

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

Greg Carbin
NOAA/NWS Weather Prediction Center

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



Winter Program Thrust Areas/Milestones

Building a Weather-Ready Nation and Evolving the NWS



Weather Ready Nation (FY19 – 24+)

FY18

FY17

FY16

FY15

FY 15 Includes:

- ✓ Winter Weather Program formally recognized as one of 11 National Programs
- ✓ National Milestones Briefed Quarterly and Completed
- ✓ First ever National Winter Program Meeting Held
- ✓ Collaboration improved between WPC and WFO's
- ✓ After Action Report praises NWS performance during historic Jan 2015 NE Blizzard

FY 16 Includes:

- Expansion of Probabilistic Snow Experiment to 18 WFO's
- WPC Day 4-7 Outlook Debuts in NDFD
- National evaluation of Winter Storm Impact Index
- WPC Day 4-7 Winter Outlook out for Public Review
- Experimental Lake Effect Snow Polygons debut
- Strategic Planning Team formed/Strategic Plan Approved
- Hazard Simplification Prototype Test

FY 17 Includes:

- Local Predictive Impacts Index Experiment
- Operationalize NOHRSC National Snowfall Analysis
- Further expansion/improvement of WFO Probabilistic Snow Experiment
- Experiment of short fused winter product/including lake effect snow polygons and snow squalls
- WPC/WFO Draft Plan for Future
- Plan for appropriate tools, guidance and framework for WPC Winter Storm Watch Issuance

FY 18 Includes:

- WPC/WFO National Center Plan approved including initial grid starting point and NDFD inclusion
- Further improvement and expansion on Experiment for Predictive Impact Based Winter Products
- Improvement and expansion on WFO Probabilistic Snow Experiment: Ice, OCONUS, intensity
- WPC Probabilistic Ice and OCONUS Probabilistic Experiment

FY 19 and Beyond Includes:

- Fully Integrated Probabilistic and Impact Based Winter Weather Services thru Day 7
- Winter Products and Services expanded to Days 8-14

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?!



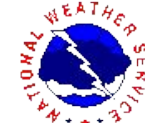


2016

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





2016

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!**





NOAA

2017: Start getting serious about WPC issuing Winter Storm Watches



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.

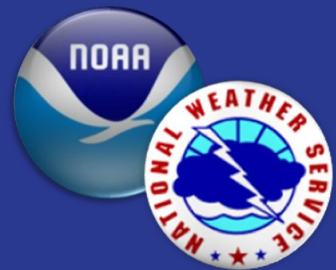
Operational Workforce Analysis

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.



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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





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)

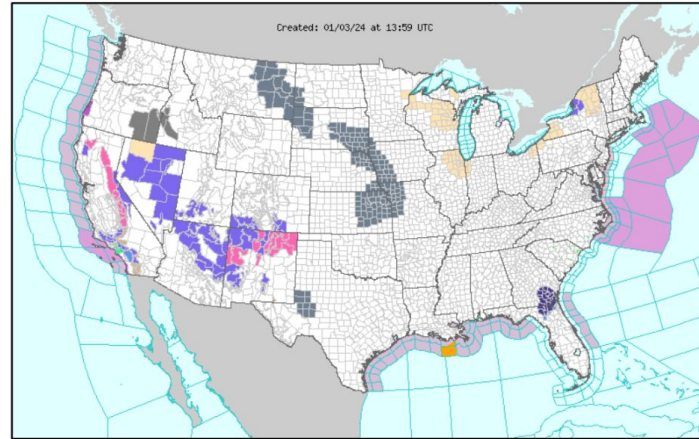
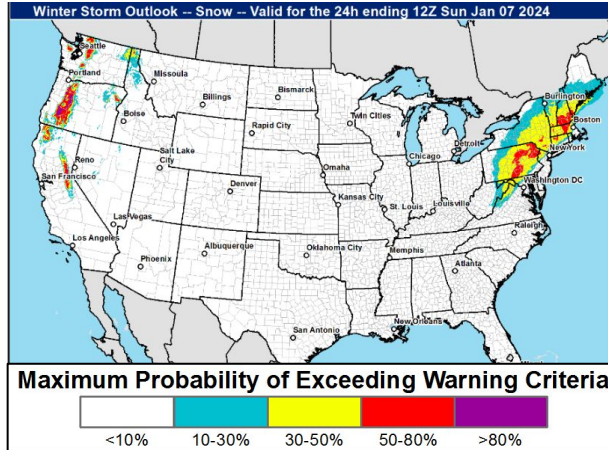
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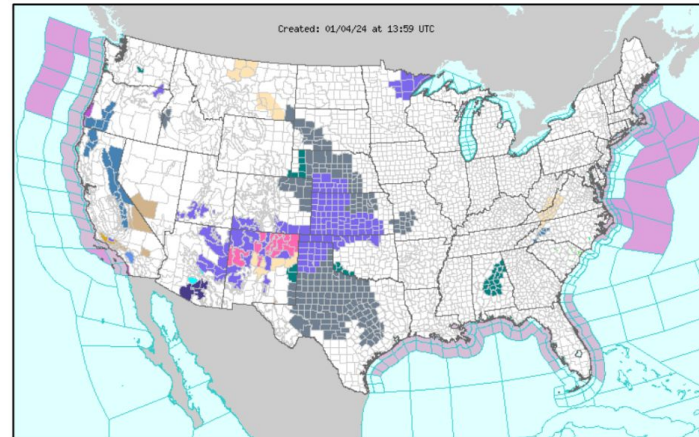
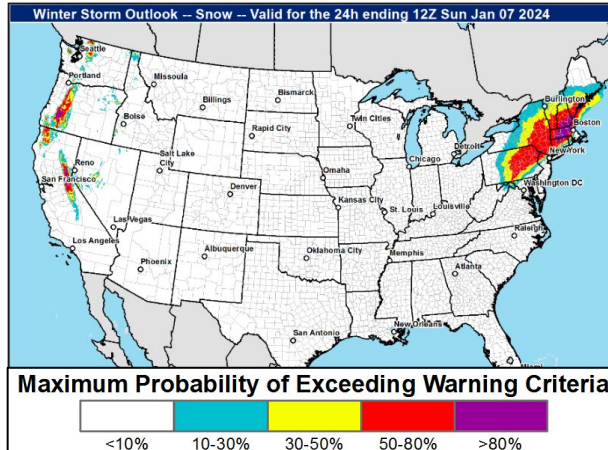
Jump forward to 2024: What does this look like?

Lead Time

Day 4

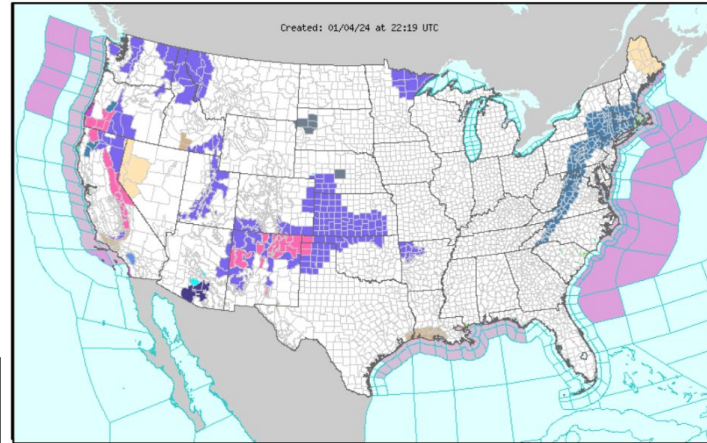
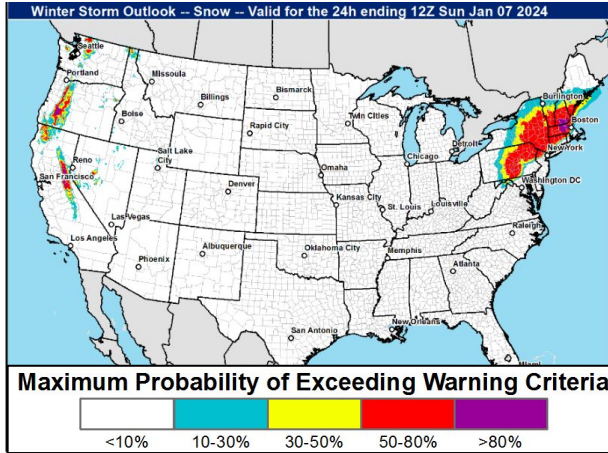


Day 3

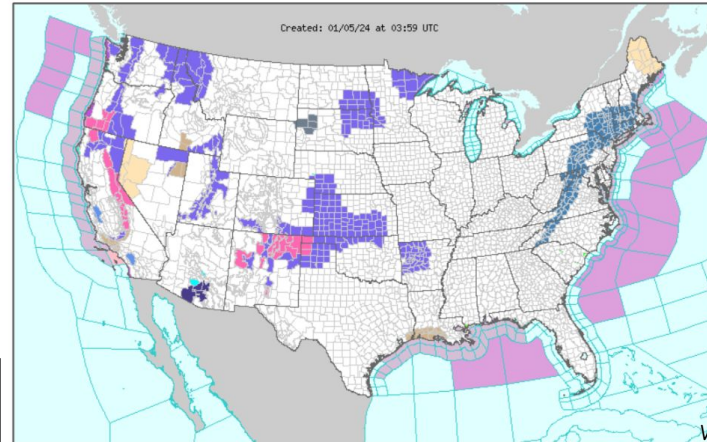
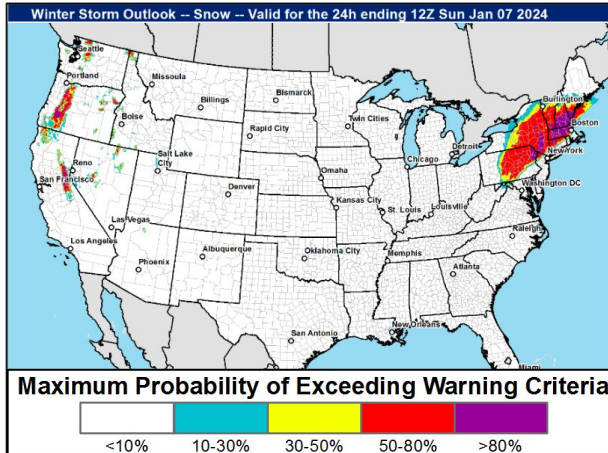


Jump forward to 2024: What does this look like?

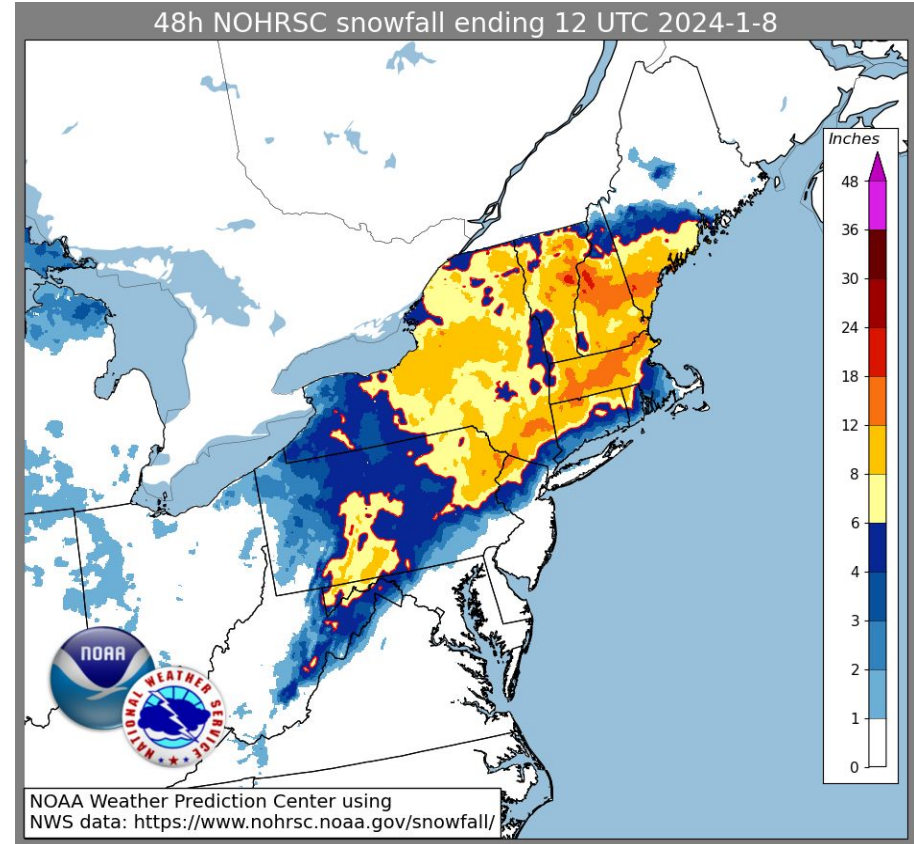
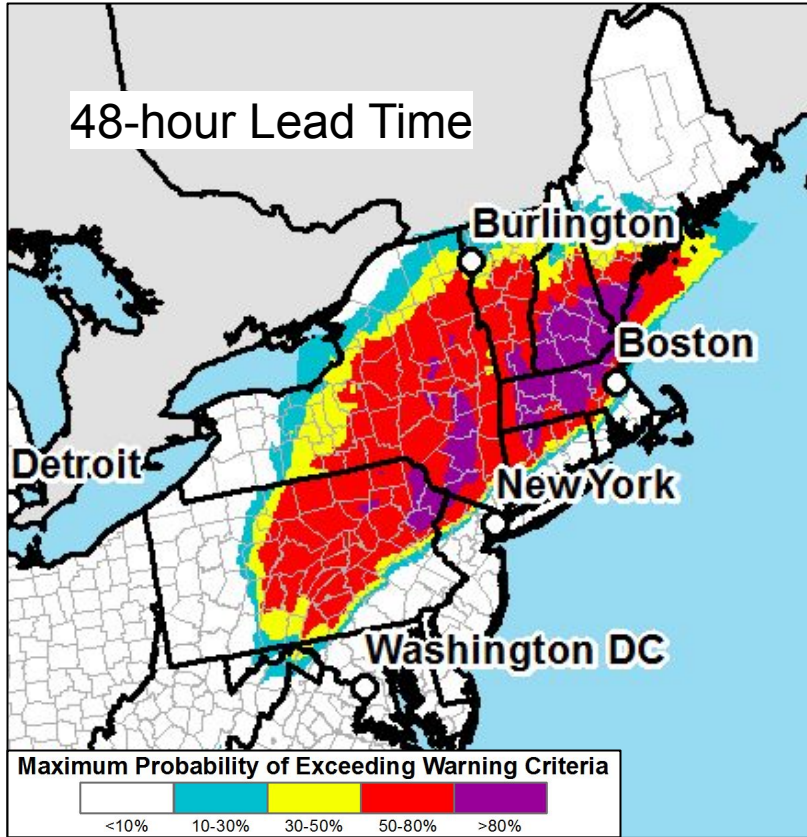
Lead Time
Day 2.5



Day 2



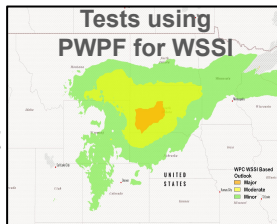
Jump forward to 2024: What does this look like?



WSSI Timeline of Progress (2016-2023)

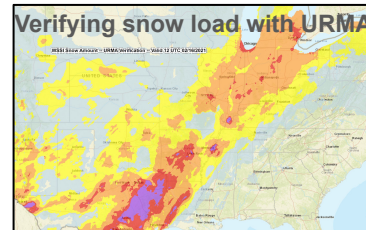
WFO BTV/GRR involved prototyping with interest in having WPC further develop.

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

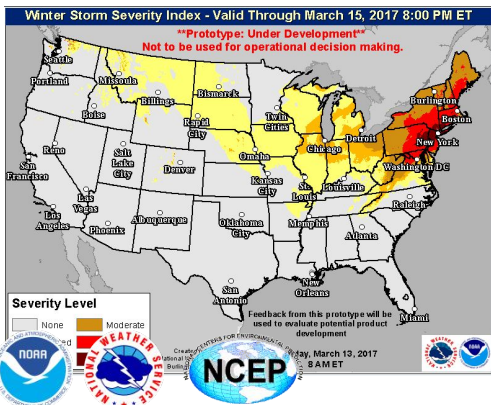
Flash Freeze change



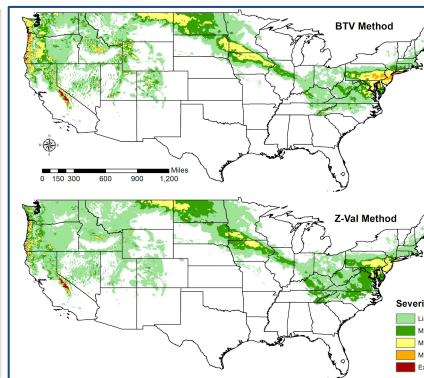
Changes to land cover, wind speed instead of gusts, remove "Limited" and other algorithm improvements.



2016-17 Season Evaluation

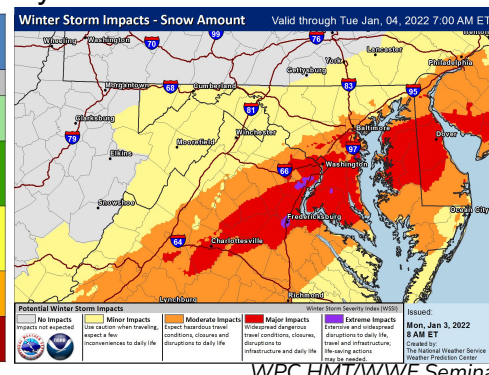


New snow climo installed



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.



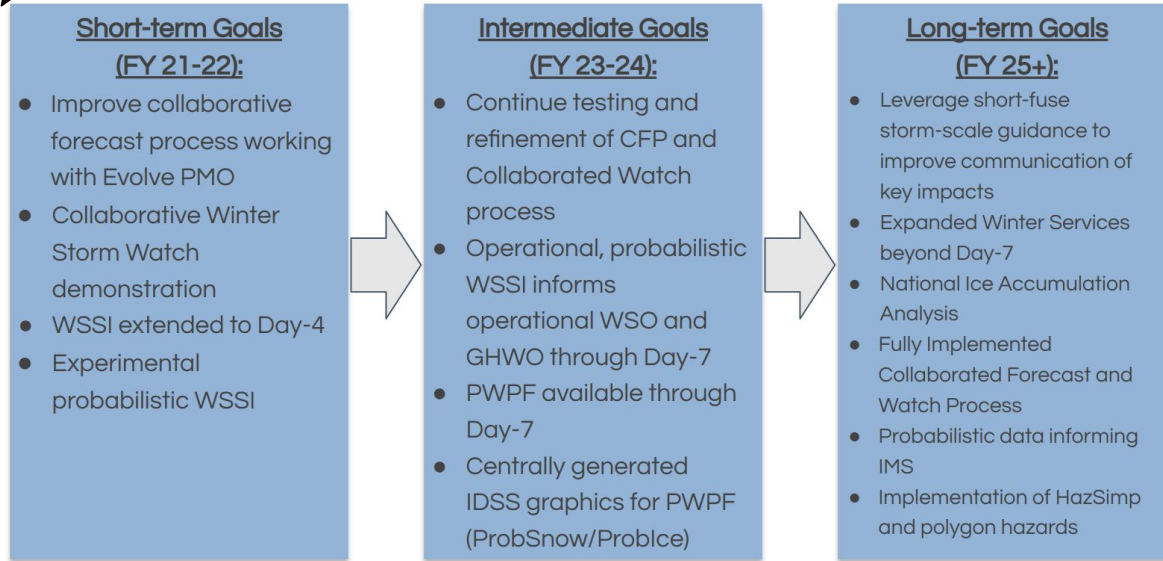
From 2016 Planning for FY19-24+:

“Fully integrated probabilistic and impact-based winter weather services through day 7.”



2021

Timeline of Winter Program Initiatives



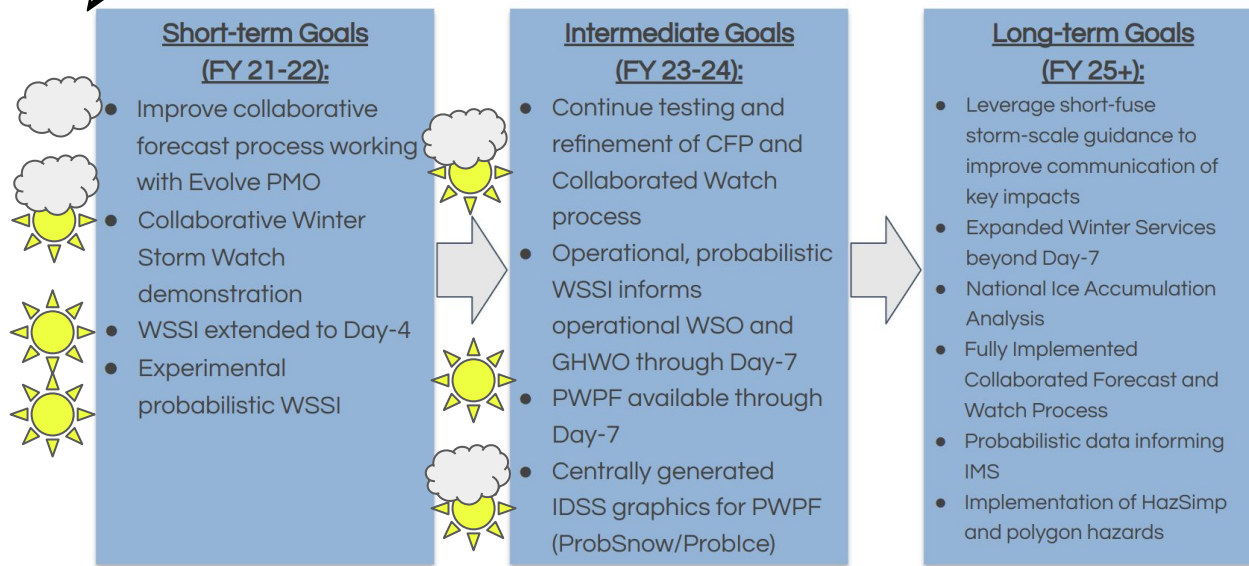
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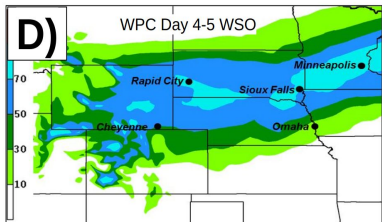
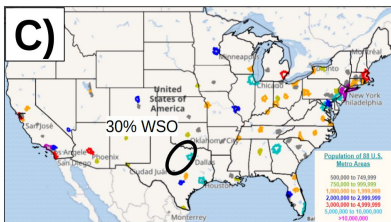
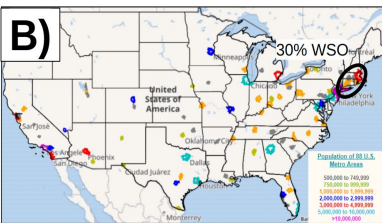
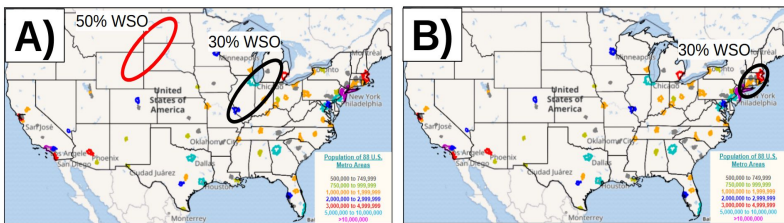


2021

Timeline of Winter Program Initiatives



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)

Key Messages for Jan 6-7 East Coast Winter Storm Updated Jan 4, 2024
5:00 AM EST

Icing likely in the Appalachians; Heavy snow expected for the interior Mid-Atlantic and Northeast

- **Developing coastal low pressure**
An area of low pressure is forecast to develop near the Gulf Coast late Friday, and then track northeast to the DelMarVa coast Saturday. This low will then likely deepen south of New England before ejecting eastward into the Atlantic Ocean by Monday morning.
- **Significant Icing Possible**
There is increasing potential for significant accumulations of ice for portions of the southern and central Appalachians. Ice accumulations exceeding 0.1” could produce hazardous travel due to slippery roads Friday night and Saturday.
- **Heavy snowfall amounts becoming more likely**
For the interior Mid-Atlantic and New England, increasing confidence that an axis of development Saturday afternoon into Monday will intensify into a major winter storm. The details are still uncertain, significant heavy and wet snow may cause concern as well as possible impacts to infrastructure.
- **Coastal Flooding a concern**
As the low intensifies on Sunday, gusts lead to minor flooding along the Mid-New England coasts.

Probability of 4” or more of Snow (through Sunday 7am EST)

Key Messages for Jan 8-13 Major Winter Storm Updated Jan 9, 2024
12:00 PM PST

Significant impacts in the Western U.S. through Wednesday, redeveloping in Central U.S. Friday

- **Continuing Blizzard Impacts in the Northwest**
Periods of heavy snow will continue into early Wednesday in the Northwest, bringing snow totals to several feet in the higher elevations of the Cascades and Olympics. Gusts to at least 60 MPH will create blizzard conditions, and snow levels will fall to between 1000-2000 ft by Wednesday, leading to considerable travel impacts for many mountain passes.
- **Western Snow Squalls and Heavy Snow Rates**
Heavy snow exceeding 12 inches is likely (70-90%) for many of the other higher elevation mountain ranges of the West, including the Northern Rockies, Sierra Nevada, and Wasatch. In the Great Basin, snow squalls are likely through Wednesday. Intense bursts of snow of 1-2 inches per hour and wind gusts over 50 MPH will lead to rapid changes in visibility, occasional whiteouts, and pose significant danger to motorists.
- **Confidence Growing in Central U.S. Impacts**
The storm will emerge into the Plains by Thursday and strengthen. A swath of heavy snow is likely somewhere in the Plains and Midwest by Friday and Saturday. Blowing snow will also be possible in strong winds. At this time, impacts appear most likely in Missouri, southeast Iowa, Illinois, northern and central Indiana, eastern Wisconsin, and Lower Michigan, but continue to check back for updates as additional forecast changes are typical as a storm comes into view.

Chances of at least Moderate Winter Impacts
Probability of a Moderate impact on Winter Storm Severity Index

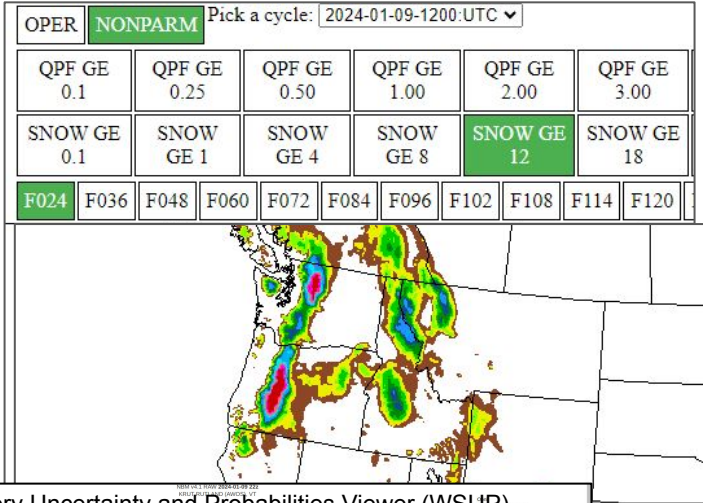
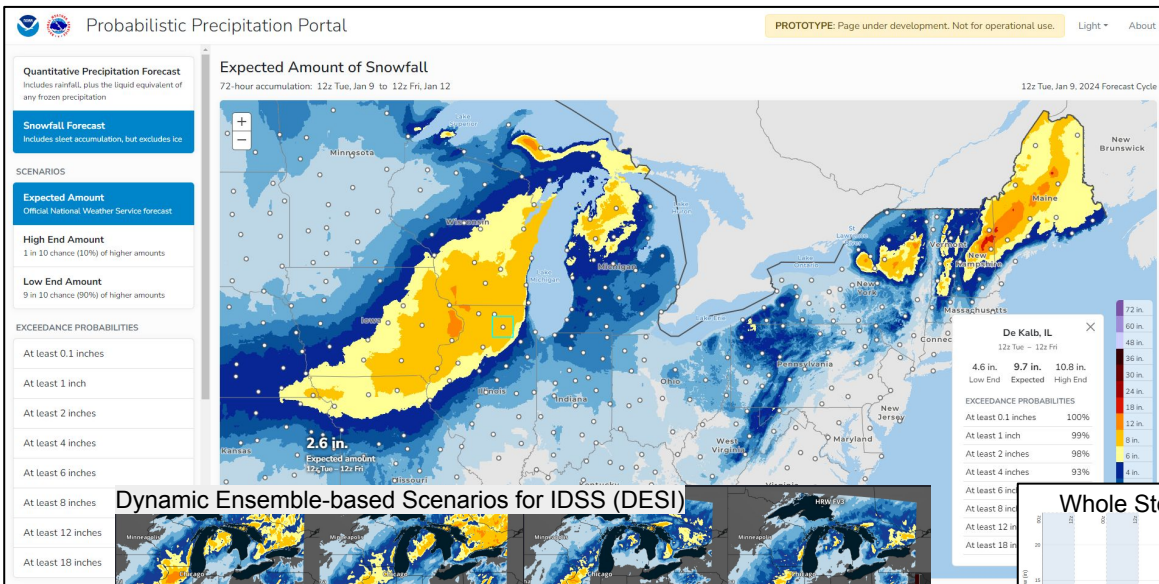
Today through early Thursday in the West

Thursday Night to Saturday in Central and Eastern U.S.

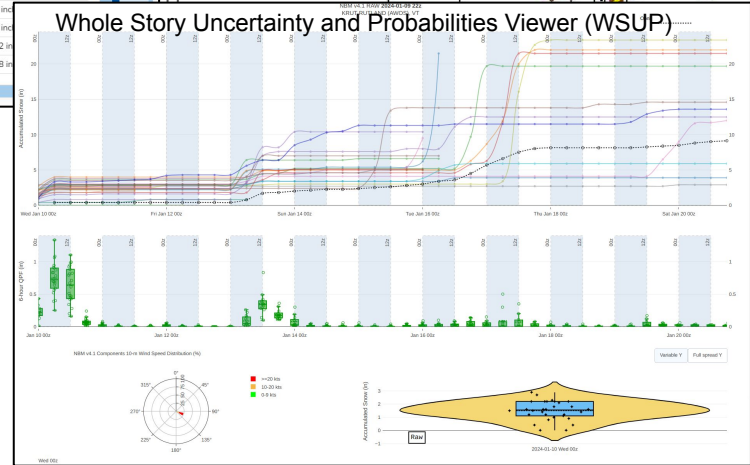
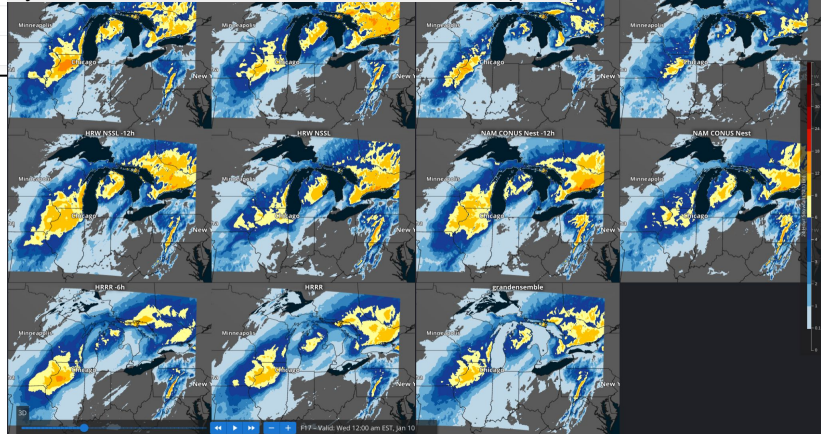
Great Basin: Brief, localized bursts of heavy snow from snow squalls through Wednesday in highlight area



The Latest in PWPF, DESI, NBM/WSUP



Dynamic Ensemble-based Scenarios for IDSS (DESI)



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



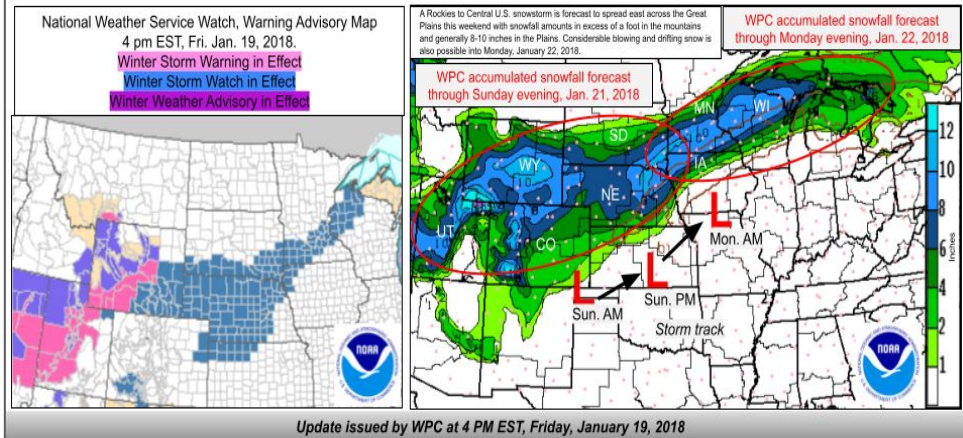
Progress in Probabilistic Winter Forecasts!

2018

2024



Developing Rockies/Central U.S. Winter Storm Jan. 20 - 23, 2018

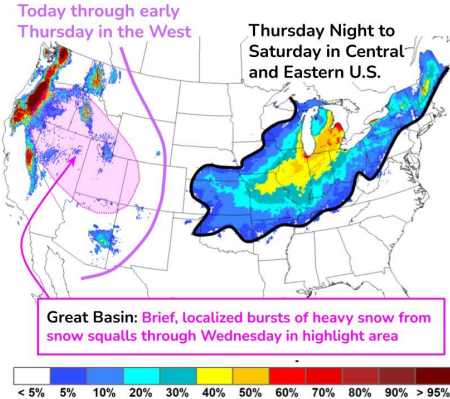


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Chances of at least Moderate Winter Impacts

Probability of a Moderate impact on Winter Storm Severity Index



Thank You!

Points of Contact

Greg Carbin, Forecast Operations Branch Chief, gregory.carbin@noaa.gov

Alex Lamers, Warning Coordination Meteorologist, alex.lamers@noaa.gov

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



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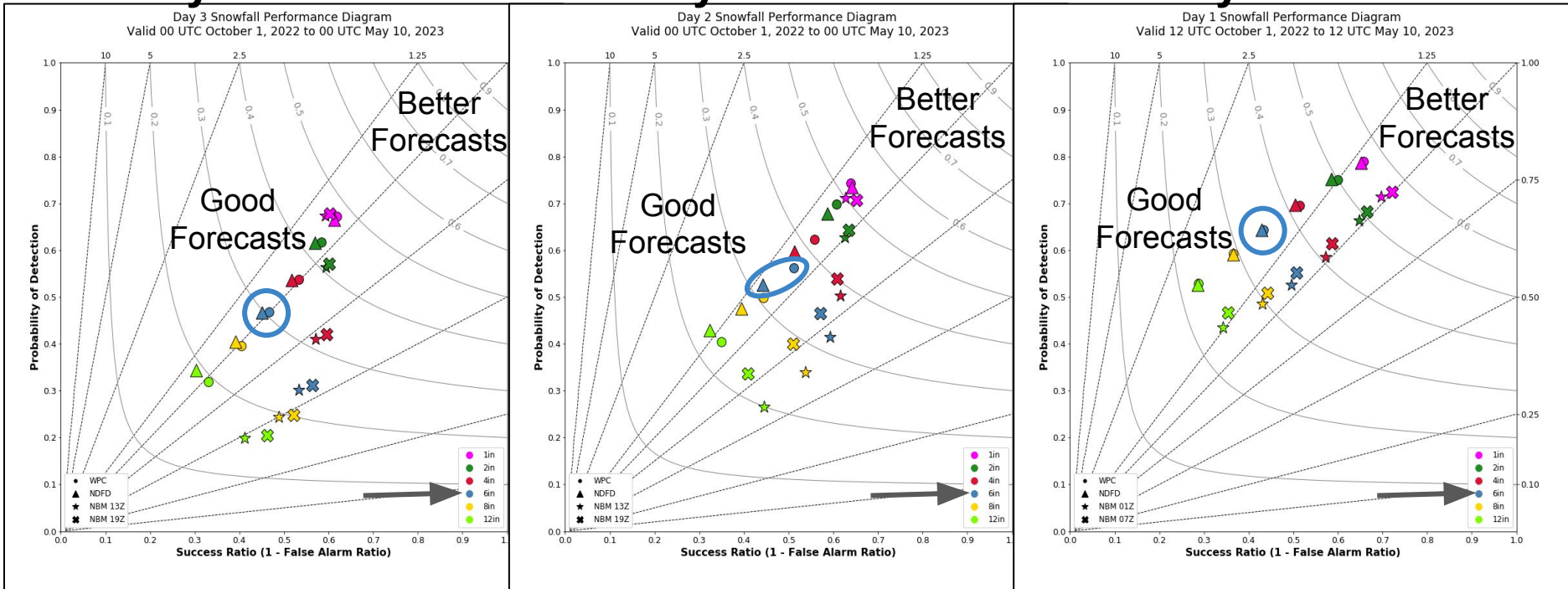
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Snowfall Forecast Verification for 22-23

3-day forecasts

2-day forecasts

1-day forecasts



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

