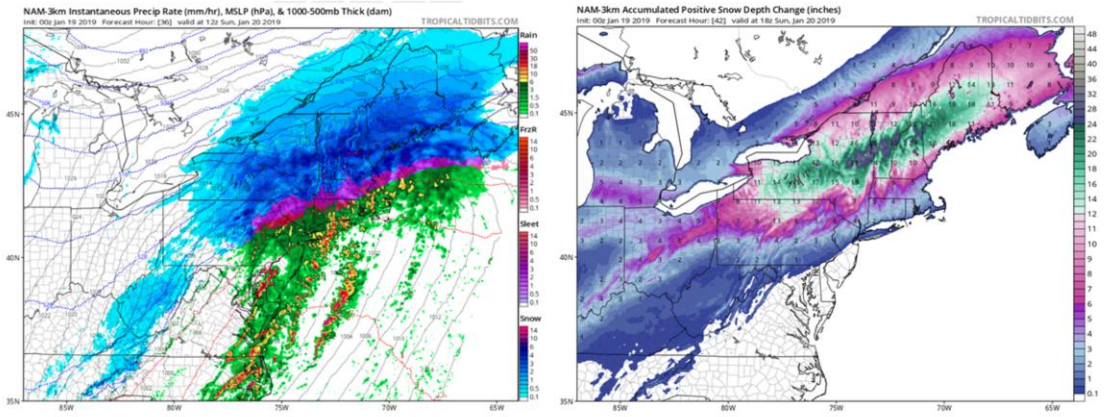
With the mixed precipitation potentially being an issue near Albany for this storm, model forecast snowfall amounts varied rather widely. This 21z January 18 run of the SREF showed a mean snowfall at Albany of 16 inches, with many members down around 10 inches, while several other were between 20 and 25 inches.

SREF snowfall at ALB run at 09z Jan 19



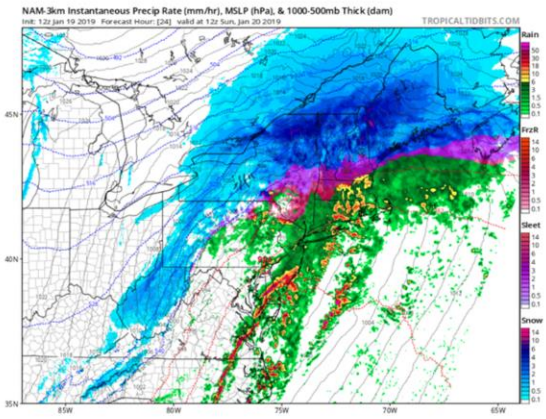
Snowfall amounts decreased slightly near Albany on the 09z run on the 19th. The mean total was just below 15 inches, with many members forecasting only 5 to 10 inches.

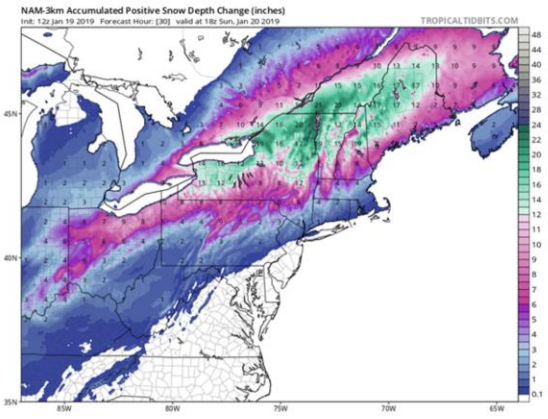
00z 19 Jan NAM precipitation valid 12z on the 20th and snow depth change valid 18z 20th



This forecast from the 00z January 19th run of the NAM nest was typical of forecasts from individual runs of high resolution models. Bands of very heavy snow were forecast from the Capital District northward at 12z on the 20th, while maximum snow depth change amounts were from 15 to 20 inches at Albany, and 20 to 30 inches just to the north. Sleet and freezing rain was forecast just to the south of the Capital District, while rain was forecast from near Poughkeepsie, southward.

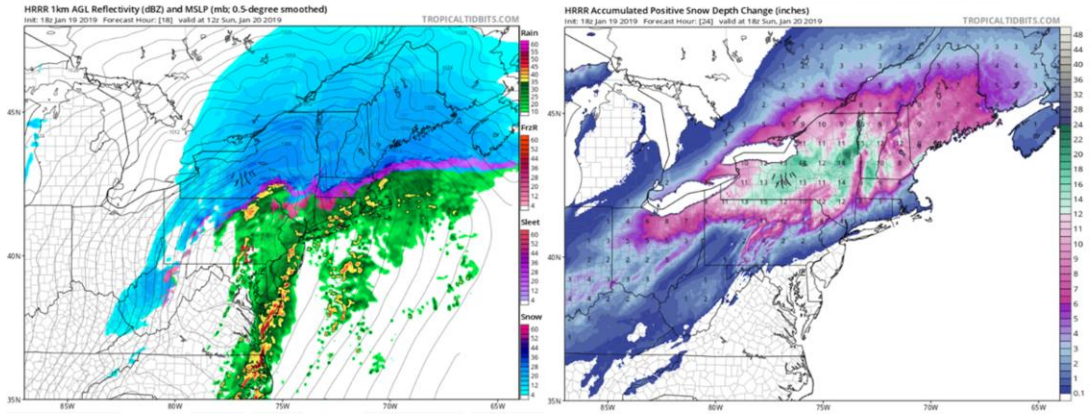
12z 19 Jan NAM precipitation valid 12z and snow depth change valid 18z





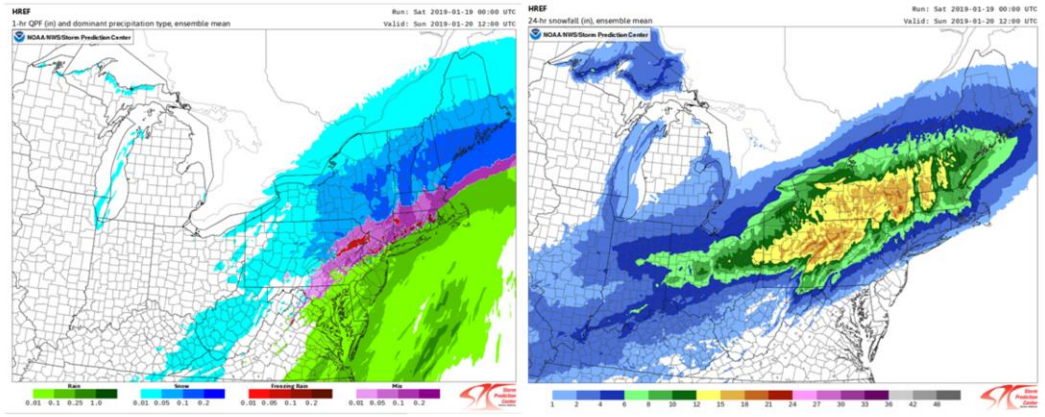
The 12z 19 January run of the NAM brought mixed precipitation further north across the Capital District and decreased snowfall amounts slightly in all areas.

18z 19 Jan HRRR precipitation valid 12z and snow depth change valid 18z



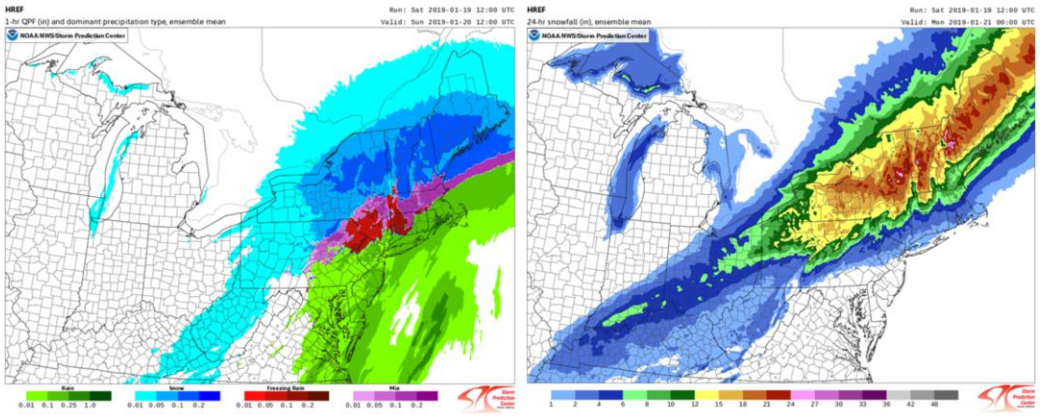
The 18z 19 January HRRR run was farther south with the snow/mix line than the NAM, with more snow farther south. Note that while the boundary between snow and mixed precipitation was farther south, the boundary between mixed precipitation and rain was in about the same place as the NAM. That indicated that while the NAM was warmer with the warm layer aloft than the HRRR, boundary layer temperatures were not much different.

00z 19 Jan HREF precipitation valid 12z and snowfall through 12z



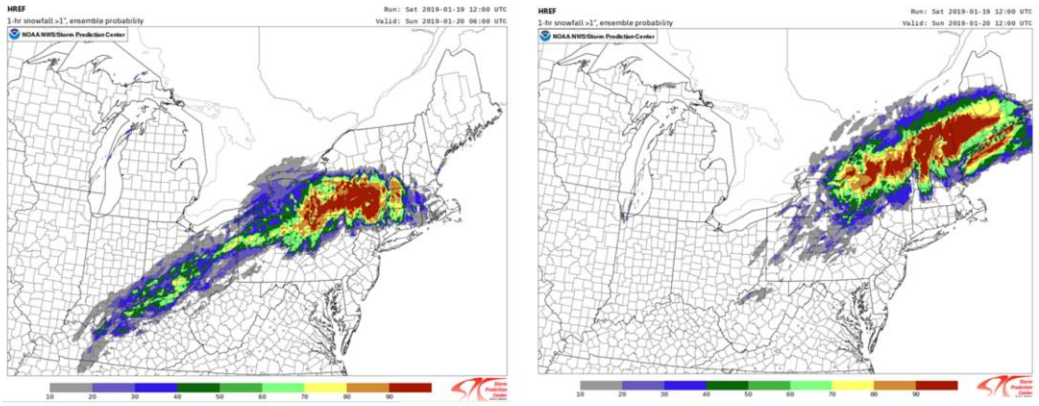
The 00z 19th run of the high resolution ensemble forecast (HREF) had the snow/mix line south of the Capital District at 12z on the 20th. Snowfall through 12z was a widespread 12 to 18 inches.

12z 19 Jan HREF precipitation valid 12z and snowfall through 00z



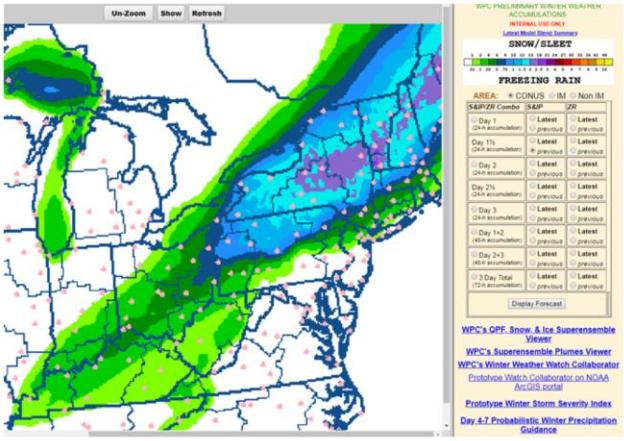
The 12z 19 January HREF trended north with the snow/mix line and also the mix/rain in the Hudson Valley for the time valid at 12z on the 20th. Forecast snowfall amounts were quite high, with widespread totals of 15 to 24 inches and some amounts of greater than 24 inches forecast for northern Saratoga and southern Warren counties.

12z 19 Jan HREF probability greater than 1 inch per hour snowfall valid 06z



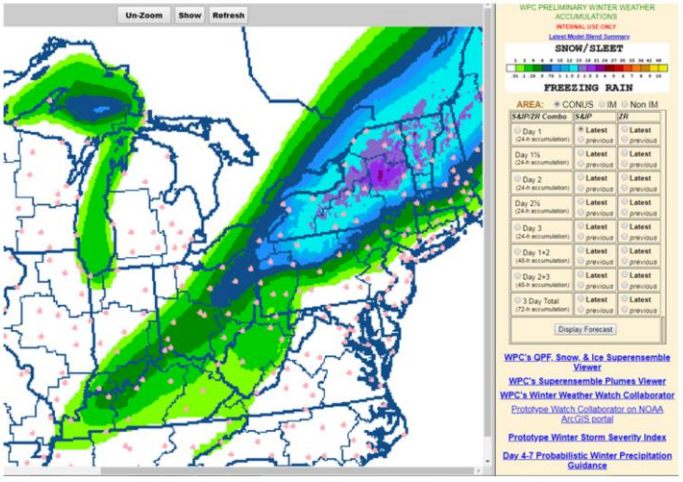
Very high probabilities of greater than 1 inch of snowfall per hour were forecast to lift northward from the mid-Hudson Valley to the Adirondacks and Green Mountains late on the 19th and early on the 20th. The highest probabilities included areas within the Hudson Valley.

WPC snowfall forecast made 06z January 19



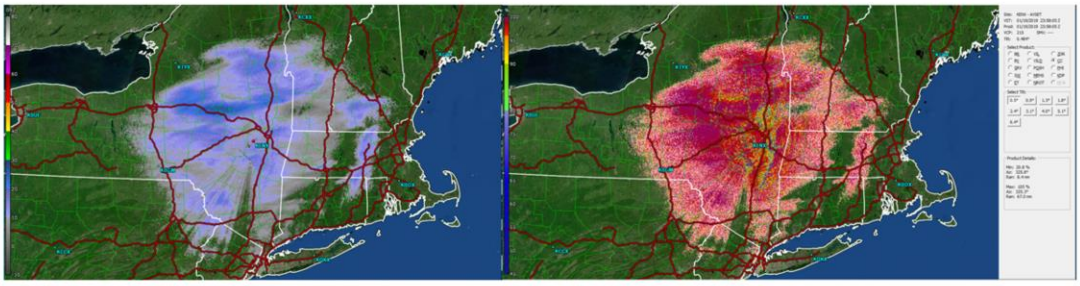
Snowfall forecasts from WPC made early on the 19th were based on slightly colder, snowier forecasts from the 00z run of the models and indicated over 15 inches of snow north of the Capital District, down to around 4 to 6 inches south of Poughkeepsie into northwest Connecticut.

WPC snowfall forecast made 18z January 19



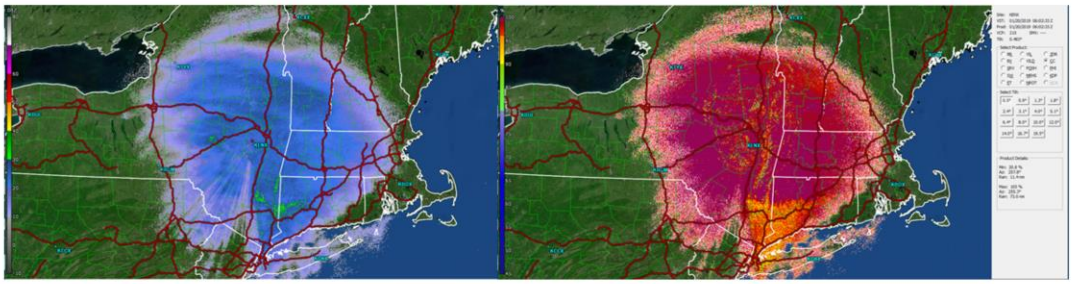
WPC forecasts made at 18z on the 19th, after the models had mostly trended warmer and northward with the heaviest snowfall, indicated that 15 inch plus snowfalls would be located well north of the Capital District. The snowfall forecast for the immediate Albany area was for around 10 inches, however a large south-north gradient was indicated across the Capital District.

Reflectivity and CC at 00z January 20th



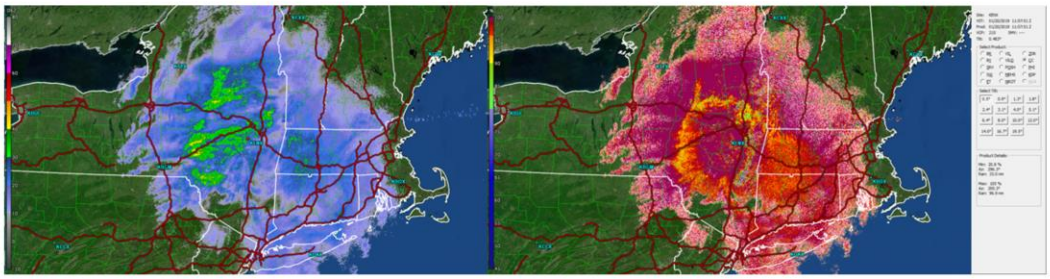
A widespread, light snow overspread the area by 00z on the 20th.

Reflectivity and CC at 06z



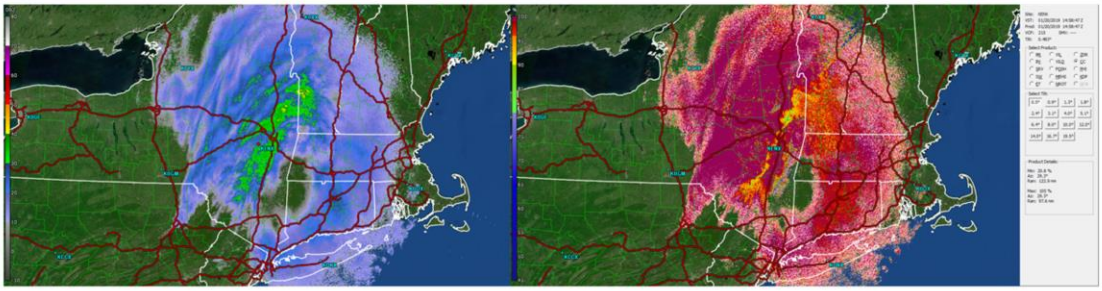
The snow became more intense by 06z. Mixed precipitation can be seen over southeast NY indicated by lower correlation coefficient values.

Reflectivity and CC at 12z



By 12 UTC, bands of heavier precipitation can be seen over eastern New York. A ring of low correlation coefficient values can be seen around the radar on the right, indicating a layer of mixed precipitation as far north as the upper Hudson Valley and as far west as the Catskills.

Reflectivity and CC at 15z



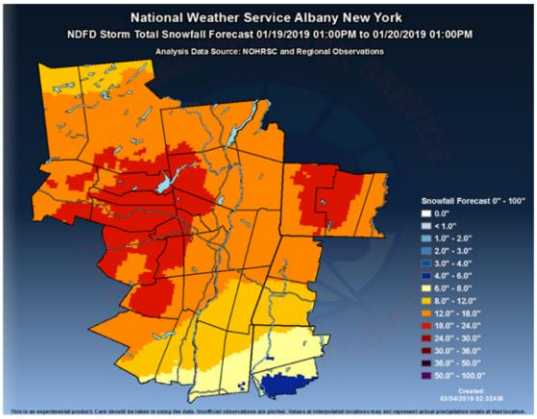
At 15z on the 20th, a band of mixed precipitation can be seen advancing from west to east across the Hudson Valley, associated with a change from a mix to snow. The mix shows up as higher values of reflectivity on the left, and lower correlation coefficient on the right. Precipitation ended across the area by 18z as the storm moved off to the east.

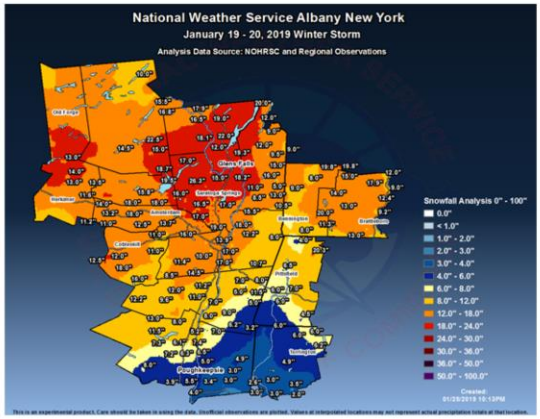
Observations at ALB from 01z to 14z on the 20th

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Precip Accum	Condition
8:04 PM	8 °F	2 °F	76 %	N	3 mph	0 mph	29.7 in	0.0 in	0.0 in	Heavy Snow
8:51 PM	8 °F	3 °F	80 %	NNW	3 mph	0 mph	29.6 in	0.1 in	0.0 in	Heavy Snow
9:05 PM	8 °F	3 °F	80 %	NW	5 mph	0 mph	29.6 in	0.0 in	0.0 in	Heavy Snow
9:41 PM	8 °F	3 °F	80 %	WNW	5 mph	0 mph	29.6 in	0.1 in	0.0 in	Heavy Snow
9:51 PM	8 °F	3 °F	80 %	WNW	3 mph	0 mph	29.6 in	0.1 in	0.0 in	Heavy Snow
10:51 PM	9 °F	3 °F	77 %	NNW	6 mph	0 mph	29.5 in	0.1 in	0.0 in	Heavy Snow
11:09 PM	9 °F	4 °F	80 %	N	3 mph	0 mph	29.5 in	0.0 in	0.0 in	Snow
11:51 PM	9 °F	4 °F	80 %	N	5 mph	0 mph	29.4 in	0.1 in	0.0 in	Snow
12:51 AM	11 °F	5 °F	77 %	NW	5 mph	0 mph	29.4 in	0.1 in	0.0 in	Light Snow
1:24 AM	12 °F	6 °F	77 %	N	6 mph	0 mph	29.3 in	0.1 in	0.0 in	Light Snow
1:51 AM	12 °F	7 °F	80 %	NNW	3 mph	0 mph	29.3 in	0.1 in	0.0 in	Light Snow
2:00 AM	13 °F	7 °F	77 %	NNW	3 mph	0 mph	29.3 in	0.0 in	0.0 in	Light Snow
2:08 AM	13 °F	7 °F	77 %	NW	3 mph	0 mph	29.3 in	0.0 in	0.0 in	Light Snow and Sleet
2:51 AM	14 °F	8 °F	77 %	NNE	5 mph	0 mph	29.2 in	0.0 in	1.0 in	Light Snow and Sleet
3:04 AM	14 °F	8 °F	77 %	NE	6 mph	0 mph	29.2 in	0.0 in	0.0 in	Light Sleet
3:10 AM	12 °F	7 °F	80 %	NE	6 mph	0 mph	29.2 in	0.0 in	0.0 in	Wintry Mix
3:23 AM	13 °F	7 °F	77 %	CALM	0 mph	0 mph	29.2 in	0.0 in	0.0 in	Snow and Sleet
3:44 AM	13 °F	8 °F	81 %	CALM	0 mph	0 mph	29.2 in	0.1 in	0.0 in	Snow and Sleet
3:51 AM	14 °F	9 °F	80 %	CALM	0 mph	0 mph	29.2 in	0.1 in	0.0 in	Snow and Sleet
4:51 AM	16 °F	11 °F	81 %	N	6 mph	0 mph	29.1 in	0.1 in	0.0 in	Snow and Sleet
5:01 AM	16 °F	11 °F	81 %	NNW	9 mph	0 mph	29.2 in	0.0 in	0.0 in	Snow and Sleet
5:13 AM	17 °F	11 °F	77 %	N	12 mph	0 mph	29.1 in	0.0 in	0.0 in	Snow and Sleet
5:51 AM	18 °F	12 °F	78 %	NNW	12 mph	0 mph	29.1 in	0.1 in	0.0 in	Snow and Sleet
6:40 AM	19 °F	14 °F	81 %	N	7 mph	0 mph	29.1 in	0.1 in	0.0 in	Snow and Sleet
6:47 AM	19 °F	14 °F	80 %	NNE	6 mph	0 mph	29.1 in	0.1 in	0.0 in	Snow
6:51 AM	19 °F	14 °F	81 %	N	5 mph	0 mph	29.2 in	0.1 in	0.0 in	Snow
7:28 AM	19 °F	14 °F	81 %	NNE	3 mph	0 mph	29.2 in	0.1 in	0.0 in	Light Snow
7:51 AM	19 °F	14 °F	81 %	NNW	9 mph	0 mph	29.2 in	0.1 in	0.0 in	Light Snow
8:10 AM	20 °F	14 °F	78 %	NNW	13 mph	0 mph	29.2 in	0.0 in	0.0 in	Snow
8:21 AM	20 °F	15 °F	81 %	NNW	13 mph	0 mph	29.2 in	0.0 in	0.0 in	Snow
8:51 AM	21 °F	16 °F	81 %	N	9 mph	0 mph	29.2 in	0.0 in	0.0 in	Light Snow

Observations at the Albany (ALB) observation site indicated a period of heavy snow around Albany during the evening on the 19th, transitioning to light sleet and snow by around 07z on the 20th. A mix continued through the early morning hours, before the precipitation changed back to mainly snow by around 12z. Observations from around the area at 12z indicated that sleet continued to mix with the snow until after 12z, implying that there may have been some sleet that was not being reported at the airport around 12z.

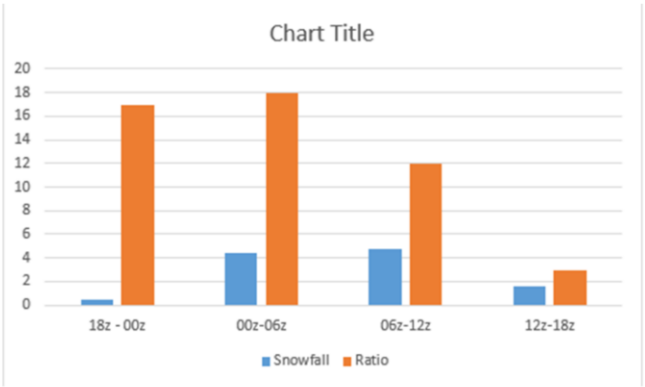
WFO ALY Snowfall Forecast





The WFO Albany snowfall forecast (left) from the morning on the 19th indicated a large area of 12 to 18 inches of snow expected, with as little as 6 inches in the mid-Hudson Valley and areas of over 18 inches north and west of the Capital District. Observations indicated a little less snow than forecast for the mid-Hudson Valley, otherwise snowfall forecasts were fairly close to what occurred. A widespread 10 to 20 inches of snow fell across most of the area.

Snowfall and snow/liquid ratios at Albany



Snow to liquid ratios at Albany were between 15 and 20 to 1 during the first half of the storm, then decreased to less than 10 to 1 during the tail end of the storm when the snow mixed with sleet.

Summary and conclusion

- A major winter storm affected eastern New York and western New England on January 19-20, 2019
- Heavy snow fell across the area north of the mid-Hudson Valley, however precipitation ultimately mixed with or changed to sleet as far north as the upper Hudson Valley early on the 20th.
- Model guidance suggested that a warm nose aloft would bring mixed precipitation northward to the Capital District, with a slight trend northward with the warm air as the event approached.
- Observations including radar, soundings, and profiler data were useful in tracking the progress of the warm nose northward.