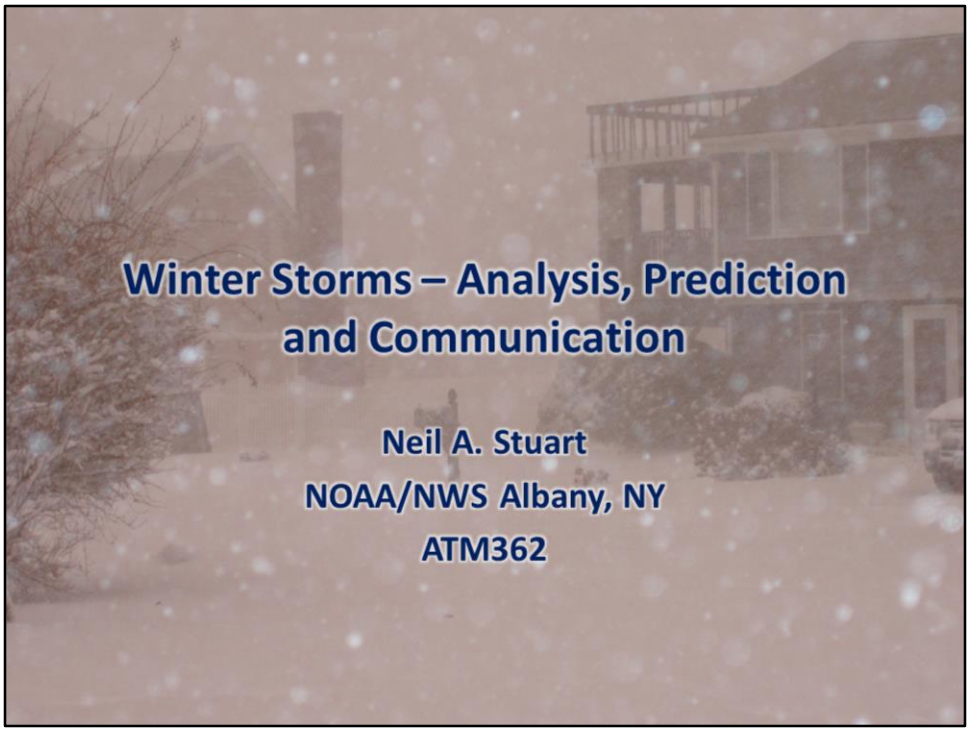
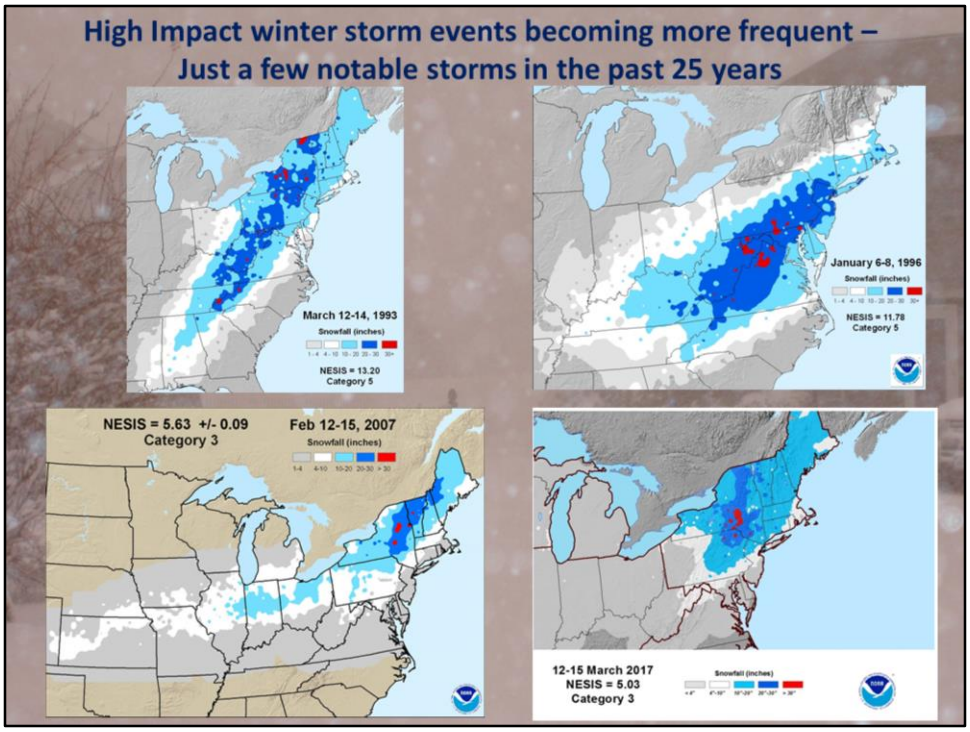
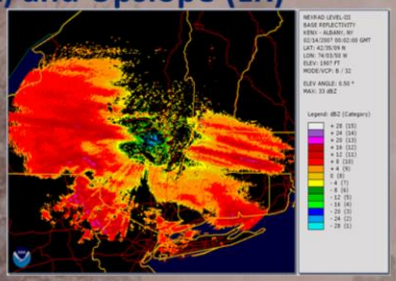
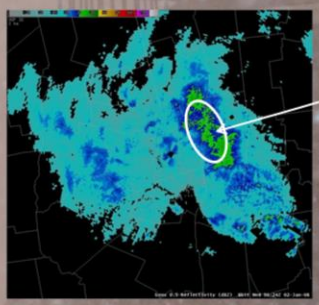
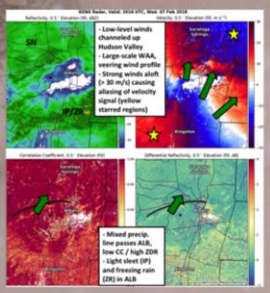

Winter Storms – Analysis, Prediction and Communication
Neil A. Stuart
NOAA/NWS Albany, NY
ATM362

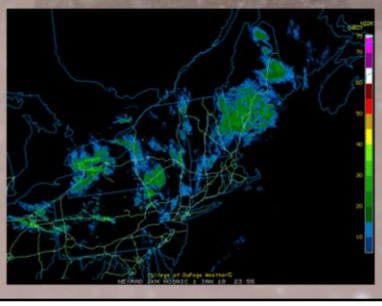

High Impact winter storm events becoming more frequent –
Just a few notable storms in the past 25 years
March 12-14, 1993
Snowfall (inches)
NESIS = 13.20
Category 5
January 6-8, 1996
Snowfall (inches)
NESIS = 11.78
Category 5
NESIS = 5.63 +/- 0.09
Category 3
Feb 12-15, 2007
Snowfall (inches)
12-15 March 2017
NESIS = 5.03
Category 3
Snowfall (inches)

Many types of threats – Mesoscale Banding (UL), Mohawk/Hudson Convergence (UR), Mixed Precipitation (LL) and Upslope (LR)

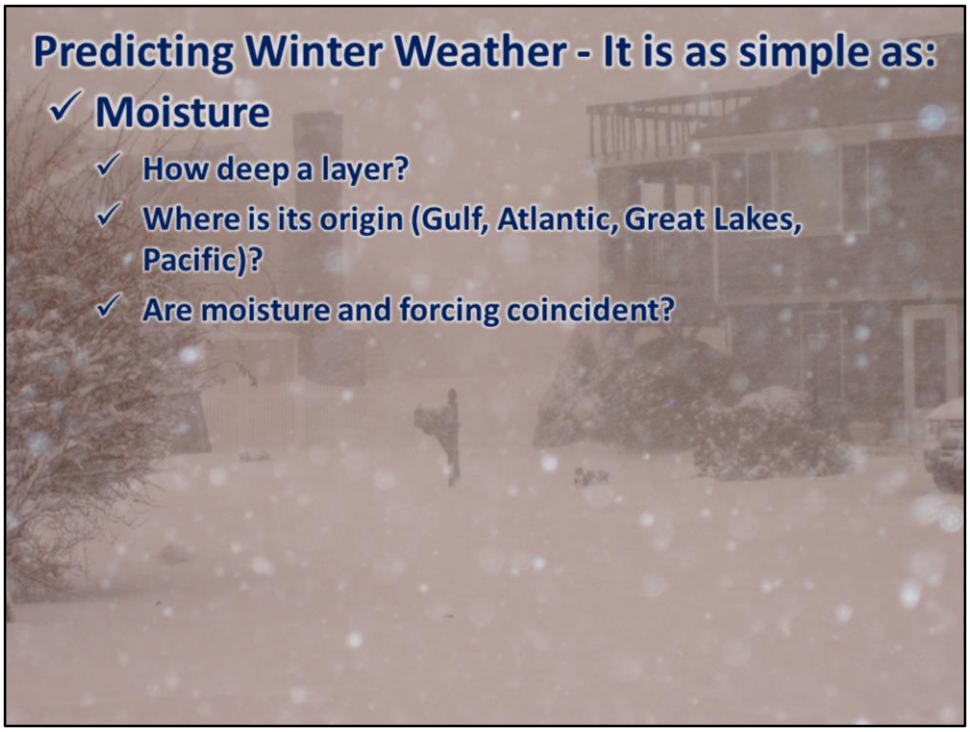


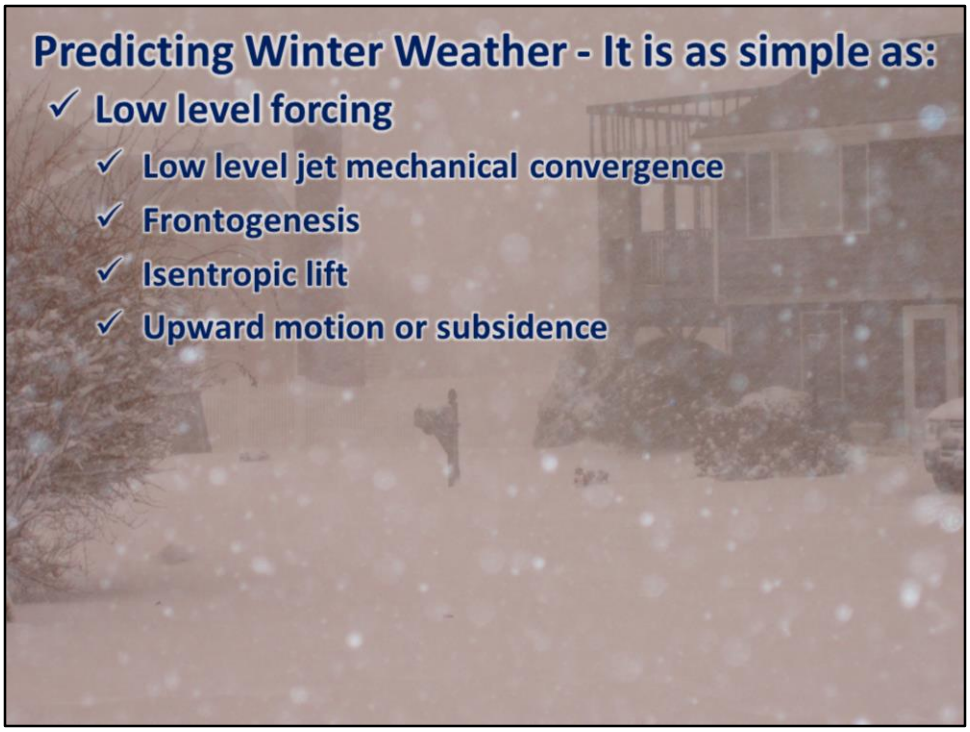


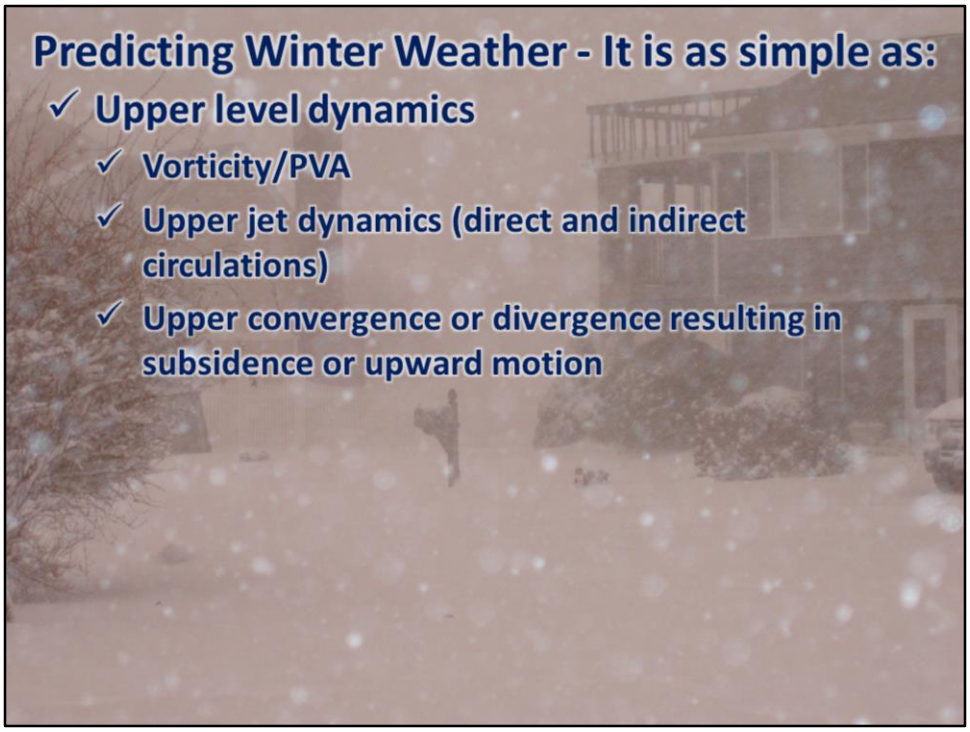


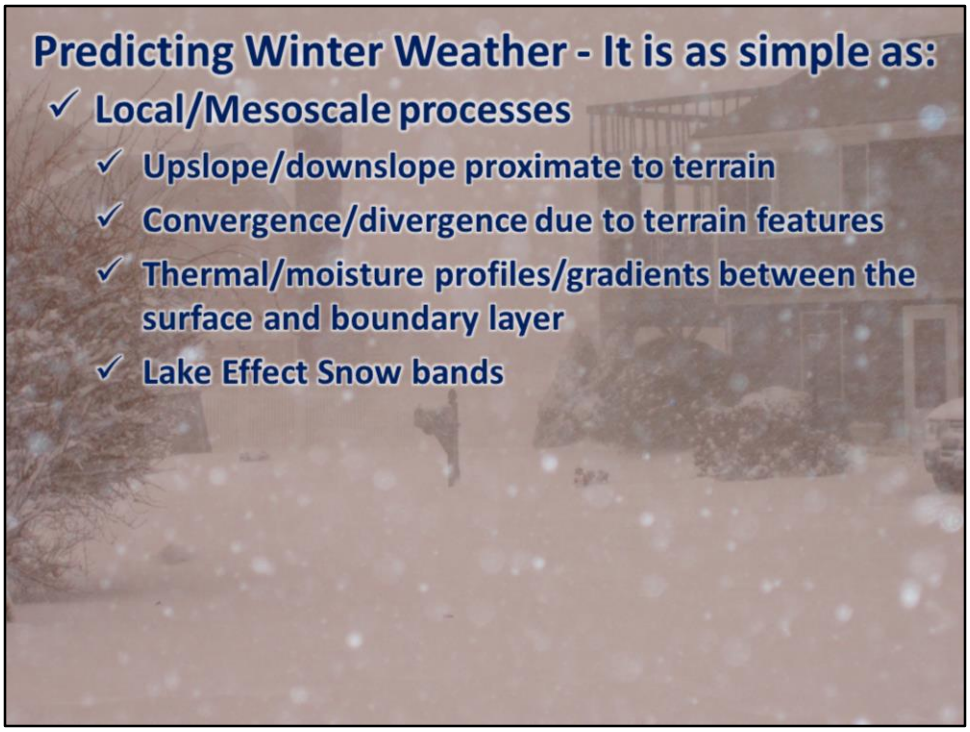


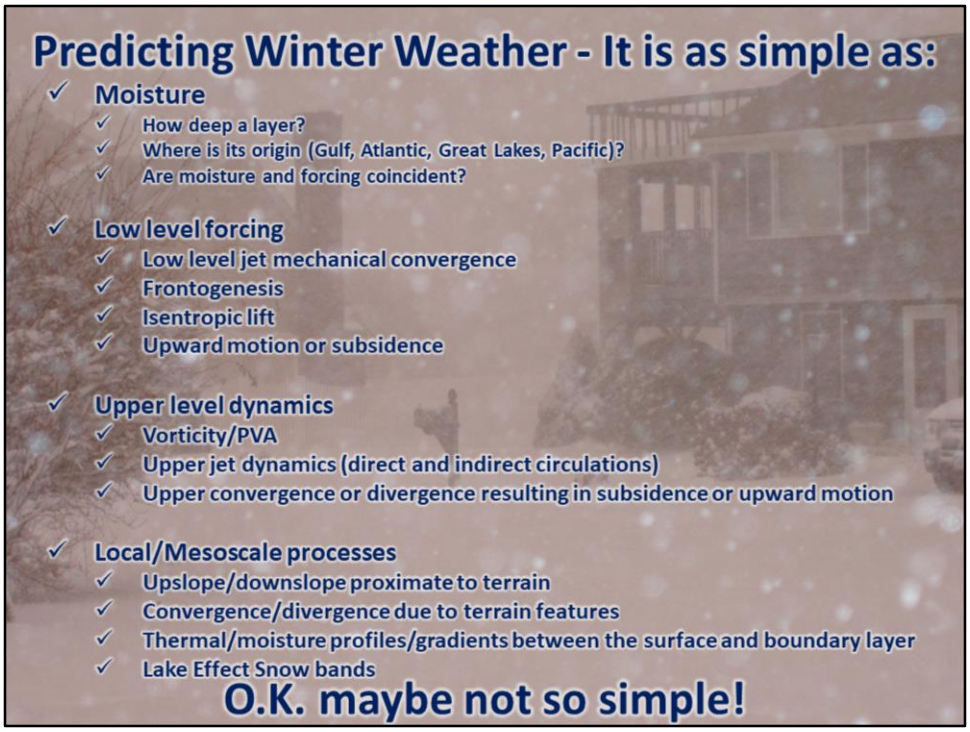

Predicting Winter Weather - It is as simple as:


Predicting Winter Weather - It is as simple as:
✓ Moisture
✓ How deep a layer?
✓ Where is its origin (Gulf, Atlantic, Great Lakes, Pacific)?
✓ Are moisture and forcing coincident?


Predicting Winter Weather - It is as simple as:
✓ Low level forcing
✓ Low level jet mechanical convergence
✓ Frontogenesis
✓ Isentropic lift
✓ Upward motion or subsidence


Predicting Winter Weather - It is as simple as:
✓ Upper level dynamics
✓ Vorticity/PVA
✓ Upper jet dynamics (direct and indirect circulations)
✓ Upper convergence or divergence resulting in subsidence or upward motion


Predicting Winter Weather - It is as simple as:
✓ Local/Mesoscale processes
✓ Upslope/downslope proximate to terrain
✓ Convergence/divergence due to terrain features
✓ Thermal/moisture profiles/gradients between the surface and boundary layer
✓ Lake Effect Snow bands


Predicting Winter Weather - It is as simple as:
Moisture
How deep a layer?
Where is its origin (Gulf, Atlantic, Great Lakes, Pacific)?
Are moisture and forcing coincident?
Low level forcing
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Local/Mesoscale processes
Upslope/downslope proximate to terrain
Convergence/divergence due to terrain features
Thermal/moisture profiles/gradients between the surface and boundary layer
Lake Effect Snow bands
O.K. maybe not so simple!

Outline

- ✓ Synoptic Analysis
  - ✓ Conceptual Models – Longwave patterns, Pattern recognition
  - ✓ Data, Deterministic NWP Models, Ensembles, Anomalies
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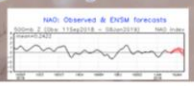
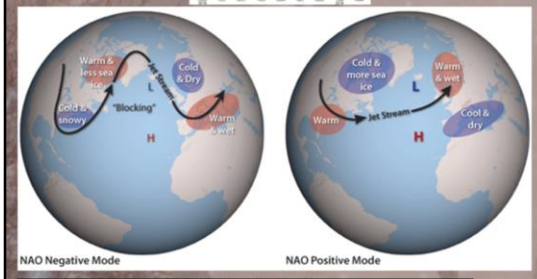
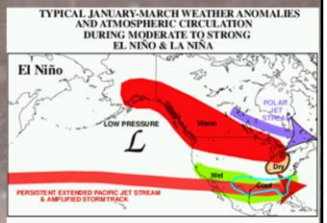
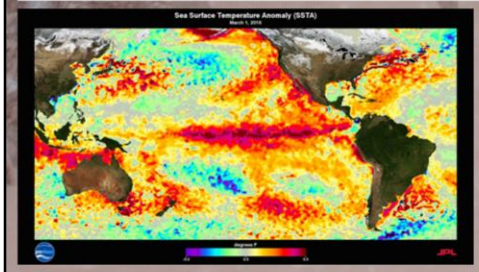
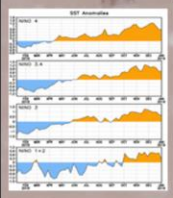
Large scale pattern recognition – (Just a few examples below among many other large scale patterns/oscillations)

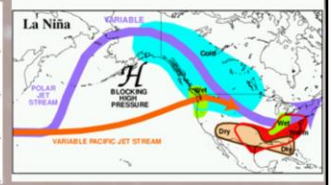




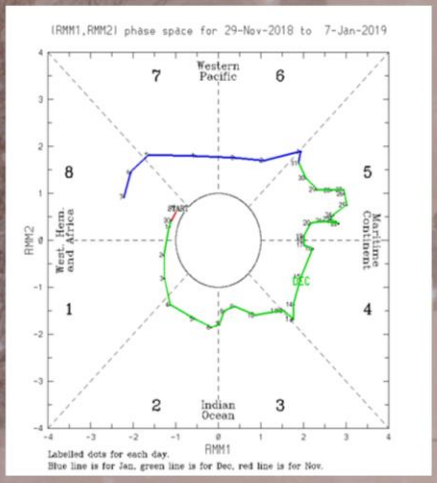


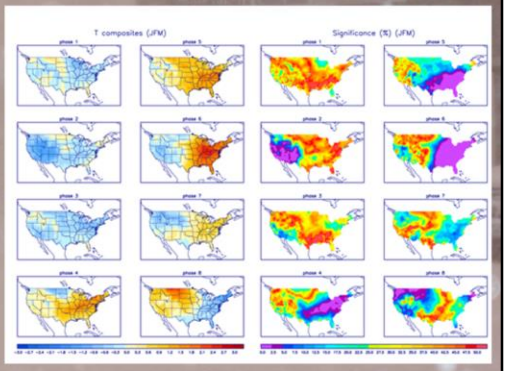




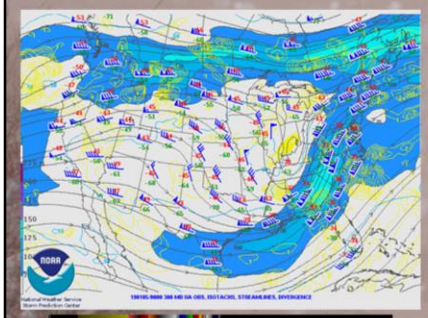


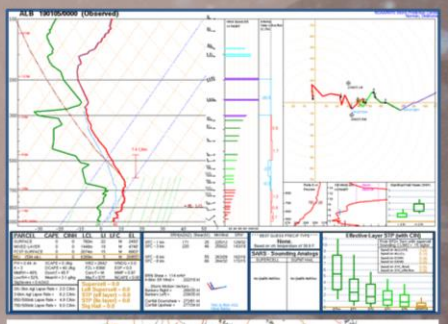
Madden Julian Oscillation and downstream effects – (Again just one large-scale circulation among many others)

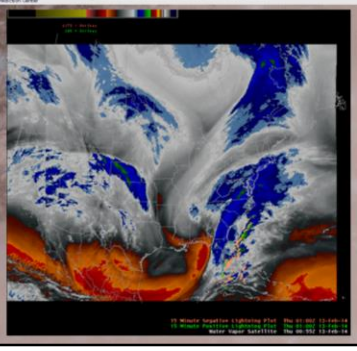


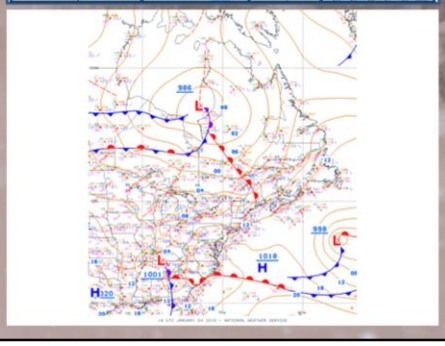


Data analysis – Current State of the Atmosphere

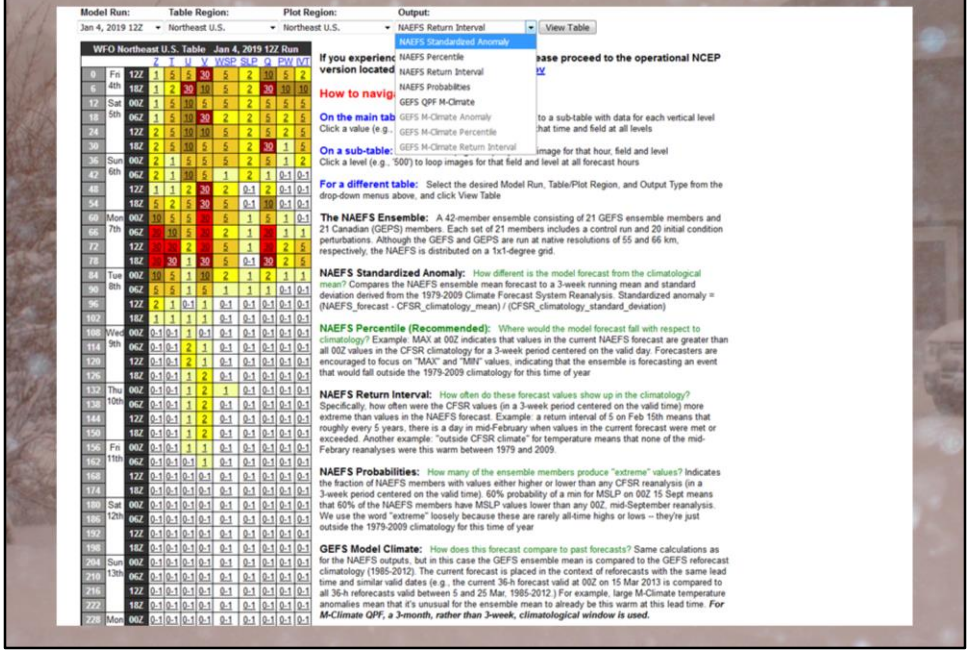




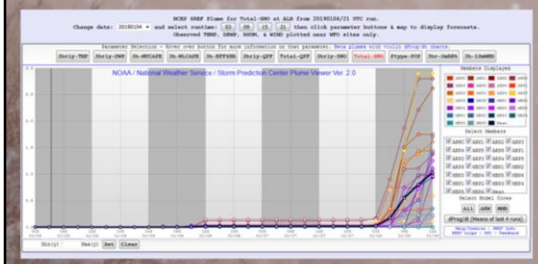


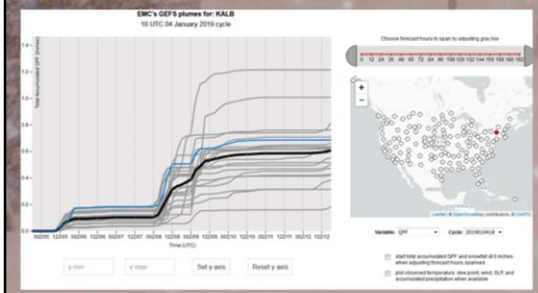


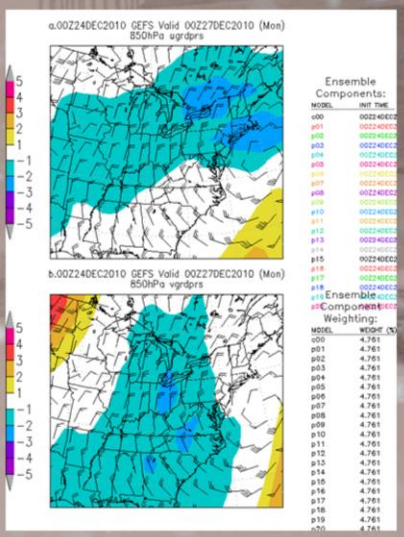
Situational Awareness Table



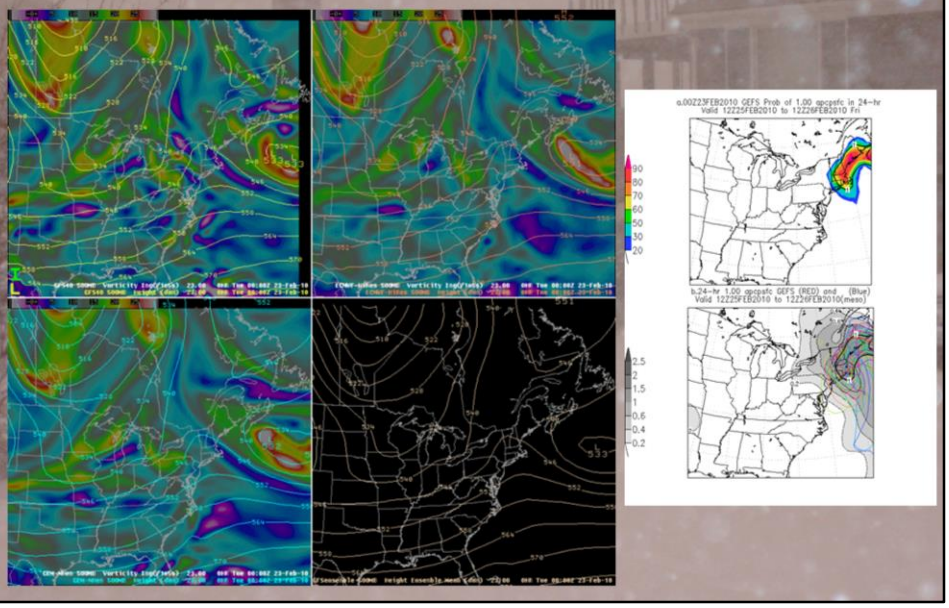
Ensemble based guidance, anomalies and run-to-run changes







Comparing derived fields from deterministic models such as the GFS, ECMWF, CMC/GEM and GFSEnsemble mean



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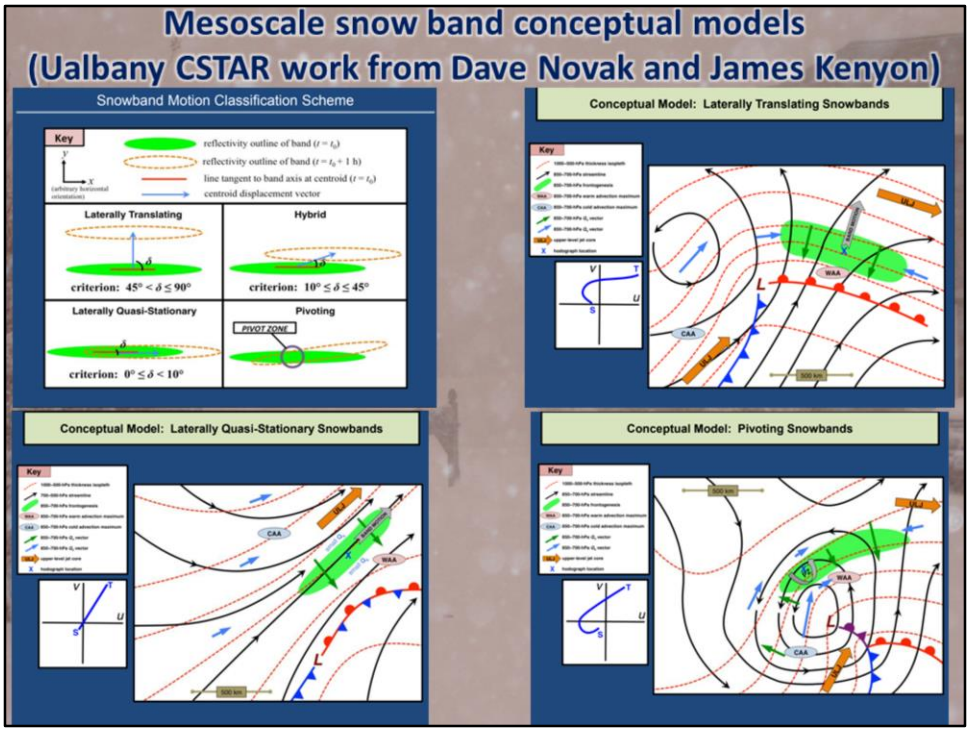
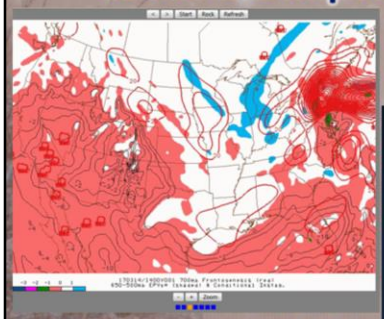
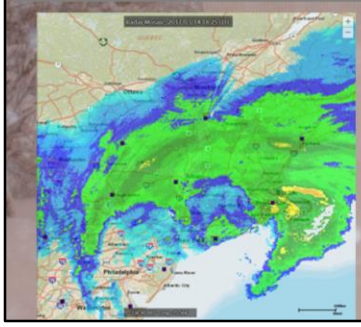
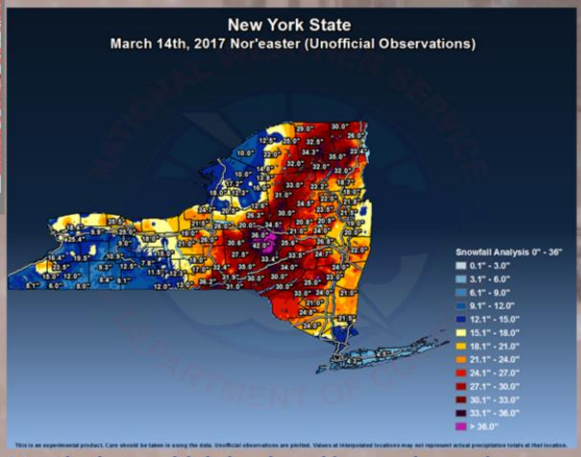

Mesoscale snow band conceptual models
(Ualbany CSTAR work from Dave Novak and James Kenyon)
Snowband Motion Classification Scheme
Key
reflectivity outline of band ($t = t_0$)
reflectivity outline of band ($t = t_0 + 1$ h)
line tangent to band axis at centroid ($t = t_0$)
centroid displacement vector
(arbitrary horizontal orientation)
Laterally Translating
criterion: $45° < \delta \leq 90°$
Hybrid
criterion: $10° \leq \delta \leq 45°$
Laterally Quasi-Stationary
criterion: $0° \leq \delta < 10°$
Pivoting
PIVOT ZONE
Conceptual Model: Laterally Translating Snowbands
Conceptual Model: Laterally Quasi-Stationary Snowbands
Conceptual Model: Pivoting Snowbands
CAA
WAA
L
500 km

Mesoscale snow band conceptual models – a word about the importance of frontogenesis/EPV



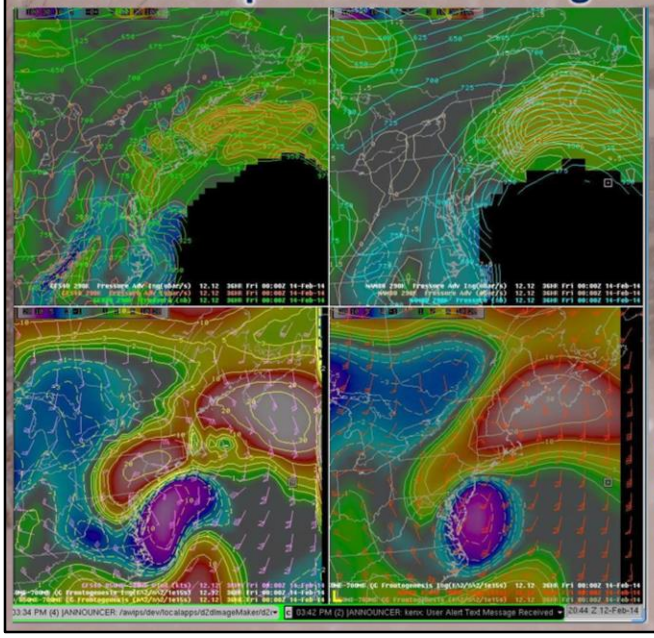


Storm Prediction Center Mesoanalyses:
650-500 hPa layer frontogenesis/EPV –
not the typical 850-700 hPa layer



Must look at multiple levels and layers – layer where dendritic growth zone is important (coming up later)

Mesoscale snow band conceptual models – a word about the importance of frontogenesis/Isentropic lift



Isentropic lift at 290K

850-700 hPa
QG frontogenesis and winds - Pettersen Frontogenesis very useful as well

Upslope snows – Froude Number

925-850 mb Layer Average Wind/RH. Avg QPF over the _GreenBerkLitchHills.

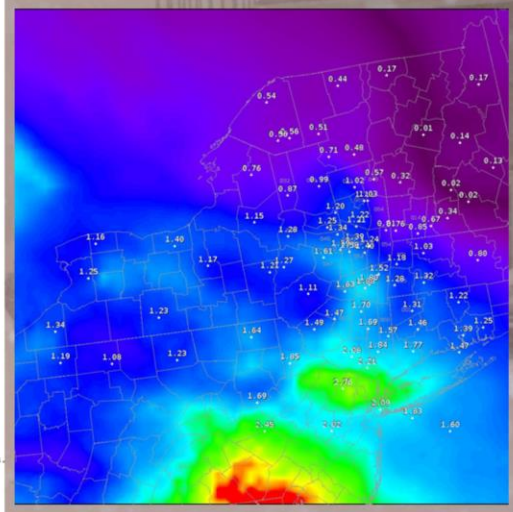
Date Day	Time mm/dd	hhZ	Frd#	Wind DDFF	RH%	700 (C)	850T	QPF (in)
Wed	01/09	06Z	0.13	2013	95	75	0	0.00
Wed	01/09	09Z	0.19	2110	98	91	0	0.09
Wed	01/09	12Z	0.51	2714	97	88	-3	0.12
Wed	01/09	15Z	0.58	3125	96	90	-4	0.15
Wed	01/09	18Z	0.95	3035	94	77	-5	0.08
Wed	01/09	21Z	1.42	2934	94	68	-7	0.02
Thu	01/10	00Z	1.28	3034	93	72	-8	0.02
Thu	01/10	03Z	0.93	3030	93	76	-8	0.02
Thu	01/10	06Z	0.99	3028	94	77	-9	0.01
Thu	01/10	09Z	0.99	3127	93	85	-10	0.01
Thu	01/10	12Z	0.85	3228	93	85	-11	0.02
Thu	01/10	15Z	1.06	3228	93	84	-12	0.02
Thu	01/10	18Z	0.98	3128	89	85	-12	0.01
Thu	01/10	21Z	0.57	3131	87	73	-11	0.00
Fri	01/11	00Z	0.46	3133	87	69	-11	0.00
Fri	01/11	03Z	0.41	3131	86	56	-12	0.00
Fri	01/11	06Z	0.39	3131	84	43	-12	0.00
Fri	01/11	09Z	0.38	3132	81	35	-13	0.00
Fri	01/11	12Z	0.36	3133	80	16	-13	0.00
Fri	01/11	15Z	0.36	3129	73	1	-14	0.00
Fri	01/11	18Z	0.45	3128	55	4	-15	0.00
Fri	01/11	21Z	0.55	3131	54	27	-16	0.00
Sat	01/12	00Z	0.51	3136	53	35	-16	0.00
Sat	01/12	03Z	0.50	3132	54	22	-16	0.00
Sat	01/12	06Z	0.48	3136	54	47	-14	0.00
Sat	01/12	09Z	0.54	3135	56	46	-15	0.00
Sat	01/12	12Z	0.56	3134	58	43	-14	0.00
Sat	01/12	15Z	0.52	3030	60	47	-14	0.00
Sat	01/12	18Z	0.51	3023	63	43	-14	0.00

Run total areal avg QPF for the _GreenBerkLitchHills is: 0.57 inches.

Froude Number (Frd#):
Frd# < 0.5 Flow is subcritical and blocked.
Upslope clouds/precip backed farther upwind of and up to mtn crest.
Gap winds possible.
Frd# 0.5-1 Flow is subcritical/slow moving/blocked.
Upslope clouds/precip falls immediately upwind of mtn crest.
Gap winds possible.
Frd# 1-2 Flow is critical.
With strong winds, Mountain waves/downslope winds possible.
Precip falls close to mountain ridge crests and on lee side.
Froude > 2 Flow is supercritical/unblocked(rapid flow).
Air flows freely over terrain.
Persistent upslope snow not favored. Scattered snow showers and flurries.

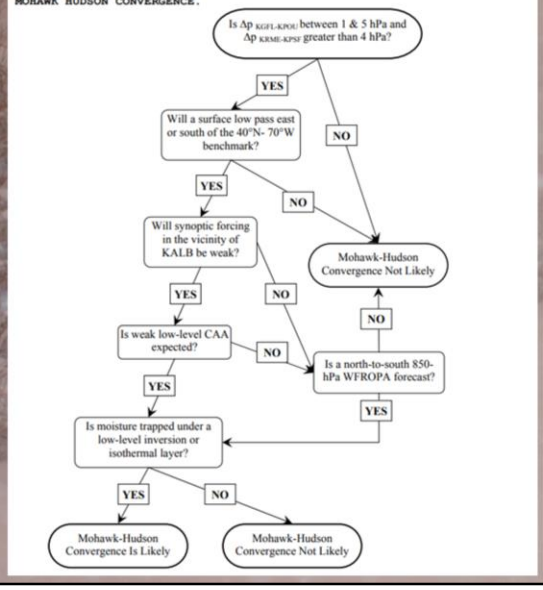
Relative Humidity (RH):
925-850 mb RH > 90% needed for upslope precipitation.
with 700mb RH > 70% favors upslope snow.
with 700mb RH > 90% greater amounts of W upslope snow possible.

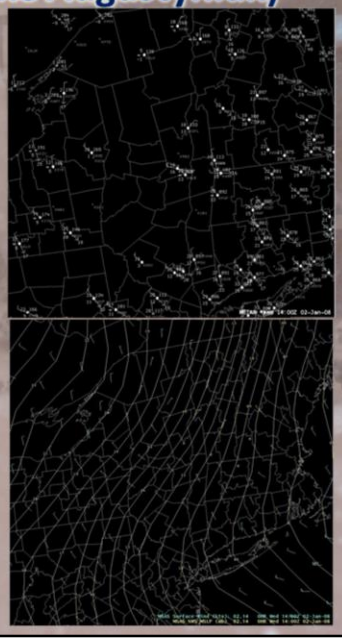
850mb Temperature (T degC) Westerly Upslope Snow Ratios: (Avg=28:1)
T > -11 10-15:1
T -11 to -15 25-35:1
T < -15 15-20:1



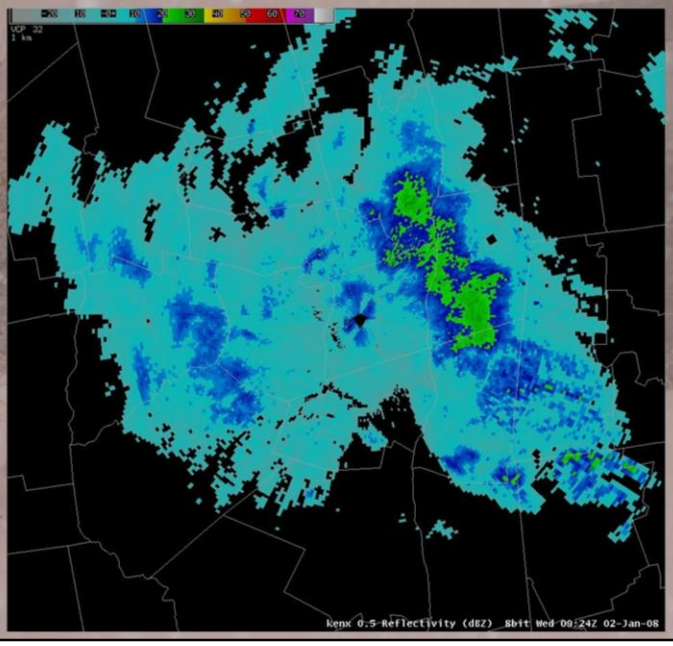
Mohawk Hudson Convergence
(Ualbany CSTAR work by Mike Augustyniak)

EAST WINDS AT KGFL (3KTS OR MORE) versus NORTH TO NORTHEAST WIND AT KALB (3 KTS OR MORE) SEEMS TO BE AN IMPORTANT FACTOR CONTRIBUTING TO MOHAWK HUDSON CONVERGENCE.

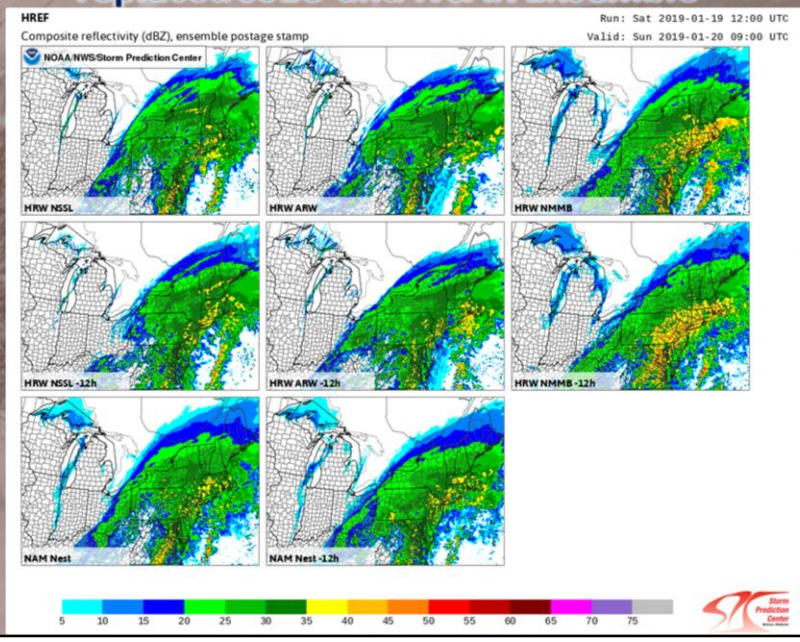




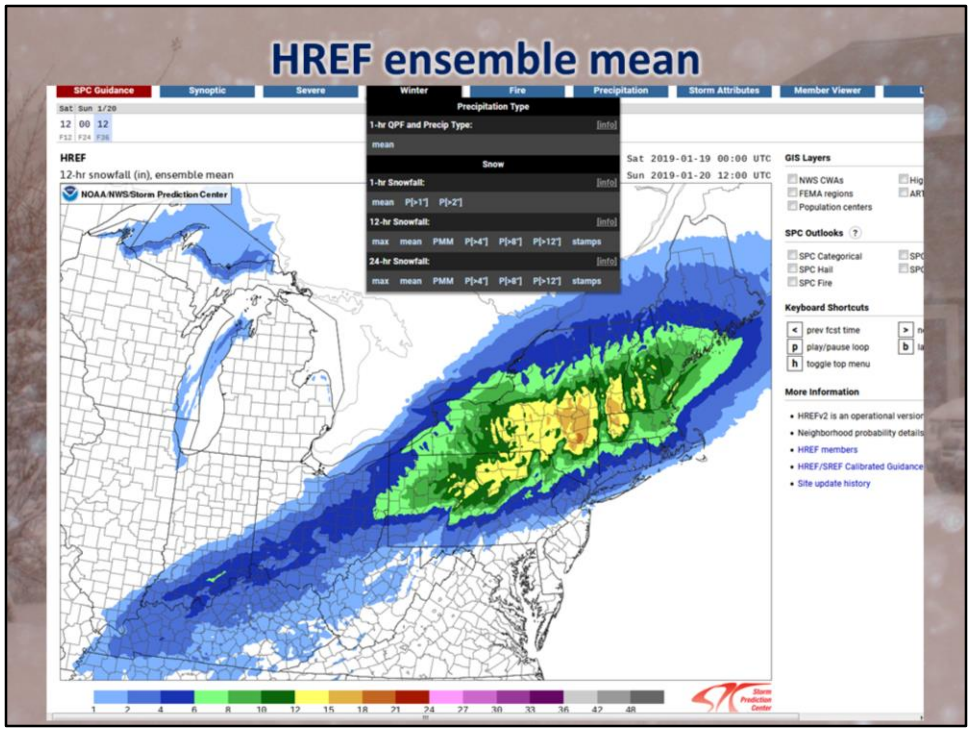
Mohawk Hudson Convergence



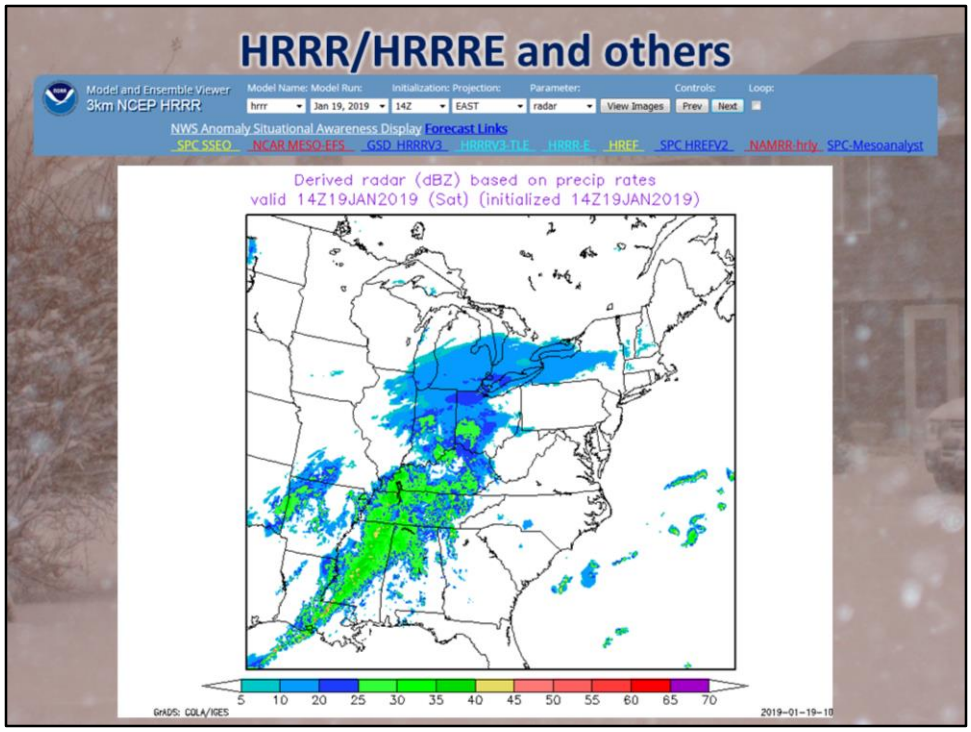
HREF individual member forecasts – HREF replaced SSEO and NCAR Ensemble



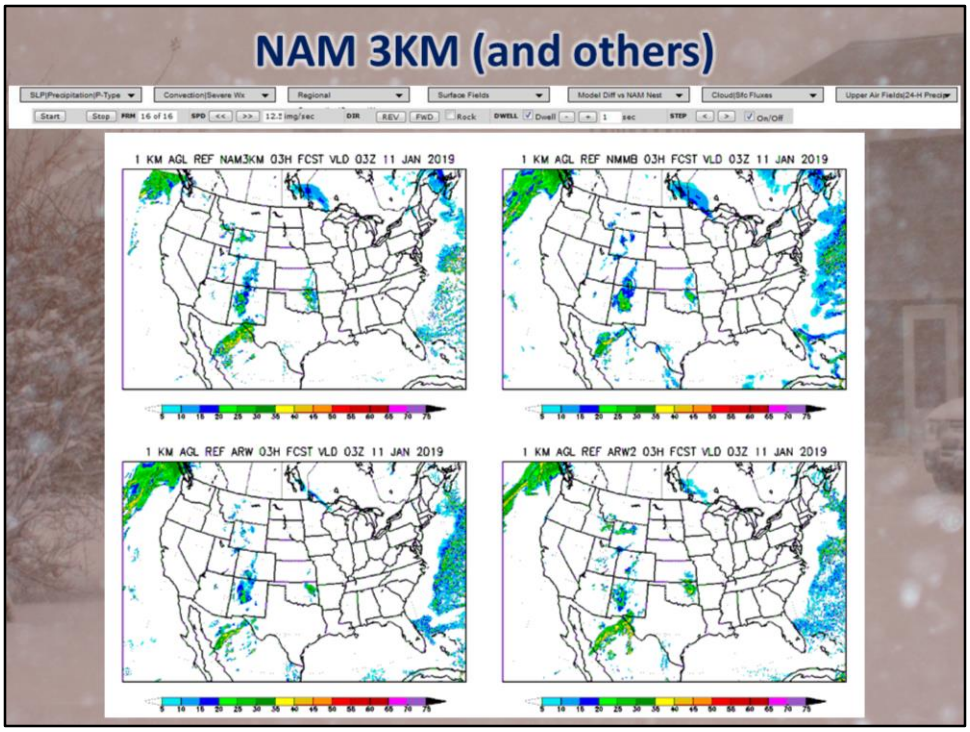
HREF ensemble mean



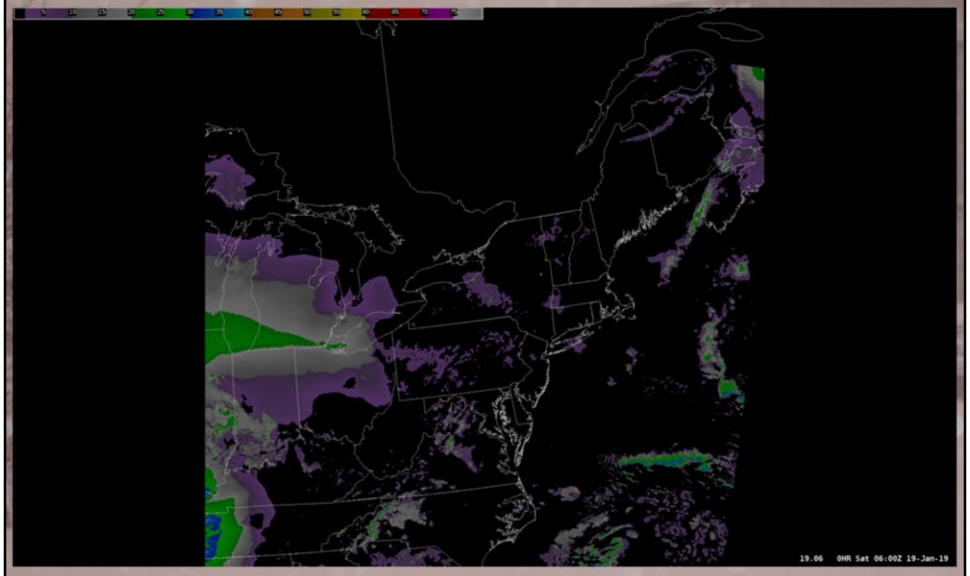
HRRR/HRRRE and others



NAM 3KM (and others)

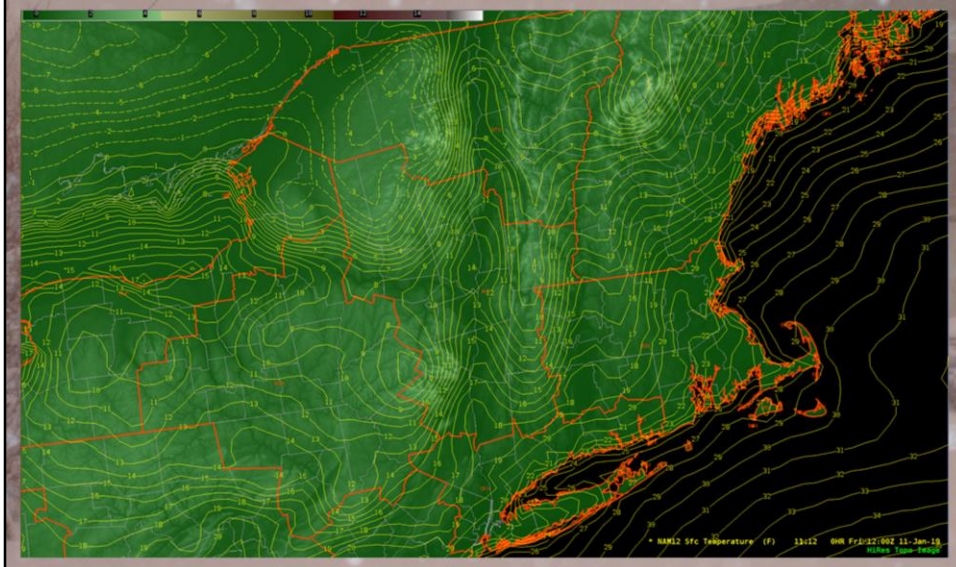


Another way to look at the NAM 3KM in AWIPS D2D



Reflectivity forecasts

NAM 3KM 2 meter temperatures



Very terrain dependent

- ✓ How do NAM 3KM 2 meter temperatures compare with MOS guidance?
- ✓ Is the rest of the MOS forecast guidance consistent with what you analyzed in plan view?

```
1»¿
274
FOUS21 KWNO 050600
MAVNE1
KALB    GFS MOS GUIDANCE    2/05/2014  0600 UTC
DT /FEB   5       /FEB   6              /FEB   7              /
HR   12 15 18 21 00 03 06 09 12 15 18 21 00 03 06 09 12 15 18 00 06
X/N          30          9          18          4          20
TMP  23 26 28 28 25 22 18 13  9 12 16 16 14 11  9  8  7 14 18 15  8
DPT  17 19 20 19 16 13  8  3  0  1  3  4  3  1 -1 -1 -1  3  4  3 -2
CLD  OV OV OV OV OV OV OV SC SC SC CL FW BK BK OV OV BK BK FW SC CL
WDR  01 03 02 35 33 33 32 33 32 32 30 29 29 28 24 24 25 26 27 26 26
WSP  05 09 05 05 08 09 08 05 05 06 05 05 05 04 05 04 05 09 11 09 09
P06      100     84      7      0      4      2      0      0      5  0  0
P12          100             7             6             3         8
Q06        3     2      0      0      0      0      0      0      0  0  0
Q12           4             0             0             0         0
T06     1/ 2  1/ 9  0/ 0  0/ 8  0/10  0/ 2  0/ 7  0/ 3  0/ 4  0/ 5
T12           1/ 9         0/10         0/12         0/ 5  0/14
POZ   4 10 11  7  4  3  3  3  4  3  3  2  2  2  3  4  5  4  4  2  4
POS  96 90 89 93 96 98 98 97 96 97 97 97 98 97 97 96 95 96 96 95 96
TYP   S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S  S
SNW                        6                          0
CIG   3  3  2  3  4  5  6  8  8  8  8  8  8  8  8  8  8  8  8  8  8
VIS   2  1  1  1  5  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7  7
OBV  FG FG BL FG BR  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N  N
```

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1»¿055
FOUS44 KWNO 050000
METNE1
KALB    NAM MOS GUIDANCE    2/05/2014  0000 UTC
DT /FEB   5       /FEB   6              /FEB   7              /
HR   06 09 12 15 18 21 00 03 06 09 12 15 18 21 00 03 06 09 12 18 00
X/N                    27          9          23          11    26
TMP  27 26 24 25 25 24 23 21 16 12  9 16 21 22 19 16 15 14 14 24 20
DPT  20 20 19 20 20 18 16 14  9  4  0  3  5  5  6  7  7  7  8  6
CLD  OV OV OV OV OV OV OV OV OV OV OV BK CL SC SC OV OV OV OV OV OV
WDR  00 02 01 01 02 34 33 34 32 32 32 31 29 27 27 21 23 19 25 28 27
WSP  00 03 04 05 07 08 13 07 05 04 02 05 07 07 03 04 04 04 05 13 05
P06          94     92     85     29      1      3      1      0      4  6  4
P12                         92            33             4             4   13
Q06           2      3      3      0      0      0      0      0      0  0  0
Q12                         4             0             0             0   0
T06      5/ 2  4/ 9  1/10  0/ 1  0/ 0  1/ 3  1/ 2  1/ 7  1/ 5  1/15
T12           5/ 9         1/10         1/ 3         1/ 7  2/ 7
SNW                                     6                          0
CIG   7  7  4  4  3  4  5  5  5  6  8  8  8  8  7  8  6  6  6  6  7
VIS   7  7  5  2  2  2  4  5  7  7  7  7  7  7  7  7  7  7  7  7  7
OBV   N  N BR FG BR BR BR BR  N  N  N  N  N  N  N  N  N  N  N  N  N
```

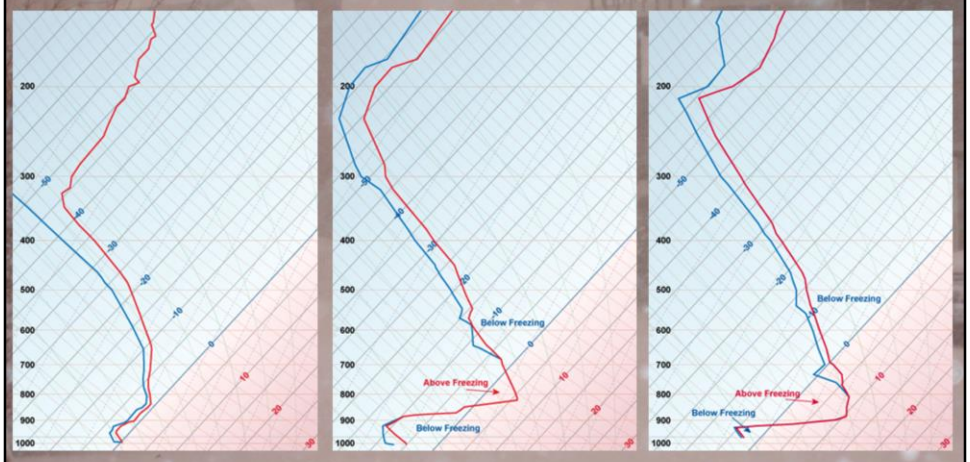
Compare all parameters offered in the MOS guidance, successive runs and for all locations within the forecast area (KGFL, KPOU, KPSF, KDDH etc.)

Once synoptic and mesoscale analyses are complete, it is all about local effects

- ✓ Synoptic Analysis
  - ✓ Conceptual Models – Longwave patterns, Pattern recognition
  - ✓ Data, Deterministic NWP Models, Ensembles, Anomalies
- ✓ Mesoscale Analysis – Data, CAMs, CAM ensembles
  - ✓ Conceptual Models – Banding, MHC, Upslope
  - ✓ HRRR, HREF, 3Km NAM
- ✓ Real-time data trends
  - ✓ Conceptual Models – Sounding profiles for different precipitation types, Thermal profiles for SLR
  - ✓ Radar, satellite, NY Mesonet, Upper air

- ✓ Real-time data helps fill in the gaps in time and space in the model initializations and near-term forecasts, accounting for what the models are missing
- ✓ This is the process of determining what aspects of an upcoming weather event the models did not resolve that could contribute to forecast errors
- ✓ The result will be adding value to the model forecasts and optimizing Impact Based Decision Support Services (IDSS) to the user community, especially in the near term

✓ **Subtle differences in depths of layers have a big effect on precipitation type – model vertical resolutions vary, resulting in varying skill in predicting thermal/moisture layers**



Snow sounding **Sleet sounding** **Freezing rain sounding**

Note importance of looking at thermal profiles through a deep layer: Can't just rely on temperatures at mandatory levels like 850 hPa, you would miss an important warm layer

✓ Subtle differences in depths of layers have a big effect on precipitation type – model vertical resolutions vary, resulting in varying skill in predicting thermal/moisture layers

Real Cases

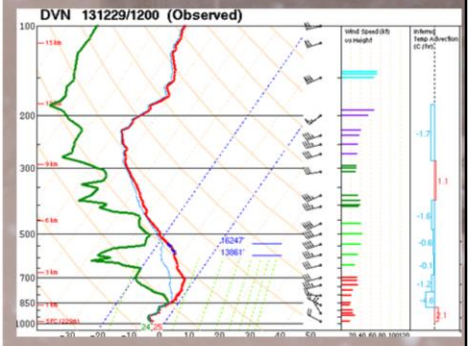
Top-Down Reminder

- Ice Producing Layer: -12C for likelihood of ice.
- Warm Layer?

Warm Layer Maximum Temperature	Precipitation Type with ice introduced	Precipitation Type without ice introduced
< 1C	Snow	Freezing Rain/Drizzle
1C to 3C	Mix (1C) to Sleet (3C)	Freezing Rain/Drizzle
> 3C	Freezing Rain/Drizzle	Freezing Rain/Drizzle

- Evaporation or Sublimation Layer?
- Surface:
  - 0C at surface or lower? 2"/4" soil temperature in 30s?
  - Can FZRA turn to IP (trend to colder/deeper air)? SN? -12C?
  - Tw >33F possibly rain (greater than 1000 ft)

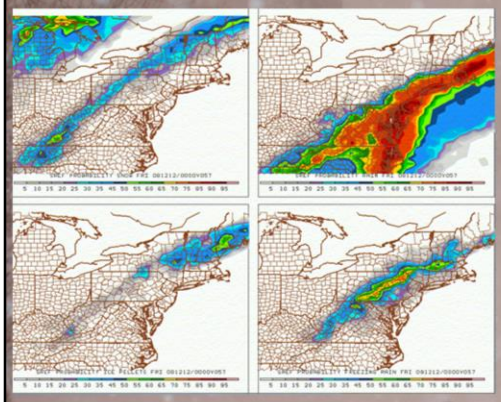
Figure 1. From the VISIT session "Precipitation-Type Forecasting: The Top-Down Approach". A warm layer temperature below 1 degree C will produce snow if ice is introduced to the layer.



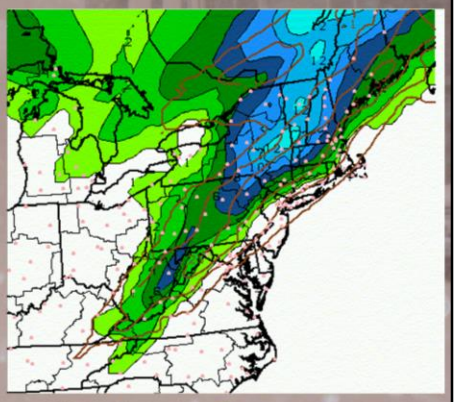
Freezing drizzle sounding

- ✓ Subtle differences in depths of layers have a big effect on precipitation type – model vertical resolutions vary, resulting in varying skill in predicting thermal/moisture layers

11-12 December 2008 Ice Storm

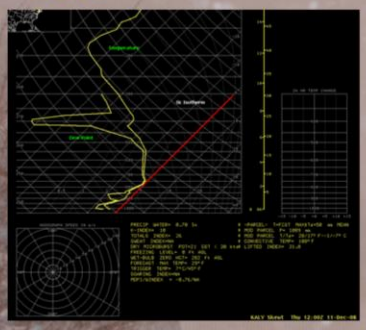


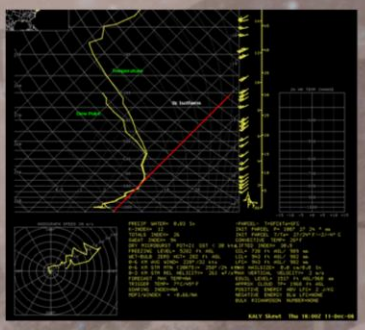
SREF P-Type predictions



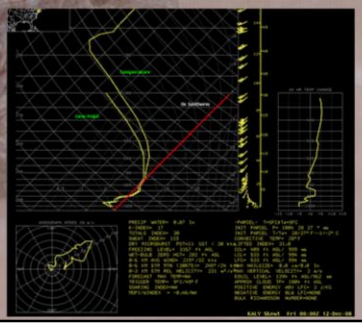
Weather Prediction Center Guidance

✓ Monitoring thermal profiles during the 11-12 December 2008 ice storm



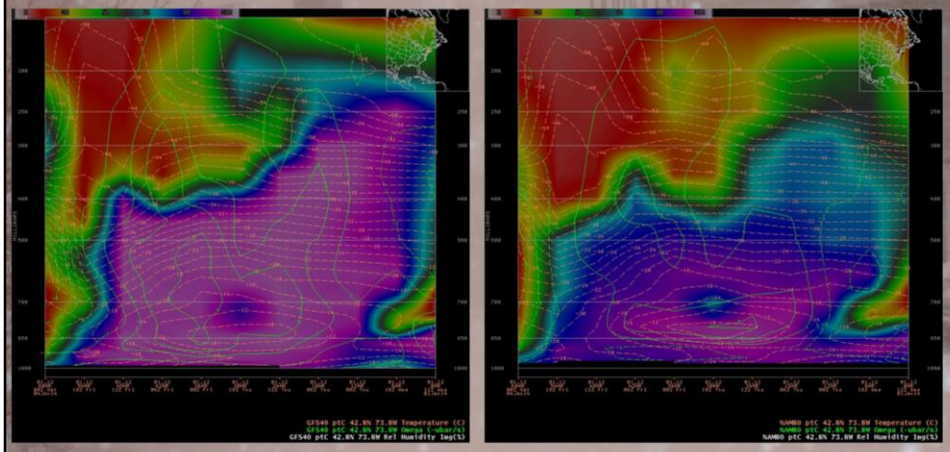


Note importance of looking at thermal profiles through a deep layer



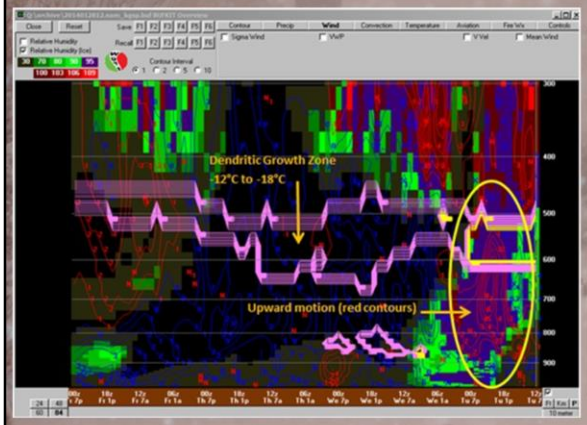
Can't just rely on temperatures at mandatory levels like 850 hPa, you would miss an important warm layer

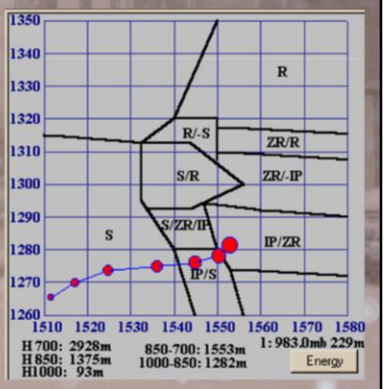
✓ Snow to liquid ratios – above climatology when the core of maximum vertical motion extends through the -12C to -18C saturated layer



Maximum vertical motion through the dendritic growth zone in GFS but not NAM – which will be right?

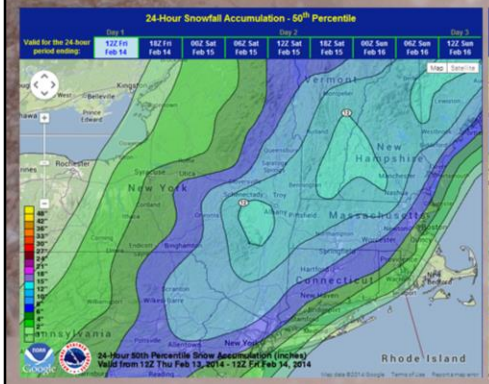
✓ Snow to liquid ratios – above climatology when the core of maximum vertical motion extends through the -12C to -18C saturated layer



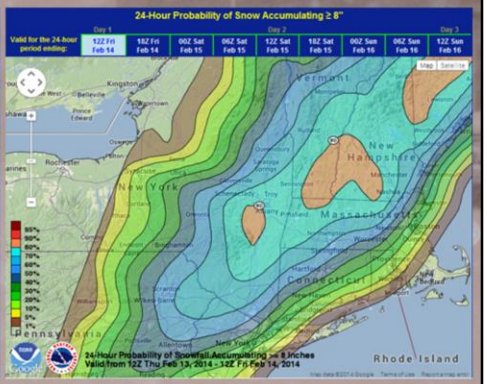


BUFKIT output very effective for analyzing precip. type and vertical resolution of atmospheric parameters – Great for Lake Effect, too

- ✓ Probabilistic forecasts from the Weather Prediction Center
- ✓ These are for snow but probabilities for freezing rain are also available
- ✓ Numerical probabilities for precipitation amounts (WPC, GFSEnsemble, SREF, HREF etc.) can be a more objective method of determining confidence levels for Outlook (30%)/Watch(50%)/Warning(80%)/Advisory(80%)

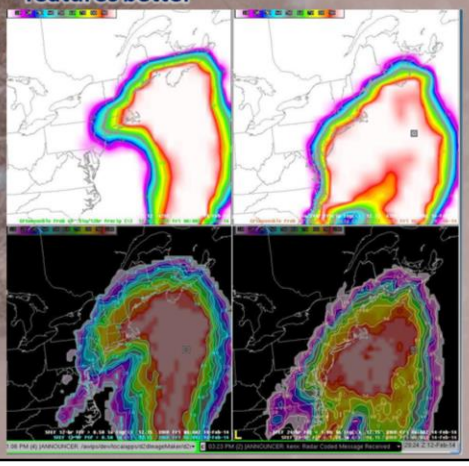


By percentile



By amount

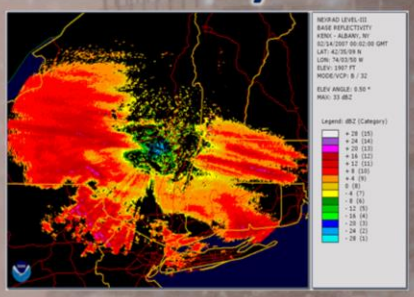
- ✓ Probabilistic forecasts from the NWP Model Ensemble Output
- ✓ Numerical probabilities for precipitation amounts (WPC, GFSEnsemble, SREF etc.) can be a more objective method of determining confidence levels for Outlook (30%)/Watch(50%)/Warning(80%)/Advisory(80%)
- ✓ Disagreements between ensembles often occurs but that is where experience and expertise help determine which guidance is resolving important storm features better



GFSEnsemble probability for 0.60" and 1.00" liquid equivalent

SREF probability for 0.50" and 1.00" liquid equivalent

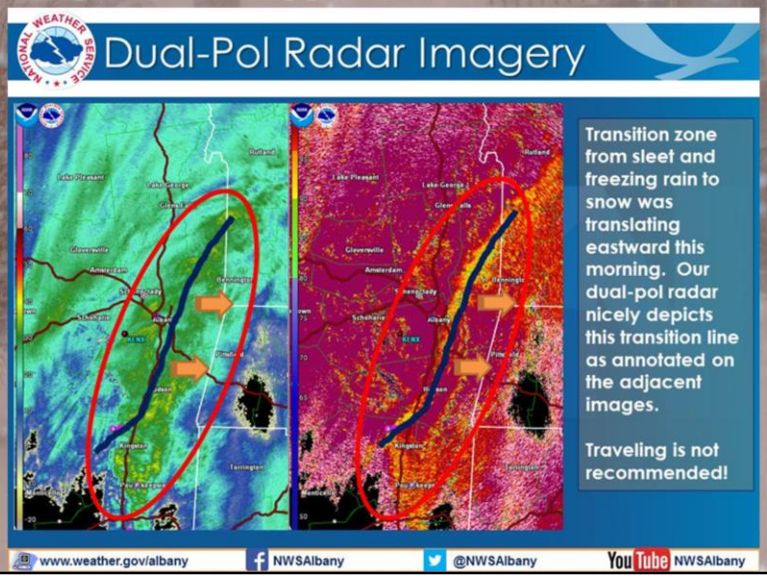
✓ Radar and lightning trends – near-term precipitation type and intensity



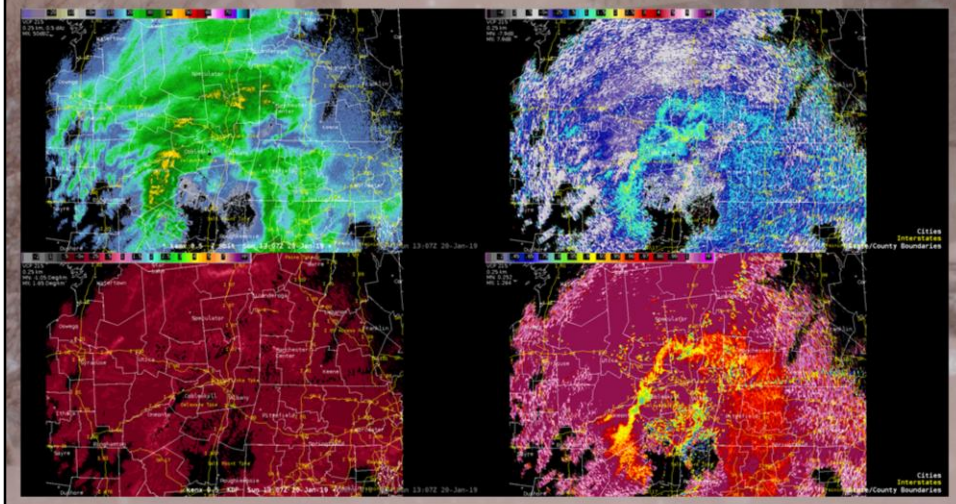
feb14snow.wmv

https://www.youtube.com/watch?v=_iCYTPeXNCQ

✓ DUAL POL Radar data – near-term precipitation type and intensity

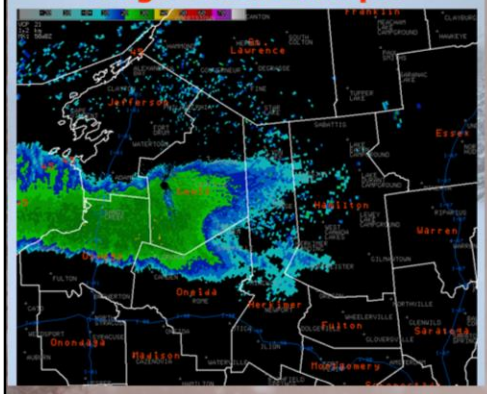


✓ DUAL POL Radar data – near-term precipitation type and intensity

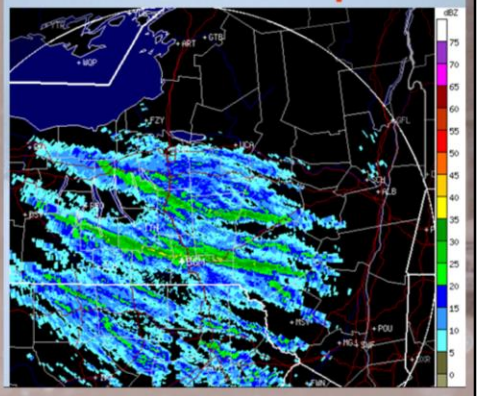


✓ A quick note about Lake Effect – BUFKIT is the ideal tool to evaluate instability class, inversion heights and flow trajectories to predict band type, intensity and inland extent

Single Band Example



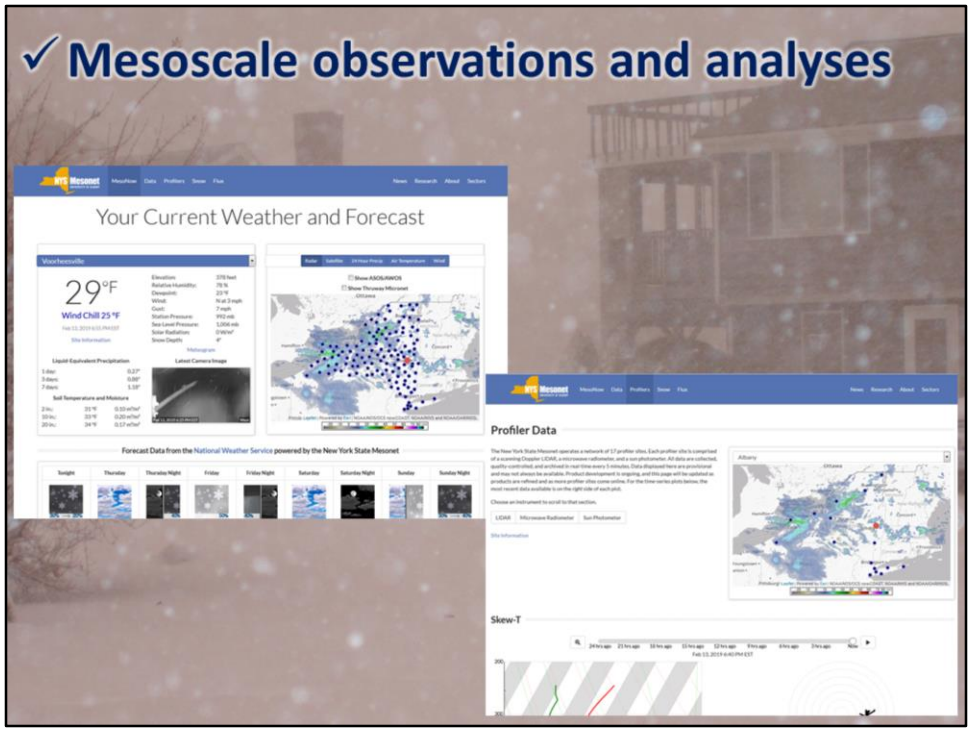
Multi Band Example



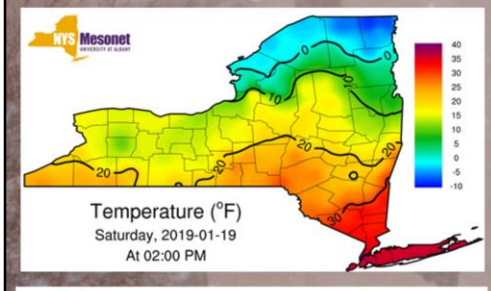
Important to be aware that bands can extend farther inland than the radar depicts due to the height of the radar beam

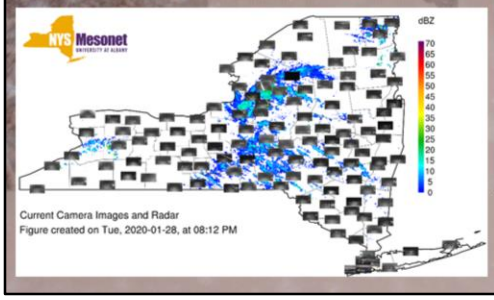
O.K., now back to our regular scheduled programming →

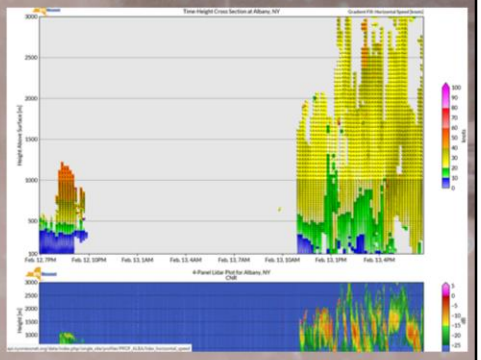
✓Mesoscale observations and analyses



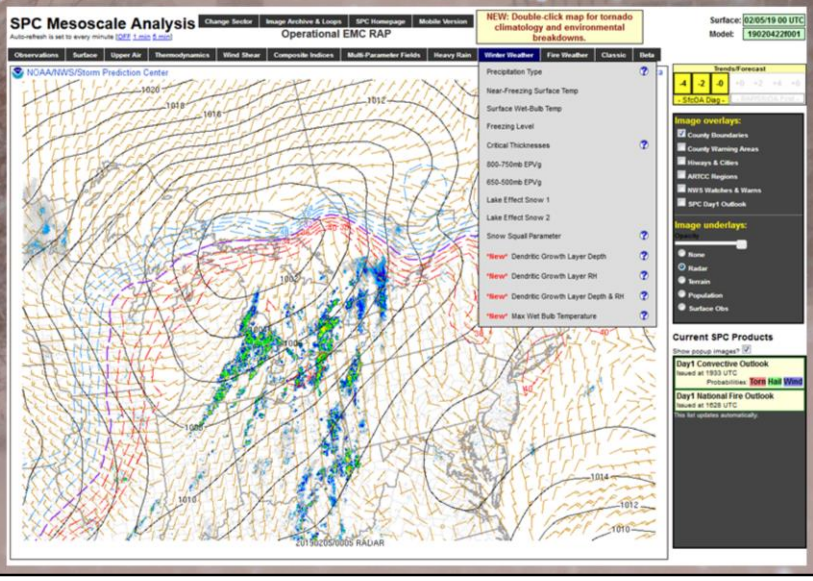
✓ Mesoscale observations and analyses (courtesy of Nicholas Bassill)



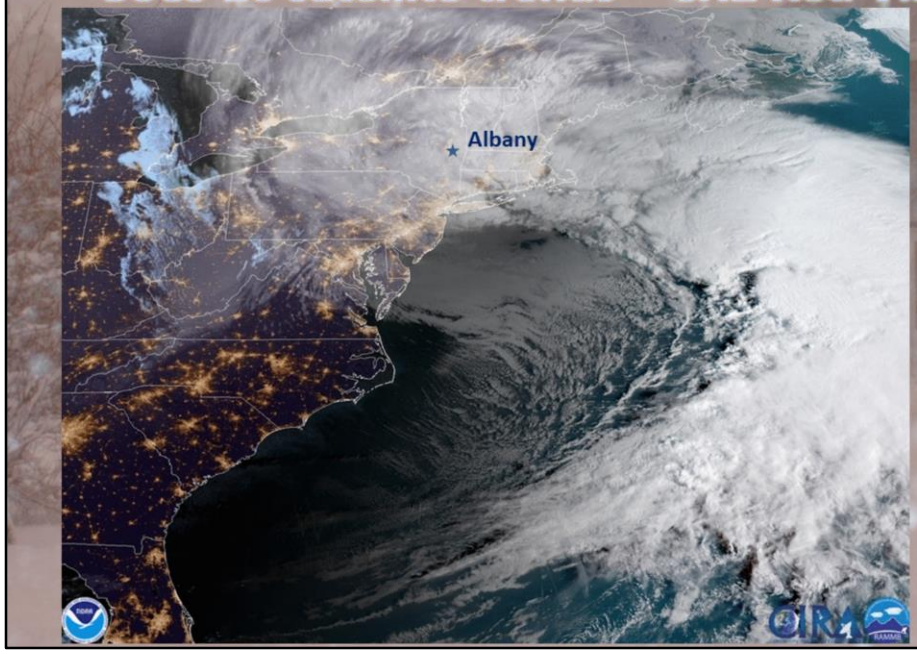




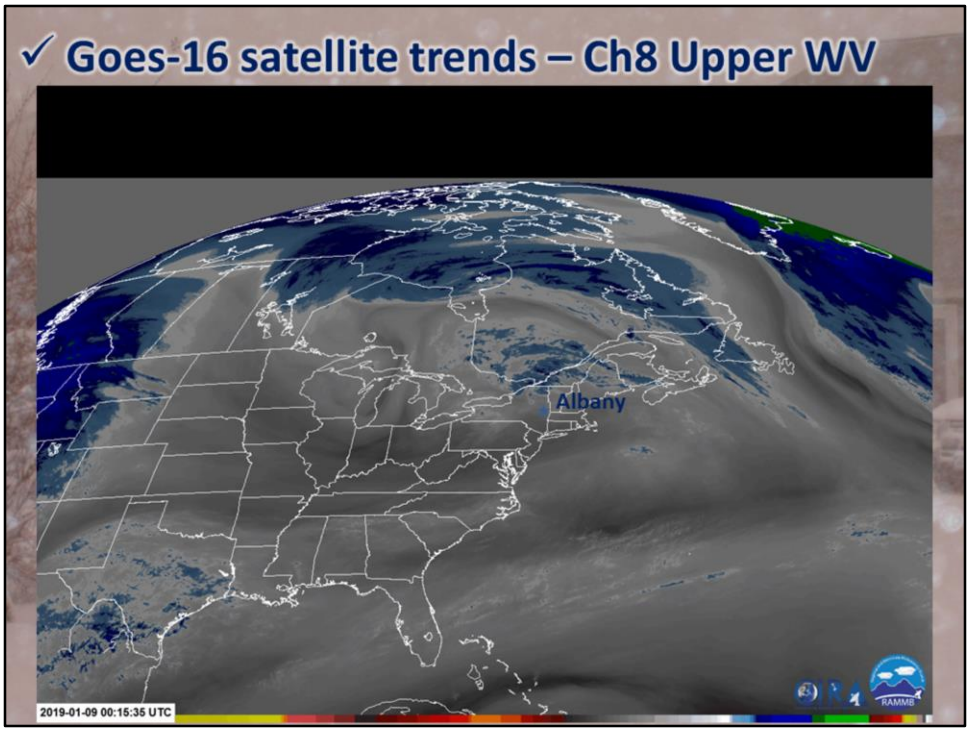
✓ Mesoscale observations and analyses (Storm Prediction Center)



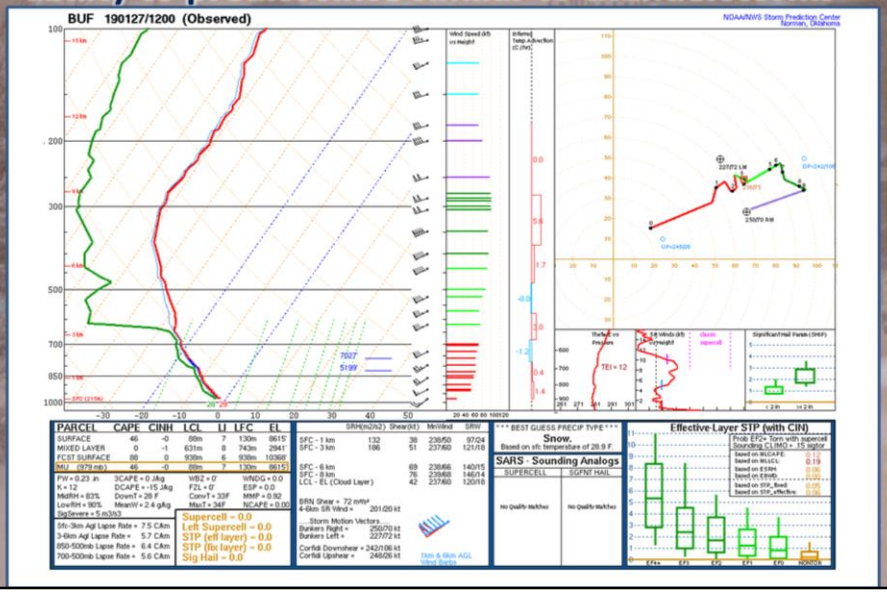
✓ Goes-16 satellite trends – CH2 Red Vis



✓ Goes-16 satellite trends – Ch8 Upper WV



✓ A brief word about Snow Squall Warnings – treat like Severe Thunderstorm Warnings, increasing ability to predict since similar to thunderstorms



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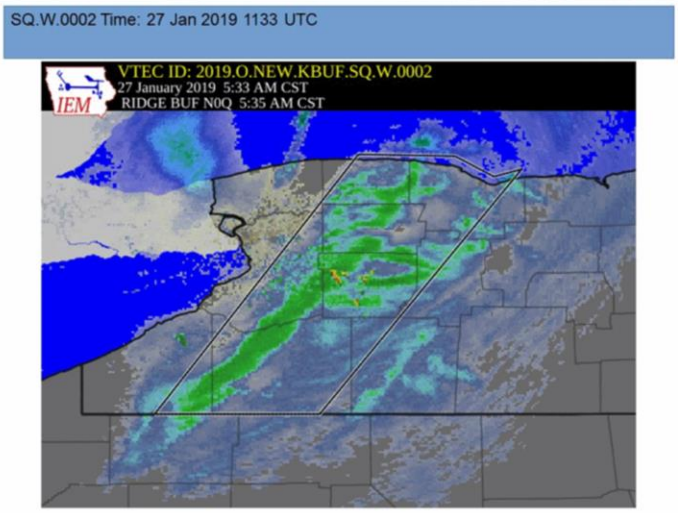
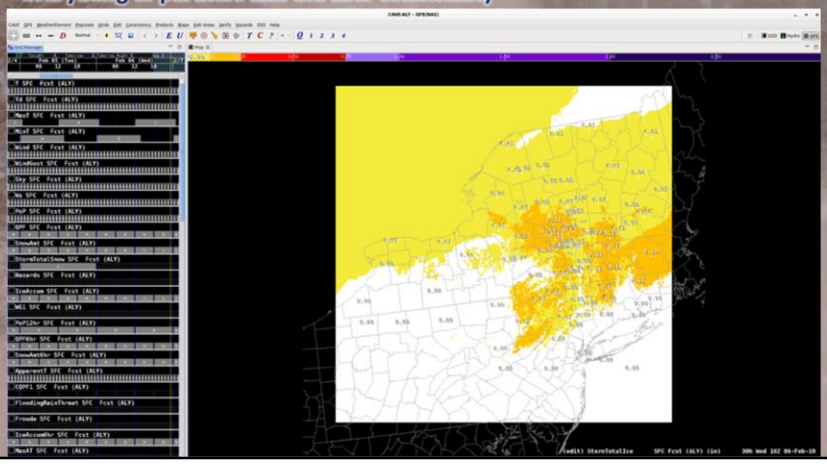
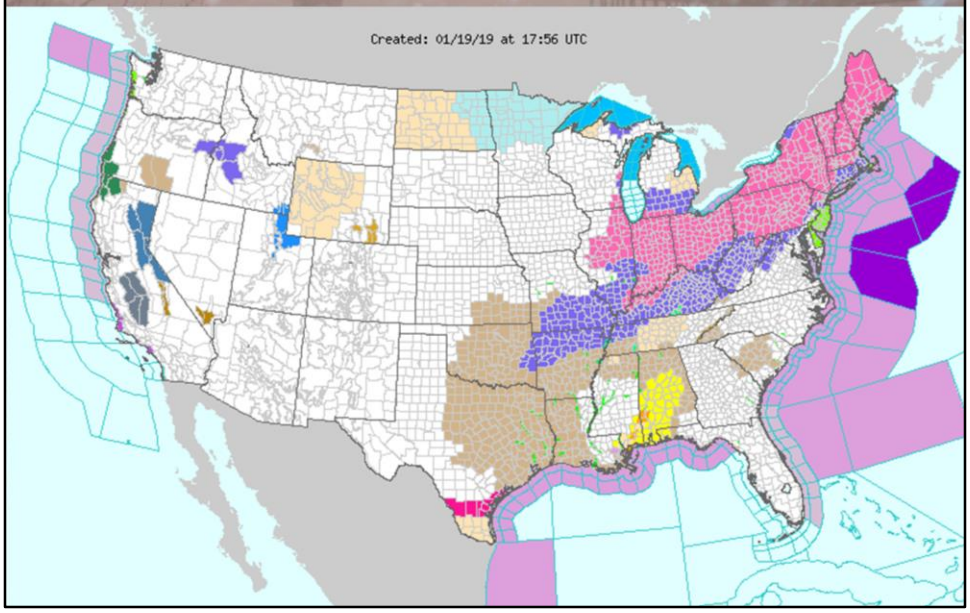


- ✓ O.K., time to issue the forecasts and briefings –
  - ✓ Variety of population methods and smart tools in a Graphical Forecast Editor (GFE)
  - ✓ Oh, and we have to coordinate with neighboring offices
  - ✓ All this data and model analysis, populating grids, editing and coordination takes LOTS OF TIME
  - ✓ Delicate balance of what we choose to analyze, how to produce grids that we believe most accurately represents what we think will happen
  - ✓ We have to cut off the meteorology at some point and meet the deadlines to issue everything to partners and the user community




✓ O.K., time to issue the forecasts and briefings –
✓ Variety of population methods and smart tools in GFE
✓ Coordinate with neighboring offices
✓ Data, model analysis, populating grids, editing and coordination = LOTS OF TIME
✓ Balance what we choose to analyze, how to produce grids that most accurately represents what we think will happen
✓ Have to cut off the meteorology at some point - meet the deadlines to issue everything to partners and the user community
(02:21:31) BGM BGM-Short Term Forecaster 2: ALY/BUF... I think we are going to hold off and wait and see how the winds are doing around midnight. So far we only have a few locations that are gusting at wind advisory and the remaining sites are below. It will be a close call. I think I want to wait and let the 10PM shift handle if they want to extend the advisory or not. -kat
(02:21:48) ALY ALY-Public Forecaster 1: BUF/BTV...I did notice the strongest boundary layer winds do shift more into eastern and southern NY through the night so I understand letting your headlines expire. I see KSYR, KRME, KELM and KN23 gisting very high right now post wind shift and not showing any sings of diminishing. It may be more our and BGM's issue to consider. Thanks. Neil
(02:24:30) ALY ALY-Public Forecaster 1: BGM..I see KSYR, KRME, KELM and KN23 gusting very high right now post wind shift and not showing any sings of diminishing. We'll look at 10 PM observations and see if there are any trends for diminishing winds. Thanks. Neil
(02:32:42) BGM BGM-Short Term Forecaster 2: ALY... we see SYR at 16 G 20. We had a peak wind of 44 but that was at 114Z. I am not seeing where you are seeing that? -kat
(02:34:13) : BGM BGM-Short Term Forecaster 2 has left the room.
(02:37:47) ALY ALY-Public Forecaster 1: BGM...yes, saw peak wind at 0114Z but upstream in KELM/KITH at 0142-0152Z big gusts and KRME showing 37 Kt at 0130Z. That seems to be the nature of gusty winds, intervals, localized channelling, lots that models can't resolve well. Again, 10 PM observations will hopefully show good trends of diminishing winds. Thanks. Neil
(02:47:18) : WPC Surface Analysis 1 has entered the room.
(02:51:52) : WPC Lead/Day 1 QPF 1 has left the room.
(02:59:04) : ALY ALY-Public Forecaster 3 has left the room.
(03:02:36) ALY ALY-Public Forecaster 1: BGM...good to see winds diminishing a little even though you and KELM are still gusting well. Some mesonet obs also show some good gusts but on the downward trend. Will let wind advisory expire naturally at midnight. Thanks. Neil
(03:03:24) : WPC Lead/Day 1 QPF 1 has entered the room.
(03:04:41) BGM BGM-Short Term Forecaster 1: BUF/CTP/ALY/PHI/OKX - HRRR 925mb winds show 40+ kts across a large portion of our FA overnight. Currently gusting to 40 at KELM, and we are getting reports of power flashes near Binghamton. Anyone considering extending the wind advisory? dp/bgm
(03:04:55) : OKX Short Term Forecaster 2 has left the room.
(03:05:12) : OKX Short Term Forecaster 1 has entered the room.
(03:08:45) : BGM BGM-Short Term Forecaster 2 has entered the room.
(03:08:56) : BUF BUF-Long Term Forecaster 1 has entered the room.
(03:11:13) : BGM BGM-Short Term Forecaster 3 has entered the room.
(03:11:18) BGM BGM-Short Term Forecaster 1: We will extend the wind advisory until 12z for the entire FA. Mid shift will cut areas overnight as needed.
(03:13:35) OKX Short Term Forecaster 1: BGM...we do not have an advisory right now and we have pretty strong inversion across our eastern areas. Maybe some gusts inland overnight, but right now going to hold off on issuing anything
(03:14:09) ALY ALY-Public Forecaster 1: BGM...well, my northern areas will likely continue to diminish and it seems even the Mohawk Valley is showing signs of winds gusting just below advisory and usually channelling enhances winds down the Mohawk Valley. Now, the Schoharie Valley and the eastern Catskills may see some gusts but temperatures are cooler there and some inversions are limiting the mixing seen in mesonet observations. The strongest wind may actually stay along and west of the eastern Catskills based on the models as the low level wind core shifts more south than east. Keeping advisory up til midnight and decision to extend or not will depend on trends between now and midnight. Thanks. Neil
(03:15:04) : GYX Long Term Forecaster 1 has entered the room.
(03:20:01) BGM BGM-Short Term Forecaster 1: aly-okx-ctp-phi-buf: Looks like we'd be on an island if we extended. So after conferring with the incoming mid shift, we decided to allow the advisory to expire at 5z as planned. Will handle localized issues with an SPS. Thanks for the collaboration. dp/bgm

O.K., time to issue the forecasts and briefings



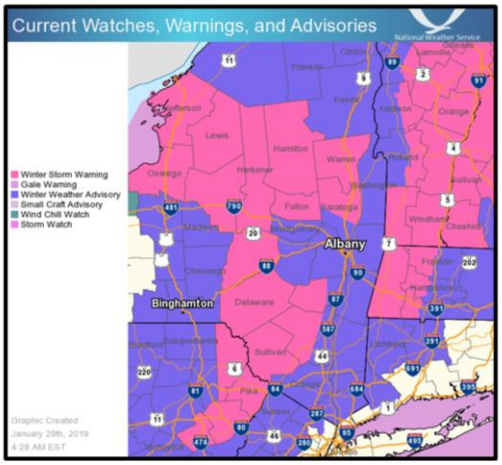
Specialized multi-slide briefings for Emergency Managers and other deep core partners – also uploaded to our NWS Albany NY web site – graphics based on GFE with text explanations

Winter Storm

Decision Support Briefing # 4
As of: 500 AM January 29, 2019

What Has Changed?

- ✓ *Berkshires upgraded to a Winter Storm Warning*
- ✓ *Winter Weather Advisories now in effect for the Greater Capital Region, Taconics, mid Hudson Valley, Schoharie Valley, Helderbergs, eastern Mohawk Valley, Washington Co., and Litchfield County, CT*



Specialized briefings for Emergency Managers and other deep core partners - Summary of multi slide graphical/text briefing to emphasize important points

Event Summary

Winter Storm Expected….

- ✓ Confidence is **HIGH** that this event will occur and **Moderate to High** on expected impacts
- ✓ Period of greatest impact for snow: This Morning – daybreak Wednesday
- ✓ Wind Chill threat: Wednesday night – Thursday morning & Thursday night – Friday morning

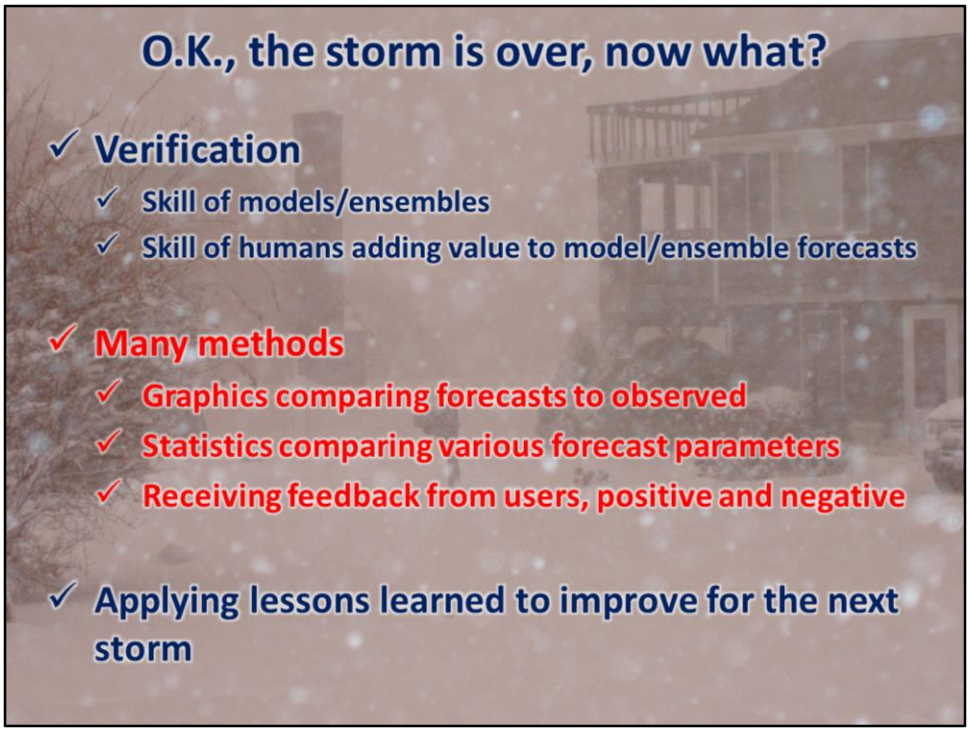
Snow will overspread the area from west to east this morning over eastern New York and this afternoon over western New England. Snow will be heavy at times tonight.

Berkshires upgraded to a Winter Storm Warning.
Winter Weather Advisories now in effect for the Greater Capital Region, Taconics, mid Hudson Valley, Schoharie Valley, Helderbergs, eastern Mohawk Valley, Washington Co., and Litchfield County, CT.

Frigid air will move into the region Wednesday night through Friday. Dangerous to life threatening wind chills are expected Wednesday night – Friday morning

O.K., the storm is over, now what?

- ✓ **Verification**
  - ✓ Skill of models/ensembles
  - ✓ Skill of humans adding value to model/ensemble forecasts
- ✓ **Many methods**
  - ✓ Graphics comparing forecasts to observed
  - ✓ Statistics comparing various forecast parameters
  - ✓ Receiving feedback from users, positive and negative
- ✓ **Applying lessons learned to improve for the next storm**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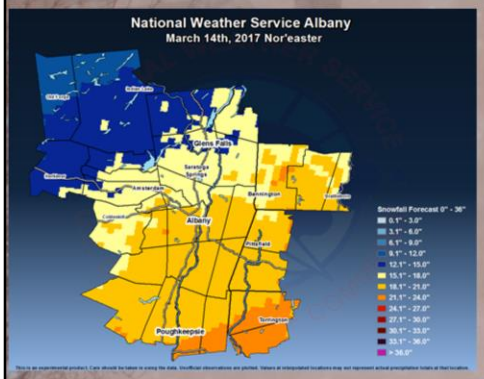
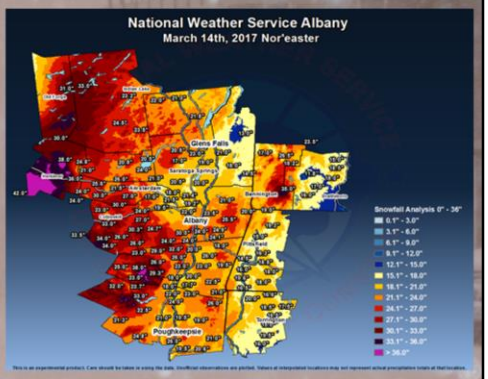
Verification methods
Gazpacho: GIS-based plots and comparisons

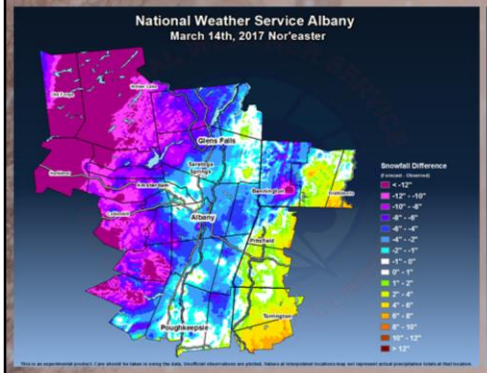


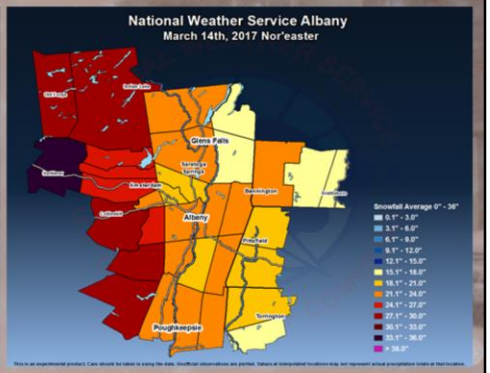


Gridded snow forecast **Observed snow**

Gazpacho: Developed by Charles Gant of NWS Greenville-Spartanburg, SC
and Joe Villani and Vasil Koleci of NWS Albany, NY

Verification methods
Gazpacho: GIS-based plots and comparisons

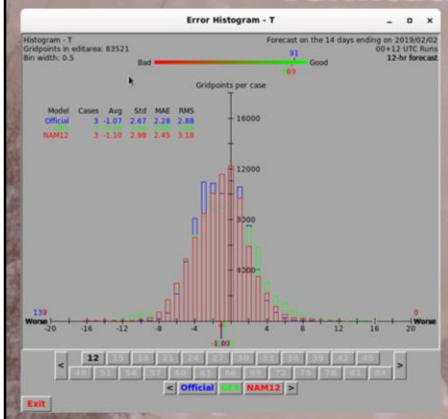


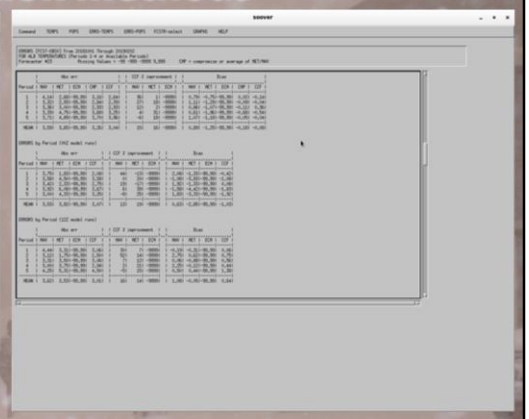


Snowfall difference – under forecasted in western areas and over forecasted in eastern areas

Verify by zone average

Verification methods

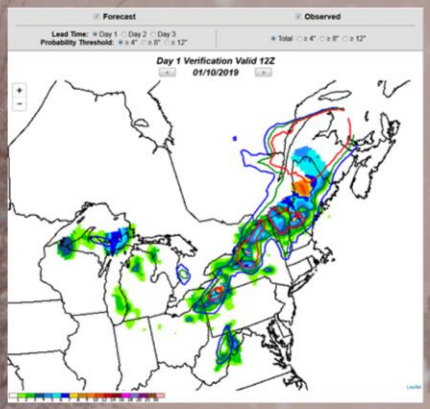




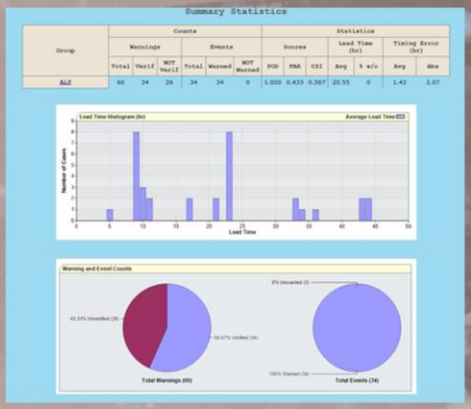
Various methods to verify temperatures and other parameters - Boiverify

Various methods to verify temperatures and other parameters - LinuxSoover

Verification methods

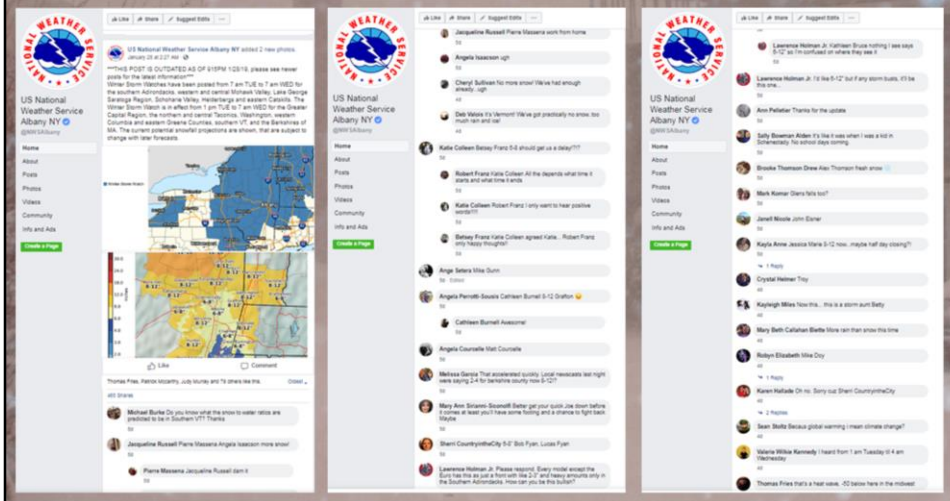


WPC probabilistic verification



Statistics on POD, FAR, CSI and lead time from the NWS Verification web site

Applying lessons learned – User feedback



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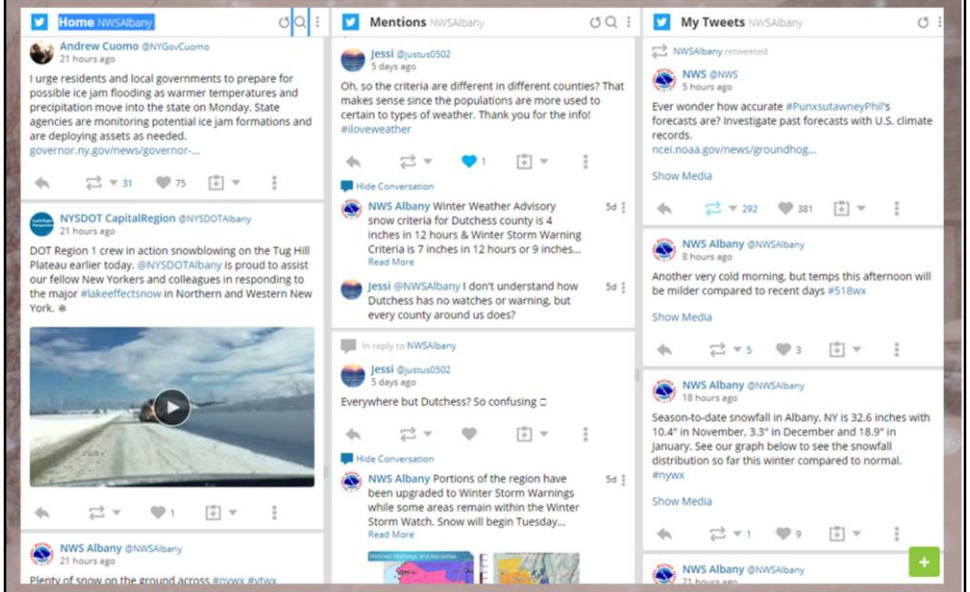

Responses and feedback from social media users – Facebook and Twitter

Applying lessons learned – Internal Quality Assurance Reports for significant events

8. Customer Feedback:

"I liked that the winter storm watch went out as early as it did for this event…from what I recall it went out Saturday afternoon – lots of lead time for a big event, even though at that time there was great uncertainty in storm track. But a good call there. And the change to blizzard warning for the event was appropriate which I think really helped in cementing the message that the traveling would be a nightmare throughout the region, which was really what we were trying to convince people to avoid…and I think that worked out well based on news reports showing a minimum of traffic accidents and issues through the duration of the storm.

The experimental snowfall projection graphics on the website were what really stood out to me…excellent. The March 14 storm was the first time I had looked at those products and the concept of offering the three scenarios of "Expect this much" "The most probable amount" and "This is possible" are very effective at telling the story, even for the very probability challenged public. I'm going to try to figure out a way to do something similar on air for next season…although for us they would be quite labor and time intensive to produce which will make it tricky. But it's definitely the way to go in the future."

"Overall good lead time with NWS communications, forecast was accurate and your graphics are very good as well. Thx."

"Thank you very much for your briefings which are incredibly helpful in our storm preparations. The only comment that I have is that there was not enough mention of the possible snow ratios in either the briefings or your daily forecast discussion. The consistency of the snow is very critical for the utility industry, so we would welcome as much information on snow ratios as possible in your future forecasts. Thank you."

"Thank you guys for keeping the area alerted and informed about the storm yesterday; I really appreciate the hard work you guys put in leading up to/during a system like this. I chased the storm out in the Berkshires yesterday afternoon, and I can honestly say that the conditions we experienced were nothing short of life threatening. On top of the extremely heavy snow, we experienced some outrageous winds near the town of Florida MA, with a wind gust of 74 mph, measured by our mobile weather station. Feel free to share my video on your page for educational purposes!"

Many people on social media questioned the airport's total of 17.0", because it was the lowest total in the area. It's easy to see why people are critical of that report. But it does make sense given that it's one of the areas most susceptible to blowing in the Capital District. We double-checked the report with the observer, so I'm not sure what more can be done.

8. Customer Feedback:

Thank you for providing these weather briefings. They are very helpful to the Department when we are preparing our storm responses. I have one question/request – earlier in the week, one of the NWS Offices (I believe it was Albany) included a Statewide map of expected snowfall in addition to the regional map that is normally provided. This Statewide map was incredibly useful to us because it allowed us to look at the entire picture. We still used the briefings from all of the other offices for specific details, but the single Statewide map gave us something to quickly reference as we conducted our pre-storm planning. Is there any way we can get a Statewide map in all of your briefings?

Kudos to NWS Albany for good weather sleuthing and for your caution that mixing could occur with the snowstorm (February 7 snow event) as suggested by multiple NAM runs in contrast to the colder GFS/ECMWF global solutions.

Ultimately – No forecast is perfect: life-long learning is the key!

Remember: Weather occurs in the atmosphere, not the models – Any Questions?