

# The Heavy Mixed Precipitation and Localized Ice Storm on the 3-4 February 2022 in Eastern New York

## Part I: Synoptic and Mesoscale Overview

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**WINTRE-Mix Workshop**  
**NOAA/NWS at Albany**  
**May 22, 2023**

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Mike Evans, and Neil Stuart

# Outline

## Part I:

- Synoptic Overview including Large-Scale Anomalies
- Mesoscale/Sounding Analysis and Precipitation Type Challenges
- Observations

## Part II:

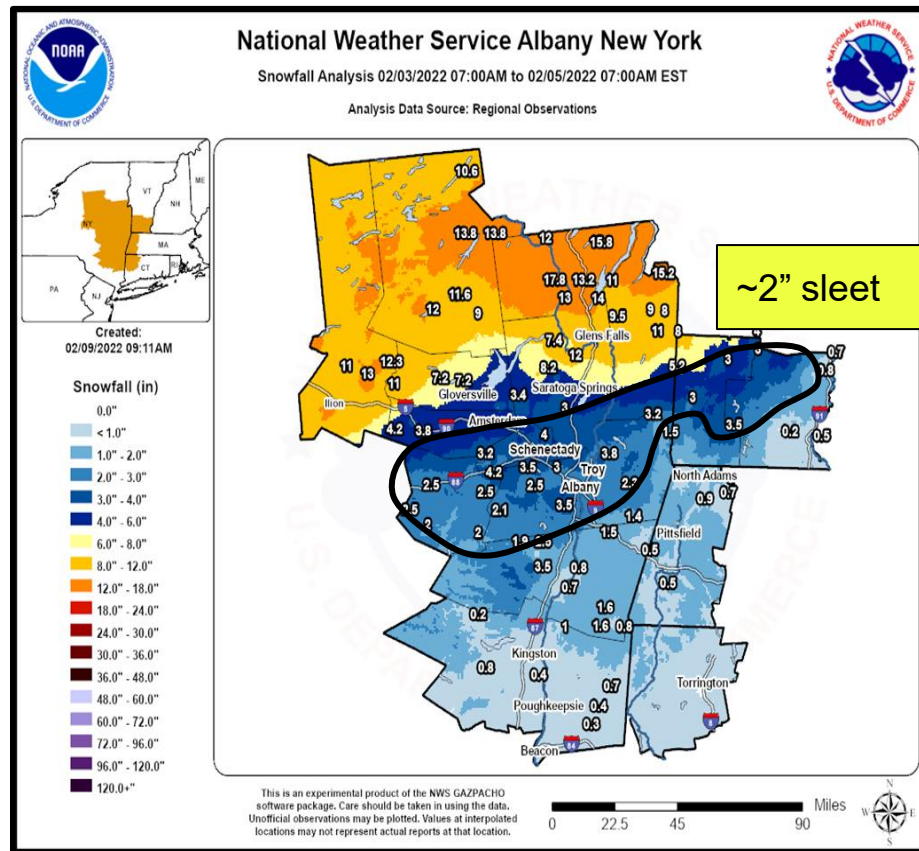
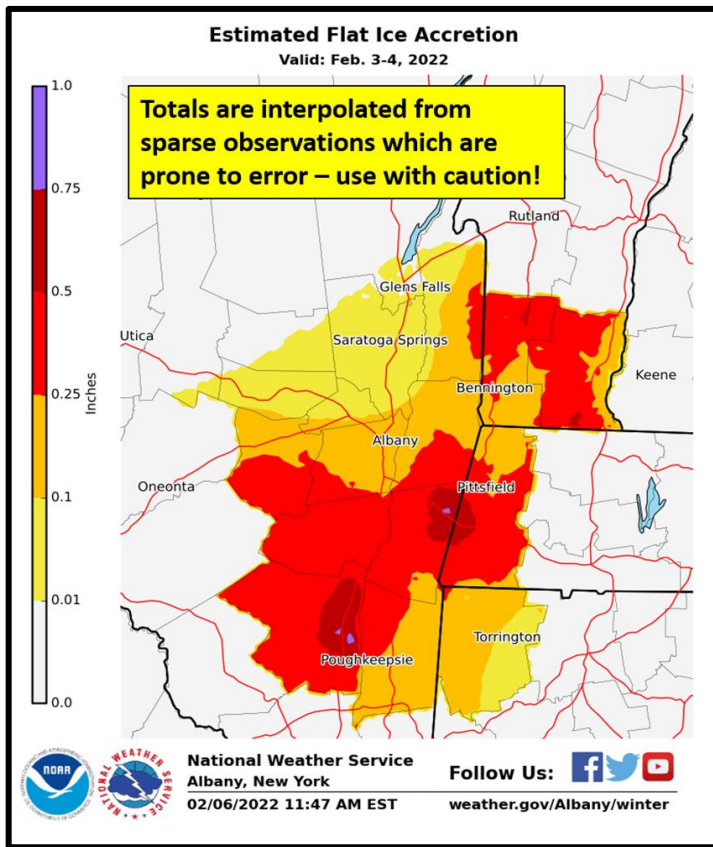
- Discussion on Impacts
- Watch/Warning/Advisories Decision Challenges
- Messaging & IDSS
- Partner Survey

# Brief Event Overview

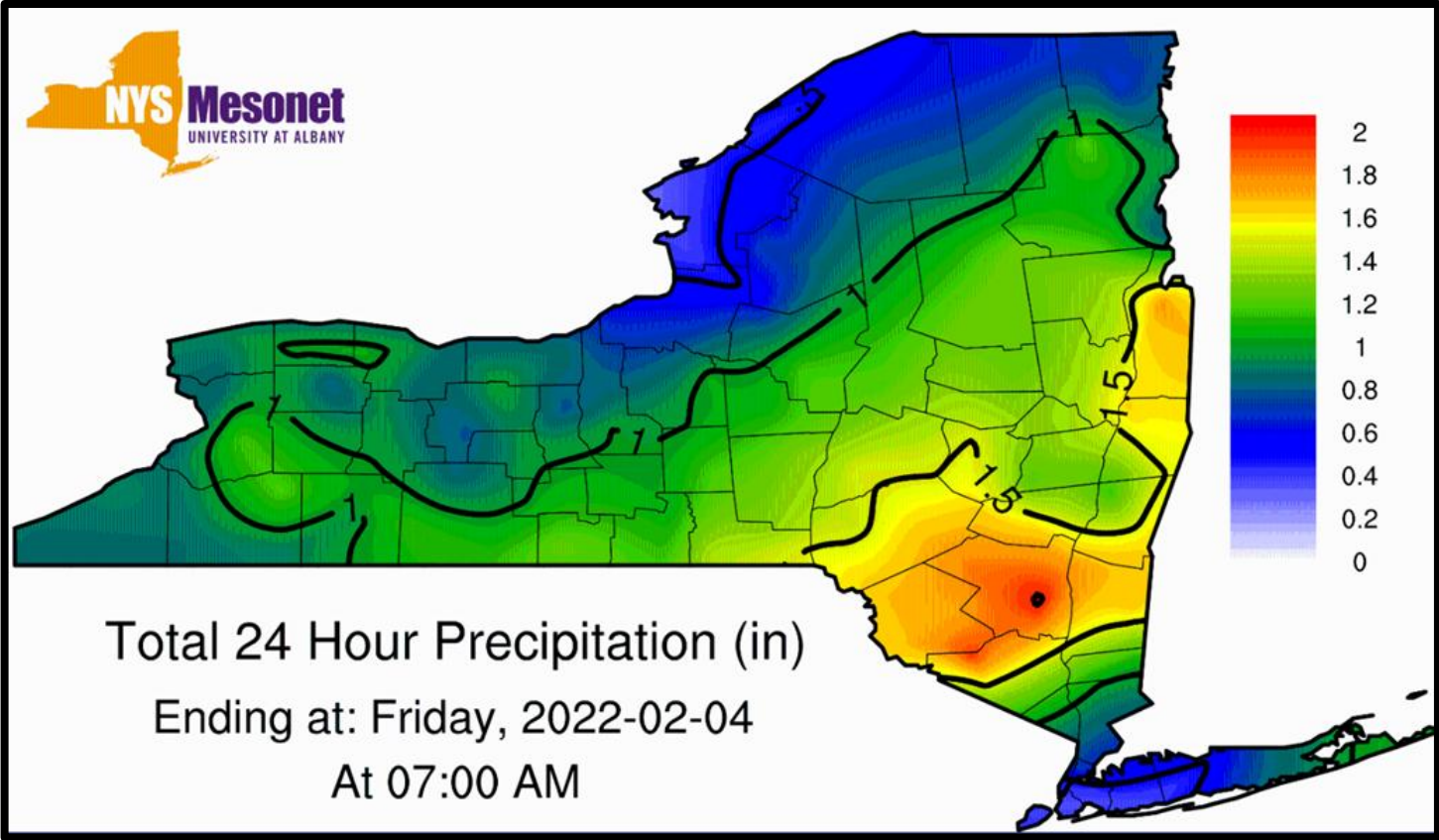
- Prolonged period of significant precipitation 3-4 Feb 2022 with 1-2.5" of liquid equivalent over eastern NY/western New England (on heels of dry January precip totals)
- Rain during the day 3 Feb turned to a variety of wintry precip types during the evening, persisting into the morning hours 4 Feb
- Severe but localized ice storm over portions of the Mid-Hudson Valley (0.25-0.50" ice with localized amounts 0.50-0.75" ice accretion in Ulster Co. in the vicinity of Kingston)
- 16 consecutive hours of sleet at KALB totaling around 2" for the Capital District
- 8-16" snow for the Mohawk Valley, Lake George Area and southern Adirondacks



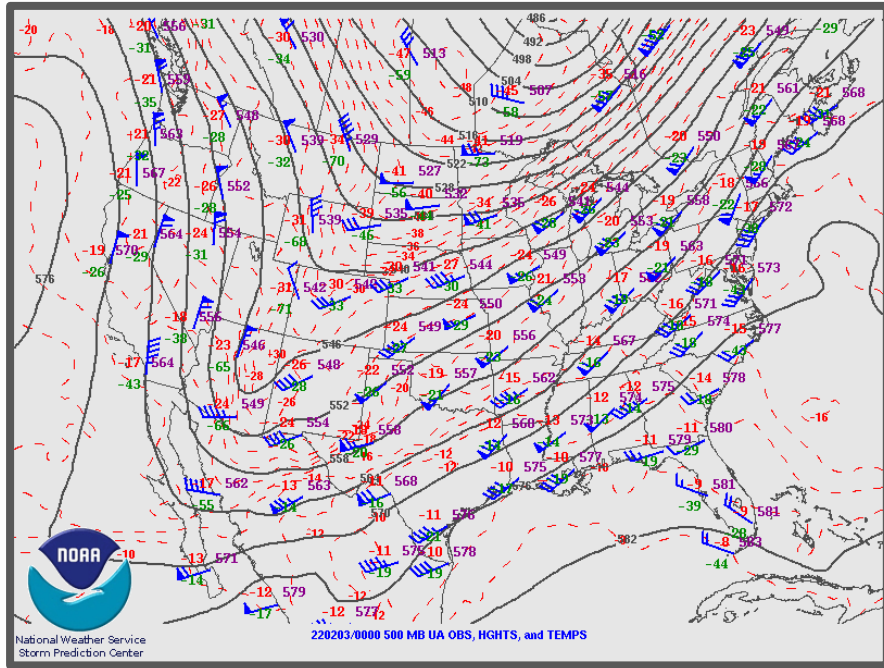
# 3-4 Feb 2022 Storm Total Ice and Snow/Sleet Maps



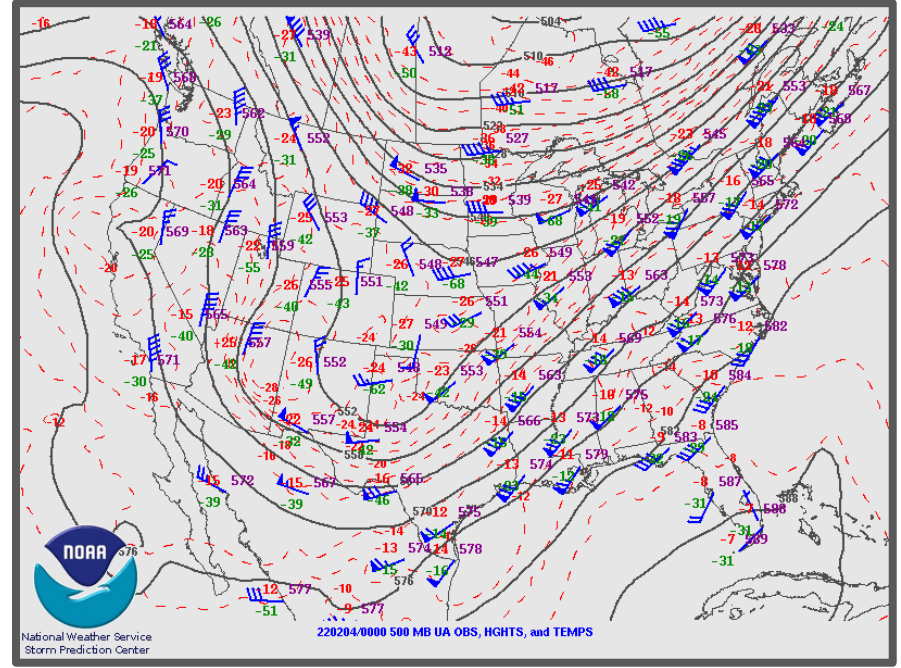
# 1200 Feb 3 -1200 UTC Feb 4 2022: 24-hr Liquid Equivalents



# 0000 UTC 3 & 4 FEB 2022 500 hPa Analyses

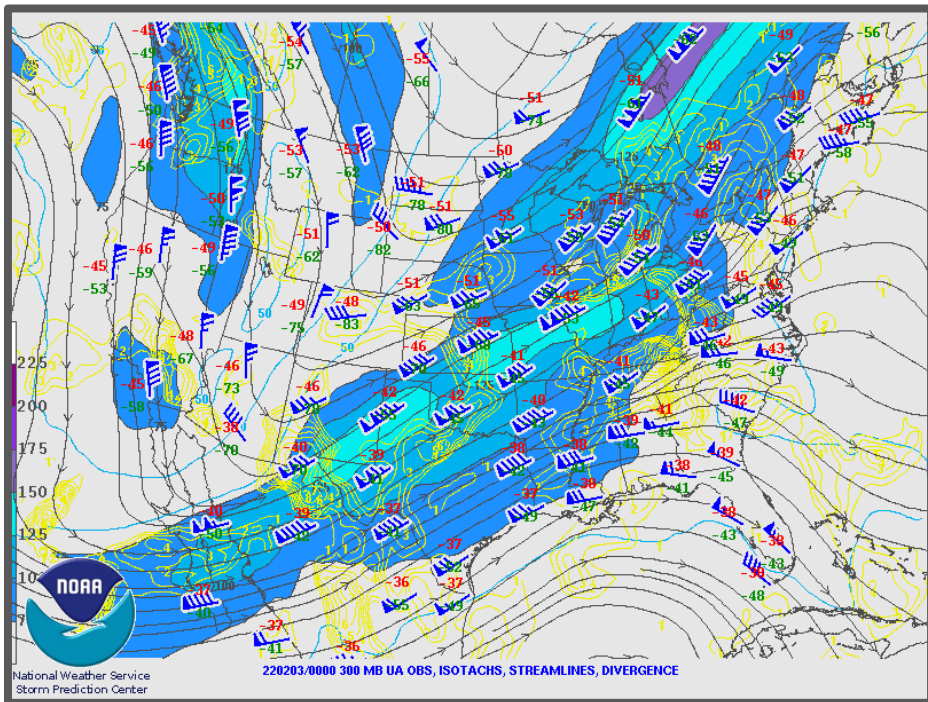


0000 UTC 3 FEB 2022

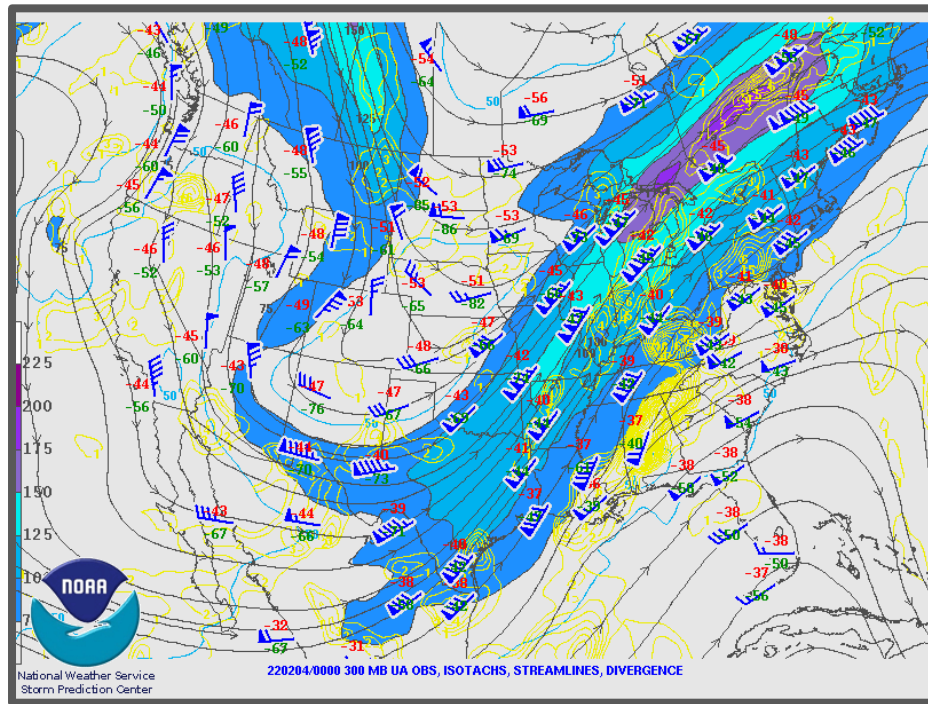


0000 UTC 4 FEB 2022

# 0000 UTC 3 & 4 FEB 2022 300 hPa Isotachs, Streamlines and Divergence

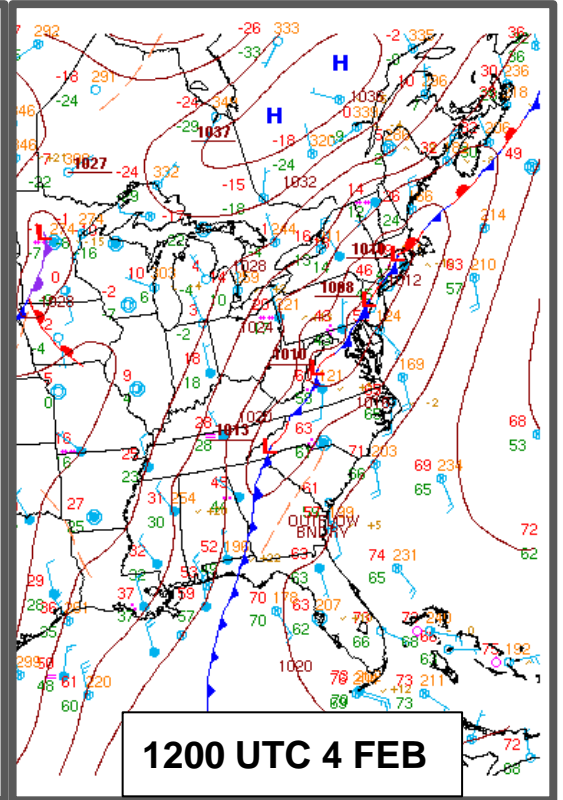
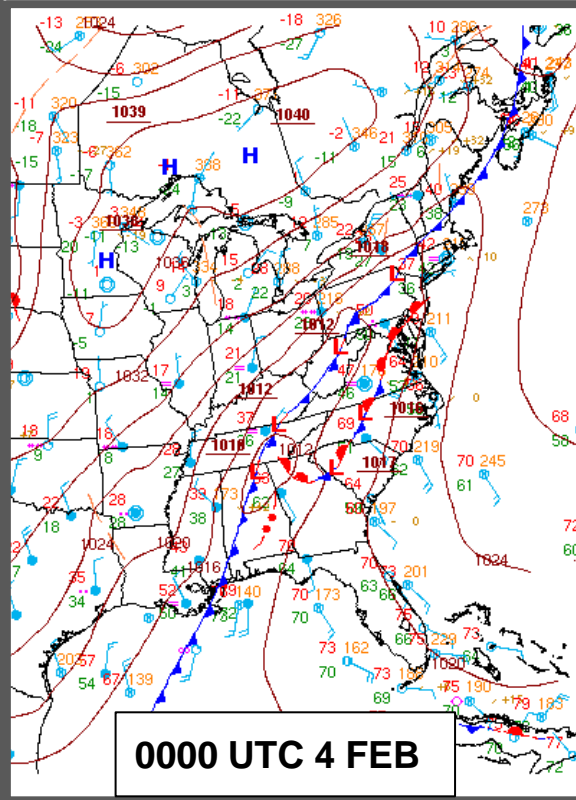
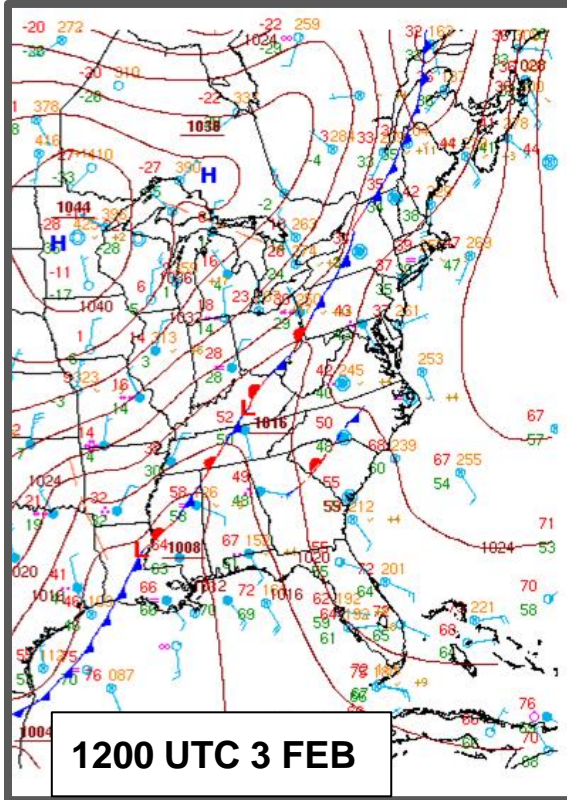


0000 UTC 3 FEB 2022



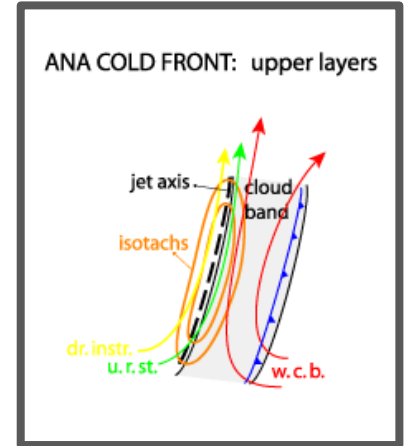
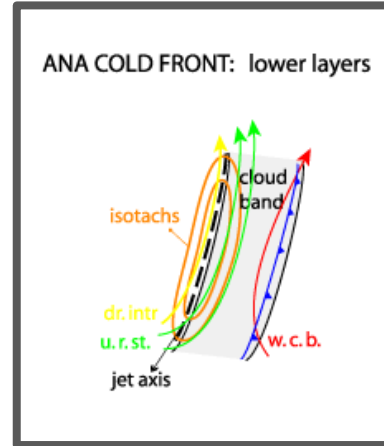
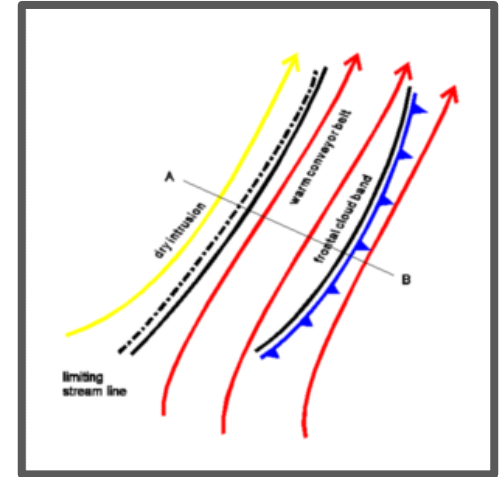
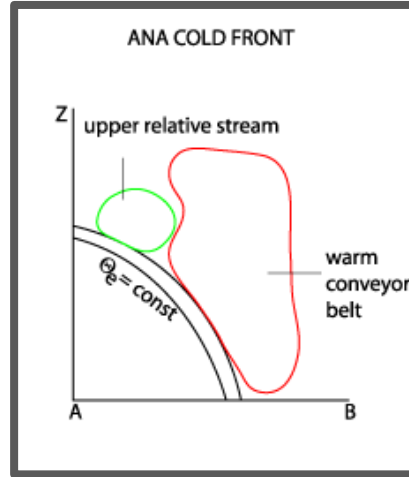
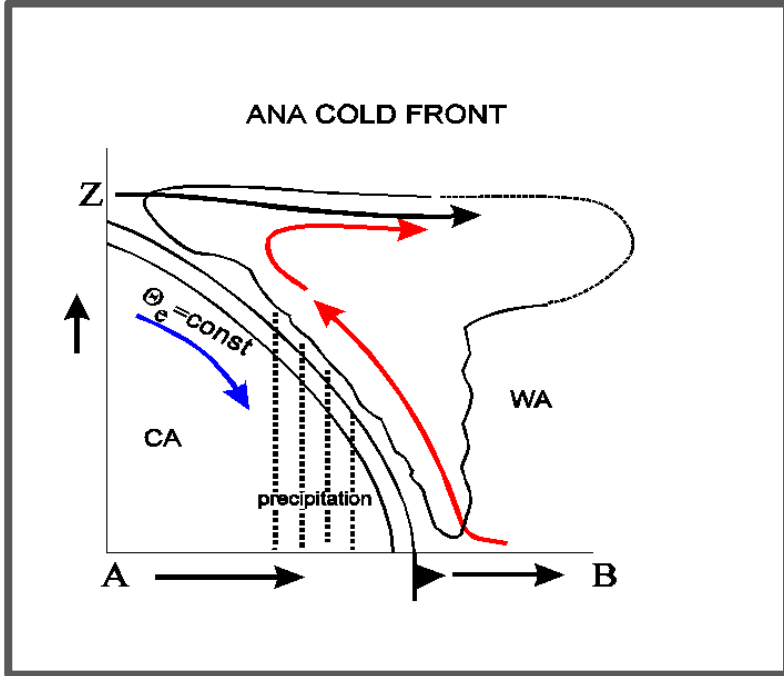
0000 UTC 4 FEB 2022

# 1200 UTC 3 Feb - 1200 UTC 4 Feb 2022 Surface Maps





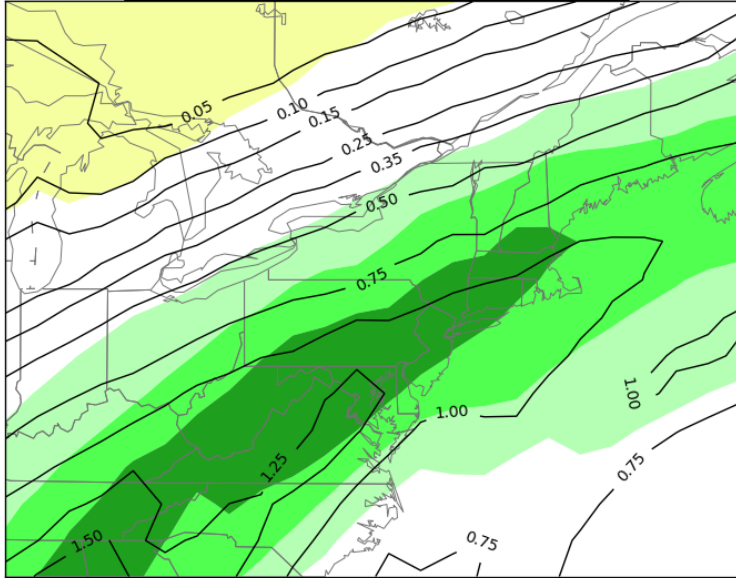
# Ana Cold Front Schematics



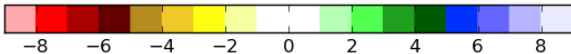
Source: <https://rammb.cira.colostate.edu/wmovl/vrl/tutorials/satmanu-eumetsat/satmanu/cms/cf/backgr.htm>

# 0000 UTC 3 Feb 2022 NAEFS PWAT Anomalies

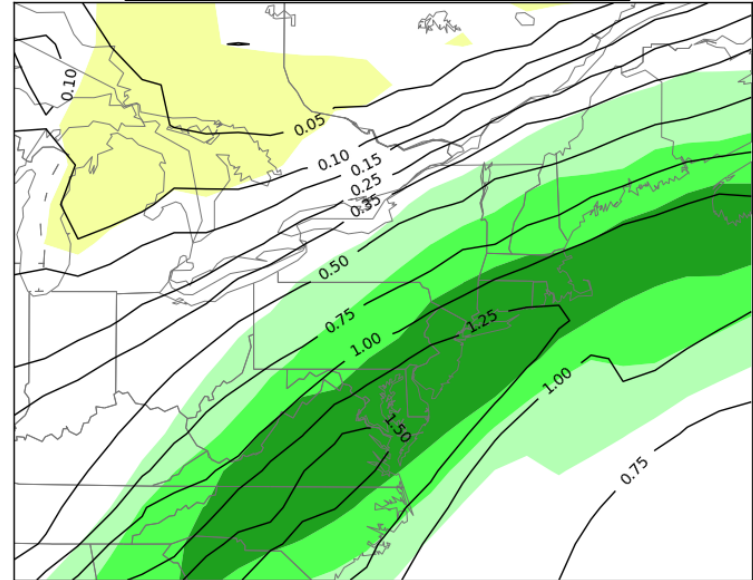
NAEFS Mean Precipitable Water (in) and Standardized Anomaly  
HOUR 024 - VALID 00:00 UTC Fri Feb 04 2022



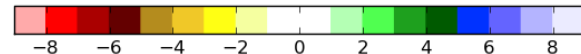
Relative to the 24-Jan to 14-Feb 1979-2009 CFSR climatology



NAEFS Mean Precipitable Water (in) and Standardized Anomaly  
HOUR 036 - VALID 12:00 UTC Fri Feb 04 2022



Relative to the 25-Jan to 15-Feb 1979-2009 CFSR climatology





# 0000 UTC 3 Feb 2022 NAEFS U and V-Wind Anomalies

U = Zonal Wind

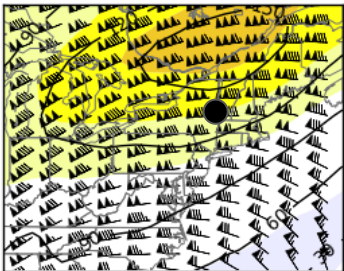
● Albany Area

V = Meridional Wind

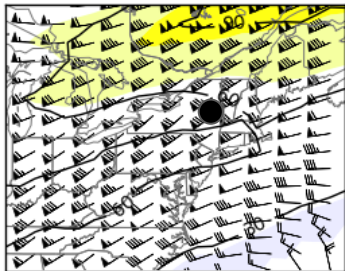
NAEFS Mean Zonal Wind (kt) and Standardized Anomaly

HOOR 024 - VALID 00:00 UTC Fri Feb 04 2022

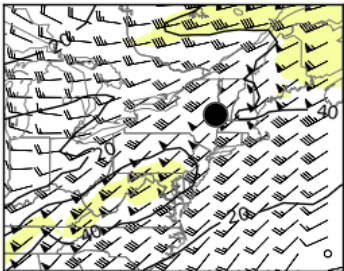
200 hPa



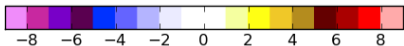
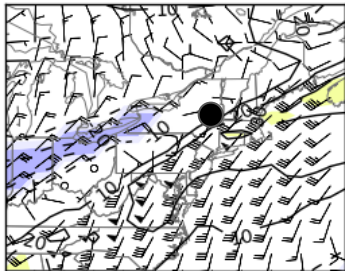
500 hPa



700 hPa



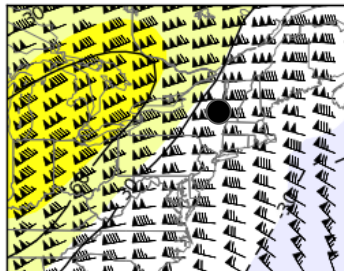
850 hPa



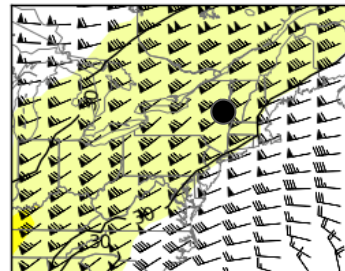
NAEFS Mean Meridional Wind (kt) and Standardized Anomaly

HOOR 024 - VALID 00:00 UTC Fri Feb 04 2022

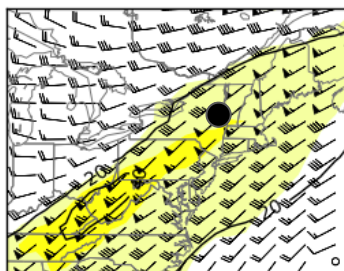
200 hPa



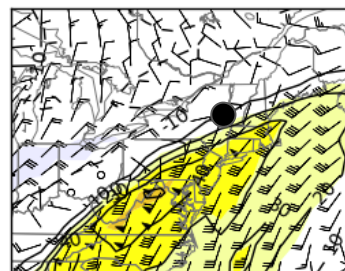
500 hPa



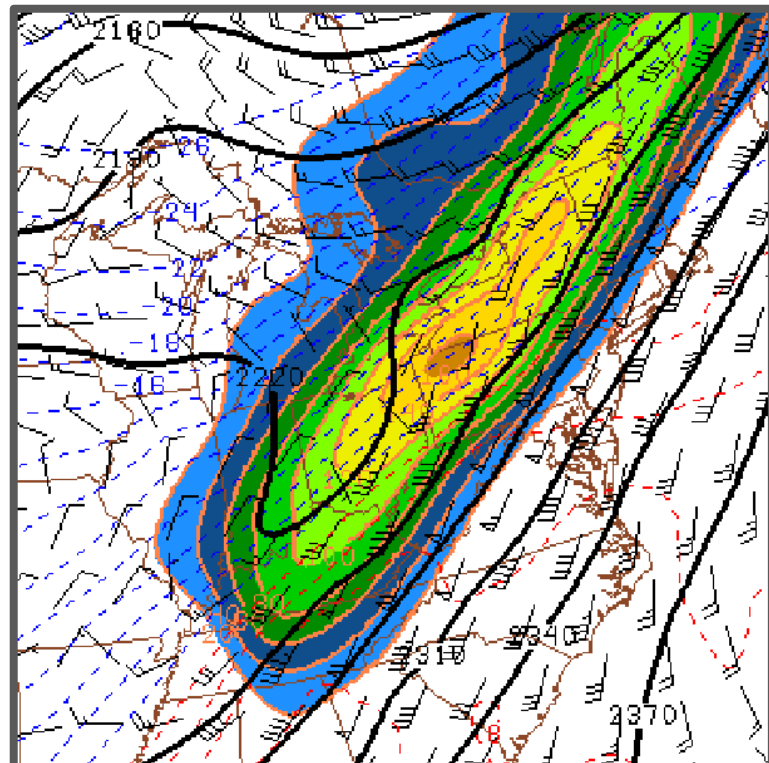
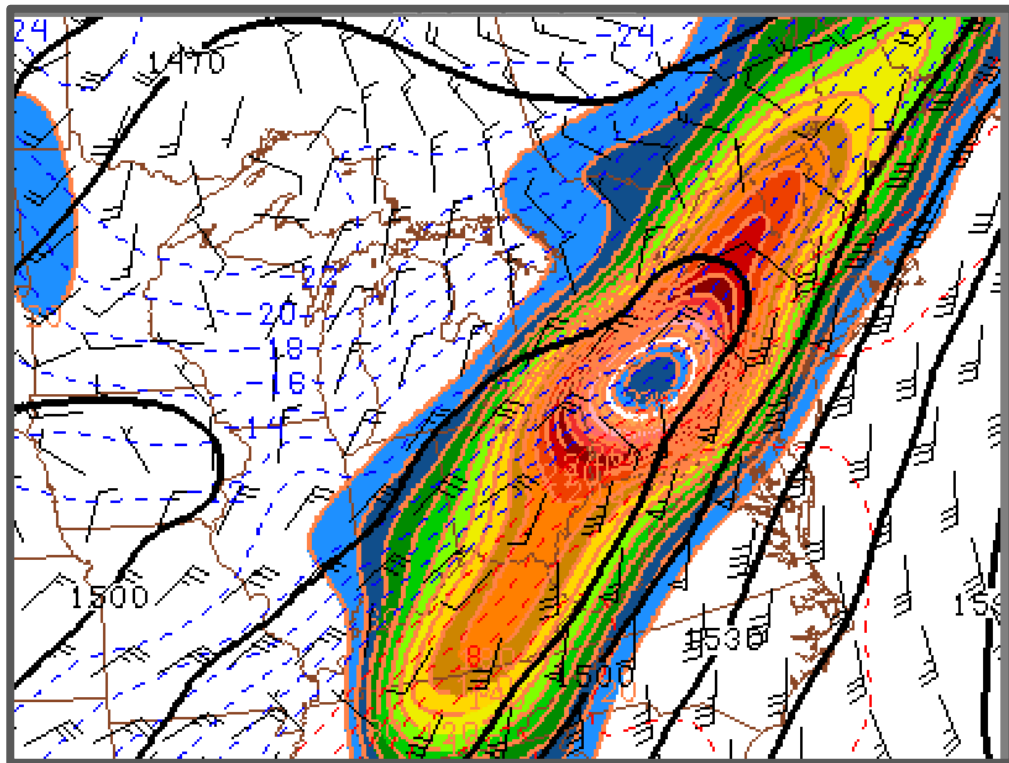
700 hPa



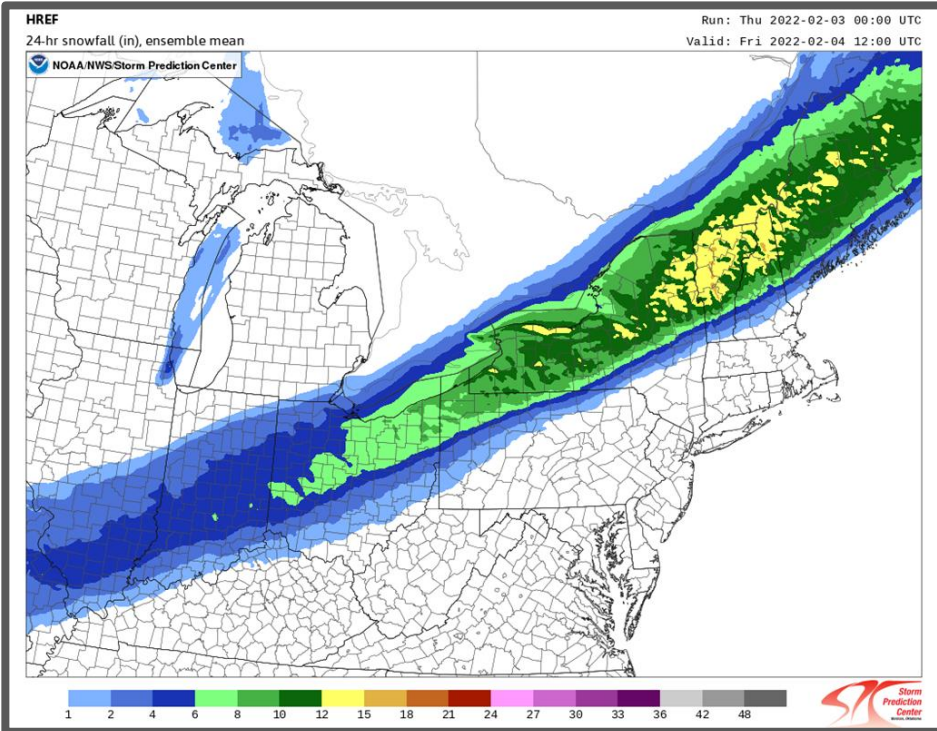
850 hPa



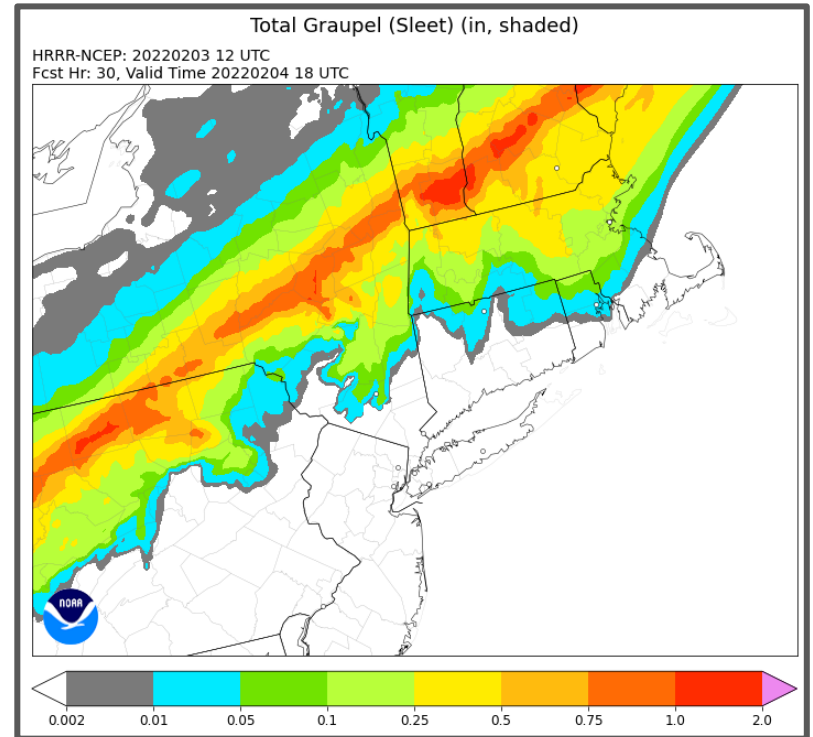
**0000 UTC 4 FEB 2022 RAPID REFRESH**  
**850 hPa & 850-700 hPa Petterssen Frontogenesis, Temp and Wind**



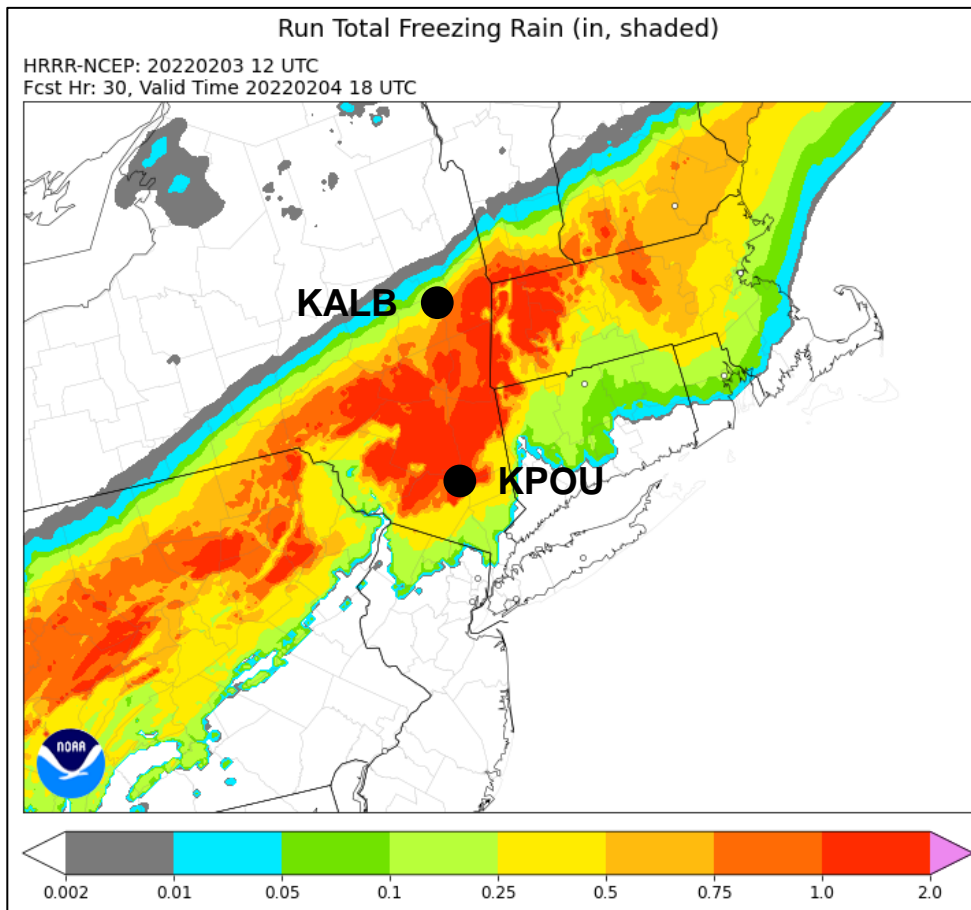
# 0000 UTC 3 FEB 2022 HREF Ensemble Mean Snowfall



# 1200 UTC 3 FEB 2022 HRRR Total Accumulated Sleet (for event)



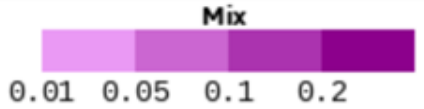
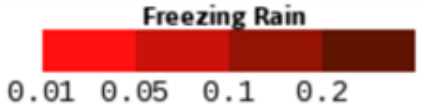
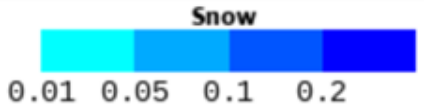
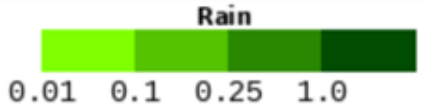
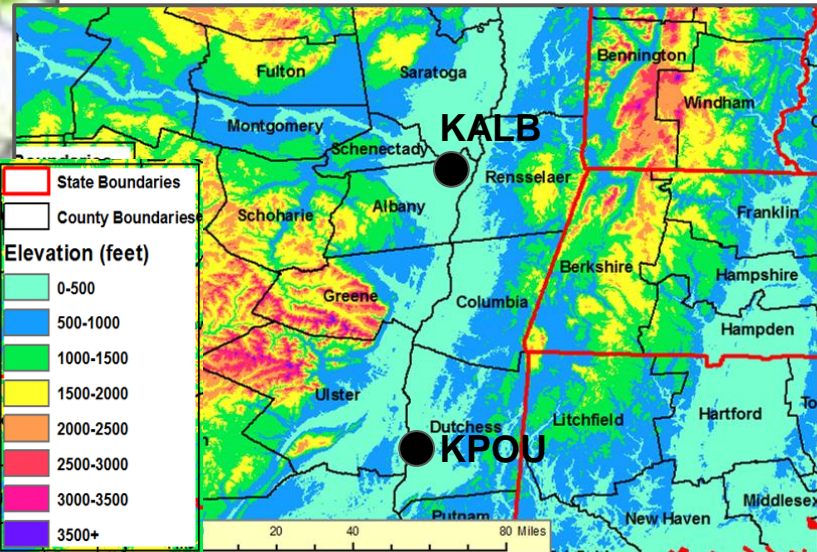
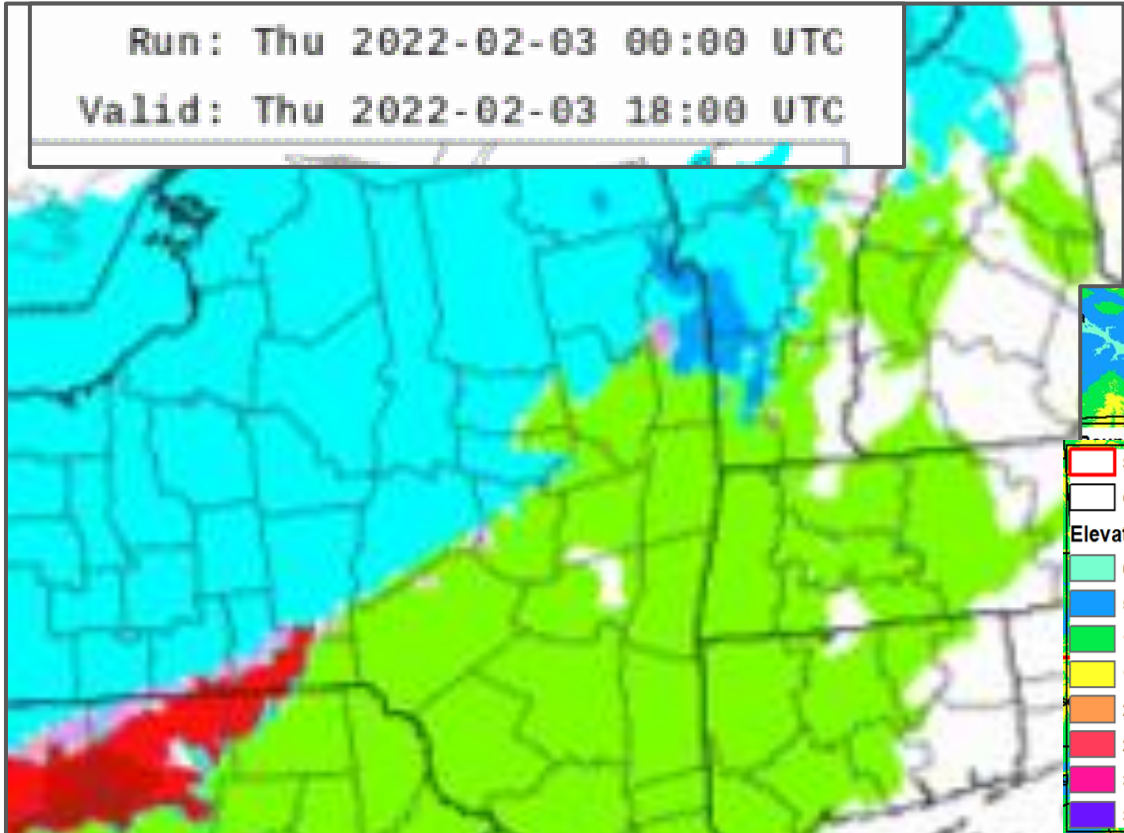
# 1200 UTC 3 FEB HRRR Accumulated Freezing Rain



13 UTC 3 Feb  
HREF P-Types  
Valid 00–21 UTC 4 Feb

Run: Thu 2022-02-03 00:00 UTC  
Valid: Thu 2022-02-03 18:00 UTC

Local Topography





# Critical P-Type Uncertainties

- **How far north would the warm nose be located in the forecast area?**
- **How quickly would shallow subfreezing near-surface air drain southward down the Hudson Valley to result in a change from rain to freezing rain?**
- **How quickly would that subfreezing layer deepen, resulting in a transition from freezing rain to sleet or snow?**

# 00Z 3 Feb KALB BUFKIT Soundings valid 06Z 4 FEB

GFS20

Deep sub-freezing layer and below 0C throughout, so snow forecasted, but too soon...

→ 17 \* 27 kts  
→ 16 \* 20 kts

2/04/22 6:00Z

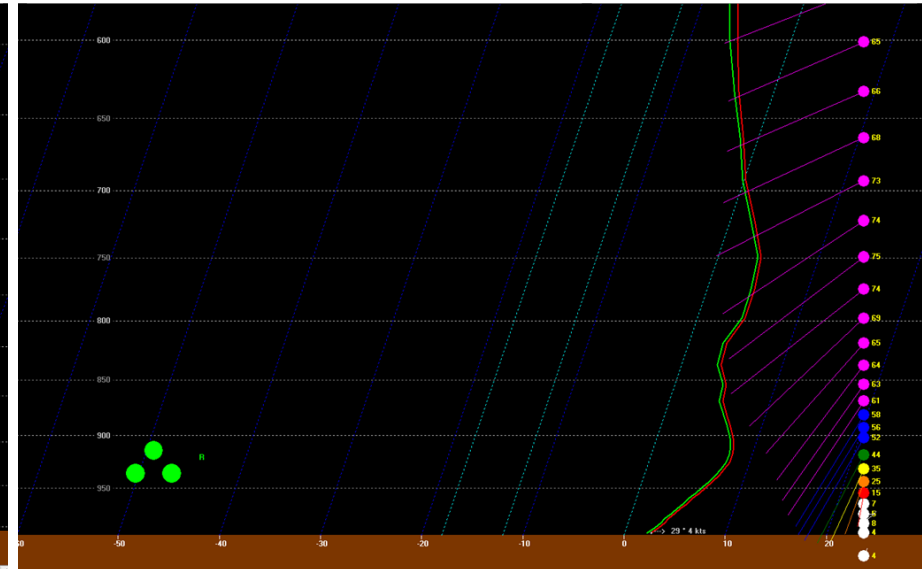
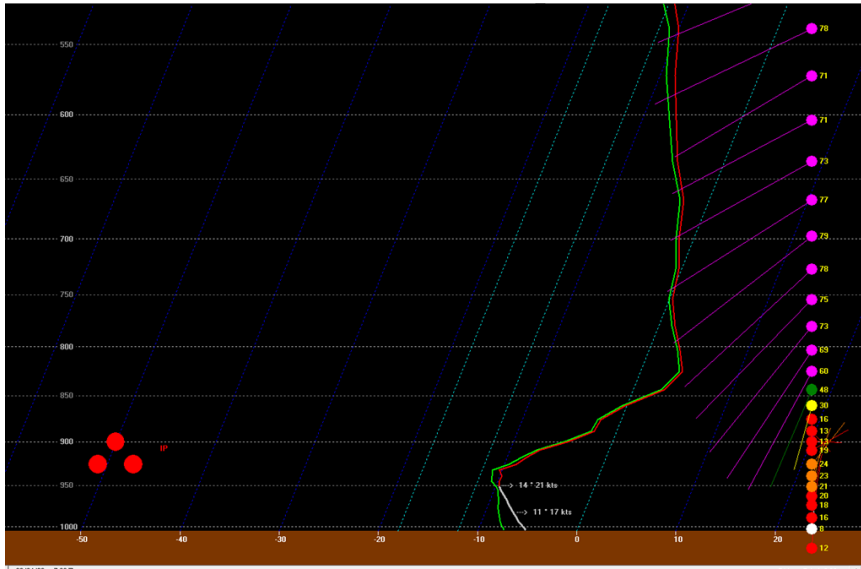
NAM3

Deep near-surface cold wedge (~ 5 kft) and shallower warm air aloft indicative of a quicker change over to sleet

→ 23 \* 24 kts  
→ 22 \* 19 kts

2/04/22 6:00Z

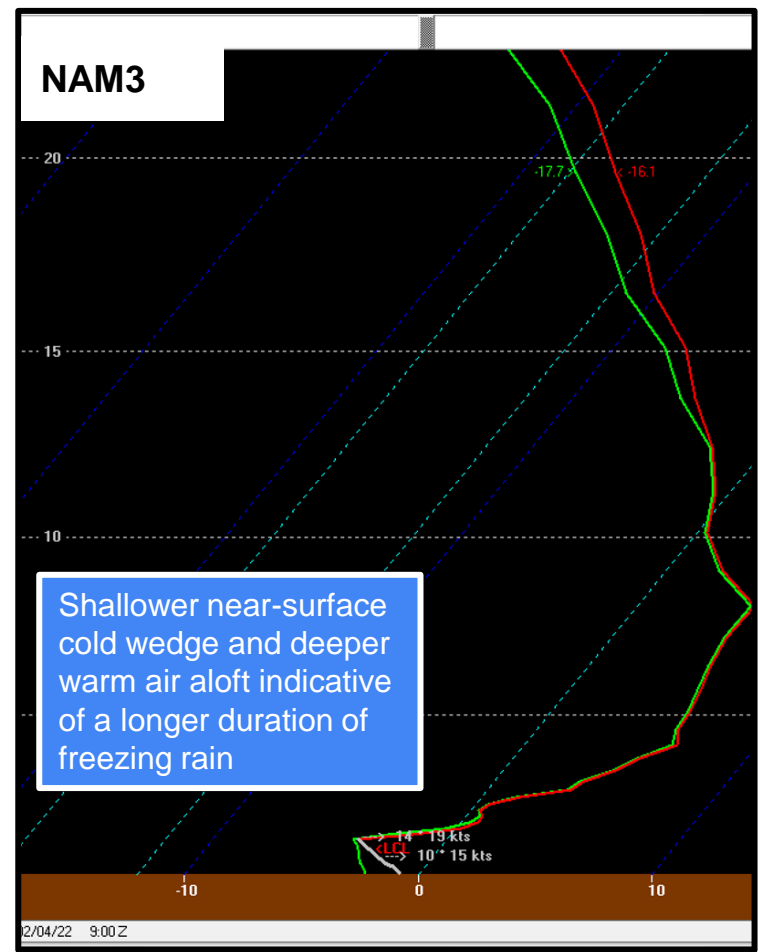
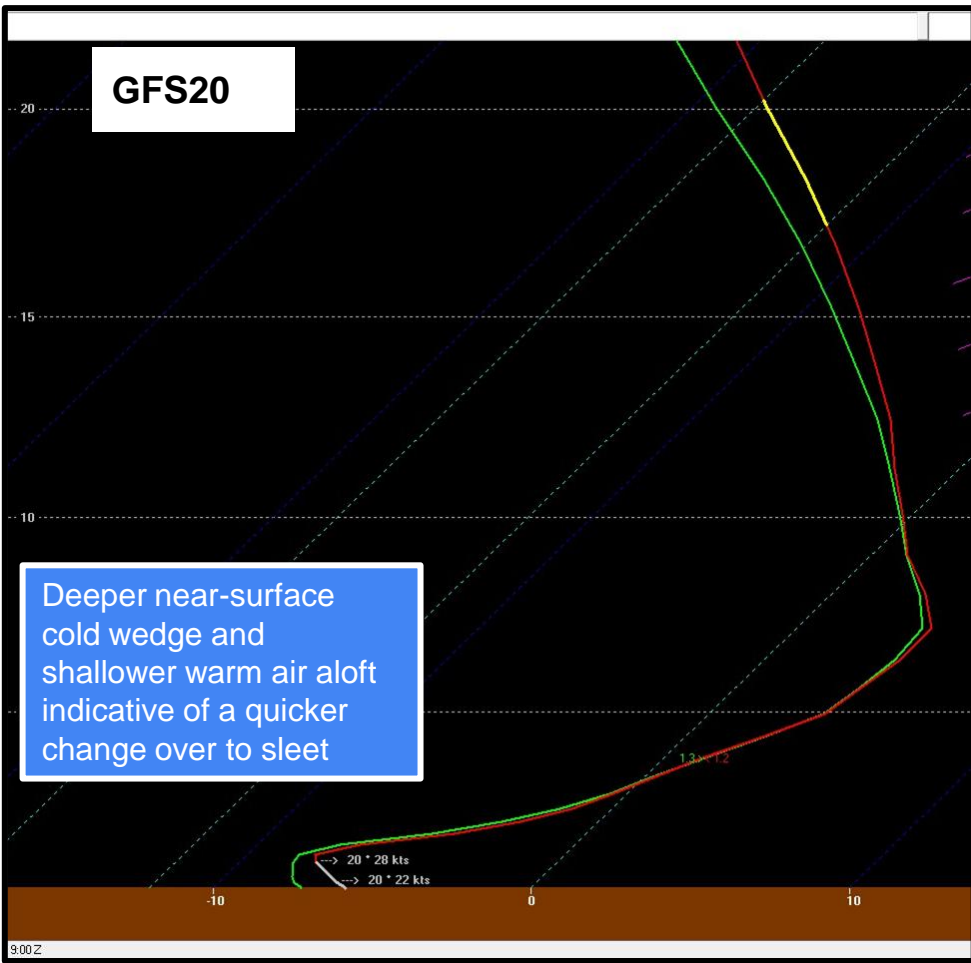
# 00Z NAM BUFKIT Soundings: KALB vs KPOU: F07Z 4 FEB 2022



“Sleet bomb” for KALB, as several hours occurred

Rain forecasted at KPOU, with a transition to FZRA by 10Z

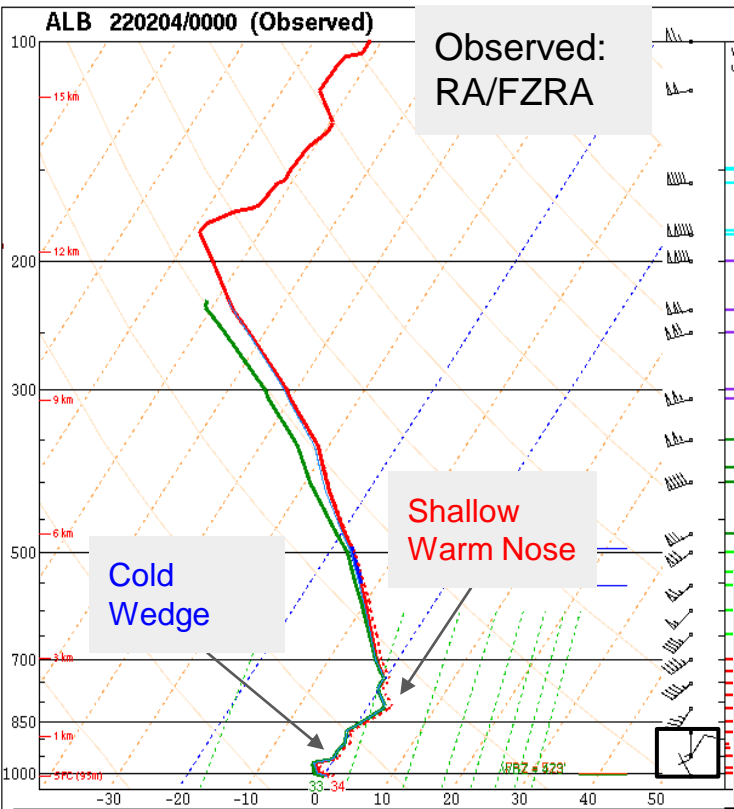
# 00Z 3 Feb KPOU BUFKIT Soundings valid 09Z 4 FEB 2022



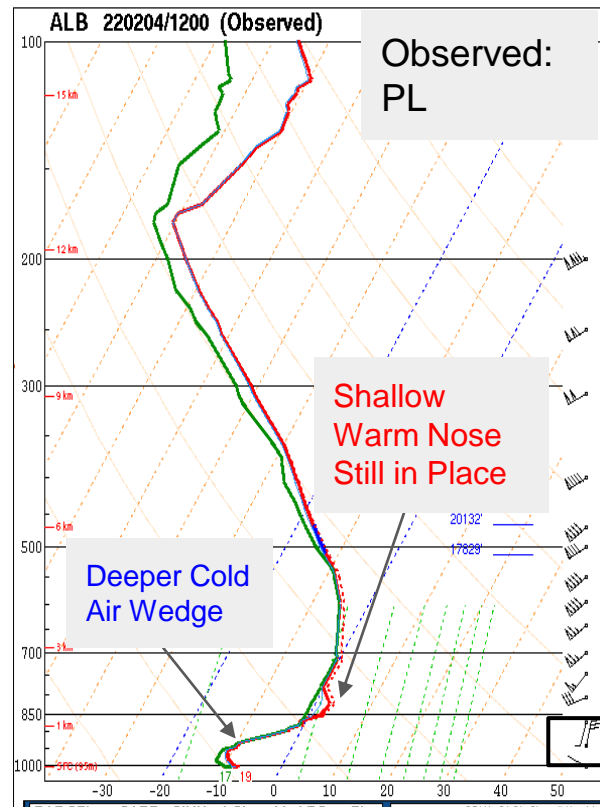
# **Observational Sounding Analysis**

# ALY Sounding Analysis

\*Cold wedge depth ~3300 ft & extended almost to 850 hPa ...sufficient to refreeze partially melted hydrometeors to sleet\*



Northerly low-level winds advecting cold air down Hudson Valley

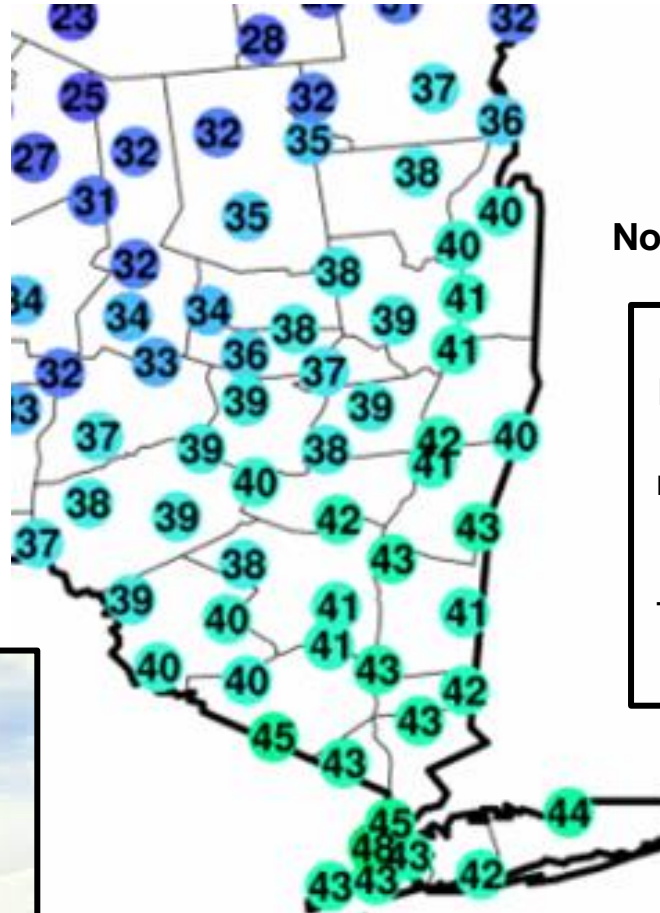


Northerly winds continue



**Temp Loop :**  
**Noon 3 Feb (Thu) to 10 am 4 Feb (Fri)**

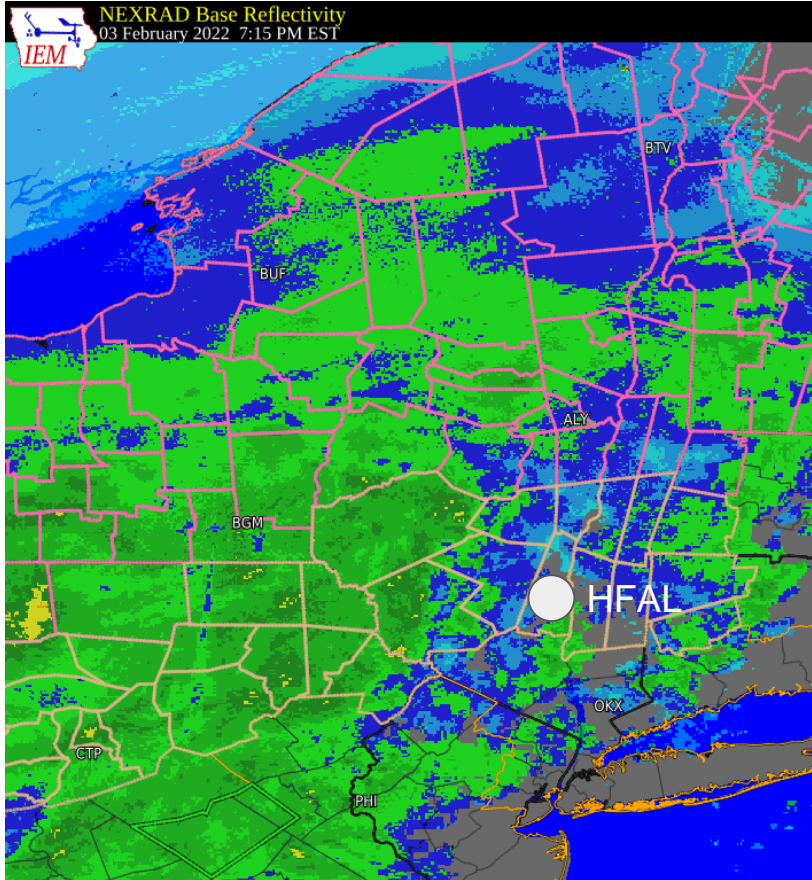
Initially mild air mass on Thursday Feb 3 before a cold front gradually tracked southward and allowed much colder air to filter southward, causing all of eastern NY to drop below freezing by Thurs evening. Temperatures remained in the 20s into Friday Feb 4.



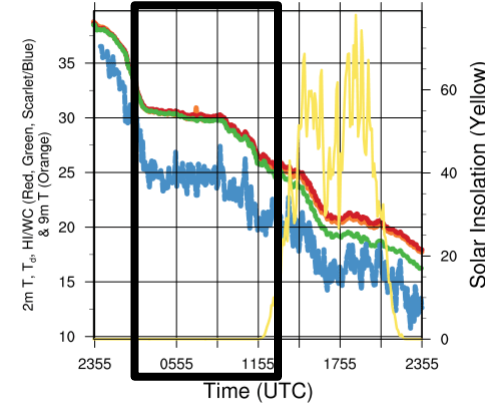
Temperature (°F)  
Thursday, 2022-02-03  
At 12:00 PM



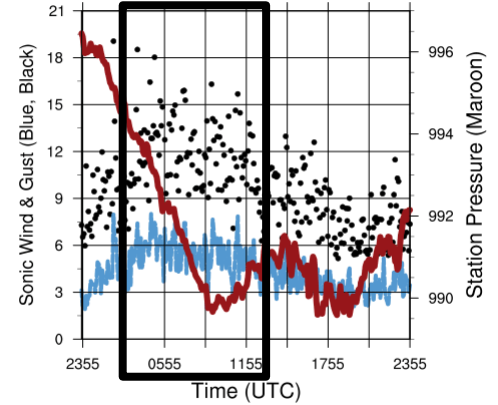
# Obs: Radar & HFAL Meteogram



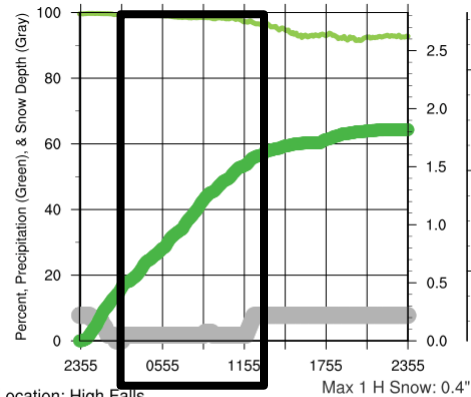
Temperature (F) & Insolation ( $W/m^2$ )



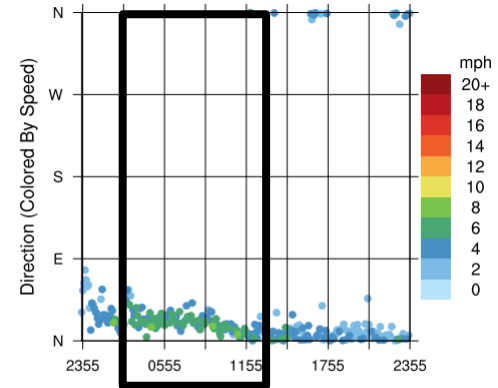
Winds (mph) & Pressure (mb)



Relative Humidity (%) & Precipitation (in)



Wind Direction



Location: High Falls

Station elevation: 193.121 m

Station lat/lon: 41.7988; -74.1231

Figure created on Fri, 2022-02-04, at 23:59 UTC

Most recent data timestamp: 2022/02/04 23:55:00

Extremes For Past 24 Hours  
(High/Low/Max Wind/Precipitation/Snow Depth)

**38.6/17.9/8/1.82/5.1**

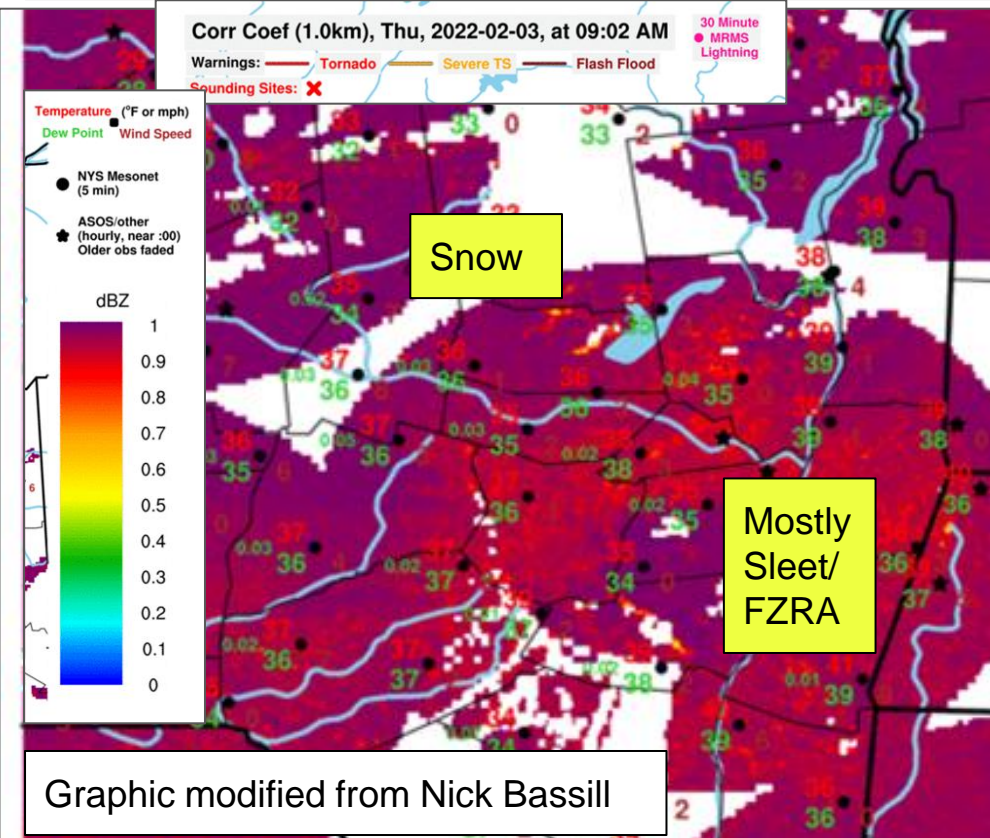
Max Gust: 19.1 mph On 02/04 at 0215 UTC

Created By Nick Bassill Using Data Provided By The NYS Mesonet



# Correlation Coefficient and Observations

KENX CC Loop and NYSM obs 10 am 3 FEB (Thu) to 1 pm 4 FEB (Fri)



Graphic modified from Nick Bassill



## National Weather Service Albany New York

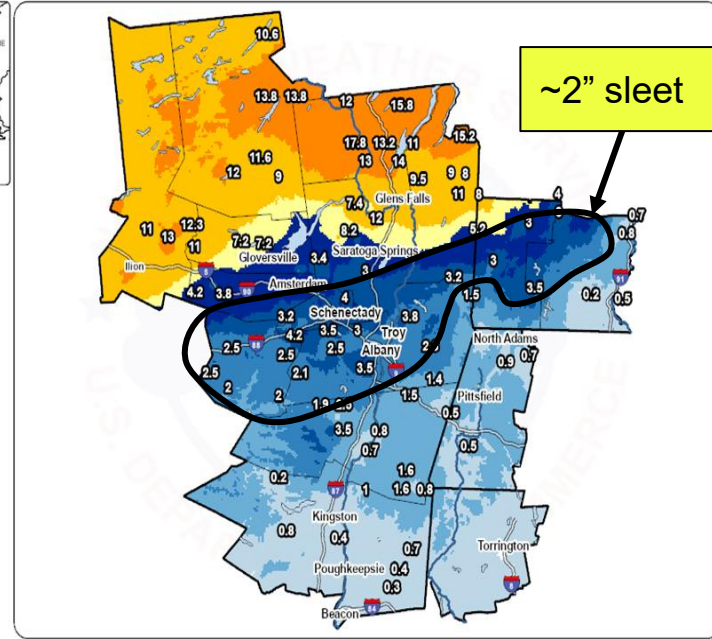
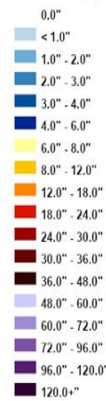
Snowfall Analysis 02/03/2022 07:00AM to 02/05/2022 07:00AM EST

Analysis Data Source: Regional Observations



Created: 02/09/2022 09:11AM

### Snowfall (in)

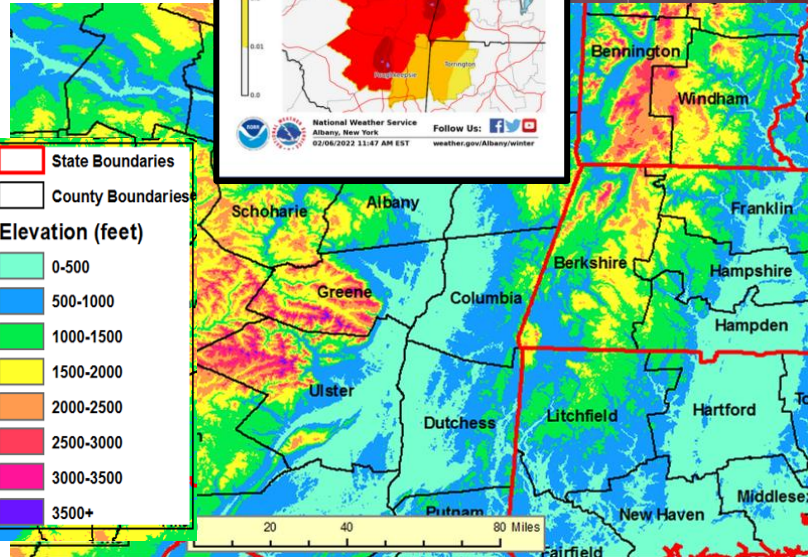
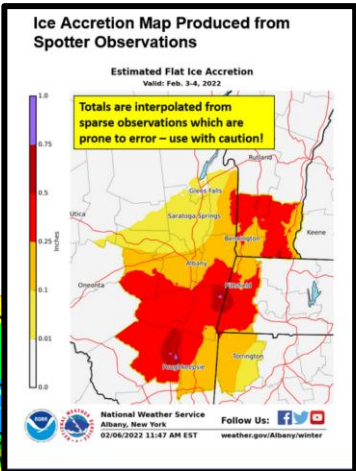


This is an experimental product of the NWS GAZPACHO software package. Care should be taken in using the data. Unofficial observations may be plotted. Values at interpolated locations may not represent actual reports at that location.



# GOES-16 Day Snow Fog RGB

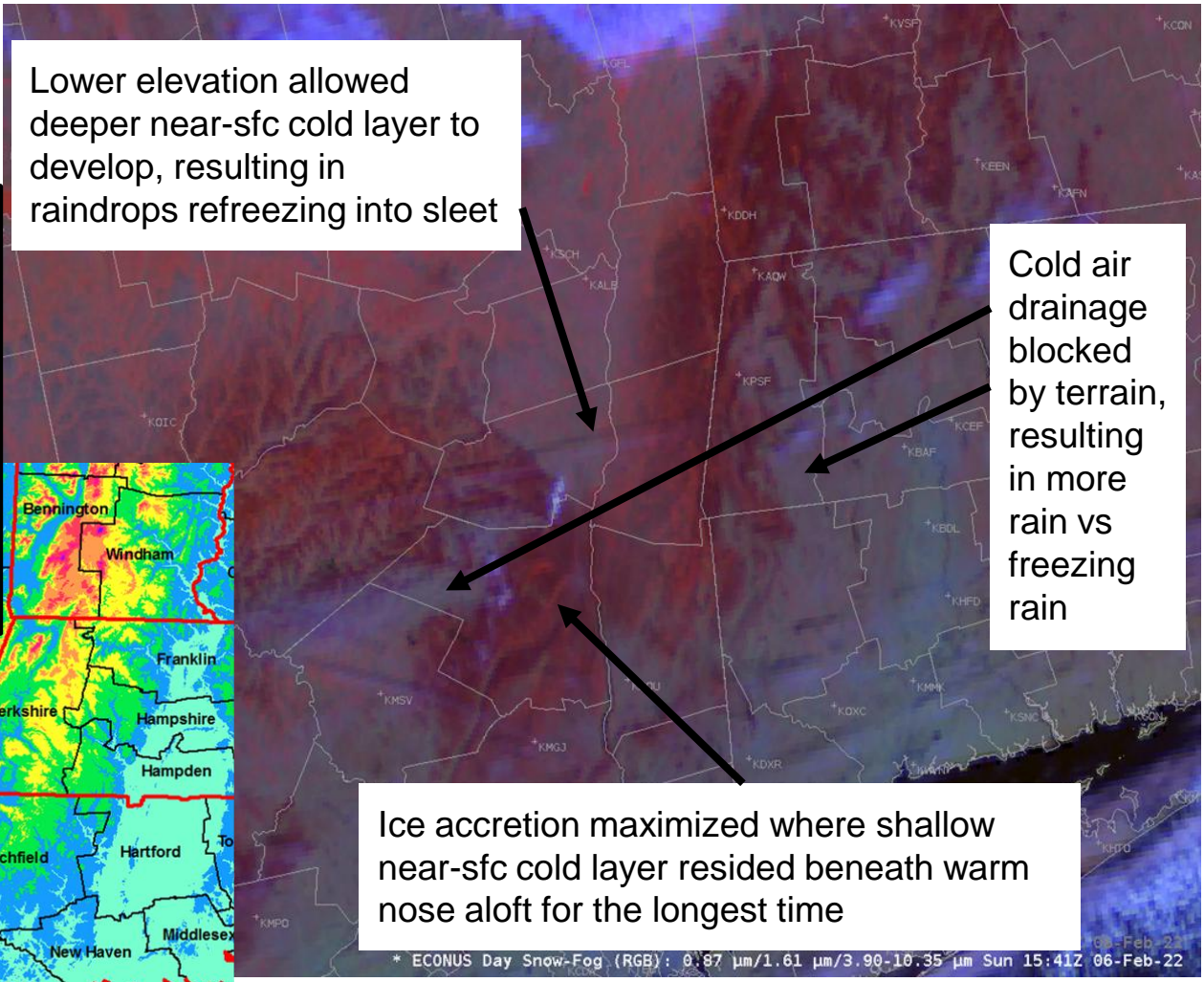
Dark colors correspond to greater ice accretion



Lower elevation allowed deeper near-sfc cold layer to develop, resulting in raindrops refreezing into sleet

Cold air drainage blocked by terrain, resulting in more rain vs freezing rain

Ice accretion maximized where shallow near-sfc cold layer resided beneath warm nose aloft for the longest time



Beacon, NY  
Elevation: 296 ft

Walkill, NY  
Elevation: 354 ft

Red Hook, NY  
Elevation: 213 ft

## NYS Mesonet Cameras Valley v. Terrain

We can infer low-level  
elevation sites iced over and  
higher elevation sites were not.

Claryville, NY  
Elevation: 1915 ft

Copake, NY  
Elevation: 685 ft

Tannersville, NY  
Elevation: 2334 ft

# Conclusions

- A plume of highly anomalous moisture persisted over the Northeast for nearly 48 hours resulting in a prolonged period of heavy precipitation (PWAT anomalies +2 to +4 STDEVs above normal)
- Favorable upper level jet dynamics (right entrance region of 150-200 kt jet streak near eastern NY) with associated upper level divergence aloft for heavy pcpn event
- Tight low-level baroclinic zone with upper jet aloft and strong 2-D FGEN in the 850-700 hPa layer contributed to strong forcing for ascent for heavy mixed precipitation

# Conclusions

- Mild thermal profiles supported rain for the onset, but an ana cold front late pm/early evening 3 Feb resulted in northerly wind shift in the low-levels with cold air draining southward with weak waves moving along front
- Prominent SW flow aloft continued overnight 3 Feb and the warm nose aloft combined with a deepening sub-freezing cold wedge to support sleet (I-90/Capital District) and freezing rain (mid-Hudson Valley, NW CT, southern Taconics). Morning Area Forecast Discussion (AFD) 3 FEB 2022 mentioned sleet accums 0.50 - 2.0”
- NYSM observations, satellite and KENX radar assisted determining challenging ptypes during and after the event

# Future Wish List

- More frequent upper air launches with mixed precipitation events (3-hr/6-hr intervals). Much appreciation from the WINTRE-Mix project this past cool season. Can we continue this?
- Physical-Social-Economic-Behavior Science “newer” research study on the impacts of sleet and ice events. For example, the jump downward from 1.25” flat/0.5” radial ice to 0.50” flat/0.2” radial ice was extreme for ice/winter warnings in the Northeast (i.e. ALY WFO forecast area). Do to a 10-year study on events to achieve better criteria based on impacts, etc. **Suggested proposal would be 1.0” flat/0.4” radial ice criteria for warnings north of the NYC corridor and Long Island.**