NATIONAL WEATHER SERVICE

A Redevelopment of Thresholding Techniques to Improve LAMP Visibility Guidance

Intermountain West Aviation Weather Safety Workshop
Salt Lake City, UT
June 21, 2024

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What is LAMP?

- LAMP = Localized Aviation MOS (Model Output Statistics) Program
- Provides guidance for aviation forecasting using observations, MOS output, and model output through multiple linear regression techniques

BASE LAMP =	Observations + Simple locally-run models + GFS MOS
MELD LAMP =	BASE LAMP + HRRR MOS

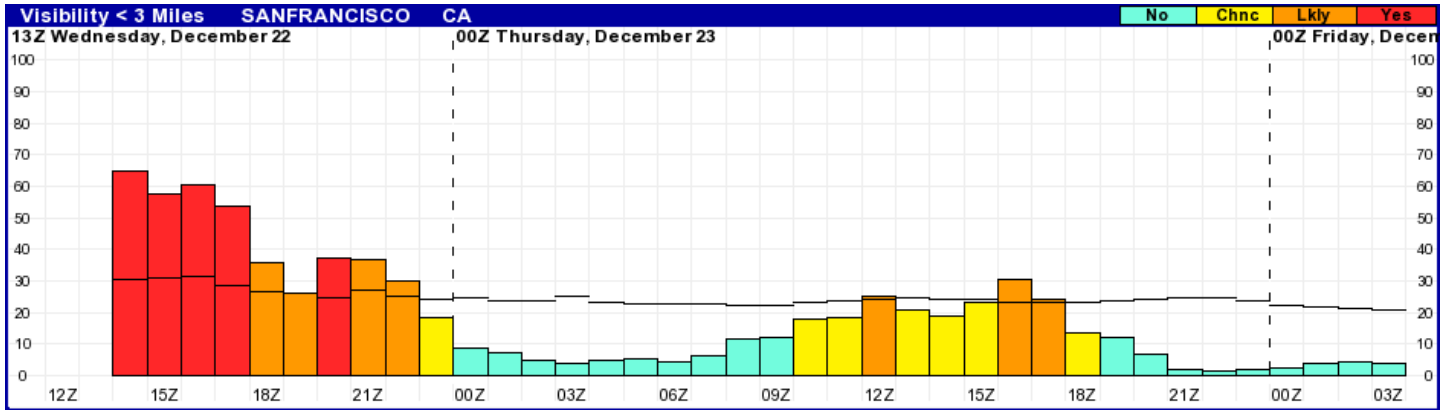
- Produced for individual stations and on a grid
- Hourly guidance out to 25 hours
  - Extended guidance out to 38 hours for some elements including ceiling height and visibility

How is LAMP visibility guidance produced?

- Meld LAMP thresholds are calculated such that using them maximizes the threat score of the forecast within a defined bias range
  - National thresholds are used for all categories and do not change by station
- Probabilities are created for each category
- Event is forecast for the rarest category that the threshold is met

VIS Categories

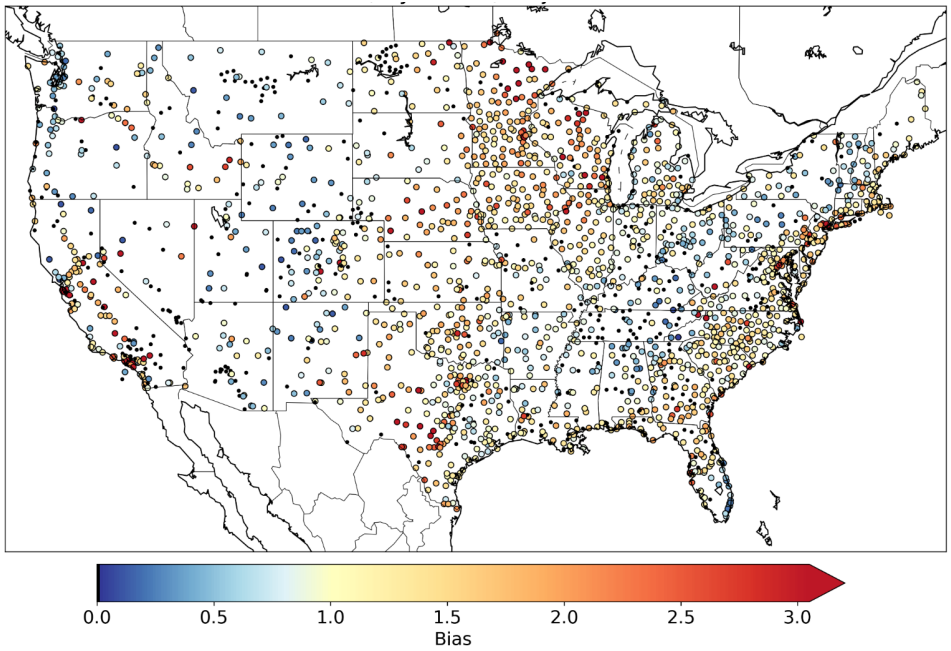
< 0.5 mi
< 1 mi
< 2 mi
< 3 mi
≤ 5 mi
≤ 6 mi

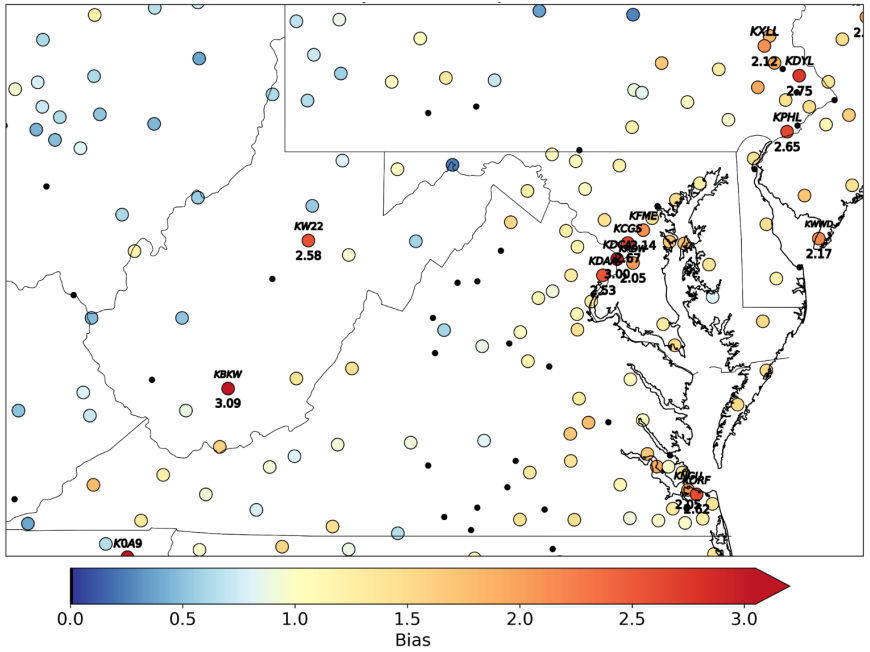


Meld LAMP Visibility Biases - Cool Season

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC

Meld LAMP Bias: VIS < 1 mi, 00z, proj 12h: **COOL** SEASON

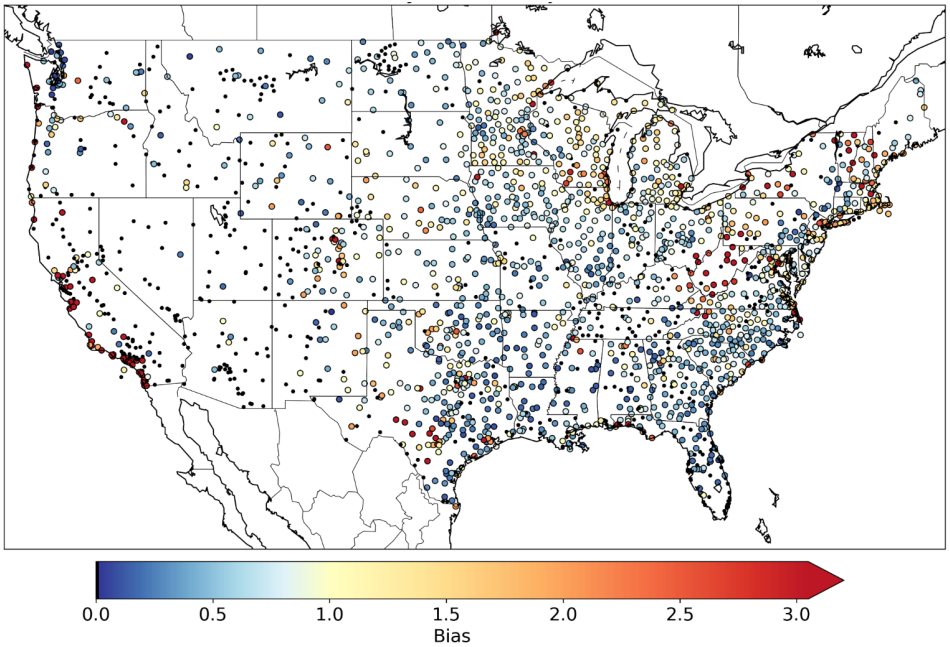


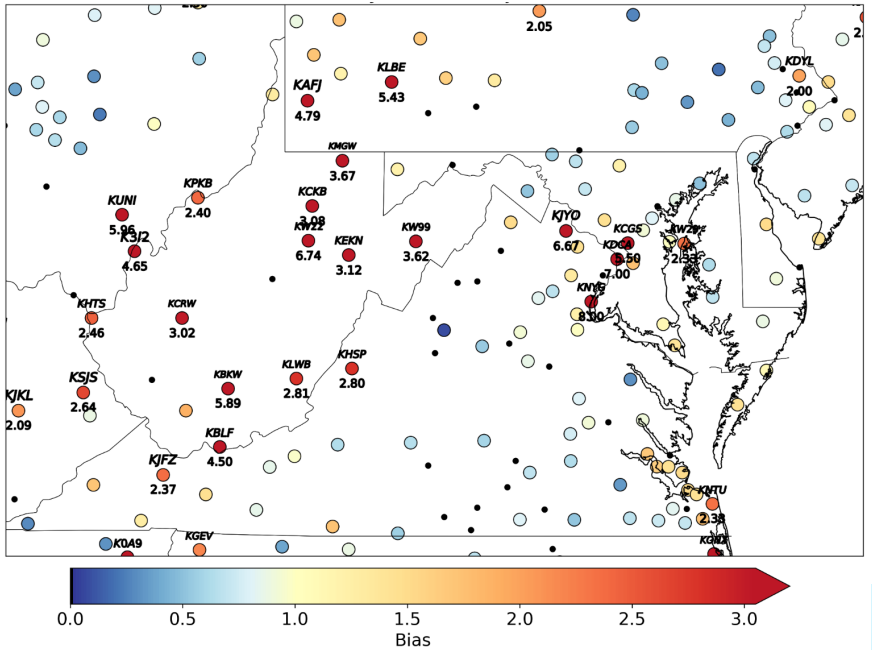


Meld LAMP Visibility Biases - Warm Season

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC

Meld LAMP Bias: VIS < 1 mi, 00z, proj 12h: **WARM** SEASON

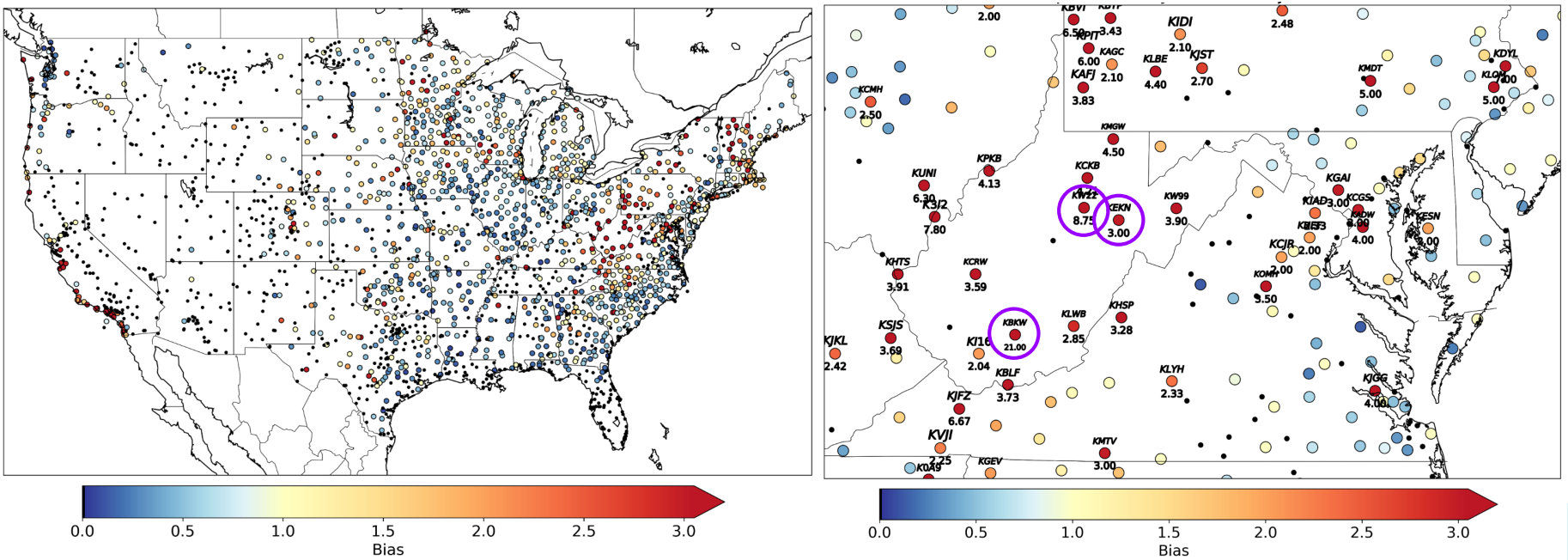




The Issue:
High Meld LAMP Visibility Biases in September

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC

Meld LAMP Bias: VIS < 1 mi, 00z, proj 12h: **SEPTEMBER**

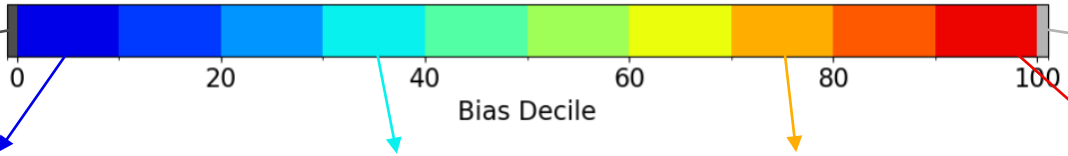


Proposed Threshold Redevelopment

Create new thresholds by grouping stations based on the deciles of Meld LAMP visibility bias using data from 2017-2022

Meld LAMP Bias Deciles: VIS < 1 mi, 00z, proj 12h: **WARM** SEASON

Bias = 0
(0 events forecast)



Bias = undef.
(0 events observed)

Bias
min val-0.25

KROA
KDAN
KHGP

Bias
0.50-0.62

KJST
KMKJ
KLYH

Bias
1.08-1.44

KI16
KMTV
KIDI

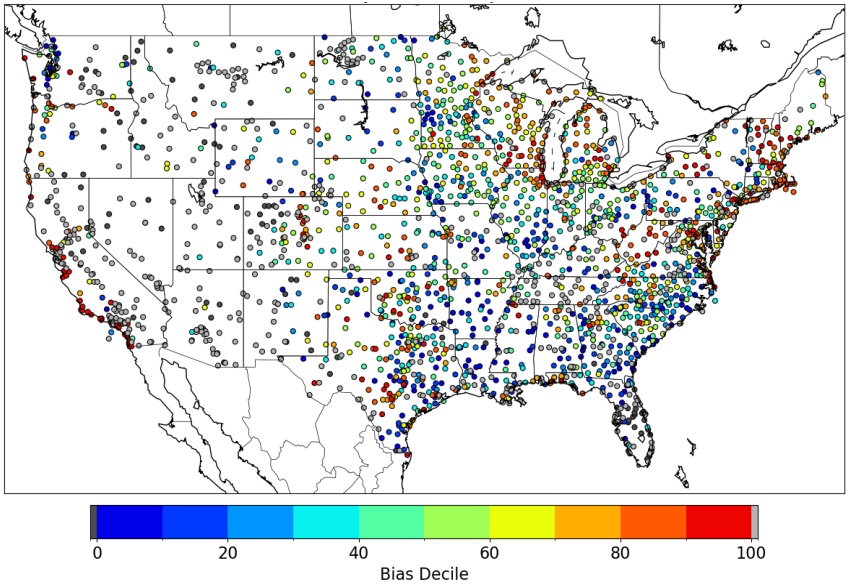
Bias
2.14-max val

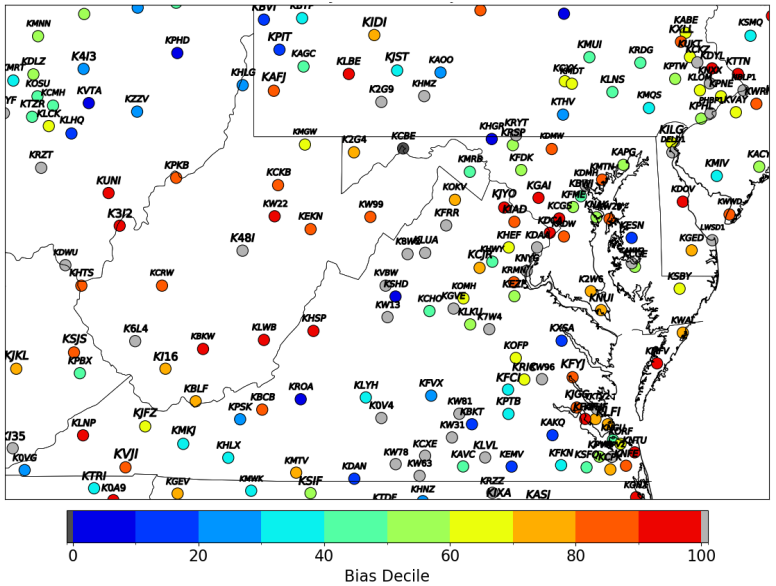
KBKW
KW22
KGAI

Proposed Threshold Redevelopment

Create new thresholds by grouping stations based on the deciles of Meld LAMP visibility bias using data from 2017-2022

Meld LAMP Bias Deciles: VIS < 1 mi, 00z, proj 12h: **WARM** SEASON



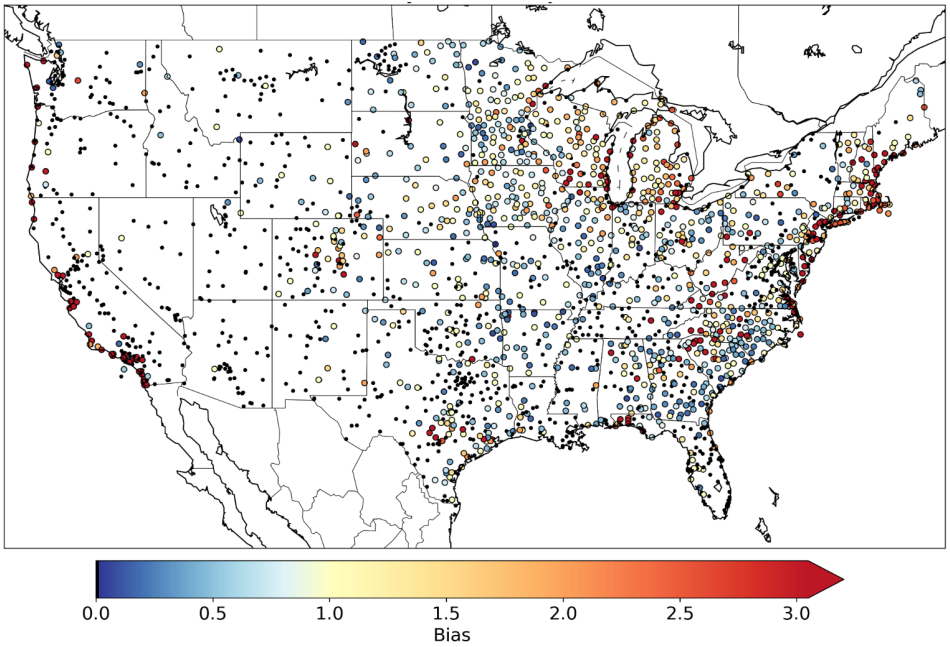


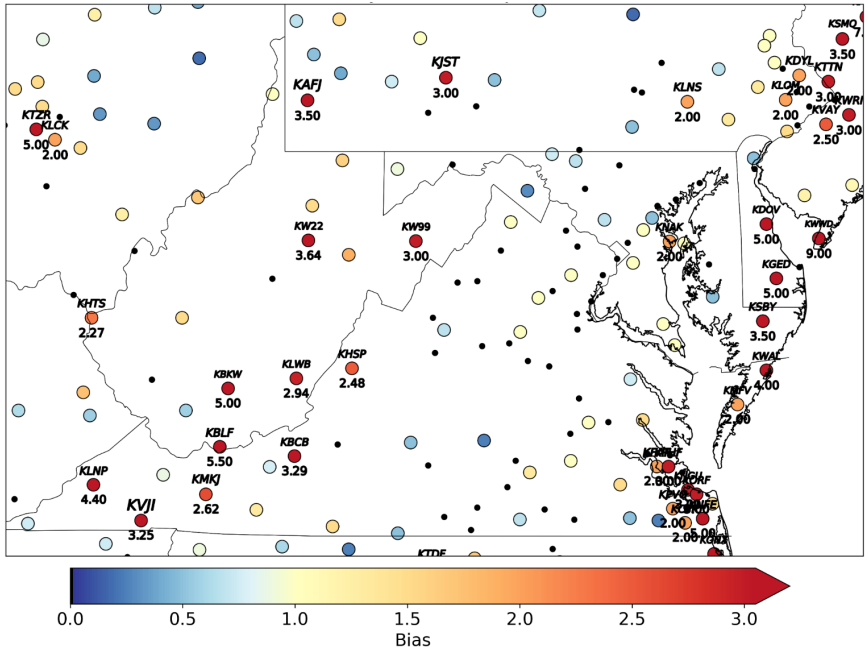
Verification Results

Completed for an independent data sample using data from 2023

Map Plots - Warm Season - Independent Data

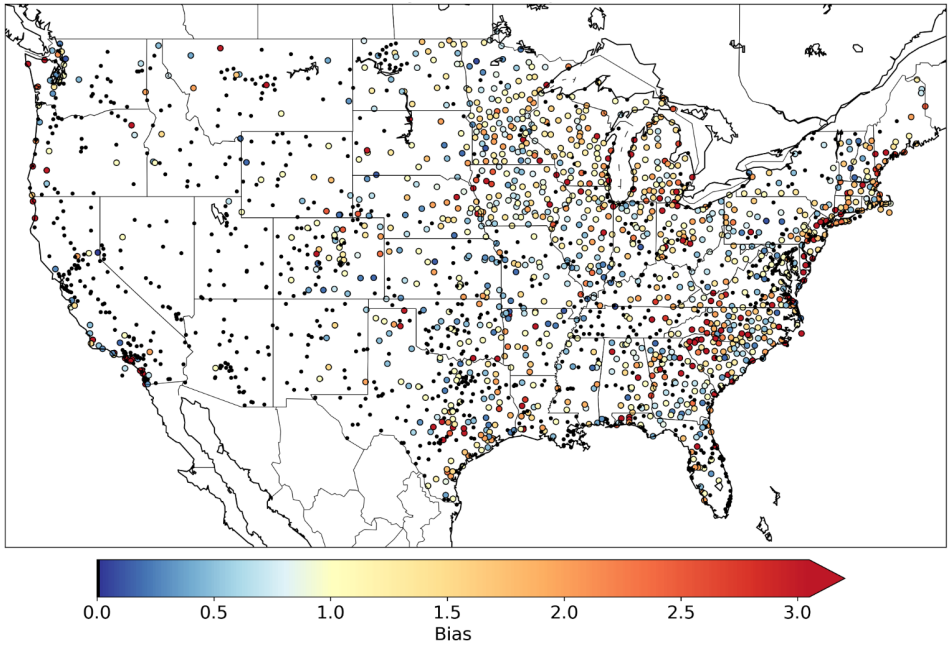
Meld LAMP Biases:
VIS < 1 mi, 00z, proj 12h: **WARM** SEASON

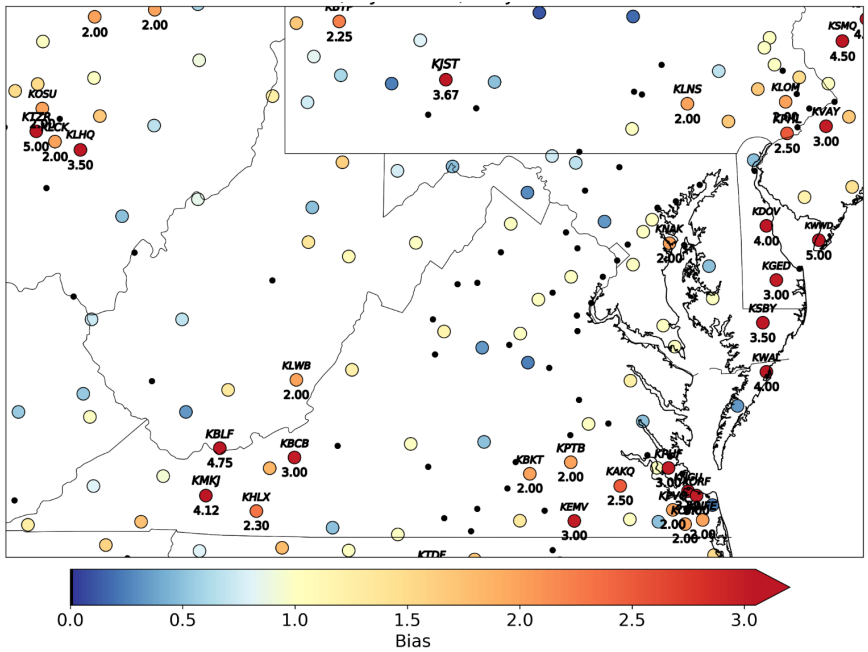




Map Plots - Warm Season - Independent Data

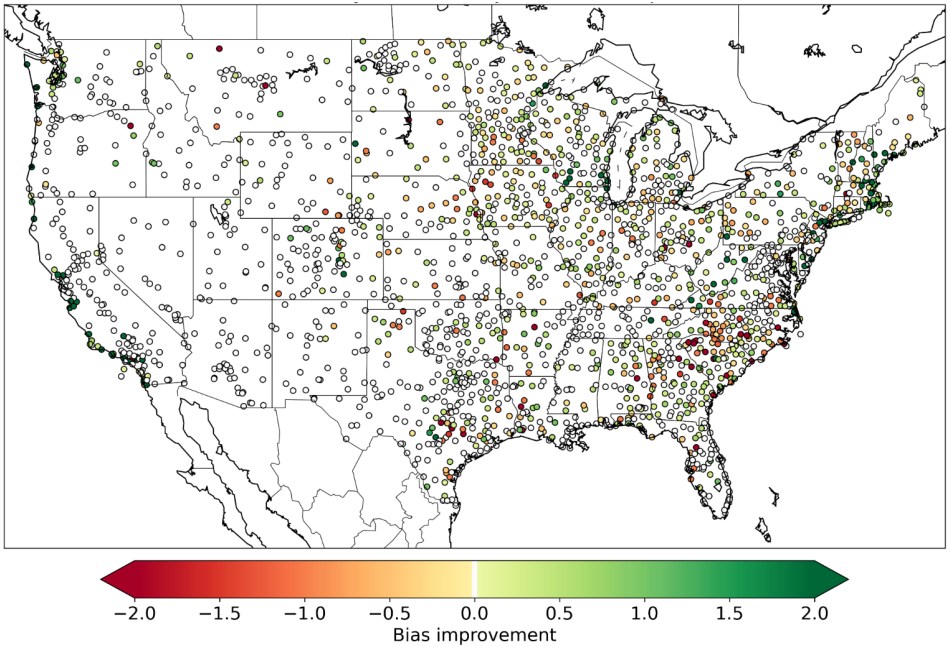
New LAMP Biases:
VIS < 1 mi, 00z, proj 12h: **WARM** SEASON

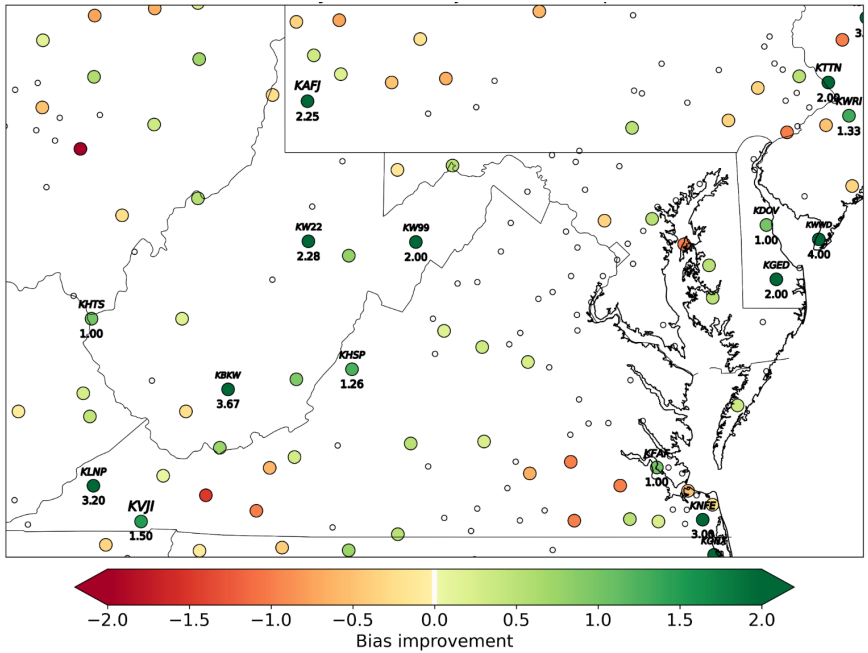




Map Plots - Warm Season - Independent Data

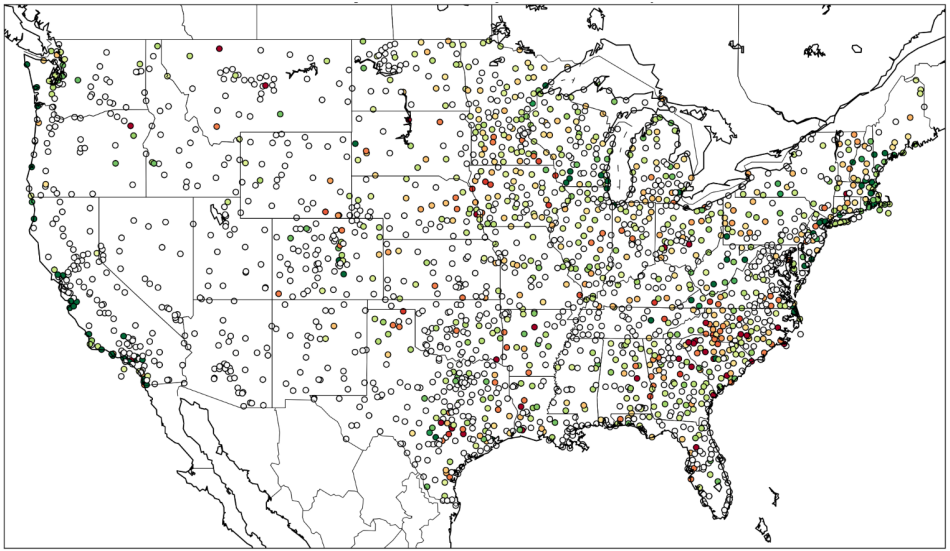
Improvement of new development over Meld LAMP Bias:
VIS < 1 mi, 00z, proj 12h: **WARM** SEASON

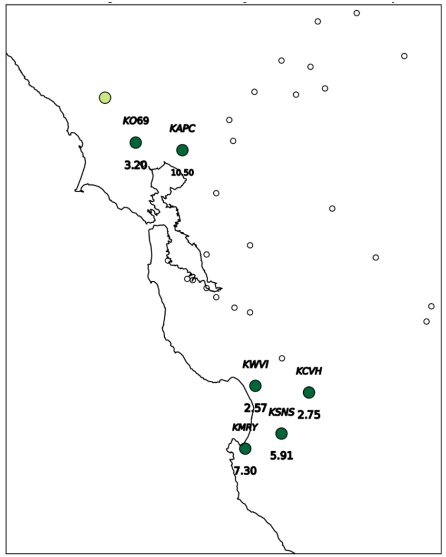




Map Plots - Warm Season - Independent Data

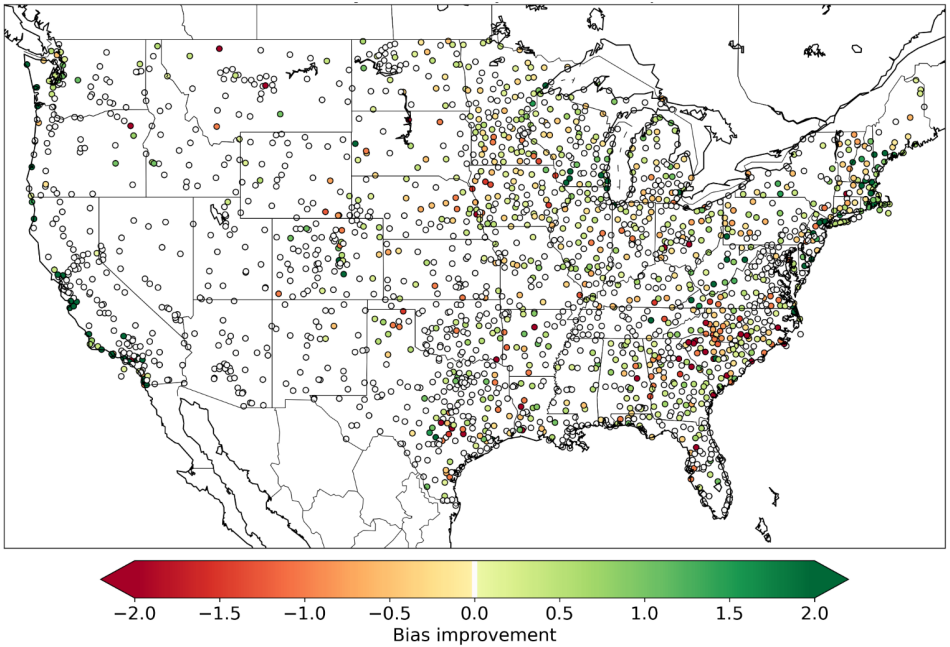
Improvement of new development over Meld LAMP Bias:
VIS < 1 mi, 00z, proj 12h: **WARM** SEASON

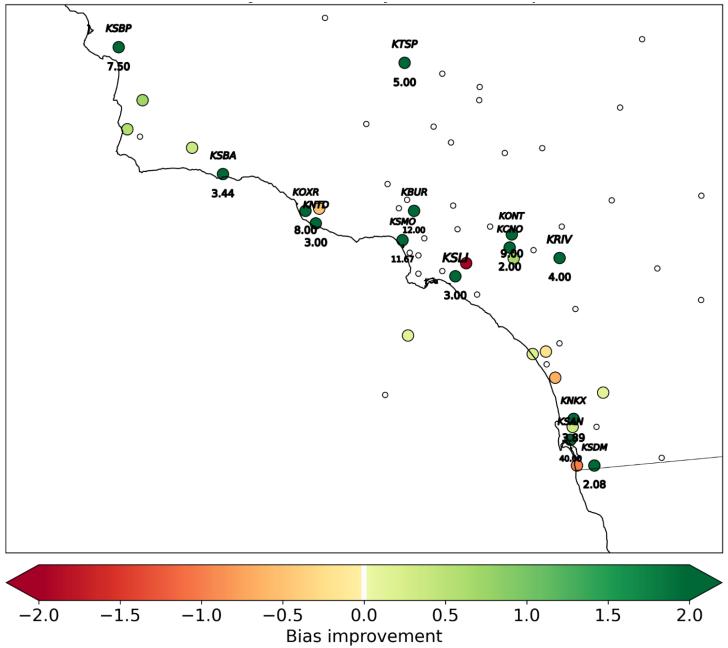




Map Plots - Warm Season - Independent Data

Improvement of new development over Meld LAMP Bias:
VIS < 1 mi, 00z, proj 12h: **WARM** SEASON

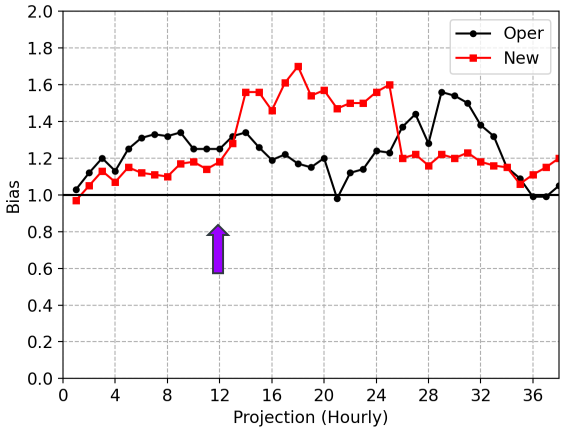




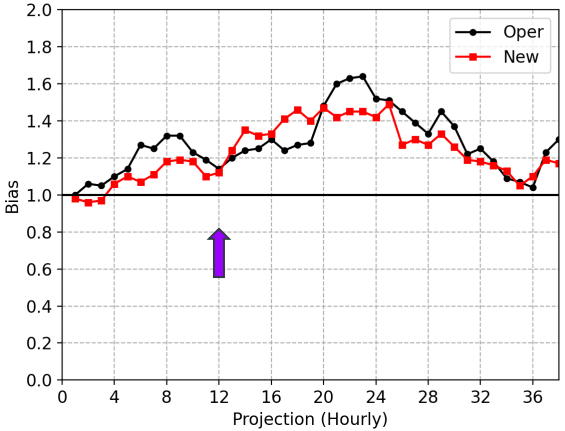
Line Plots - Warm Season - Bias

2023 Ind. Verif Bias: 00z, proj 12h, **CONUS**

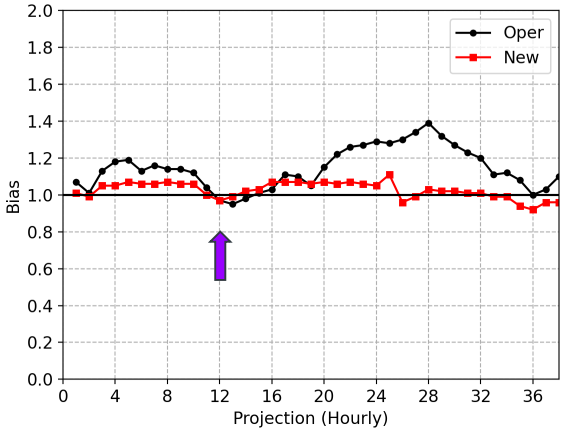
VIS < 1 mi



VIS < 3 mi



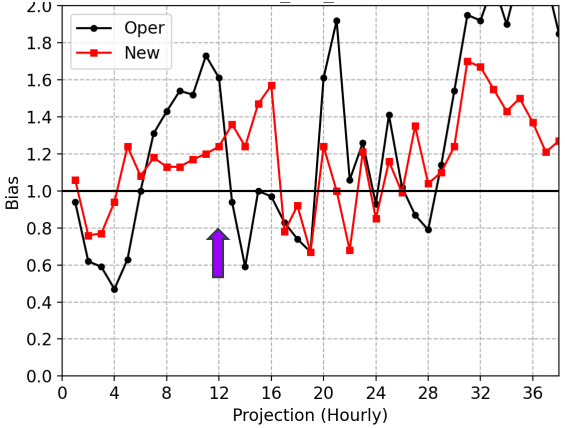
VIS ≤ 6 mi



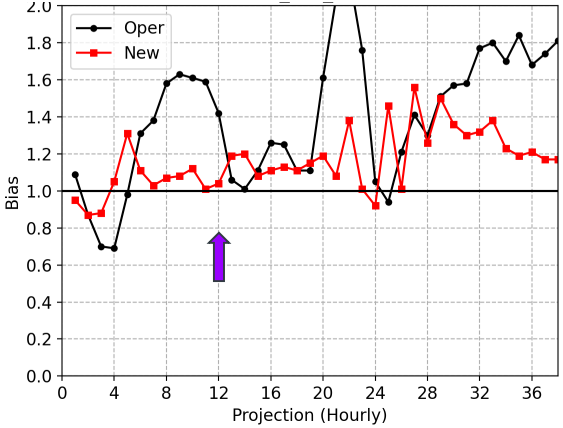
Line Plots - Warm Season - Bias

2023 Ind. Verif Bias: 00z, proj 12h, **Mid-Atlantic**

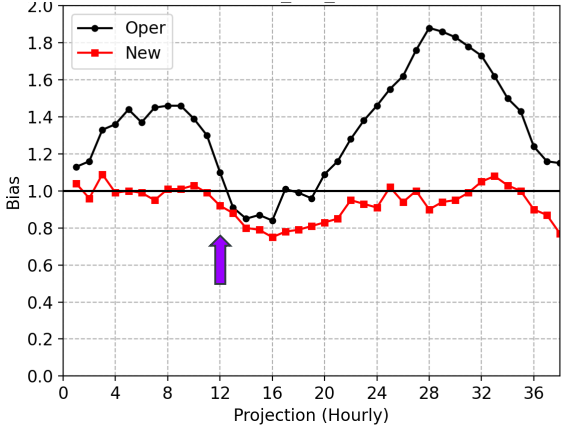
VIS < 1 mi



VIS < 3 mi



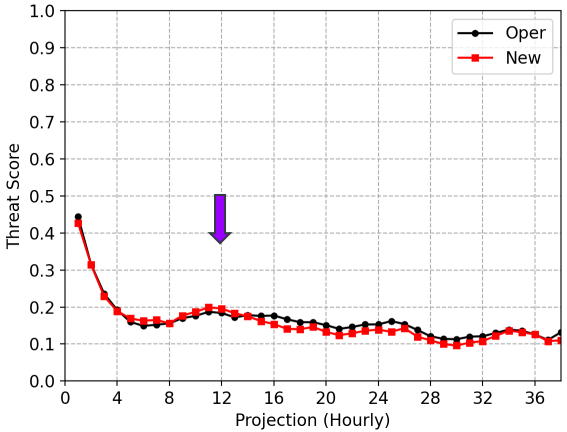
VIS ≤ 6 mi



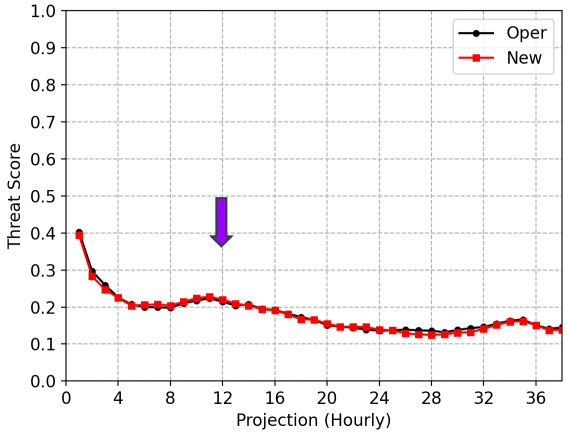
Line Plots - Warm Season - Threat Score

2023 Ind. Verif Bias: 00z, proj 12h, **CONUS**

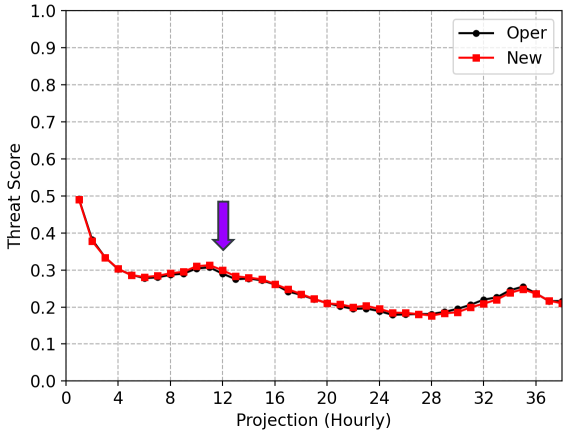
VIS < 1 mi



VIS < 3 mi



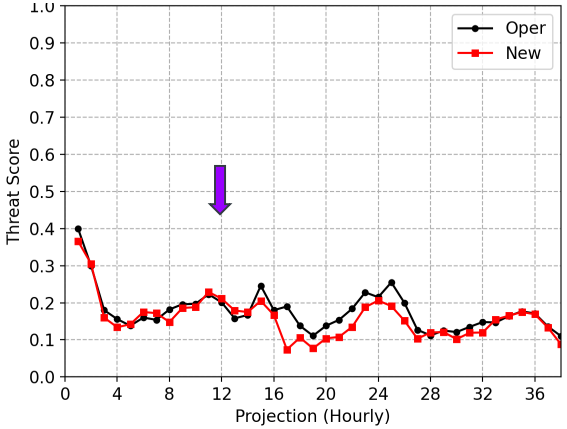
VIS ≤ 6 mi



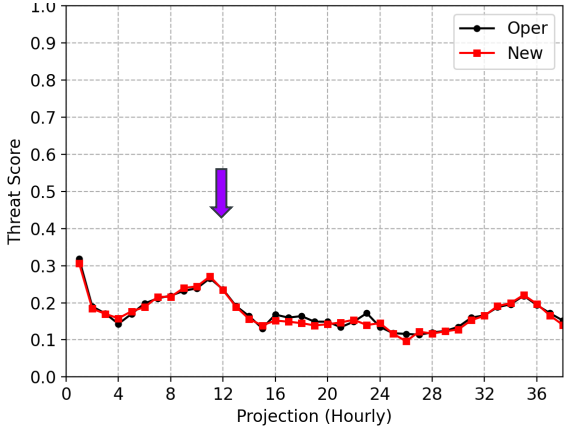
Line Plots - Warm Season - Threat Score

2023 Ind. Verif Bias: 00z, proj 12h, **Mid-Atlantic**

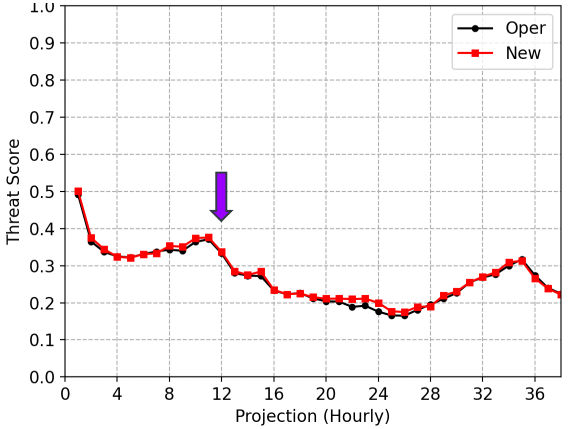
VIS < 1 mi



VIS < 3 mi



VIS ≤ 6 mi

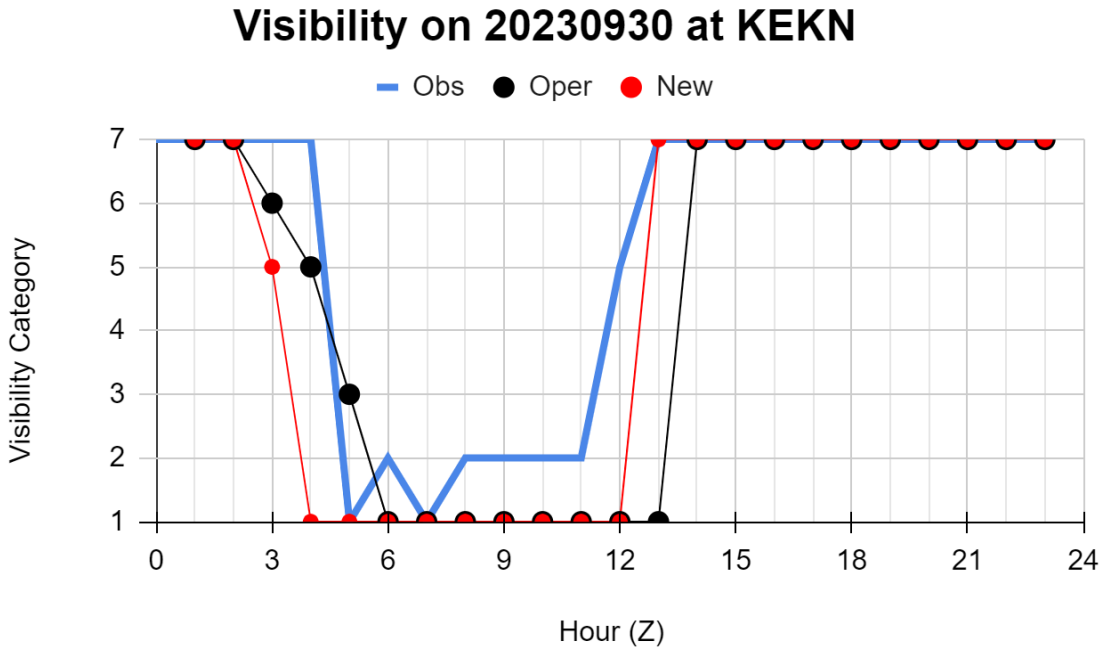


Case Study of a Low Visibility Event: Mist/ Fog on September 30th, 2023 at Elkins, WV

KEKN: Both Oper and New LAMP lowered VIS too early (at 03z), however the New LAMP was better with the timing for the VIS increase at 13z.

VIS Categories

1: < 0.5 mi
2: < 1 mi
3: < 2 mi
4: < 3 mi
5: ≤ 5 mi
6: ≤ 6 mi
7: > 6 mi

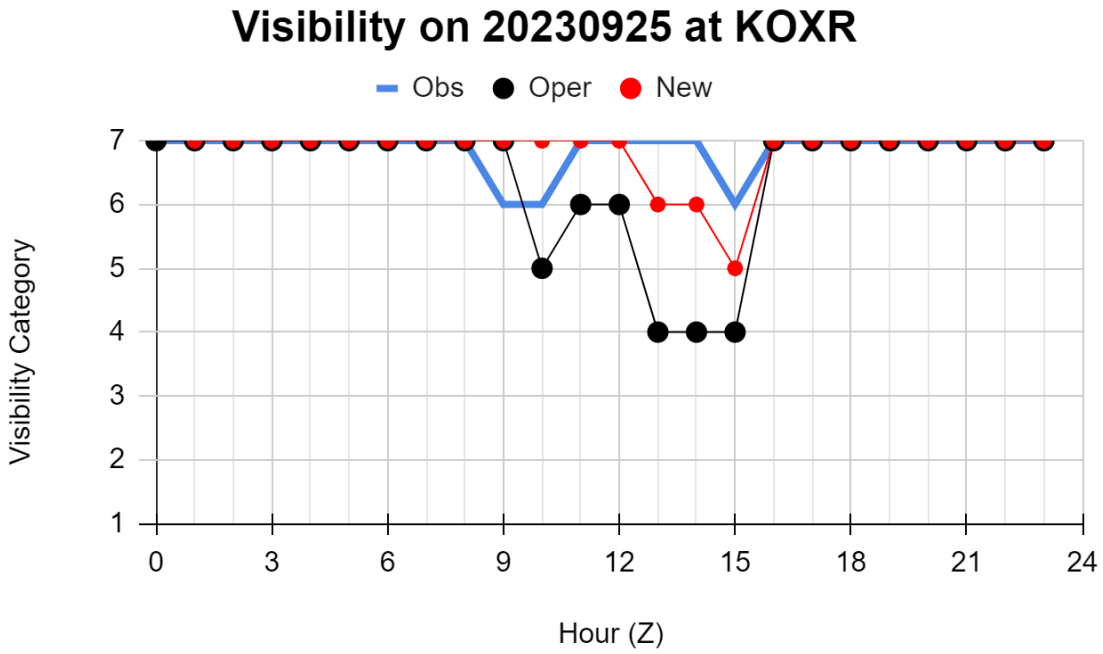


Case Study of a Low Visibility Event: September 25th, 2023 at Oxnard, CA

KOXR: New LAMP didn't catch the first lowering at 09z, but Oper LAMP overestimated the low VIS more than the New LAMP in general.

VIS Categories

1: < 0.5 mi
2: < 1 mi
3: < 2 mi
4: < 3 mi
5: ≤ 5 mi
6: ≤ 6 mi
7: > 6 mi

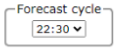


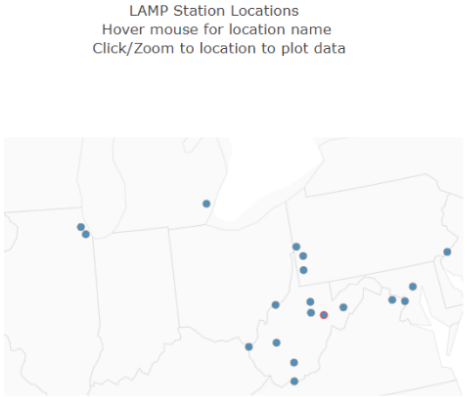
Conclusions

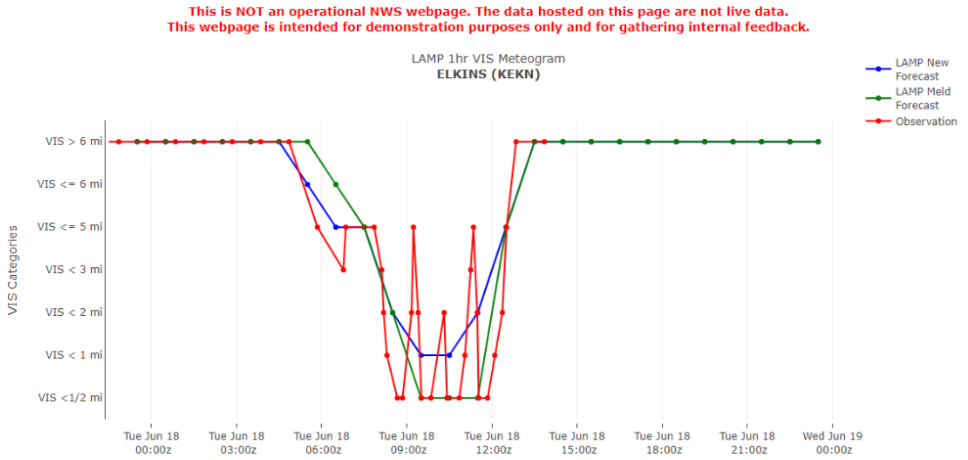
- Biases were improved at stations where the Meld bias was very high, particularly in WV where fog dissipation issues were noted
- The New method did not change the biases much or worsened the bias at some stations (e.g. KPIT)
- The threat score was typically similar between Meld and the New method
  - Mainly for earlier and later projections, middle projections (14-24) were worsened
  - Bias may have improved but TS was similar because less events were forecasted but some events were missed in the forecasts

Current & Future Work

- Experimental LAMP webpage to visualize results in real-time
- Implement in the next version of LAMP if results are promising







Thank you!

Questions?

Contact info:
Katelyn.Trinidad@noaa.gov

LAMP Web Page:
https://vlab.noaa.gov/web/mdl/lamp