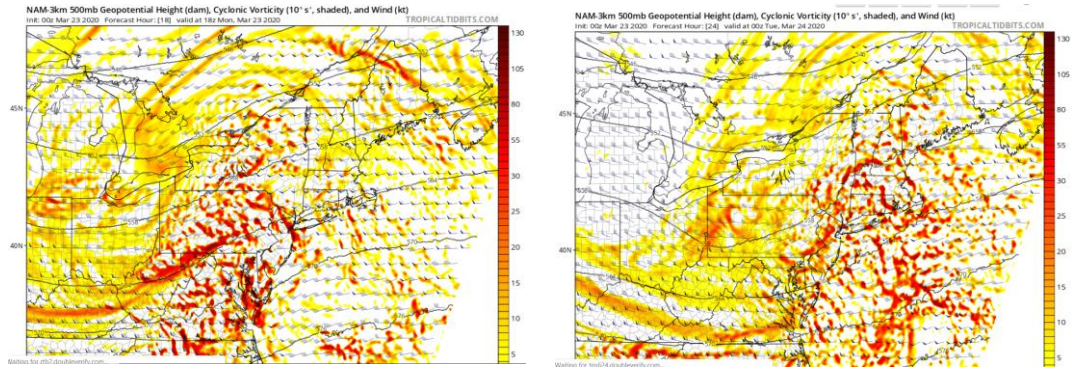


March 23, 2020 winter storm

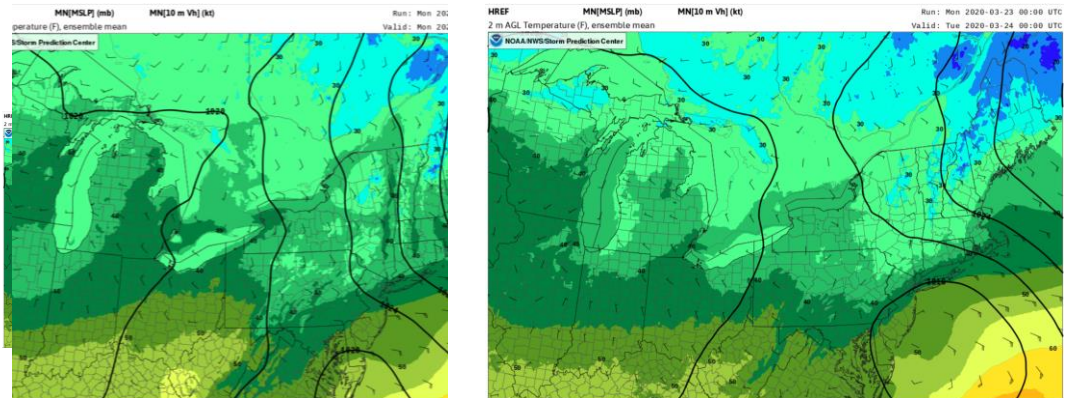
Mike Evans
NWS WFO Albany, NY

500 mb heights and vorticity



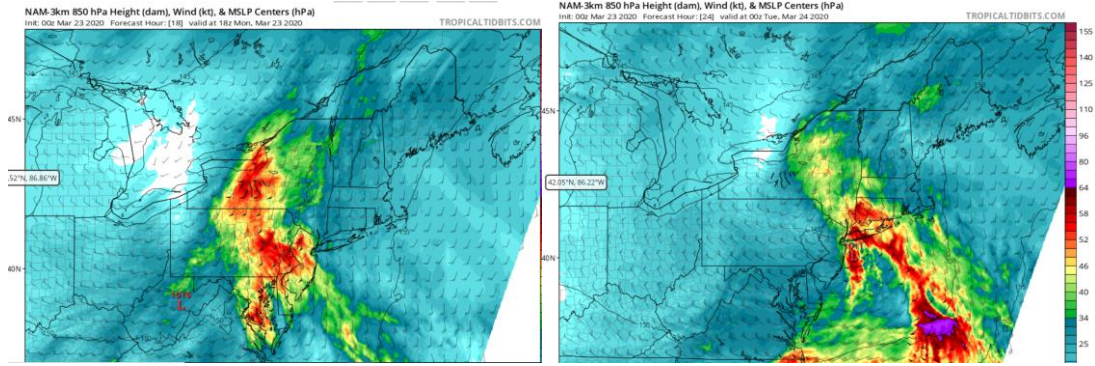
The March 23rd 2020 storm was associated with an open 500 mb trough moving east from the Midwest toward the northern mid-Atlantic coast.

Sea-level pressure and temperature



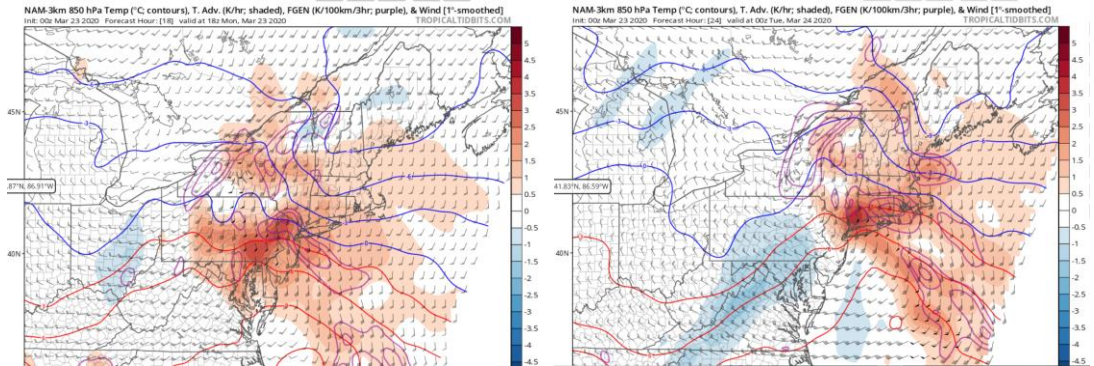
At the surface, a strong area of high pressure moved east from the Canadian maritimes, while low pressure developed along the mid-Atlantic coast.

850 mb wind



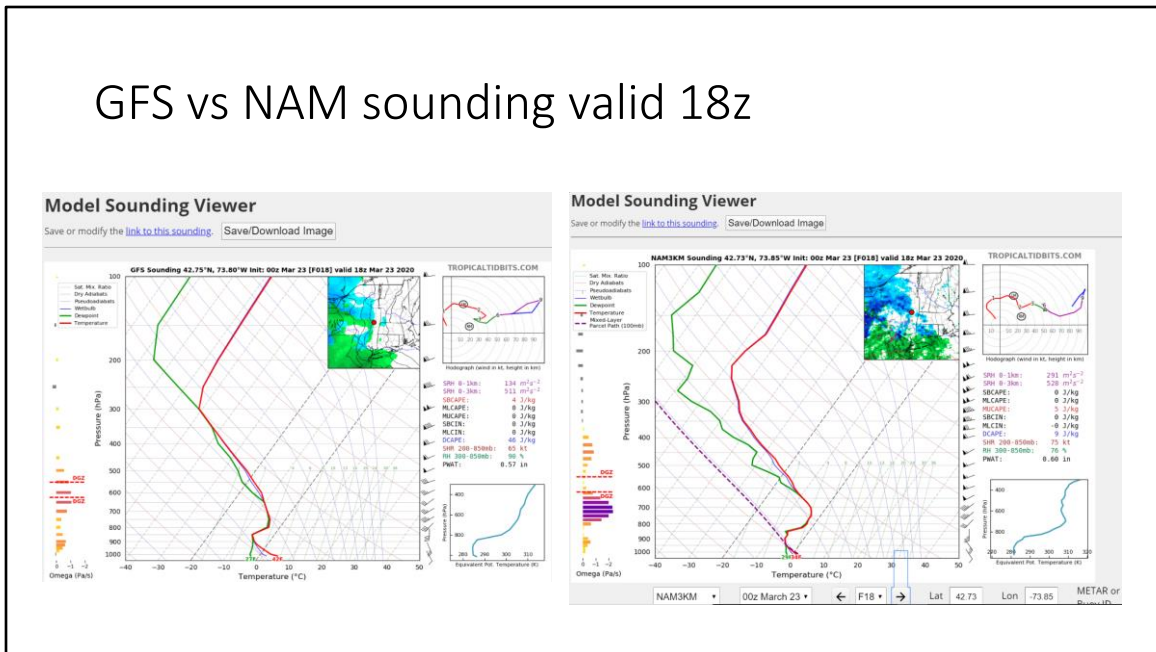
A 50 kt southerly jet at 850 mb was forecast across Pennsylvania and New York during the afternoon on the 23rd.

850 mb temperature advection and frontogenesis



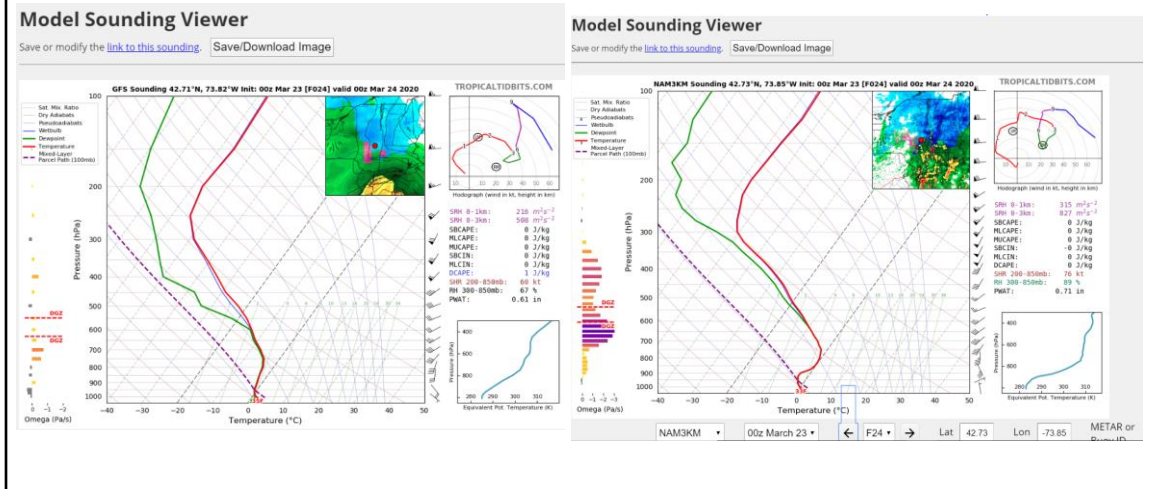
A broad area of warm-air advection was forecast across the northeast, along with a maximum of frontogenesis at 850 mb over upstate New York.

GFS vs NAM sounding valid 18z



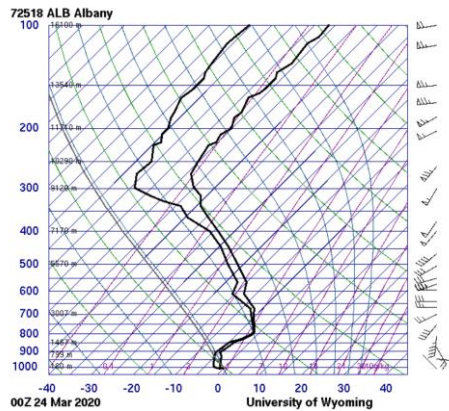
The data on this slide shows GFS and NAM forecast soundings valid at 18z on the 23rd. The usual model biases can be seen here, with the GFS showing warmer air in the boundary layer than the NAM, and also slightly colder air in the elevated warm nose around 850 mb.

GFS vs NAM sounding valid 00z



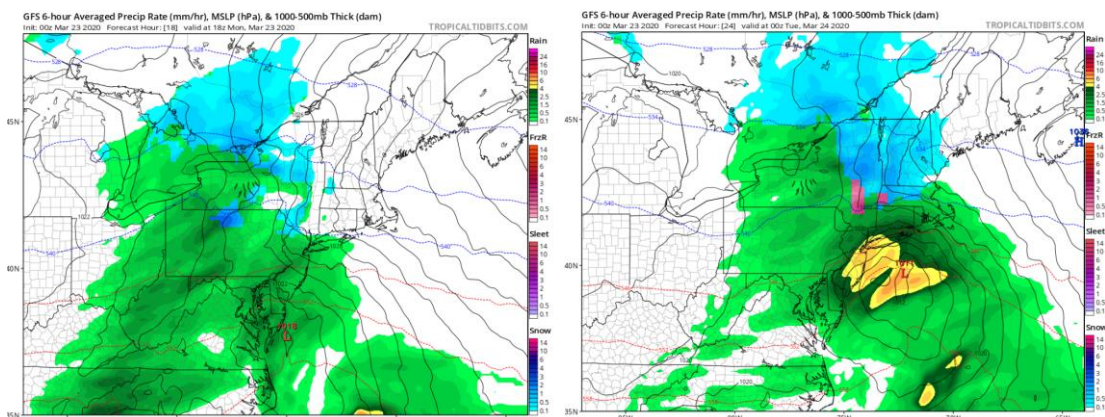
The same model differences can be seen on these forecasts valid at 00z. In particular, the NAM showed a warmer warm nose aloft, and the NAM was also about 2 degrees F colder at the surface.

Observed sounding at ALB at 00z



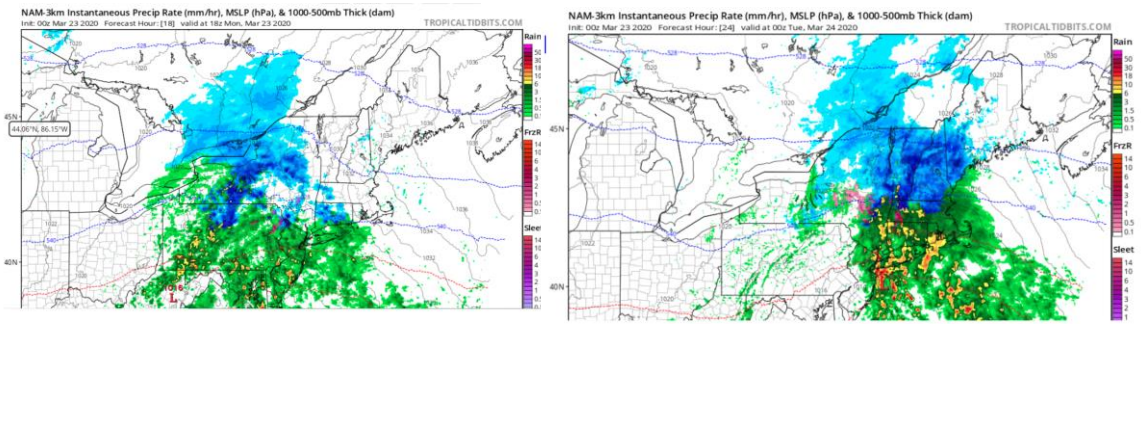
The observed sounding at ALB at 00z indicated that the NAM forecast was better than the GFS. The warm layer maximum temperature was near -1 degrees C and the surface temperature was around -1 C.

00z Mar 23 run of the GFS precipitation type



The GFS was forecasting a mix of rain and snow overspreading the area during the afternoon on the 23rd, transitioning to snow from Albany northward by 00z.

00z Mar 23 run of the NAM precipitation type



The NAM was forecasting more snow during the onset of the precipitation during the afternoon. By 00z, precipitation type was forecast to be snow from Albany northward, and mostly rain to the south.

GFS MOS Maximum Temperature Forecasts

[KALB] GFS MOS n_x Table Centered On: 2020 Mar 24, 00Z

	Model Run Initialized at:													
Valid:	20/12Z	20/18Z	21/00Z	21/06Z	21/12Z	21/18Z	22/00Z	22/06Z	22/12Z	22/18Z	23/00Z	23/06Z	23/12Z	23/18Z
21/12Z	32	31												
22/00Z	44	46	47	47										
22/12Z	15	15	16	15	16	16								
23/00Z	43	43	45	43	44	44	43	45						
23/12Z	19	25	25	24	24	25	24	24	23	23				
24/00Z			39	45	46	44	44	42	42	41	38	37		
24/12Z					33	34	34	31	31	31	30	28	30	29
25/00Z							54	50	49	49	49	47	44	42
25/12Z									33	34	33	33	31	30

MOS forecasts from the GFS produced on March 22nd indicated maximum temperatures on the 23rd at ALB in the lower 40s. The forecasts trended slightly colder with time, so that forecasts produced at 00z on the 23rd were down to 38, and down to 37 for forecasts produced at 06z.

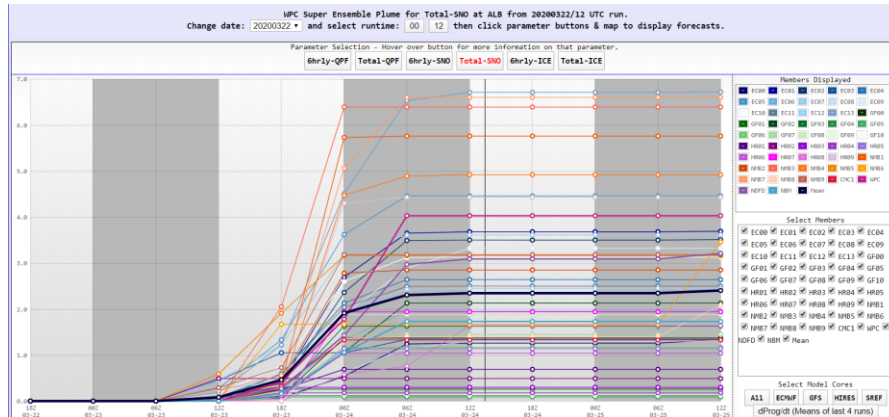
NAM MOS Maximum Temperature Forecasts

[KALB] NAM MOS n_x Table Centered On: 2020 Mar 24, 00Z

Model Run Initialized at:							
Valid:	20/12Z	21/00Z	21/12Z	22/00Z	22/12Z	23/00Z	23/12Z
21/12Z	32						
22/00Z	45	43					
22/12Z	11	14	14				
23/00Z	40	37	42	41			
23/12Z	24	10	13	25	19		
24/00Z		42	42	41	37	35	
24/12Z			30	32	32	31	29
25/00Z				49	49	49	49
25/12Z					29	28	30

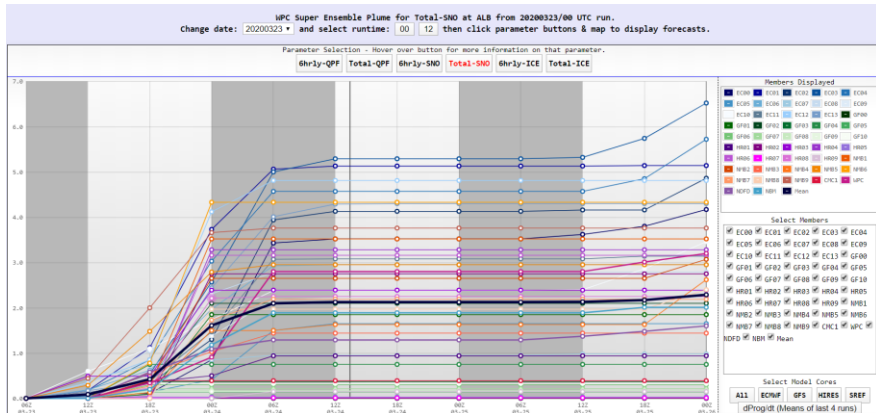
NAM MOS forecasts were a few degrees cooler than GFS forecasts. The forecast produced at 12z on the 22nd was 37, and the forecast produced at 00z on the 23rd was 35.

WPC 12z March 22 super ensemble snowfall plumes at ALB



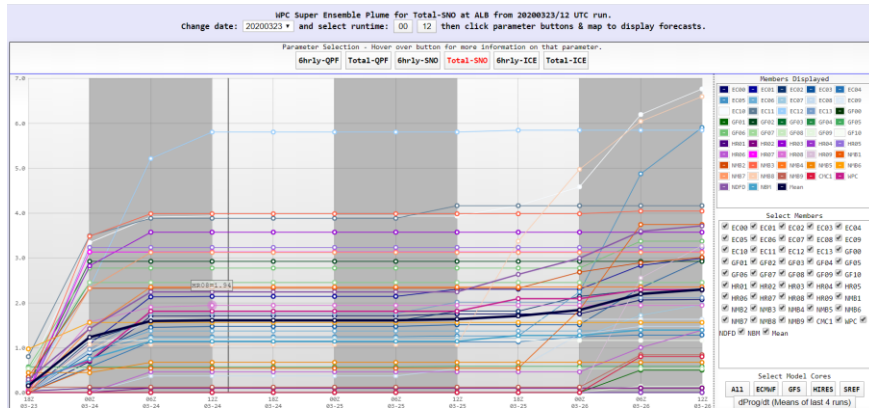
An ensemble of snowfall forecasts at ALB from 12z March 22nd showed a range from around nothing to around 7 inches, with a median of around 2.5 inches.

WPC 00z March 23 super ensemble snowfall plumes at ALB



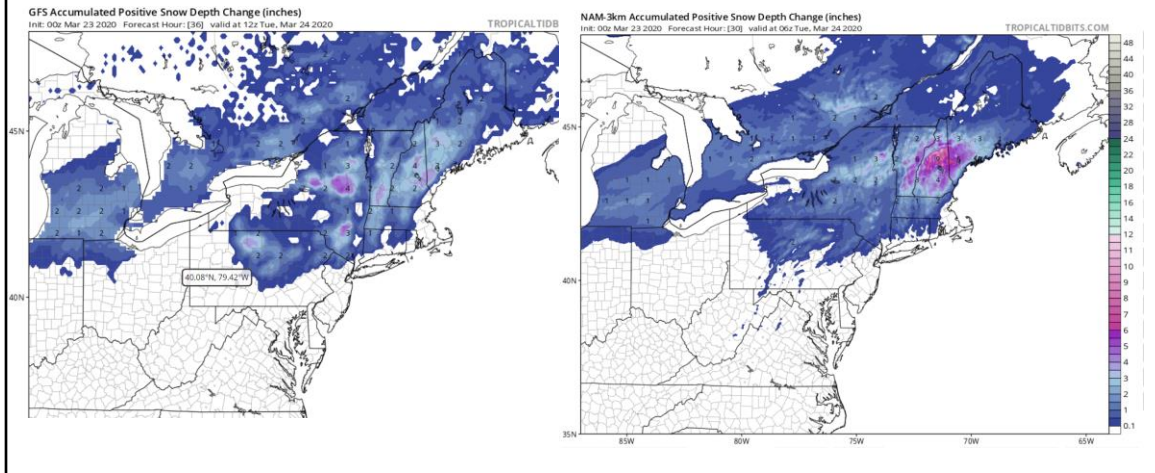
Forecasts from 00z on the 23rd trended down slightly. The forecasts ranged from nothing to around 6 inches, with a median value of around 2 inches.

WPC 12z March 23 super ensemble snowfall plumes at ALB



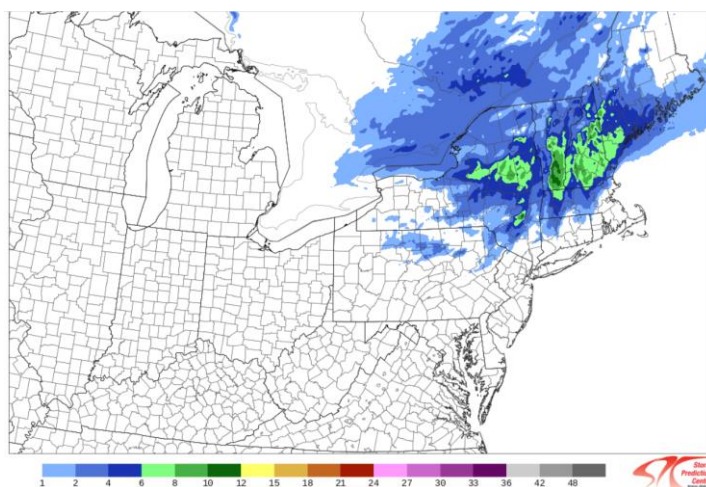
Forecasts continued to trend slightly downward (in the wrong direction) at 12z on the 23rd. These forecasts were generated at around the time that the snow began at Albany, and ranged from nothing to just under 6 inches. Note that the 6 inches observed at Albany was greater than any forecast. One ECMWF member forecast just under 6 inches, while all of the other members were less than 4 inches.

GFS vs NAM snow depth change



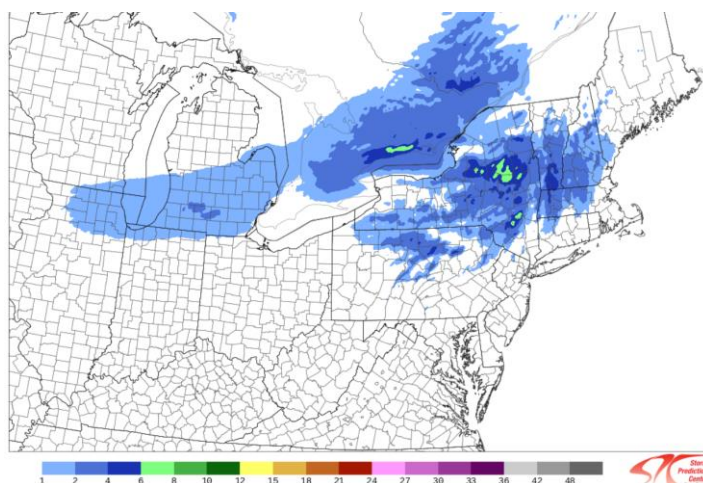
Snow depth change from the GFS vs. NAM from the 00z March 30th indicated a forecast snowfall of 1 to 2 inches for much of the area, with as much as 3 or 4 inches for the higher elevations. Despite the GFS being warmer in the boundary layer, there were not big differences between the GFS and NAM for this field.

HREF March 22 12z run snowfall valid 12z



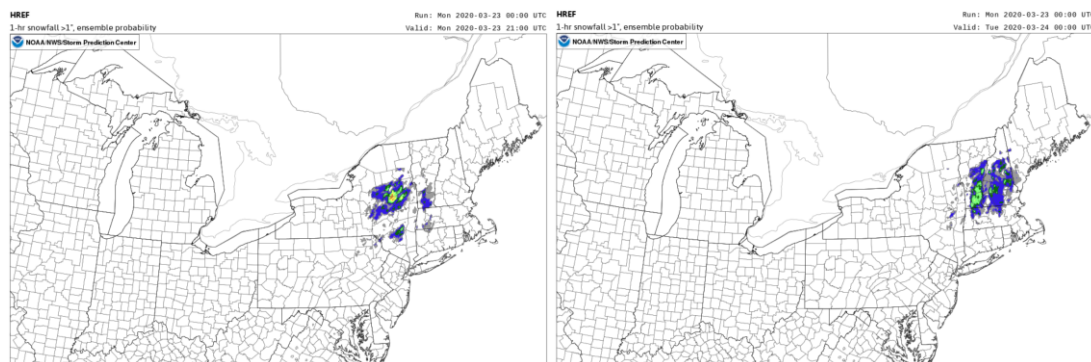
HREF snowfall from the 12z run on March 22nd indicated snowfall amounts of mostly 1 to 4 inches in the Hudson Valley with as much as 8 to 10 inches over higher terrain. In the immediate Albany area, some 4 to 6 inch amounts can be seen immediately to the north and west of Albany. Some of the lowest elevations south of Albany were forecast to get less than an inch. Note, HREF forecasts snowfall using the WPC snow/rain ratio for periods where a dominant p-type of snow is forecast.

HREF March 23 00z run valid 00z



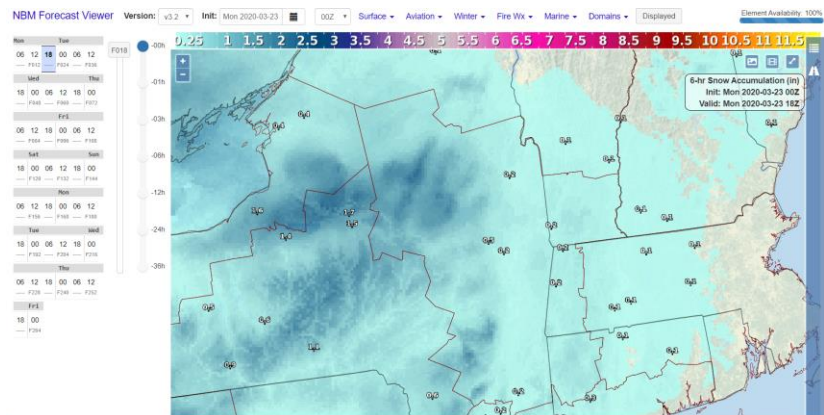
Forecasts from the 00z run on the 23rd were slightly lower than the 12z March 22nd forecast. Amounts of mostly 1 to 4 inches were forecast with as much as 8 inches over higher elevations. Note this forecast only goes through 00z on the 24th. Data beyond that time was not available.

HREF prob inch per hour snowfall – 21z, 00z



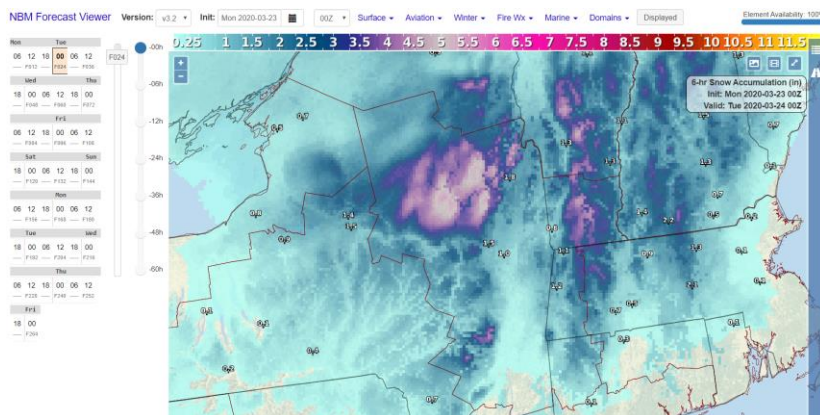
The 00z March 23rd HREF indicated elevated probabilities for more than 1 inch per hour over higher terrain north of the Mohawk valley around 21z, shifting to higher terrain in southern Vermont by 00z. One inch per hour snowfall was not forecast in the Capital District / Hudson Valley during this time.

NBM snowfall 12z-18z



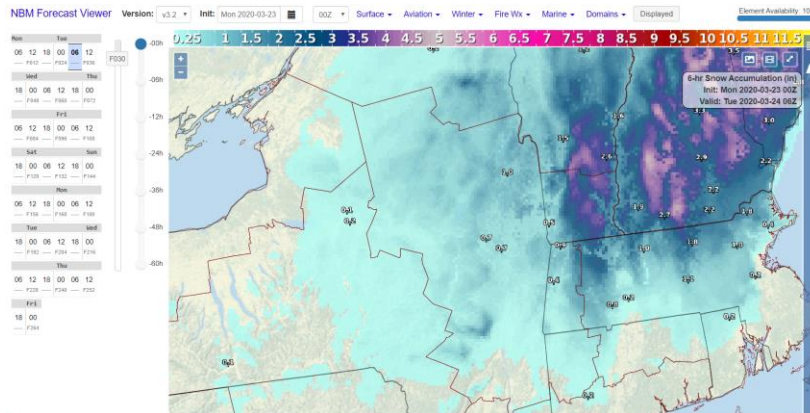
National blend of models 6 hour snowfall through 18z indicated amounts of less than an inch for most of the area, except just over an inch for the Catskills and central Mohawk Valley.

NBM snowfall 18z-00z



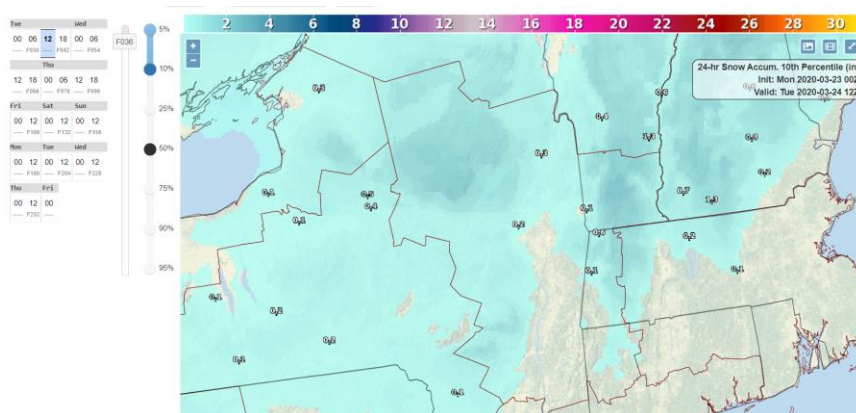
National blend of models 6 hour snowfall from 18z to 00z indicated 4 to 6 inches for higher terrain north of the Mohawk Valley and over higher terrain in southern Vermont. Amounts were generally an inch or less in the Hudson and Mohawk Valleys.

NBM snowfall 00z – 06z



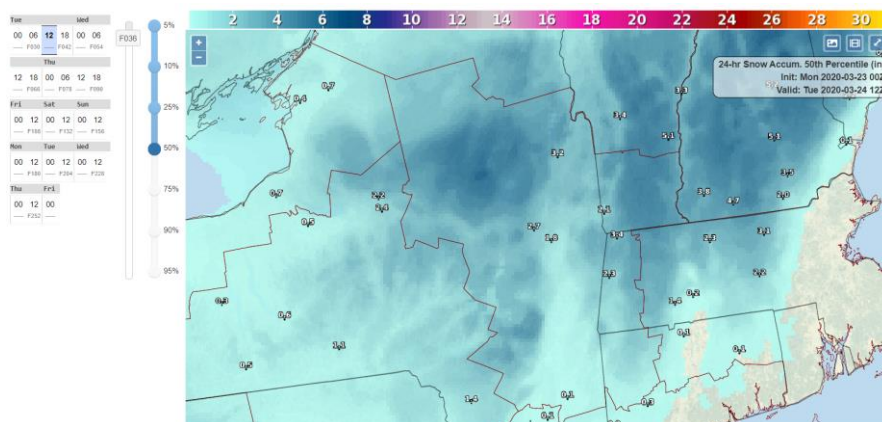
National blend of models 6 hour snowfall from 00z to 06z indicated amounts of 4 to 6 inches over the higher terrain in southern Vermont during that time, with an inch or less to the west.

NBM 10 percentile snowfall through 12z



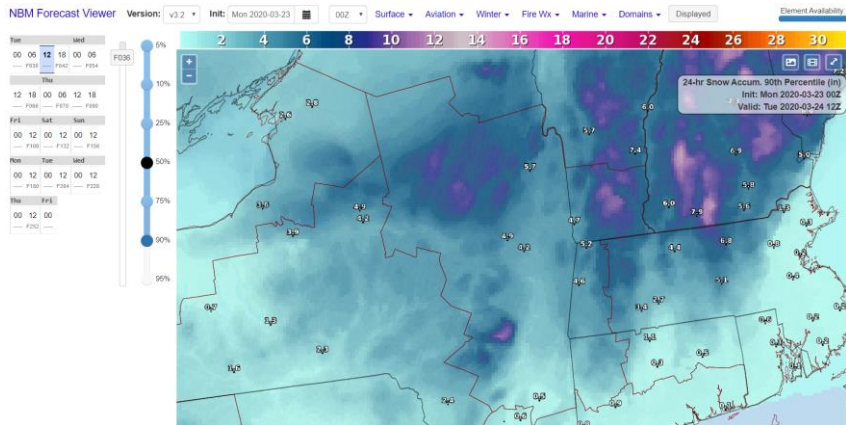
The 10th percentile of event total snowfall from the National Blend of Models (“at least this much”), indicated less than an inch of snow in the Hudson Valley from Albany southward, with 2 to 4 inches for the higher elevations in the Catskills, southern Adirondacks and southern Green Mountains.

NBM 50 percentile snowfall



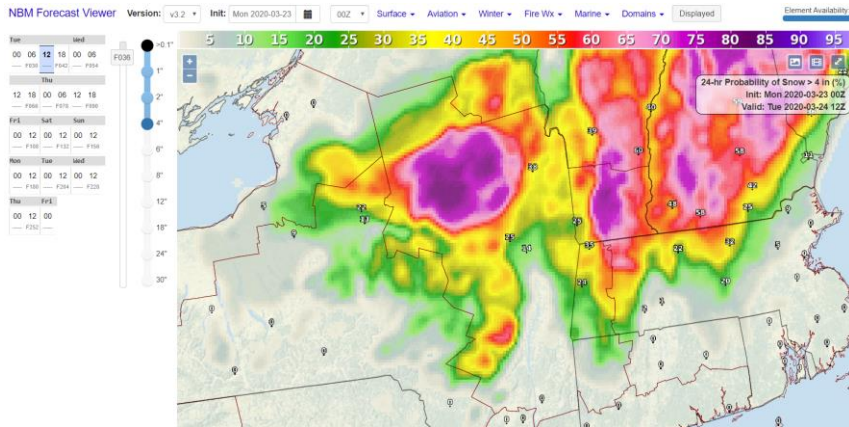
Mean (50th percentile) event total snowfall from the National Blend of Models indicated snowfall totals of up to 2 inches in the Albany area, with an inch or less down the Hudson Valley to the south. Median snowfall for the higher elevations ranged from about 4 to 8 inches.

NBM 90th percentile snowfall



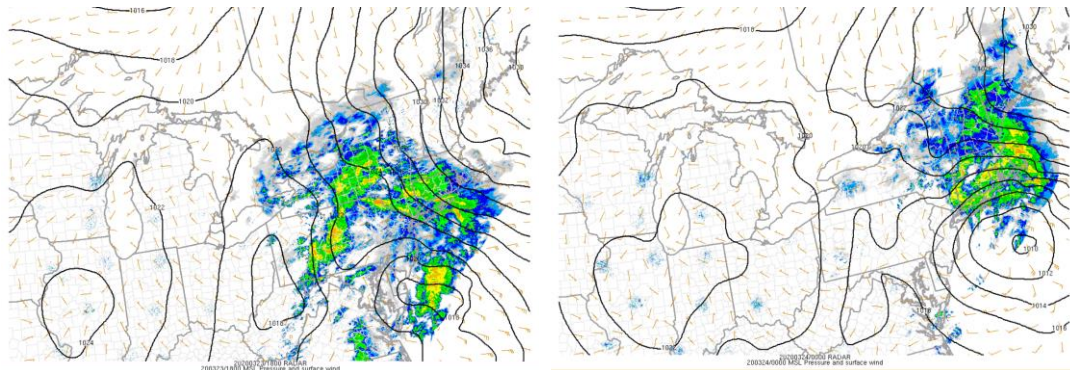
The 90th percentile of event total snowfall indicated around 4 to 5 inches of snow in the Albany area, with about 2 inches to the south down through the mid-Hudson Valley. Indications of as much as 10 inches could be seen for higher elevations. This was another indication that the models were under-dispersive on the snowfall potential near Albany, as observed snowfall exceeded the 90th percentile in this case.

NBM probability of snow greater than 4 inches



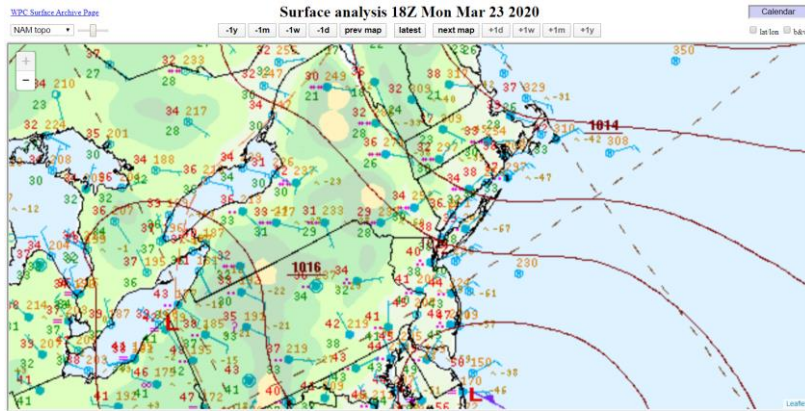
NBM probabilities of 4 inches or greater of snowfall were less than 20 percent in the Hudson Valley from Albany southward. High probabilities (greater than 60 percent) were confined to the southern Adirondacks and southern Green Mountains.

Observed radar – 18z and 00z



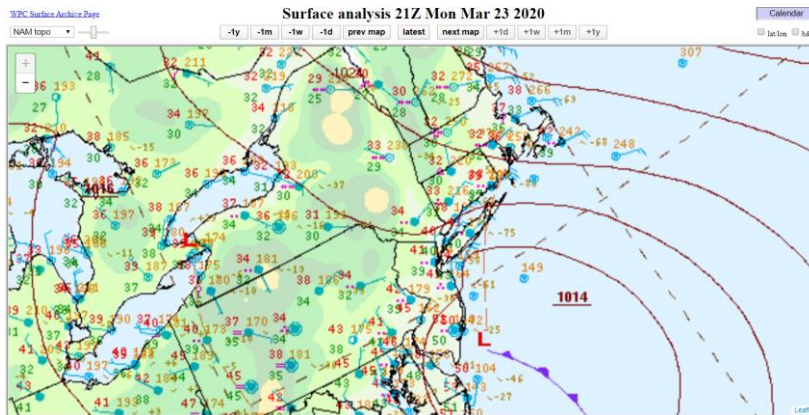
Observed radar showed bands of moderate to heavy precipitation moving northeastward across the area as low pressure tracked from Del Marva toward Cape Cod.

Surface plot – 18z



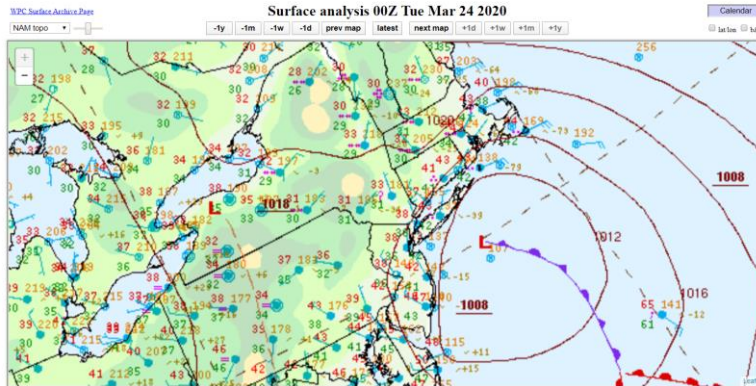
This 18z surface top plot showed snow falling across most of the area, with temperatures above freezing in the Hudson Valley.

Surface plot – 21z



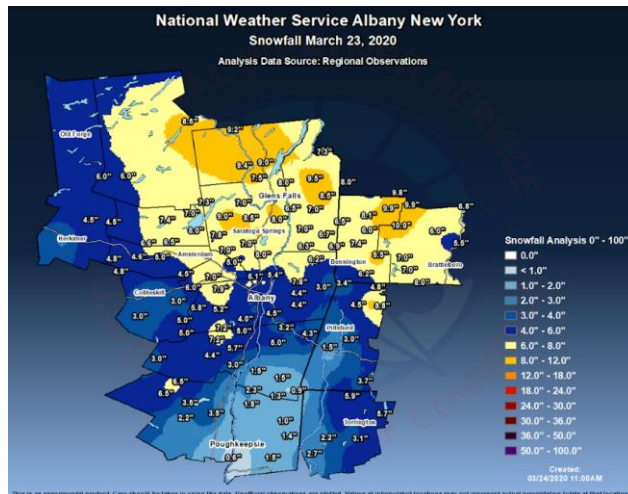
At 21z, the snow changed to rain at Poughkeepsie, but remained snow farther north. Valley temperatures were near freezing. This was near the time of heaviest snow for much of the area. Albany would report 1 to 2 inch per hour snowfall rates shortly after this time.

Surface plot – 00z



At 00z the precipitation was diminishing across the area. Valley temperatures remained near freezing. The precipitation had changed back to a mix at Poughkeepsie remaining snow farther north.

Observed snowfall



Total snow from this storm ranged from around an inch in the mid-Hudson Valley, to 5 to 6 inches in the Albany area, Catskills, and Mohawk Valley, to 6 to 10 inches for the upper Hudson Valley, southern Adirondacks and southern Vermont.

Summary

- An early spring snowstorm affected eastern NY and western New England on March 23, 2020, with moderate snow amounts.
- Forecast challenges centered around precipitation type and snow / liquid ratios.
- Models consistently under-forecast snowfall, particularly in the area centered around Albany.

