NOAA

National Weather Service

The National Blend of Models v4.1 for Aviation

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The opinions expressed in this presentation are the author's and are not necessarily the view of any federal office or agency.

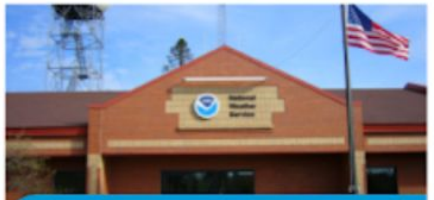
The National Blend of Models (NBM) is a nationally consistent and skillful suite of calibrated forecast guidance based on a blend of both NWS and non-NWS numerical weather prediction model data and post-processed model guidance.

The goal of the NBM is to create a highly accurate, skillful and consistent starting point for the gridded forecast.

https://journals.ametsoc.org/view/journals/bams/100/10/bams-d-18-0159.1.xml

Citation: Bulletin of the American Meteorological Society 100, 10; 10.1175/BAMS-D-18-0159.1

Priorities & Action Strategies for the Future - "Ken's 10"



Short-Term/Quick Wins

- Slack/NWSChat Conversion
- Spot Forecast
- CMU Next Steps & Governance Update

Medium-Term

- Tsunami Program
- Weather.gov
- AWIPS in the Cloud

Long-Term/Strategic

- Ops Model & Staffing Requirements
- NWS IT Architecture & IT Governance
- DEIA: Recruitment & Retention

Completed:

- Radar Lite & Radar GIS – Access and Speed

- Probabilistic IDSS/ Hazard Services

Watchlist

Underway and Well in Hand

- Flood Inundation Mapping & Next Gen Water Modeling Framework
- Shift Flexibility Team
- DEIA Tiger Team Task Force

Emerging

- Next Gen Radar

Updated: Dec 19, 2022

Topics

- NBM v4.1 Implemented January 2023
- New 24-hour probabilistic Maximum wind forecasts in NBM v4.1
- Additional post-processing added to NBM v4.1 hourly winds to address low bias
- Digital Aviation Services cloud fields
- What's next?

NBM v4.1 Introduces Probabilistic Maximum Daily Wind

Inputs:

~200 direct model output solutions/members from GFS, HREF, SREF, FNMOC, ECMWF, CMC, ACCESS

Bias correction and downscaling:

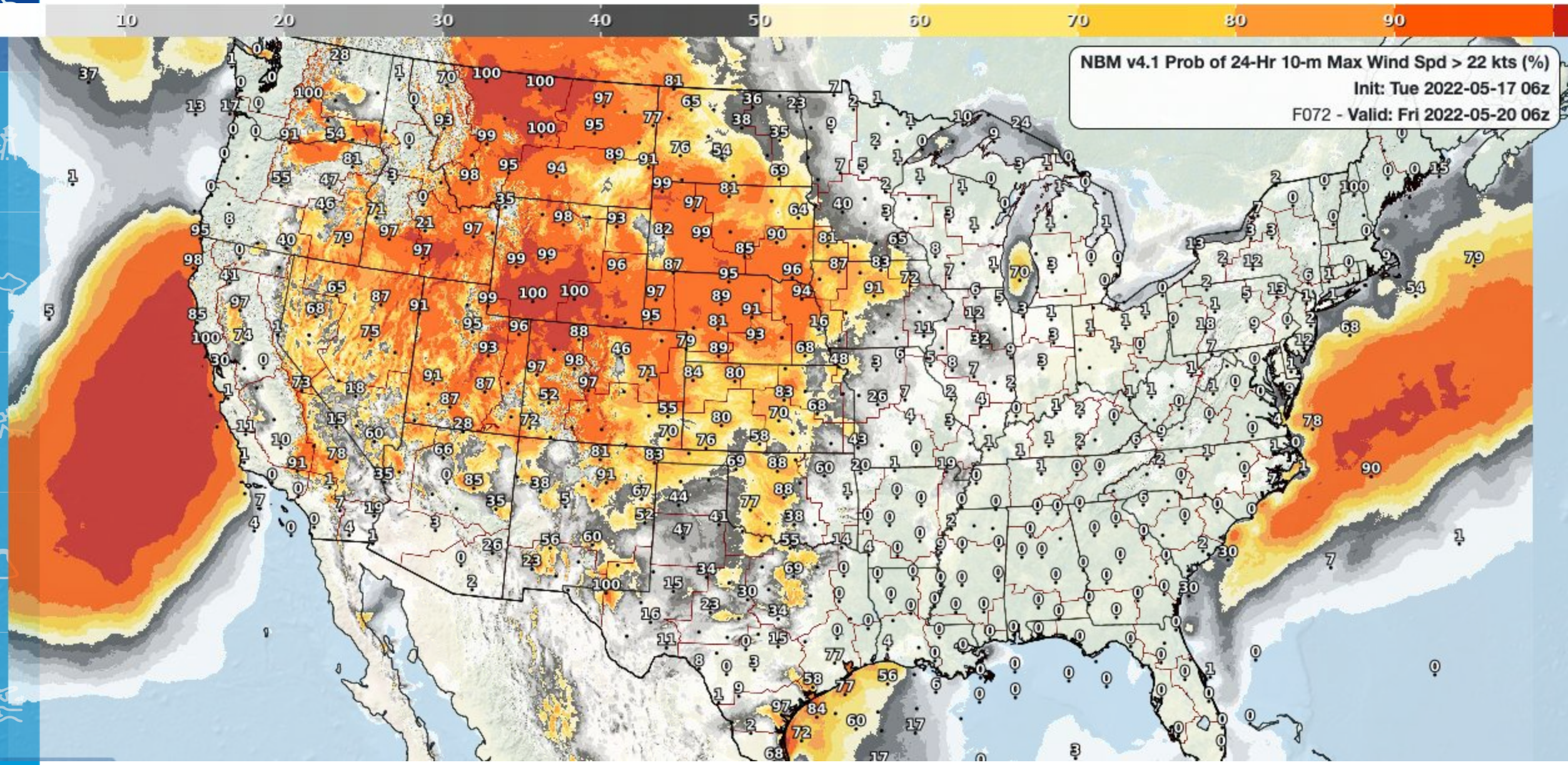
Quantile mapping based on fitted gamma distribution from previous 120 days of forecasts and observations

If a model forecast is at the 90th percentile of the fit model distribution, it gets bias corrected to the 90th percentile of the fit observation distribution

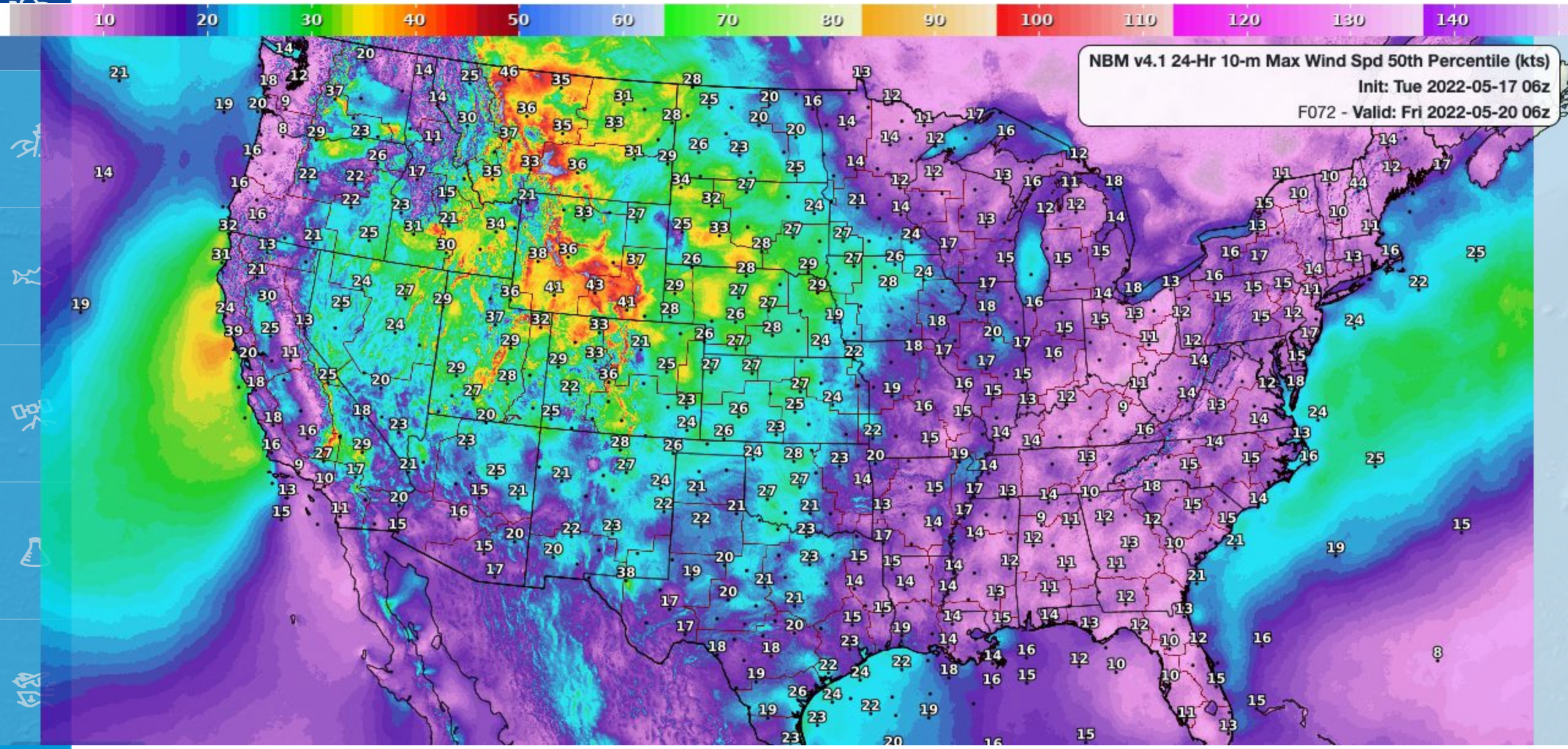
Output:

Percentiles from 1-99 and model relative frequencies of exceeding thresholds (wind: 11, 17, 22, 34, 48, 64 kts; gust: 22, 34, 41, 48, 56, 64 kts)

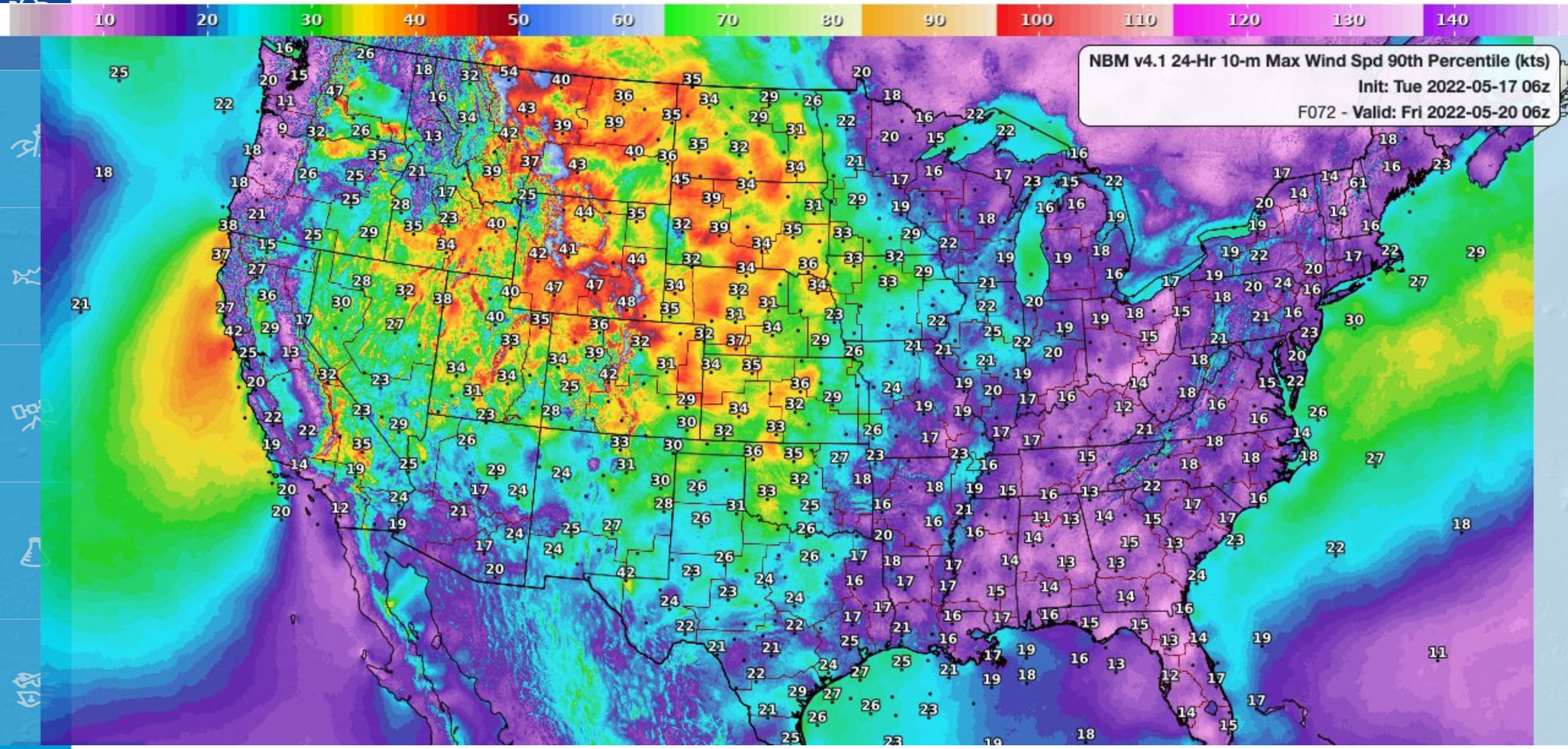
Probability of wind exceeding 22 knots



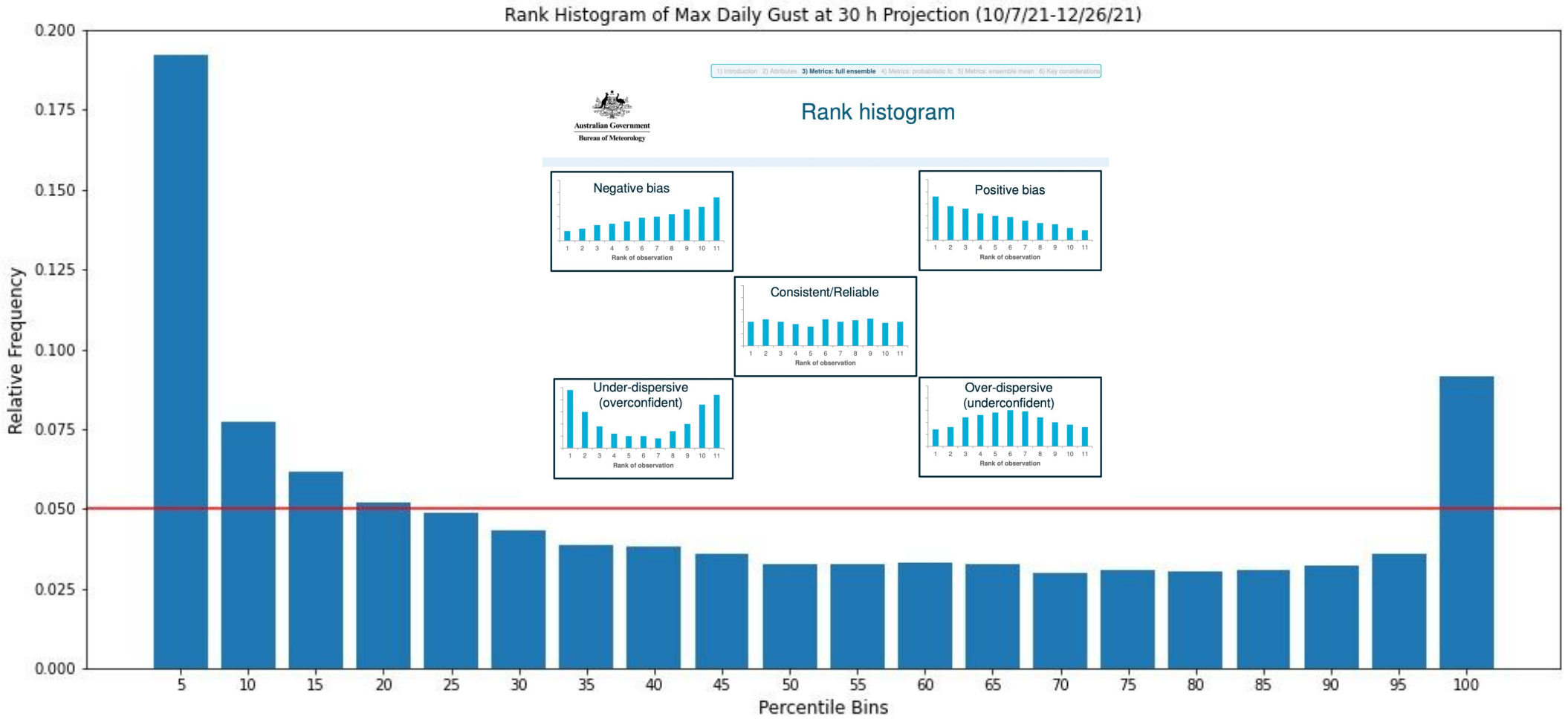
50th Percentile (Median)



90th Percentile

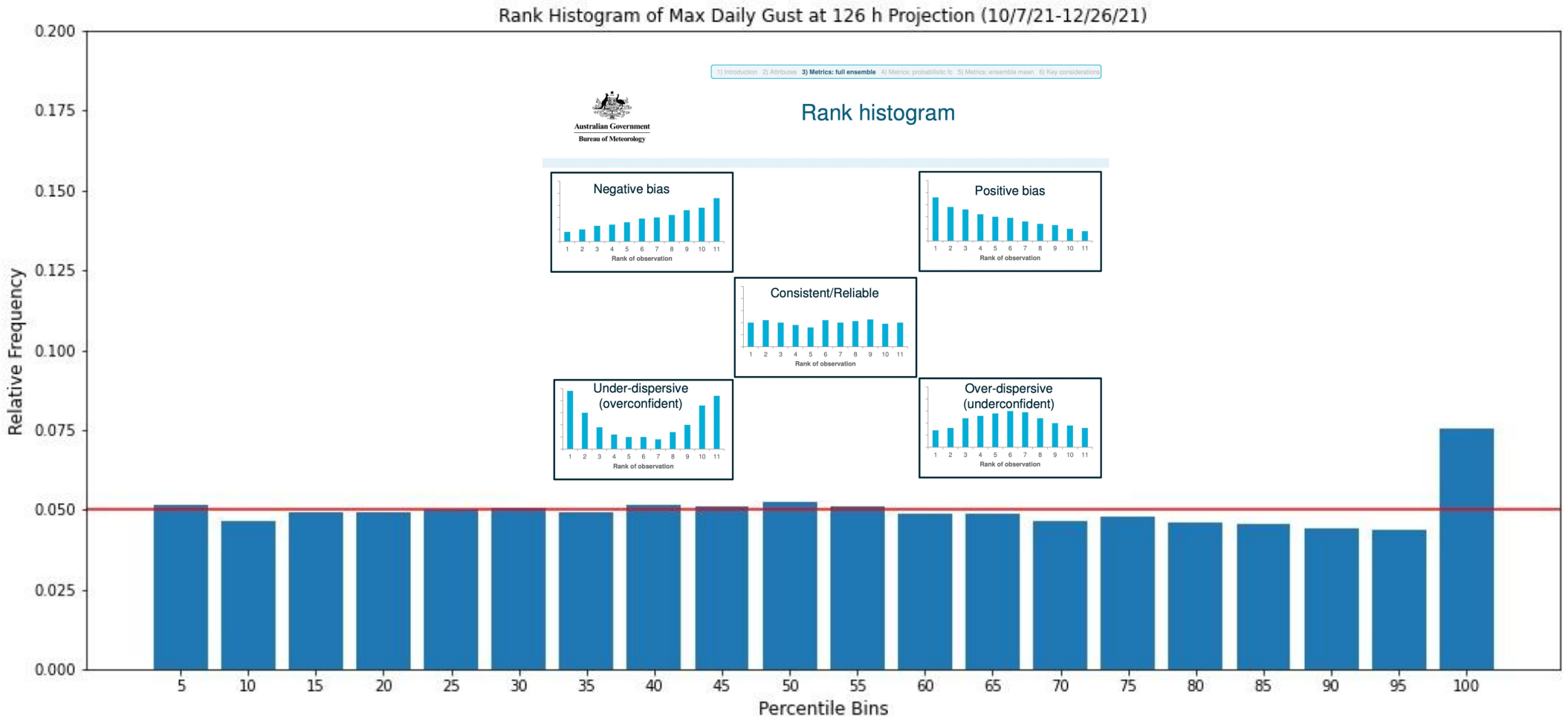


Gust Forecast Reliability Day 1



https://www.ecmwf.int/sites/default/files/elibrary/2017/17626-ensemble-verification-metrics.pdf

Gust Forecast Reliability Day 5



https://www.ecmwf.int/sites/default/files/elibrary/2017/17626-ensemble-verification-metrics.pdf

Hourly Winds blend v4.0

1. Bias correct the model solutions based on analyzed truth (URMA)
2. Create weighted average, where models that had lower mean absolute error (MAE) over recent period have higher weight.

Called MAE weighted forecasts

NBM v4.0 has low bias for wind speeds and gusts, especially for events above 20 knots

NBM v4.1 MOS postprocessor

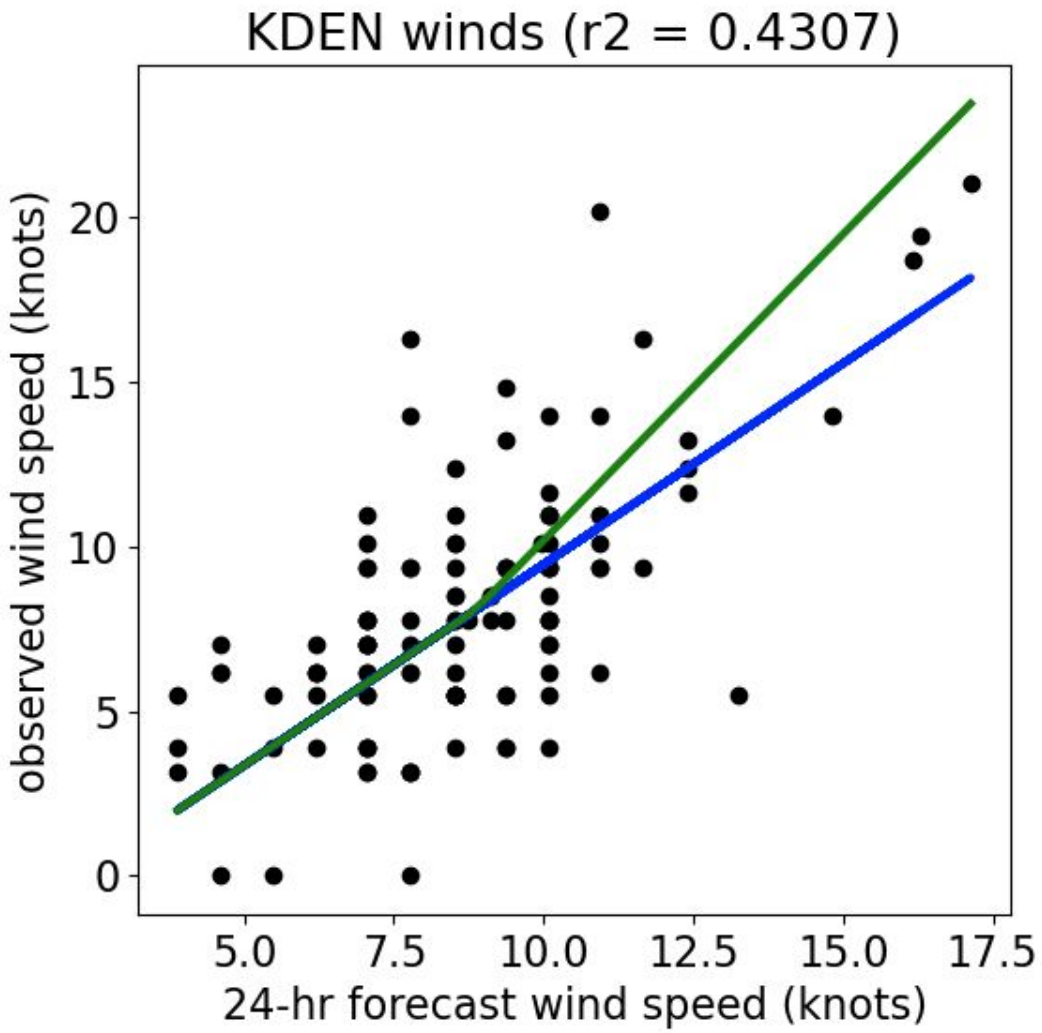
Add the same postprocessing step that has been used in GFS-MOS

Techniques

Linear regression: leverage static training period to develop relationship between v4.0 MAE forecasts and observations

Partial inflation: Increase forecasts above the mean observation

NBM v4.1 MOS postprocessor on winds



blue: linear regression model

green: linear regression model + partial inflation

partial inflation based on correlation and mean observations

Verification - Contingency Tables

v4.1	ob < 10	10 <= ob < 20	20 <= ob < 30	30 <= ob < 40	40 <= ob < 50	ob >= 50			v4.0	ob < 10	10 <= ob < 20	20 <= ob < 30	30 <= ob < 40	40 <= ob < 50	ob >= 50	
fcst < 10	179967	14271	155	24	2	0	194419		fcst < 10	184710	18127	252	37	2	0	203128
10 <= fcst < 20	12310	27798	2192	68	4	0	42372		10 <= fcst < 20	7720	25682	3540	163	11	2	37118
20 <= fcst < 30	181	1966	2004	221	12	0	4384		20 <= fcst < 30	55	267	708	282	46	10	1368
30 <= fcst < 40	13	35	141	138	25	1	353		30 <= fcst < 40	1	3	7	16	11	21	59
40 <= fcst < 50	10	7	9	35	14	4	79		40 <= fcst < 50	0	0	0	0	0	6	6
fcst >= 50	5	2	6	12	13	34	72		fcst >= 50	0	0	0	0	0	0	0
	192486	44079	4507	498	70	39	241679			192486	44079	4507	498	70	39	241679

Three Cloud Layers for Digital Aviation Services (DAS)

- Cloud layer data derived from RAP cloud fraction
- Three cloud bases (heights of bottom of cloud layer)
- Three cloud tops (height of top of cloud layer)
- Three cloud amounts (coverage of cloud layer
- AWC (DAS) logic

Sky and Ceiling

- All Cloud frields are informed by Gridded LAMP Ceiling.
- If GLMP Ceiling: Sky >= 57%
- Digital Aviation fields have same ceiling as GLMP

Take Away

- NBM v4.1 hourly winds are generally stronger than 4.0; We are aware of artifacts introduced in v4.1, especially over water.
- New max 24-hour probabilistic winds support IDSS
- New DAS cloud layer fields are available
- NBM Sky cover is no longer used to remove ceilings (ceiling from GLMP is retained)

What's Next?

- Model Input consolidation around UFS (GFS and RRFS)
- Range of hourly wind forecasts instead of single value
- Software optimization
- Additional model calibration

Thank You

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Thanks to NBM development development team

See website for NBM documentation and data.
https://vlab.noaa.gov/web/mdl/nbm