A Short History of NWS/WPC Winter Weather Services & Operations

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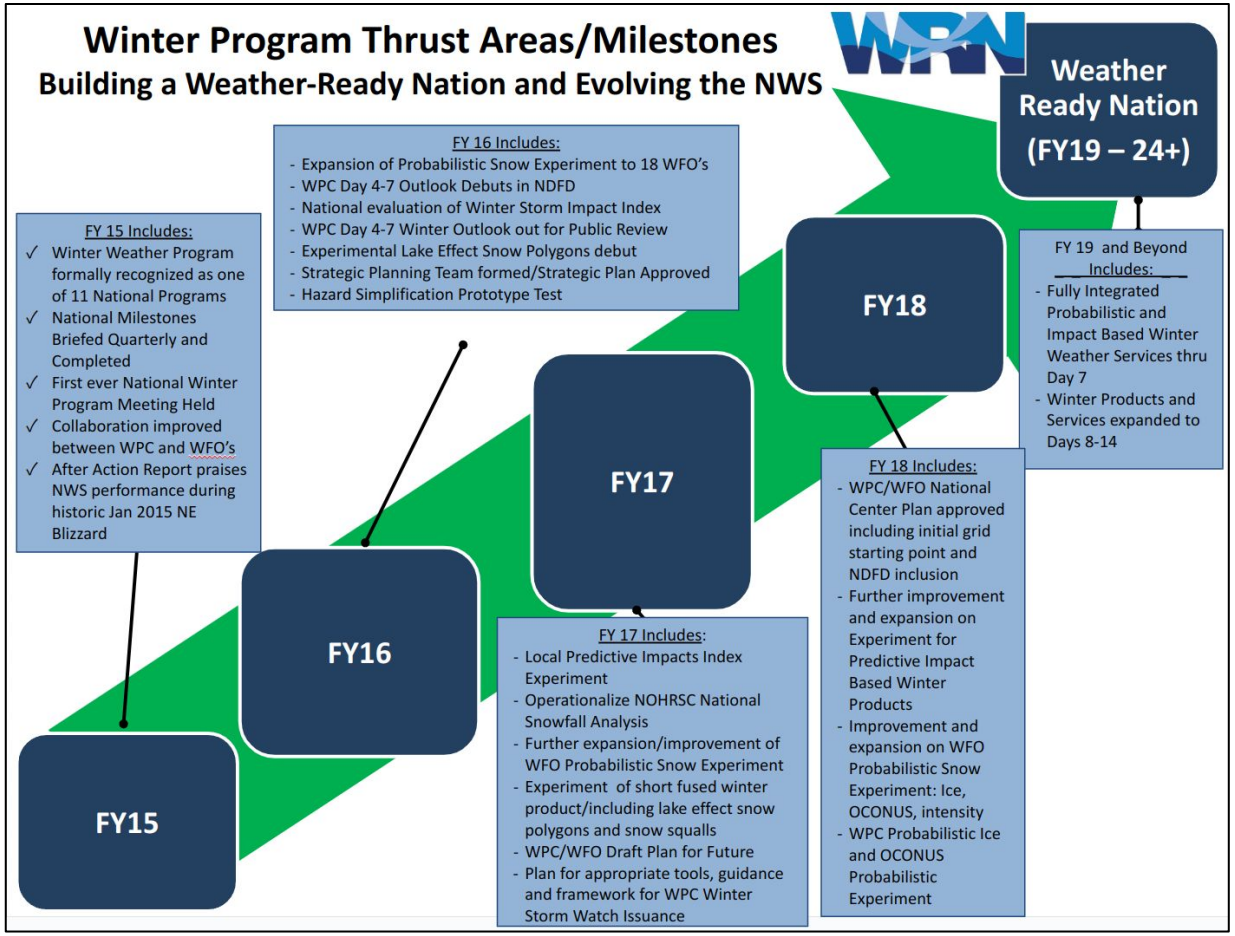
NOAA/NWS Weather Prediction Center

2023 HMT/WWE Seminar
January 11, 2024 | Virtual Presentation



2015: NWS makes winter weather a Service Program!

2016: WPC adds Day 4-7 Winter Weather Outlook to NDFD

2017: Start getting serious about WPC issuing Winter Storm Watches

2018: Improvements and upgrades to WSSI concepts

2019: Hmmm, well, not quite & KMs not mentioned

2020: COVID 

2024+: Where are we today?!

2016

Program Overview & Scope

- Winter Weather Program provides a comprehensive, consistent, coordinated suite of winter weather products.
- The Program leverages many parts of NCEP's operational and modeling expertise and combines with local needs.
- Enhances decision support services, mitigates impacts, and informs the public.
- Winter Weather Experiment at WPC provides research to operations and designates appropriate training.
- Coordination with National Partners (particularly DOT) and weather enterprise as needed.
- International collaboration with Environment Canada.

2016

~~Current~~ Service Delivery: Probabilistic Products

- WPC provides a twice daily experimental day 4-7 Winter Weather Outlook:
  - Depicts the probability of winter precipitation (snow/sleet) exceeding 0.25 inches (~6 mm) water equivalent over a 24-hour period.
  - The product is comprised of four graphics showing the forecast for Day 4, Day 5, Day 6, and Day 7.

- WPC also creates:
  - 24-h probabilistic forecasts of snowfall and freezing rain accumulations for each of three consecutive 24-h periods (days) extending 72 hours into the future.
  - These probabilistic forecasts are computed based on the deterministic accumulation forecasts combined with ensemble information.

- 18 WFOs across three regions are participating in a Probabilistic Storm Total Snow Experiment

Probabilistic Delivery on the Horizon:

- WFO Probabilistic Storm Total Snow Experiment is expected to expand across the Nation after methodology and technical issues are resolved:
  - This will involve delivering probabilistic curves via AWIPS to all offices
  - Web-based services will be transferred to IDP (This was 7 years ago!)
- WPC's Day 4-7 Winter Weather Probabilistic Outlook is expected to become operational in FY17 Done!
- WPC's Day 4-7 Probabilistic Outlook is expected to be added to NDFD as an experimental element in FY2017 Done!
- Additional elements are expected to be added to both the WPC and WFO experiments including freezing rain and snow intensity as well as expansion to OCONUS. Not Done!
- Eventually all products will become operational and become integrated into NDFD Nope!

Background (from Sep. 2017)

Plan to Improve Winter Weather Consistency Between WPC & WFOs
(Northeast and Mid-Atlantic SOO's, 2015)

As the Nation's experts in winter weather, WPC should play a leading role in providing guidance to WFOs for winter weather events.

Operational Workforce Analysis

NCEP Centers could uniformly produce long fused watch products to which local offices could layer expertise. This would improve consistency of long fused watches and weather types.

2017 Four Proposals for Consideration

- ★ Status Quo: No Changes to Winter Storm Watch Operations
- ★ WPC Probabilistic Winter Storm Outlooks inform WFO issued Winter Storm Watches
- ★ WPC Winter Storm Watch-by-county (SPC model)
- ★ Full WPC Watch Issuance

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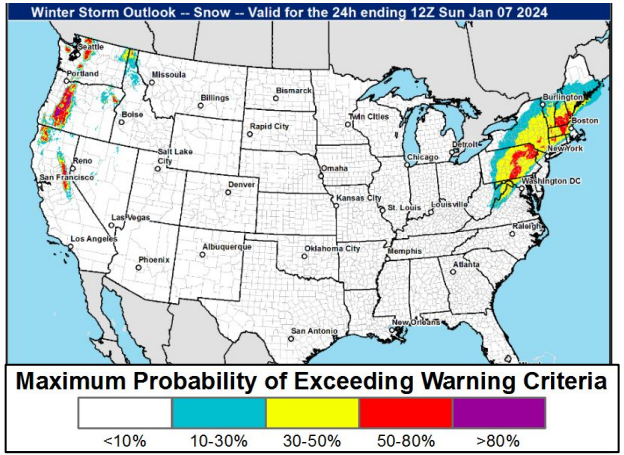
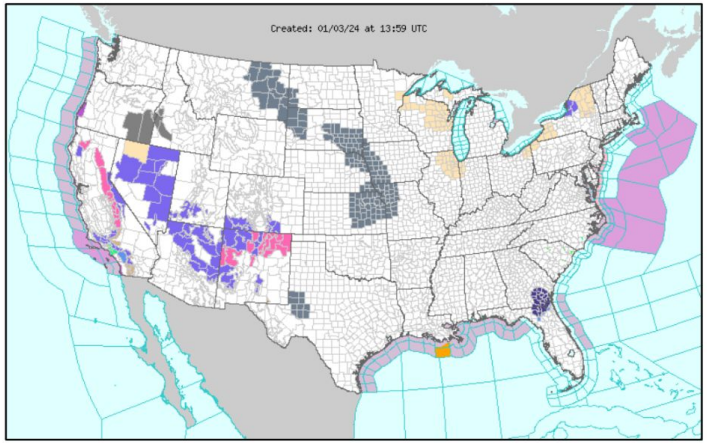
Jump forward to 2024: What does this look like?

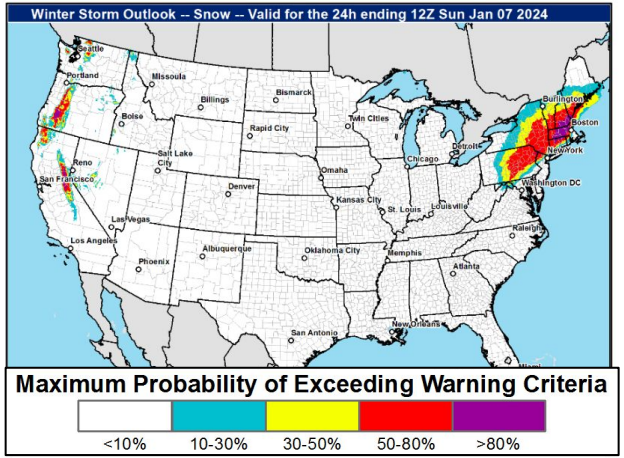
Lead Time

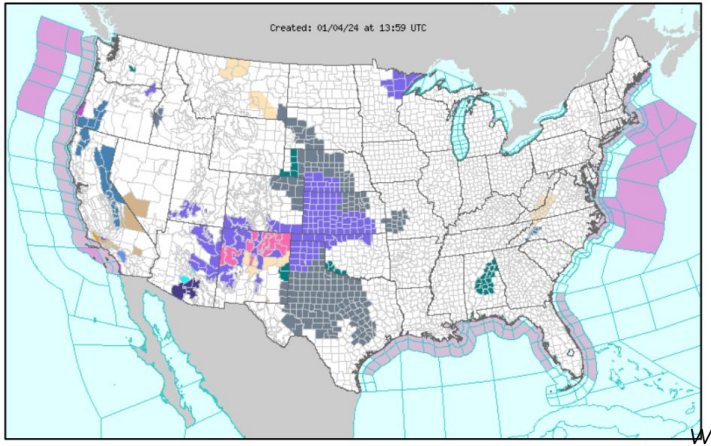
Day 4





Day 3





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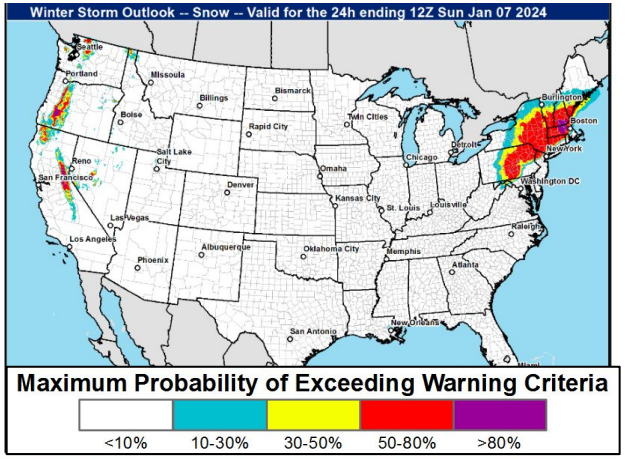
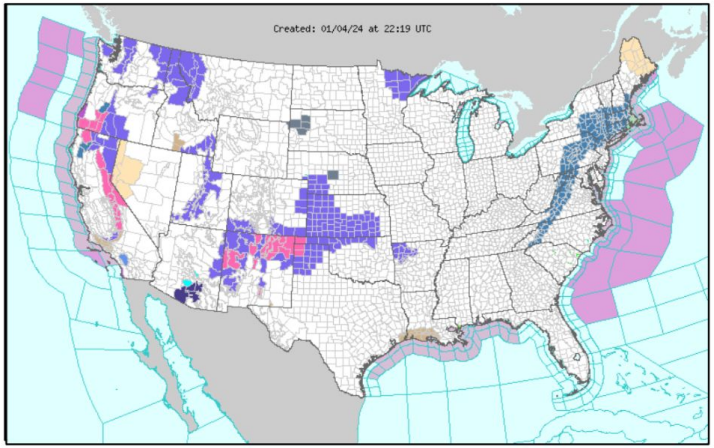
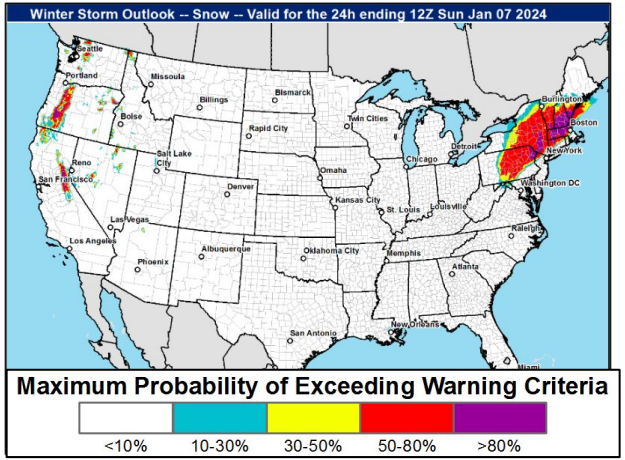
Lead Time

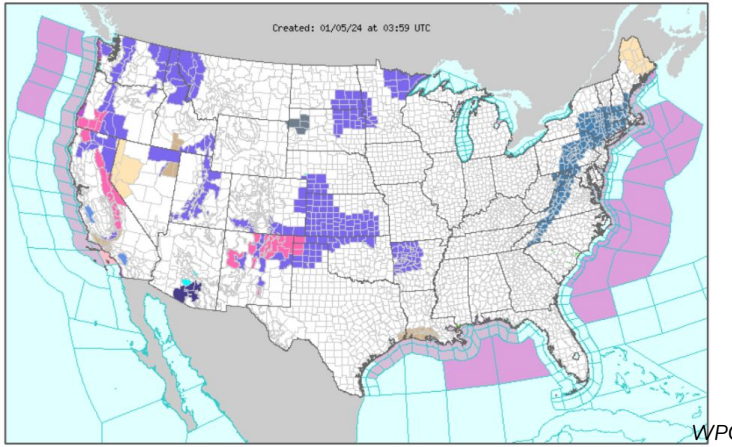
Day 2.5





Day 2





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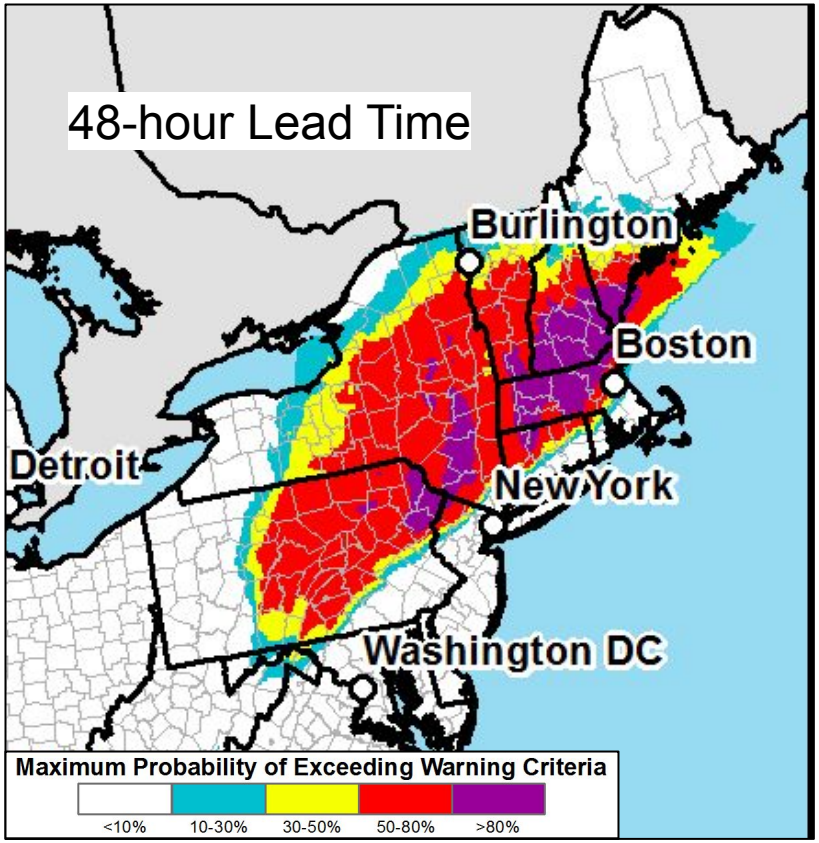
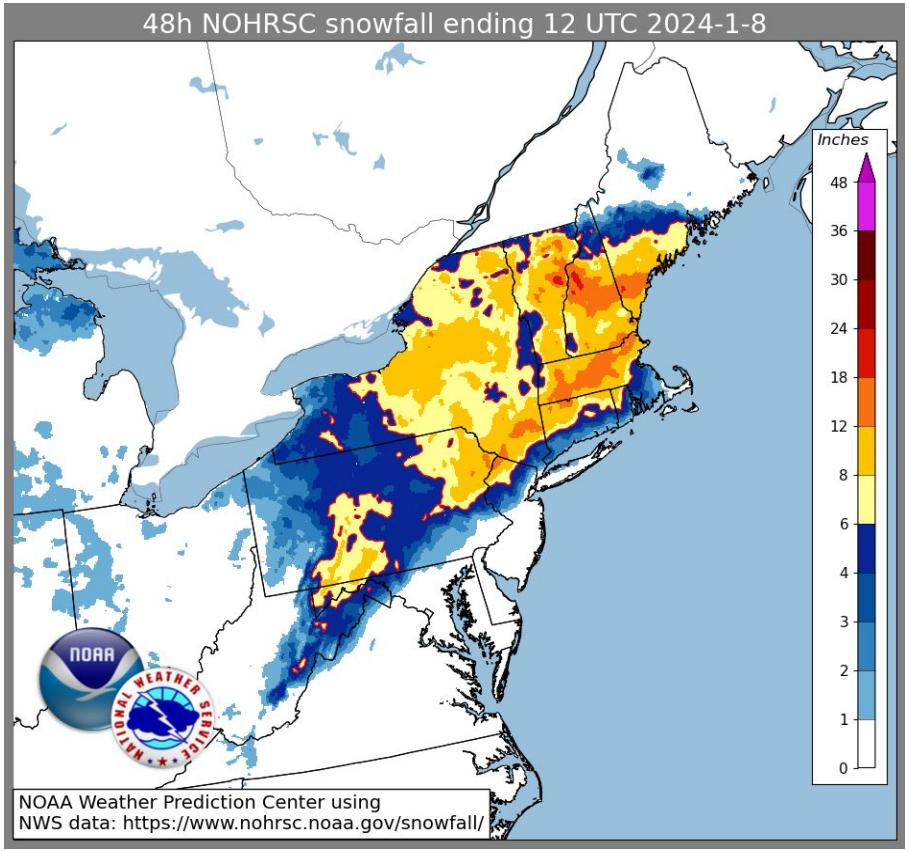
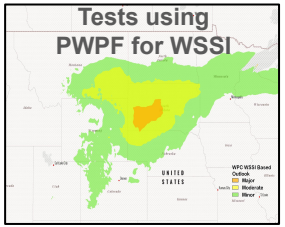




WSSI Timeline of Progress (2016-2023)

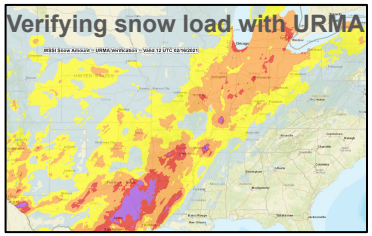
WFO BTV/GRR involved prototyping with interest in having WPC further develop.

Dr. Josh Kastman takes on WSSI improvements at WPC with a look at national snowfall climo/severity.



Early social science updates to category wording & colors

Flash Freeze change



Changes to land cover, wind speed instead of gusts, remove “Limited” and other algorithm improvements.

2016

2017
Running at WPC

2018
WFO maps

2019

COVID & Operational in ‘20

2021

WSSI-H and Ground Blizzard updated

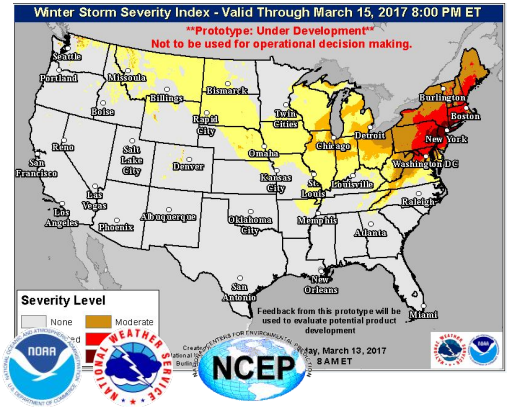
2022

Ice and Snow Load improvements

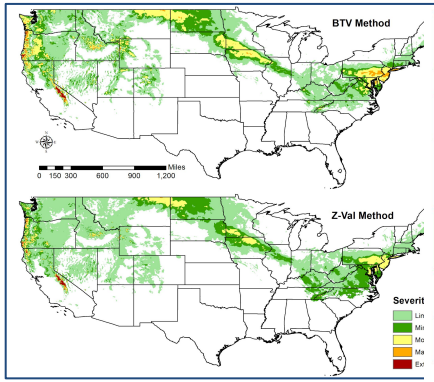
2023

WSSI Probabilistic

2016-17 Season Evaluation

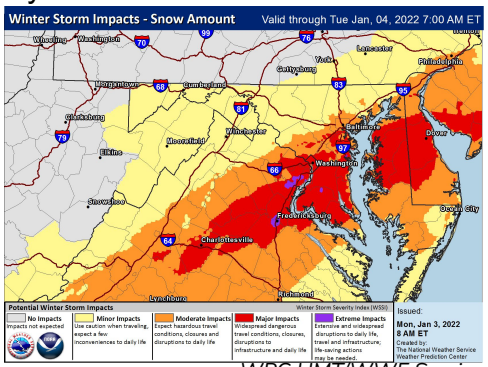


New snow climo installed



More changes informed by social science

WSSI Descriptor	General Description of Expected Storm Severity Impacts
None	No snow or ice forecast. No potential for ground blizzard conditions
Limited	Small accumulations of snow or ice forecast. Minimal impacts, if any expected. In general, society goes about their normal routine.
Minor	Roughly equated to NWS Advisory Level criteria. Minor disruptions, primarily to those who were not prepared. None to minimal recovery time needed
Moderate	Roughly equated to a NWS Warning Level criteria. Definite Impacts to those with little preparation. Perhaps a day or two of recovery time for snow and/or ice accumulation events.
Major	Significant impacts, even with preparation. Typically several days recovery time for snow and/or ice accumulation events.
Extreme	Historic. Widespread severe impacts. Many days to at least a week of recovery needed for snow and/or ice accumulation events.



From 2016 Planning for FY19-24+:

*"**Fully integrated** probabilistic and impact-based winter weather services through day 7."*

2021 Timeline of Winter Program Initiatives

Short-term Goals (FY 21-22):

- Improve collaborative forecast process working with Evolve PMO
- Collaborative Winter Storm Watch demonstration
- WSSI extended to Day-4
- Experimental probabilistic WSSI

Intermediate Goals (FY 23-24):

- Continue testing and refinement of CFP and Collaborated Watch process
- Operational, probabilistic WSSI informs operational WSO and GHWO through Day-7
- PWPF available through Day-7
- Centrally generated IDSS graphics for PWPF (ProbSnow/ProbIce)

Long-term Goals (FY 25+):

- Leverage short-fuse storm-scale guidance to improve communication of key impacts
- Expanded Winter Services beyond Day-7
- National Ice Accumulation Analysis
- Fully Implemented Collaborated Forecast and Watch Process
- Probabilistic data informing IMS
- Implementation of HazSimp and polygon hazards

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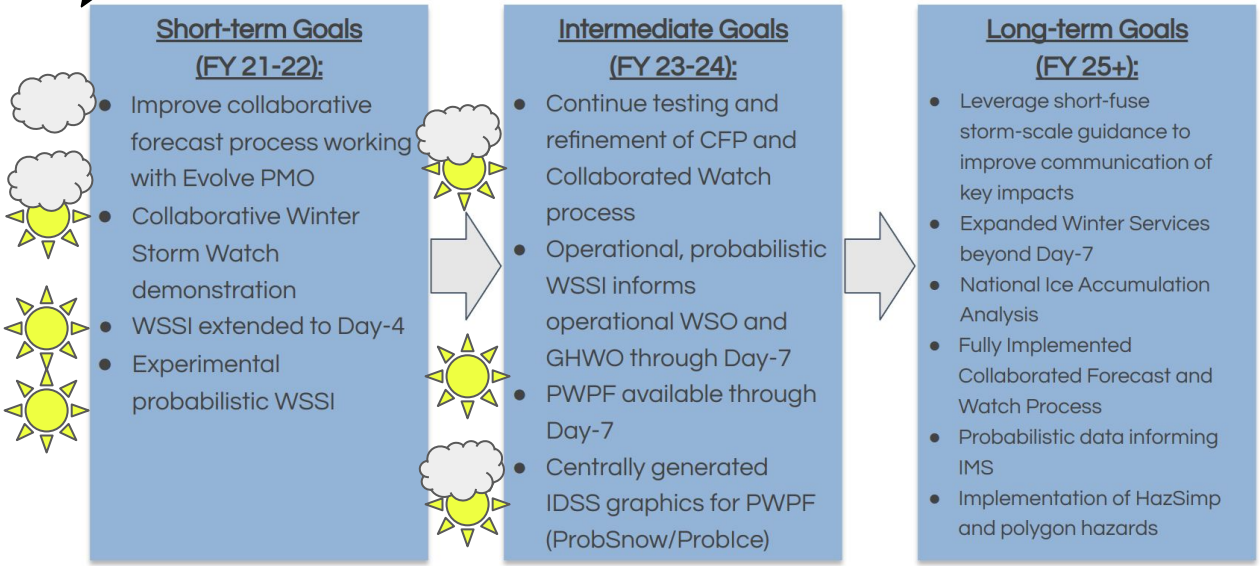
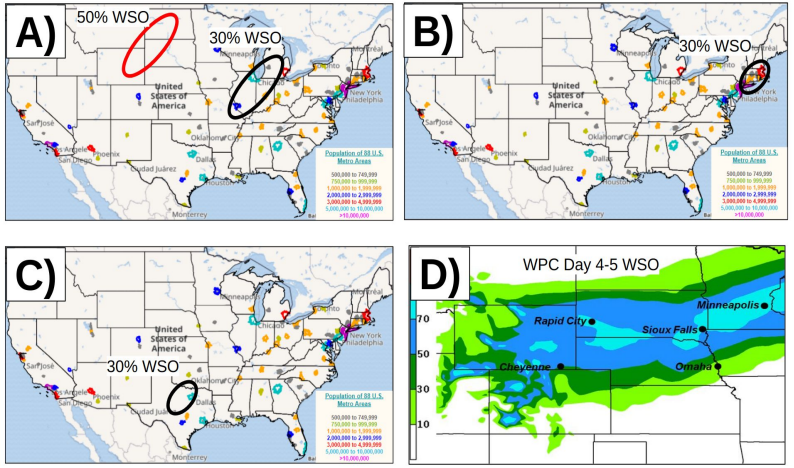
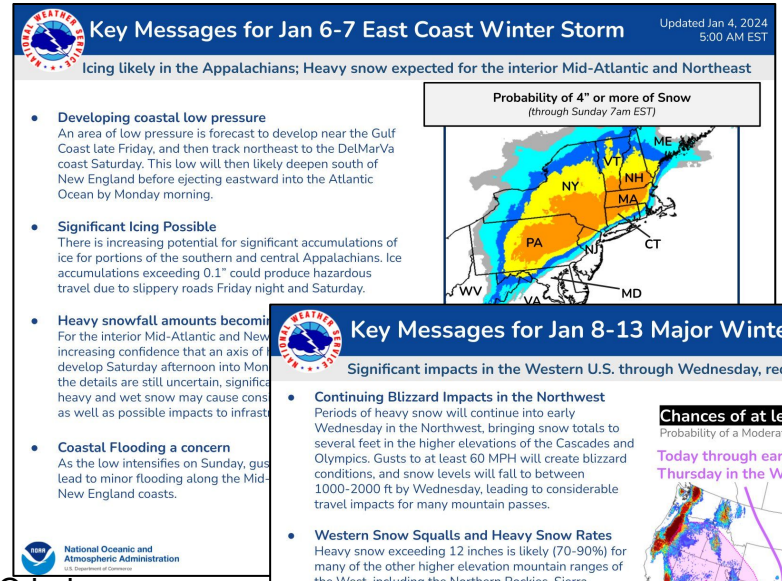
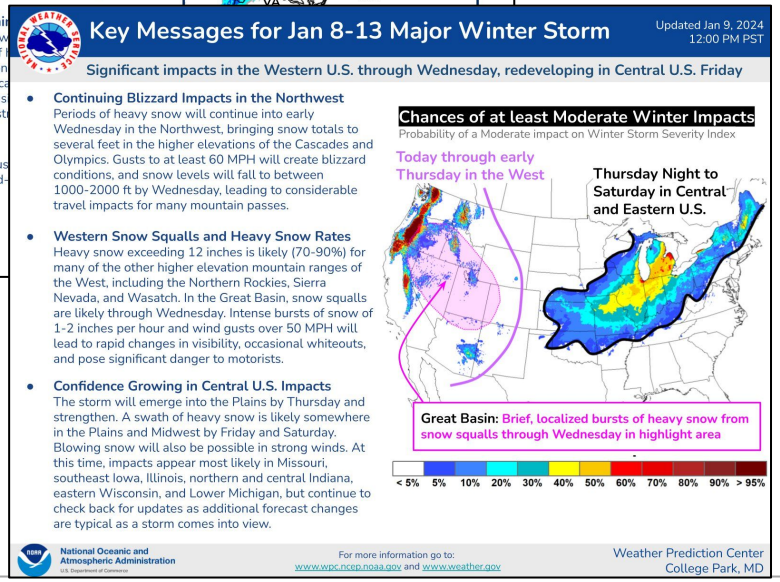


What was not on the 2016 Phasing Diagram?



Coordinated Messaging of Winter Weather Hazards





Thresholds:

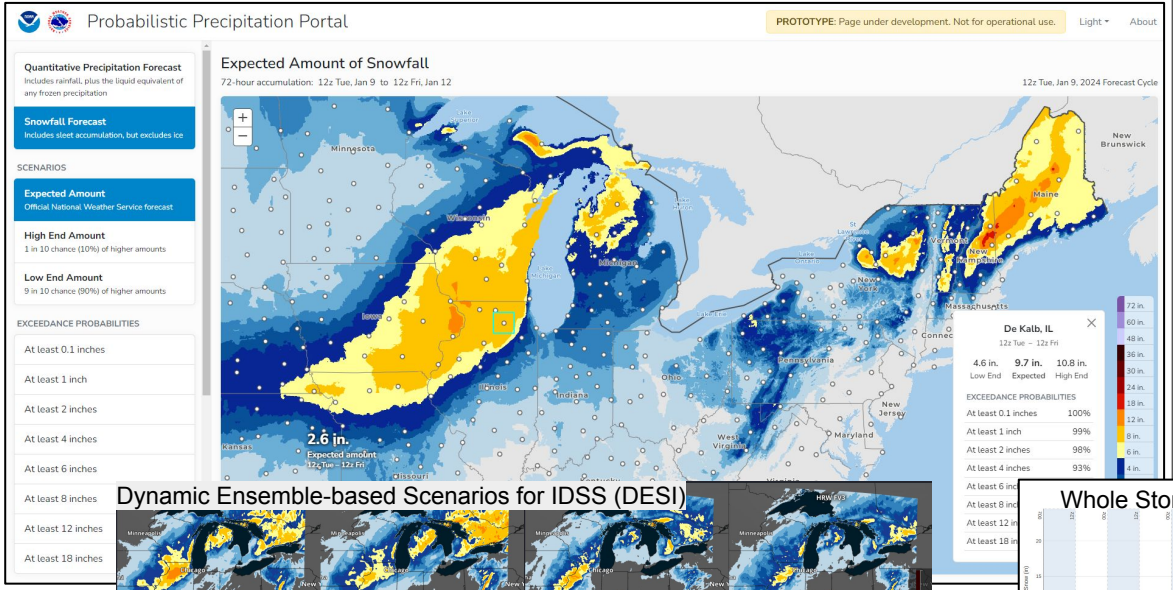
A) >500 mile long (nearly) continuous swath with >30% WSO being exceeded including at least one metropolitan area of at least 500,000 people" or a similarly extensive swath of probability, not necessarily encompassing a metro area **OR**

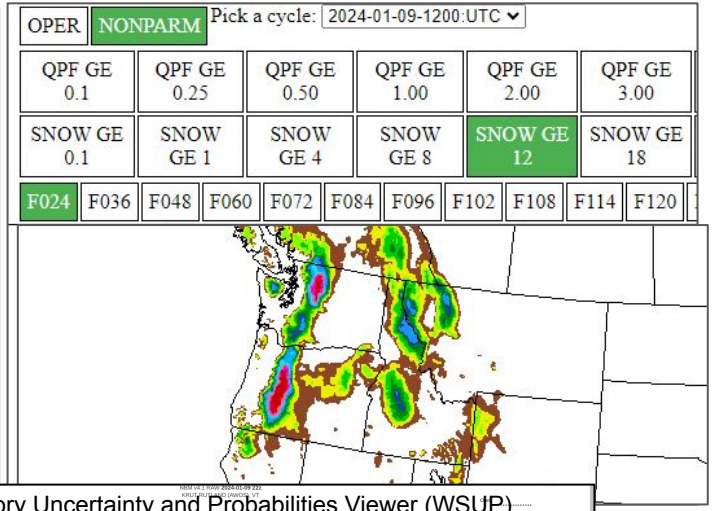
B) At least two "NE megalopolis" cities with >30% WSO **OR**

C) Forecaster Discretion: Anomalous or High Impact event **OR**

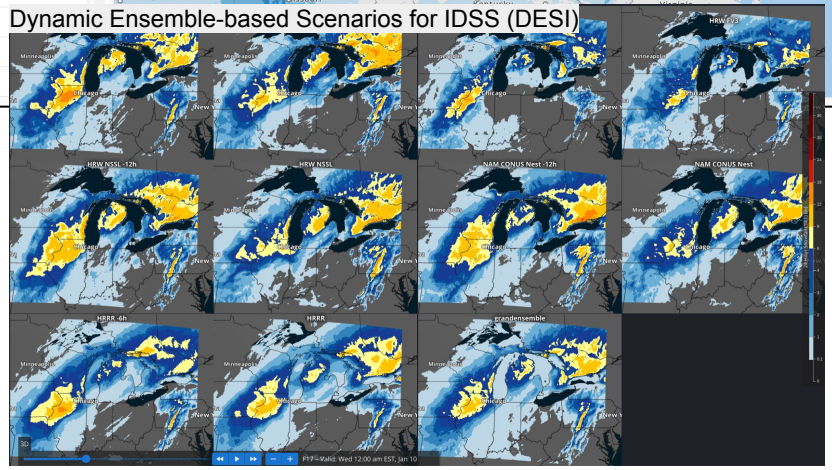
D) 70+ percent probability of 0.25 inch snow/sleet liquid equivalent is forecast for a *major metro area (>=2 million population)*

The Latest in PWPF, DESI, NBM/WSUP

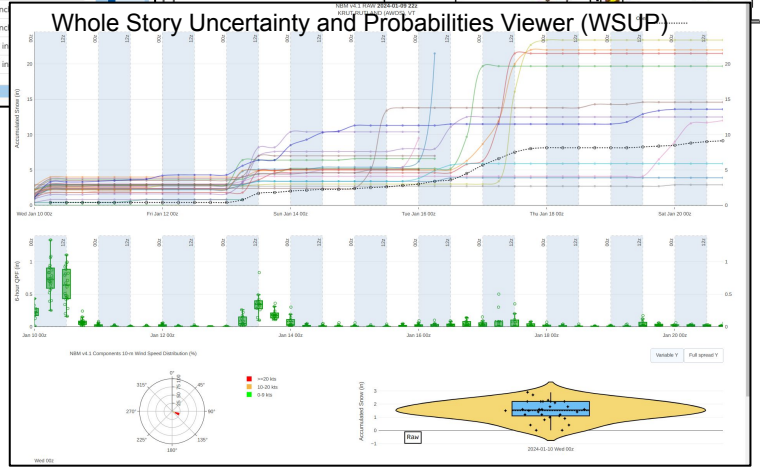




Dynamic Ensemble-based Scenarios for IDSS (DESI)



Whole Story Uncertainty and Probabilities Viewer (WSUP)

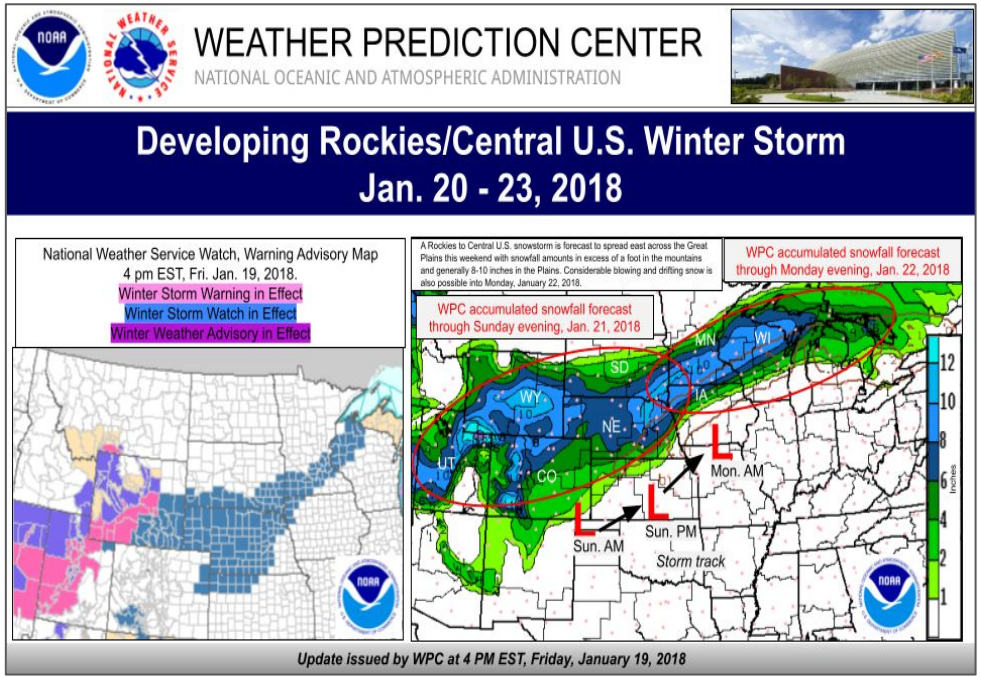


Summary & Takeaways

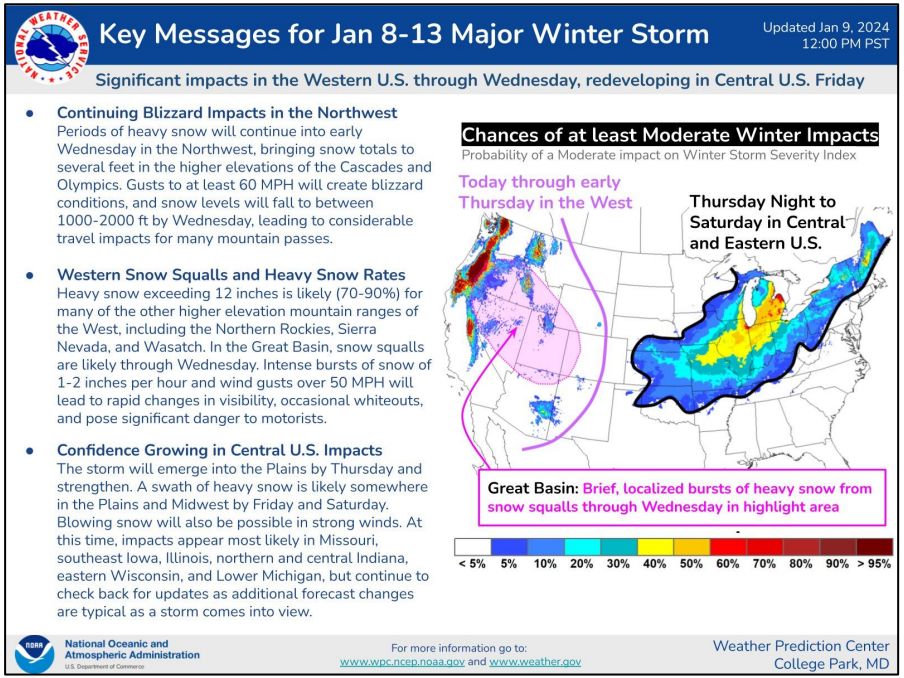
- A review of the NWS Winter Program and WPC initiatives since 2016 reveals a number of significant advances have been made!
- The true nature of winter storm watch issuance remains firmly under WFO control but there is increasing acceptance that WPC can offer crucial information
- WPC continues to advance the application of probability-based winter weather services that can aid in decision making (both internally and externally)
- Many of these advances are not yet “fully integrated” into a comprehensive NWS approach to the challenges associated with winter storms (i.e. consistently high bias in NWS snowfall forecasts, little change in WS Watch verification metrics)
- NDFD and WPC WWD forecasts drive NWS winter weather forecast products and services so agency consistency is important but not always achieved

Progress in Probabilistic Winter Forecasts!

2018



2024



Thank You!

Points of Contact

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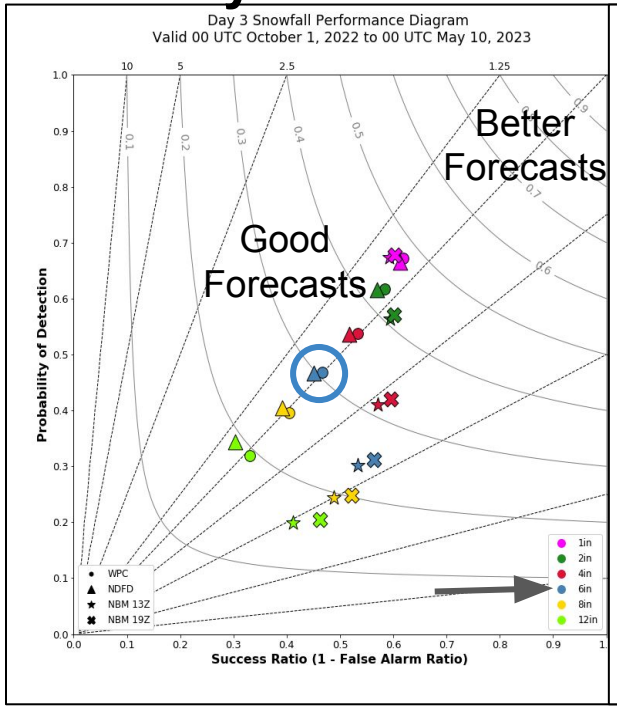
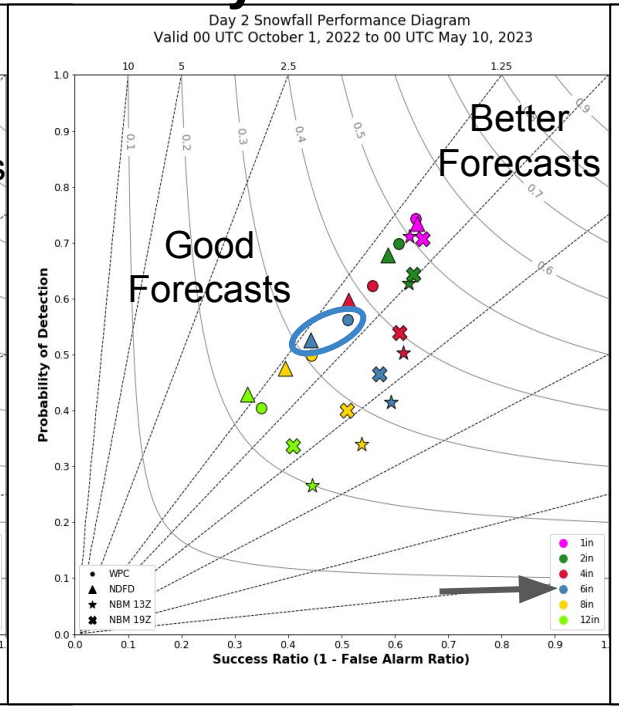
Tony Fracasso, Winter Team Lead, anthony.fracasso@noaa.gov

Snowfall Forecast Verification for 22-23

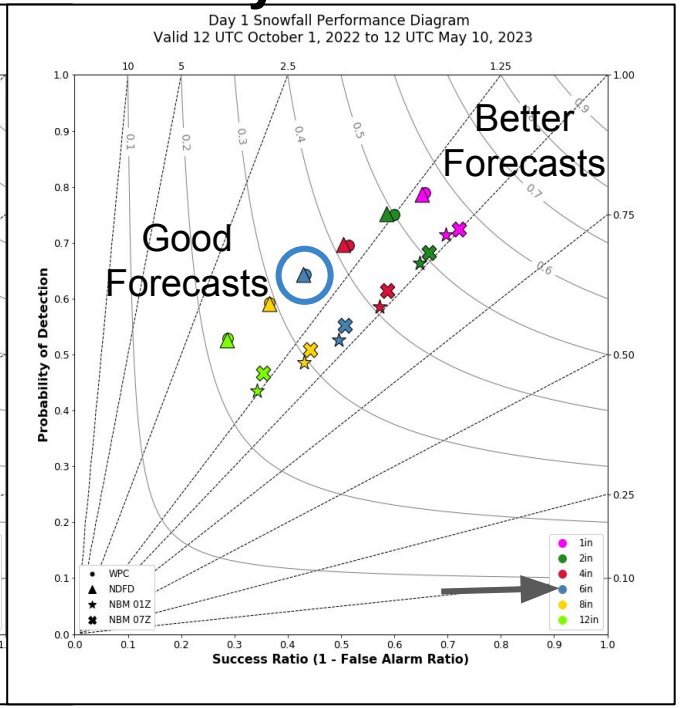
3-day forecasts



2-day forecasts



1-day forecasts



Generally improved CSI with < Lead Time. However, bias does climb as events approach.