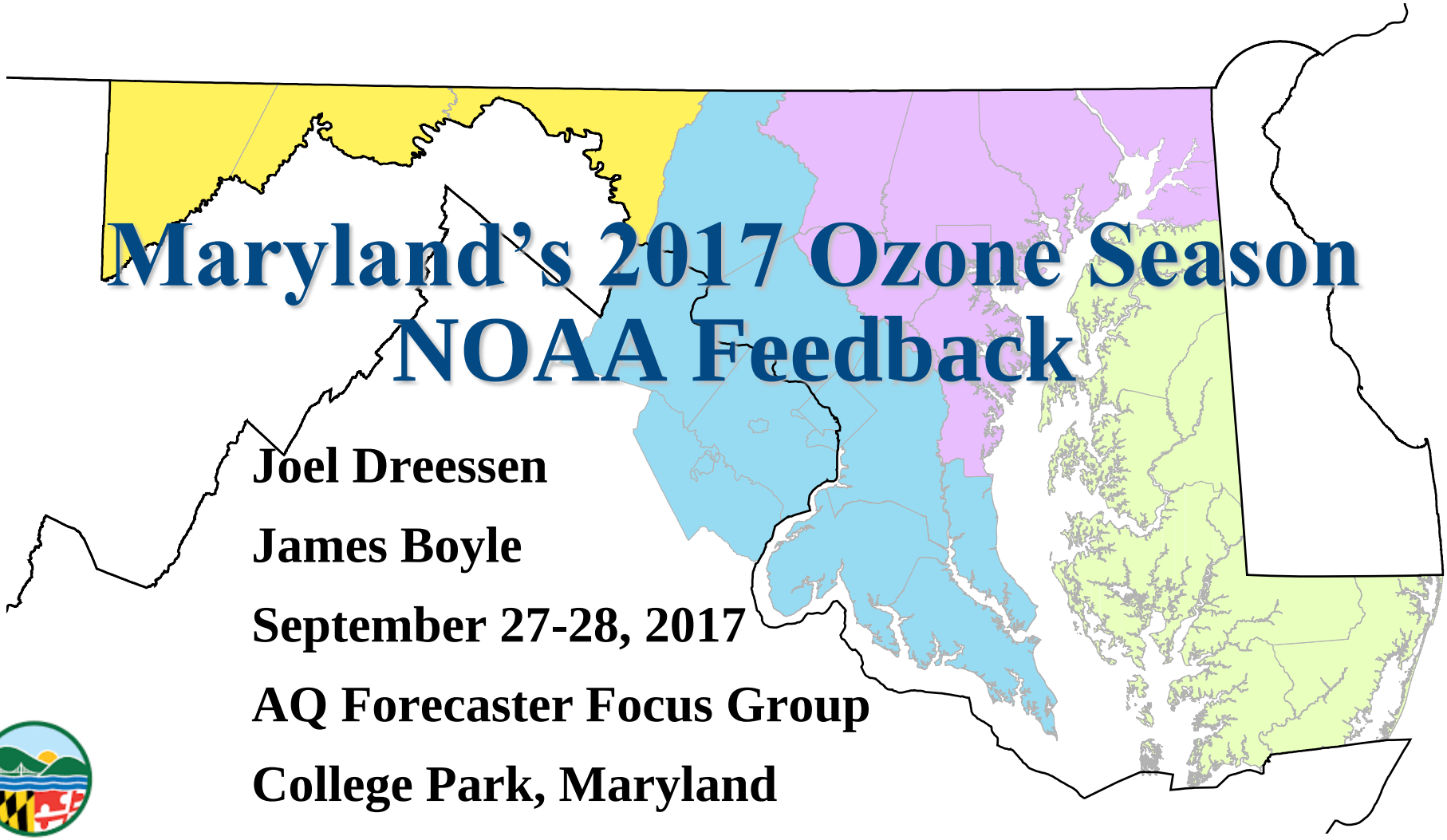
MARYLAND
DEPARTMENT OF THE ENVIRONMENT



Maryland's 2017 Ozone Season NOAA Feedback

Joel Dreessen

James Boyle

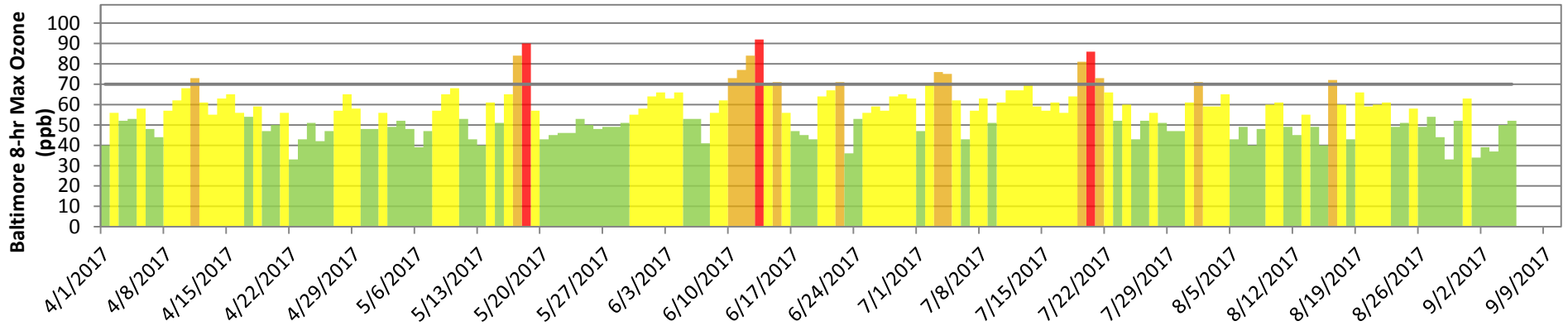
September 27-28, 2017

AQ Forecaster Focus Group

College Park, Maryland

Maryland
Department of
the Environment

2017 SEASON AT A GLANCE



90 Degree Days

YEAR	No. Days	Avg. T_{max} (^{o}F)
2017*	29	84.2
2016	41	85.3
2015	26	83.6
2014	14	82.5
2013	27	83.1
2012	45	85.6
2011	40	86.6
2010	59	87.7

Average No. of days >90 : 31

The summer of 2017 was *near* normal and *SIGNIFICANTLY cooler* than 2016. Maryland had the second fewest exceedances ever.

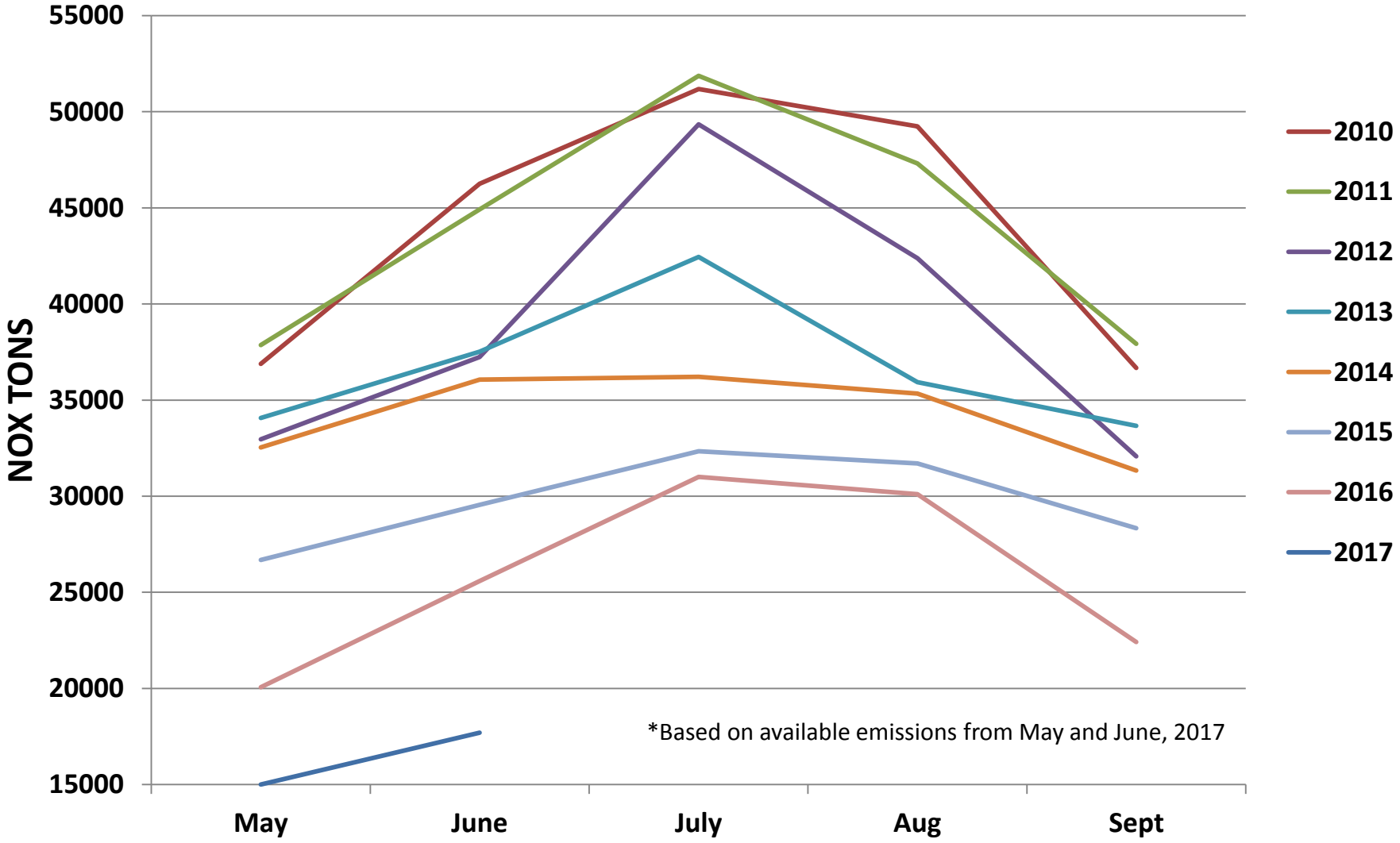
Exceedance Days

YEAR	70ppb	75ppb	84ppb
2017*	16	7	3
2016	26	14	6
2015	19	8	2
2014	11	5	1
2013	19	9	0
2012	42	30	13
2011	46	29	16
2010	61	43	21

T_{max} calculated as statewide average of T_{max} in JJA

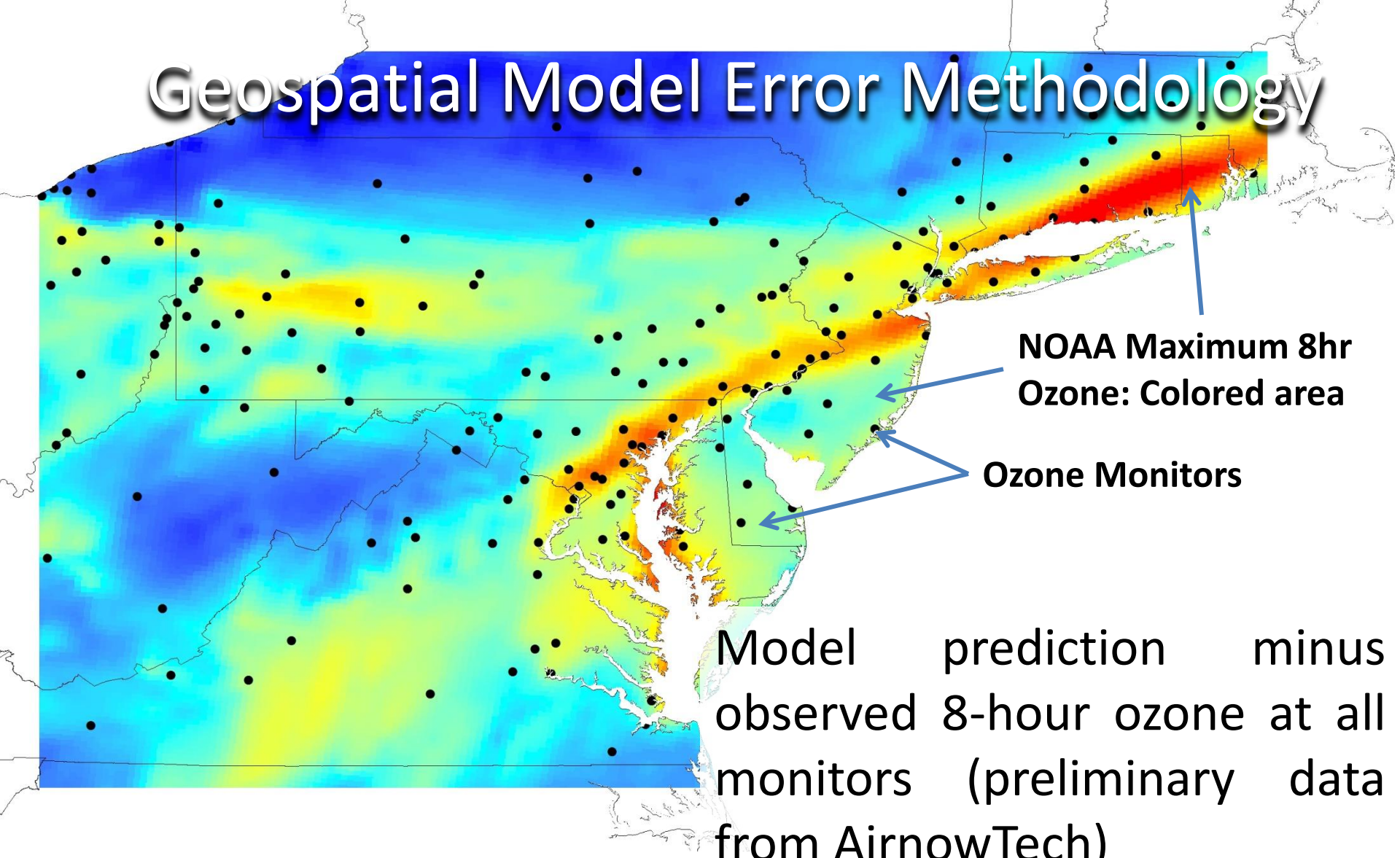
*Through August 31; Preliminary Data, subject to change;

Monthly CAMD Emissions from: IN, OH, WV, VA, PA, MD, DC



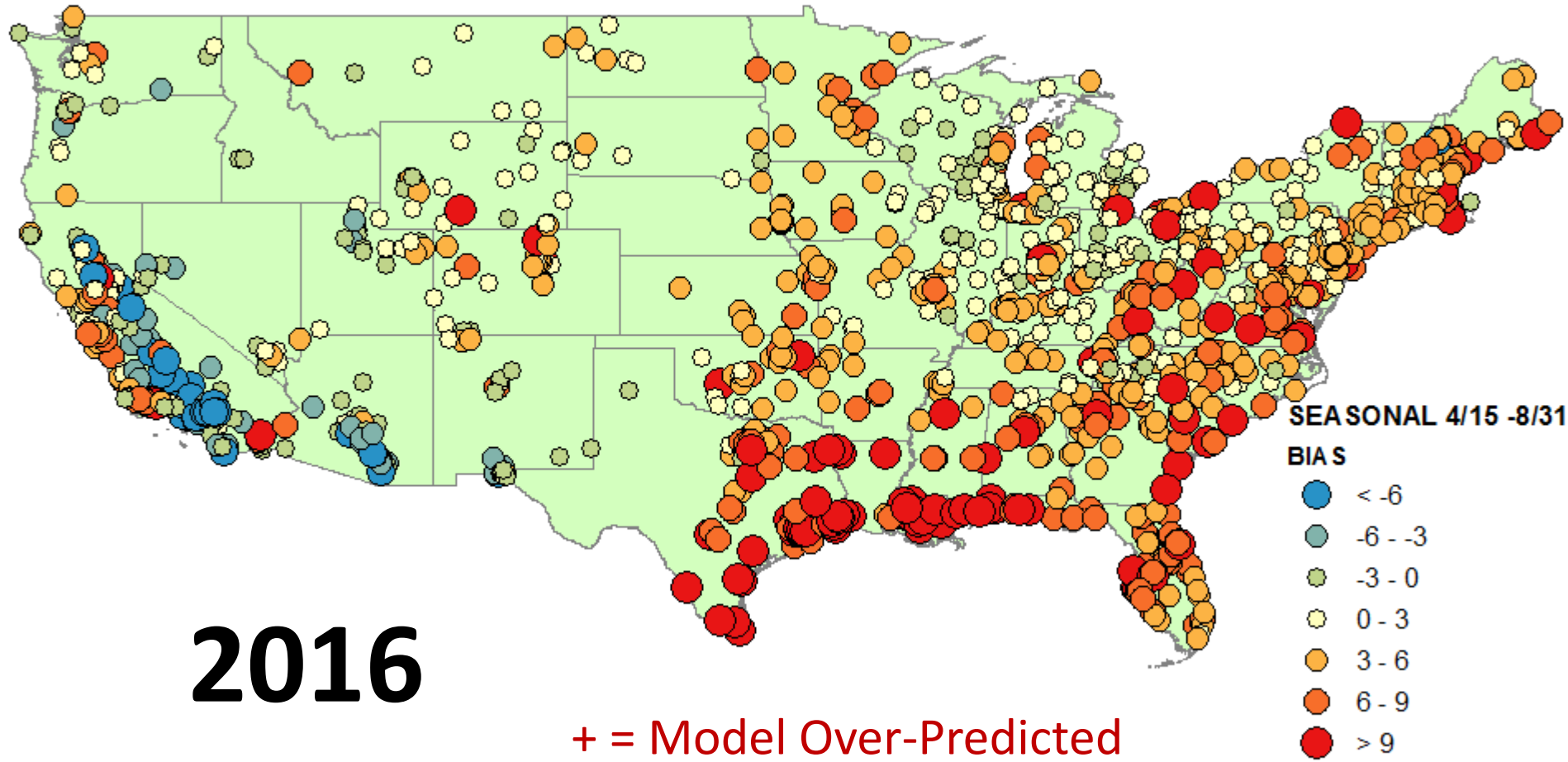
Emissions of Indiana, Ohio, West Virginia, Virginia, Pennsylvania, Maryland and the District of Columbia were summed together on a monthly basis

Geospatial Model Error Methodology



Model prediction minus observed 8-hour ozone at all monitors (preliminary data from AirnowTech)

Seasonal BIAS – 8hr Ozone

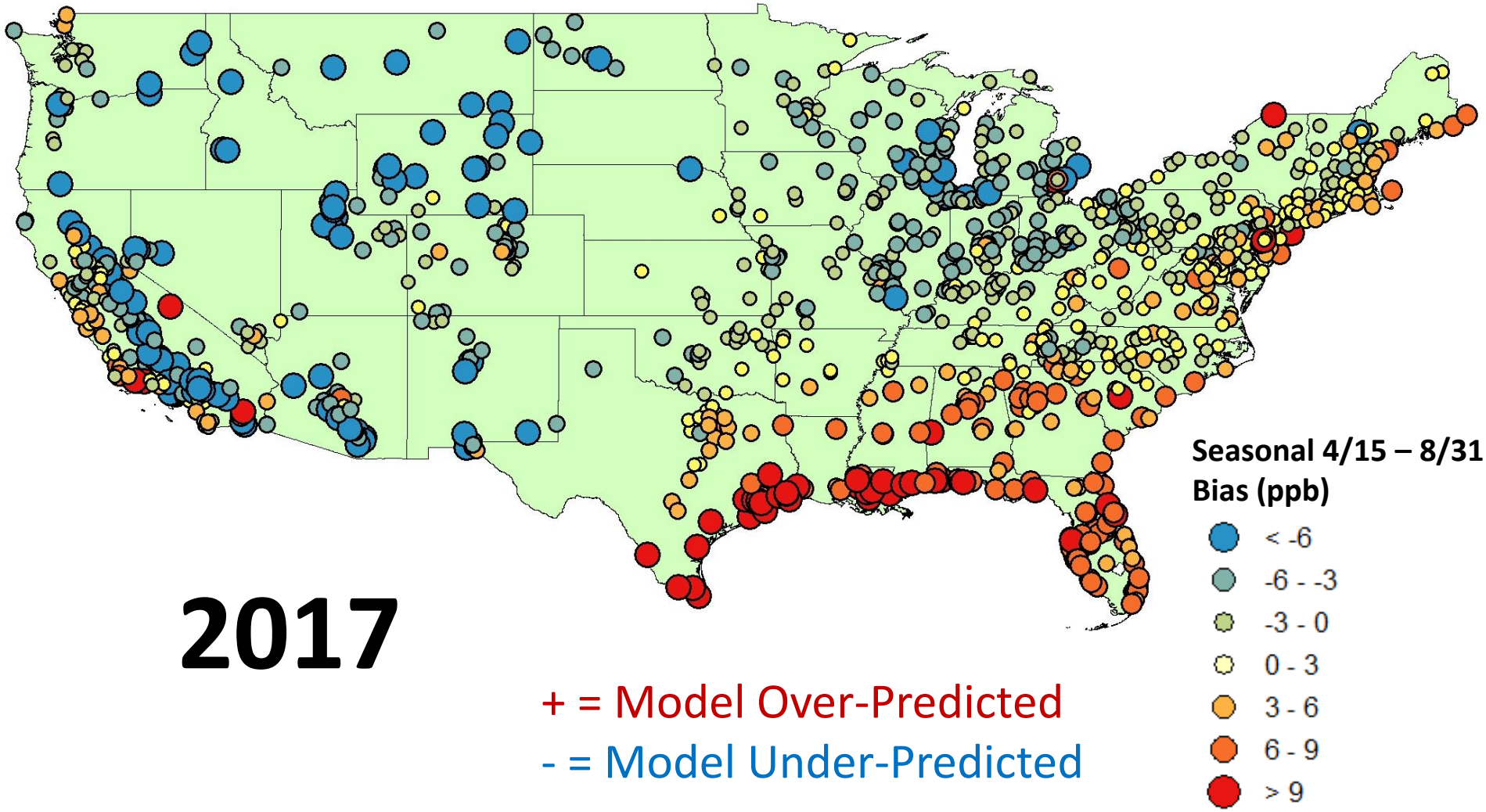


2016

\+ = Model Over-Predicted

\- = Model Under-Predicted

Seasonal BIAS – 8hr Ozone



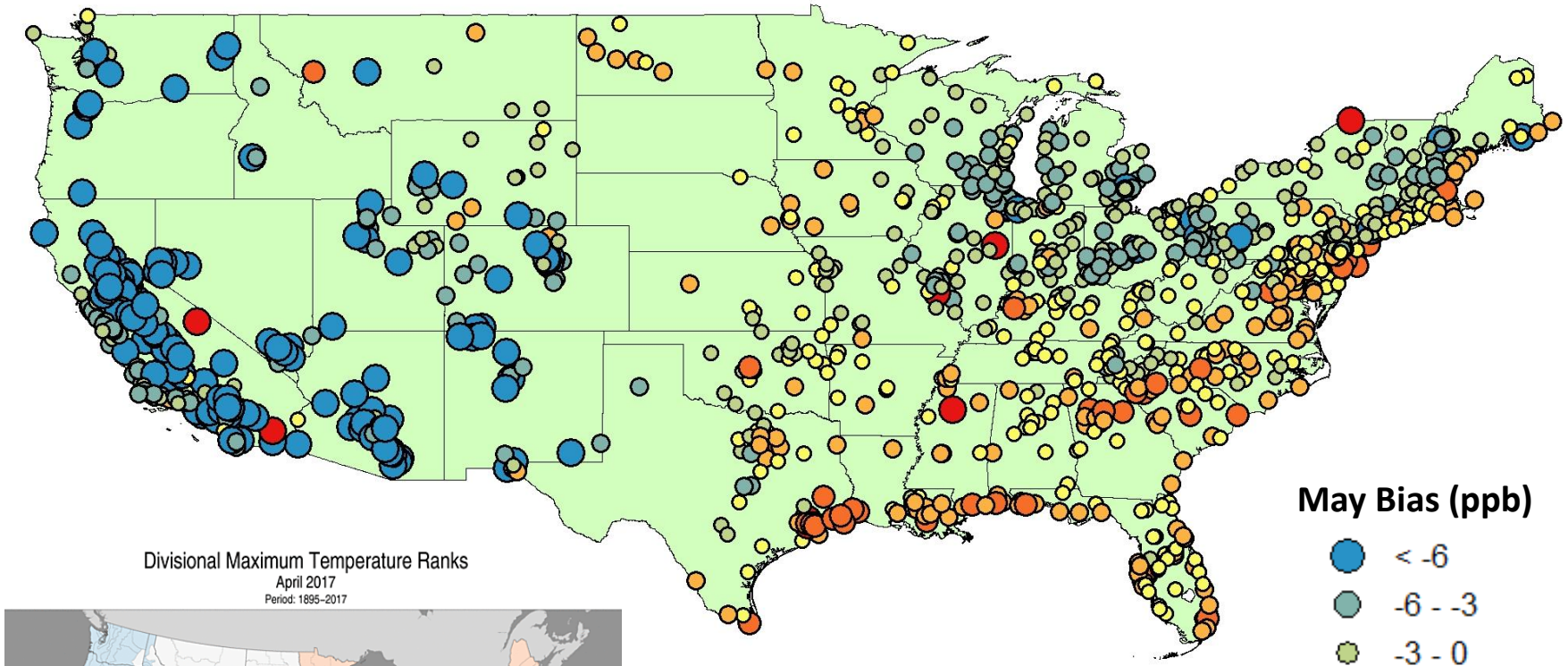
2017

\+ = Model Over-Predicted

\- = Model Under-Predicted

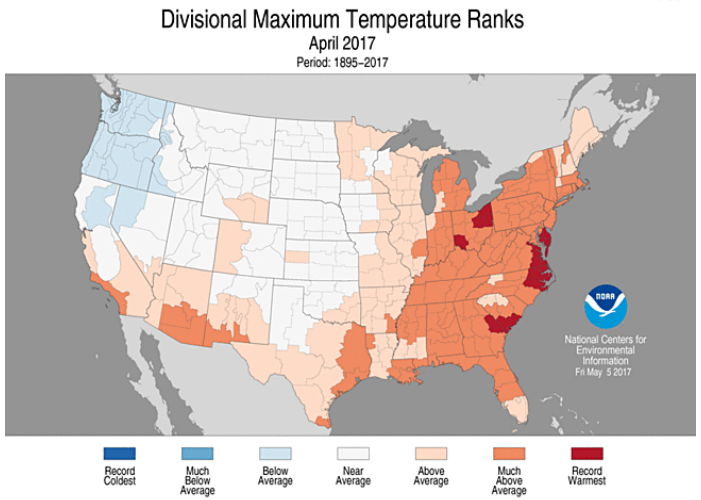
2017 data is preliminary and subject to change

Monthly BIAS – 8hr Ozone
April: 2017



May Bias (ppb)

- < -6
- -6 - -3
- -3 - 0
- 0 - 3
- 3 - 6
- 6 - 9
- > 9



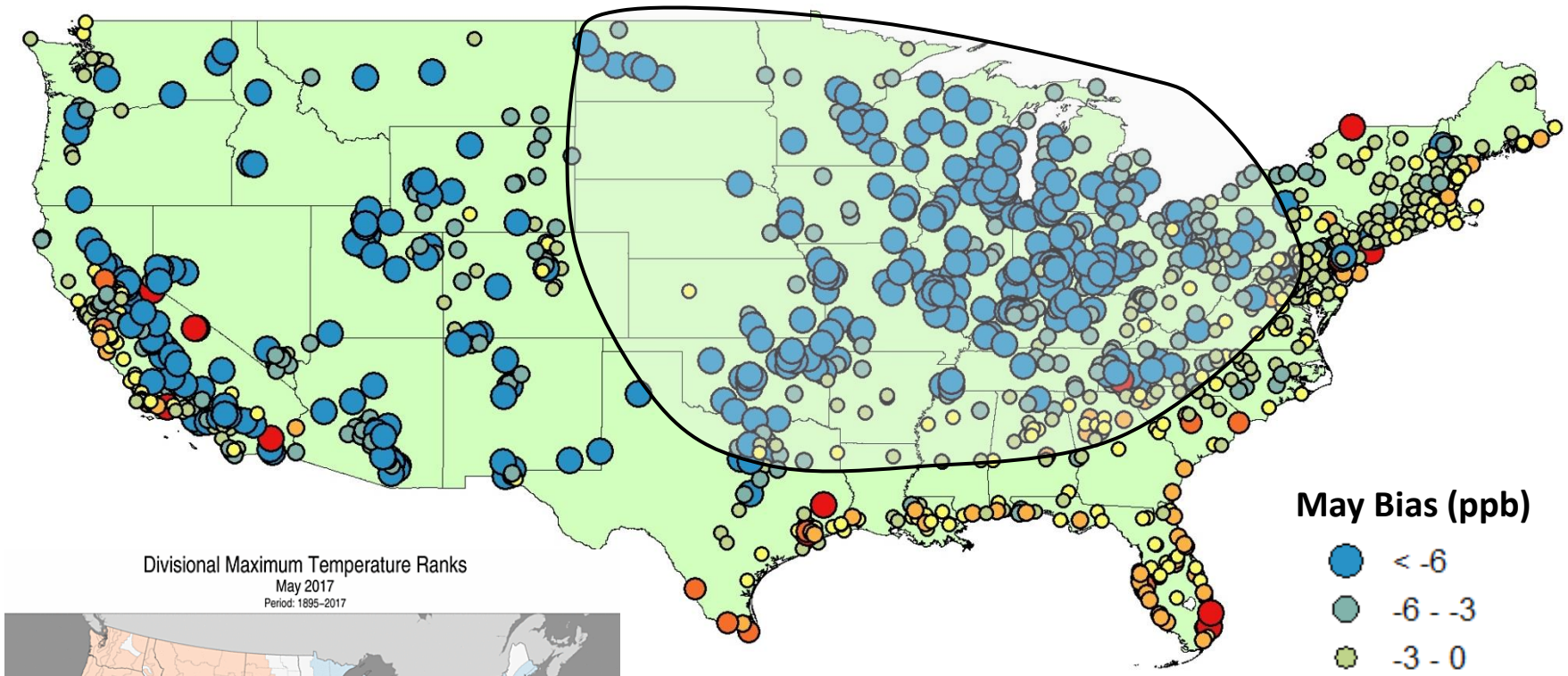
Significant underestimations: Mountain West, Pacific Coast

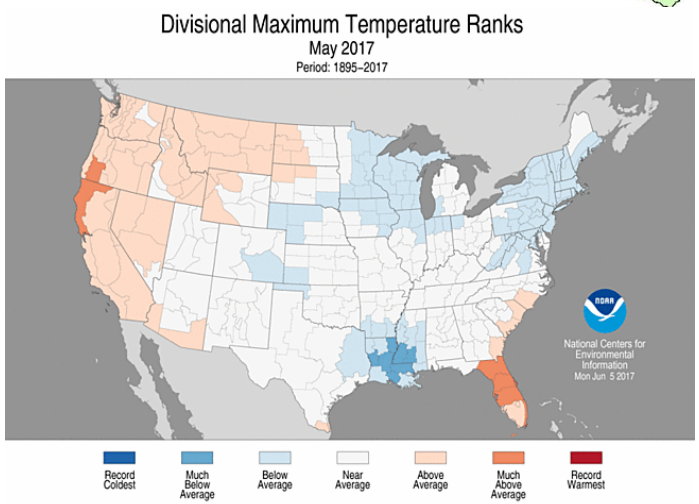
Low Bias elsewhere

2017 data is preliminary and subject to change

* Data used runs 4/15 – 4/30

Monthly BIAS – 8hr Ozone
May: 2017



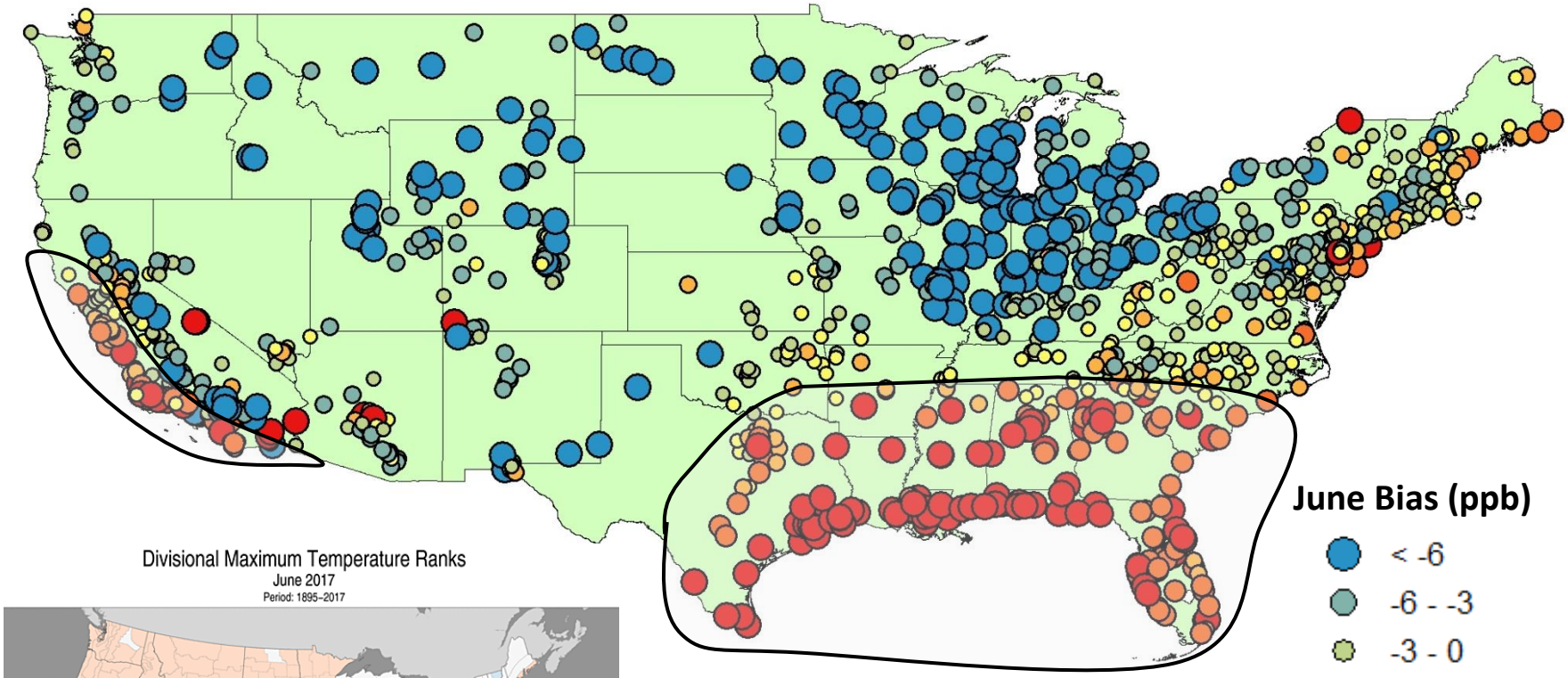


Significant underestimations:
Mid-West…Biogenics?
Continued underestimations out west.
Low bias elsewhere

2017 data is preliminary and subject to change

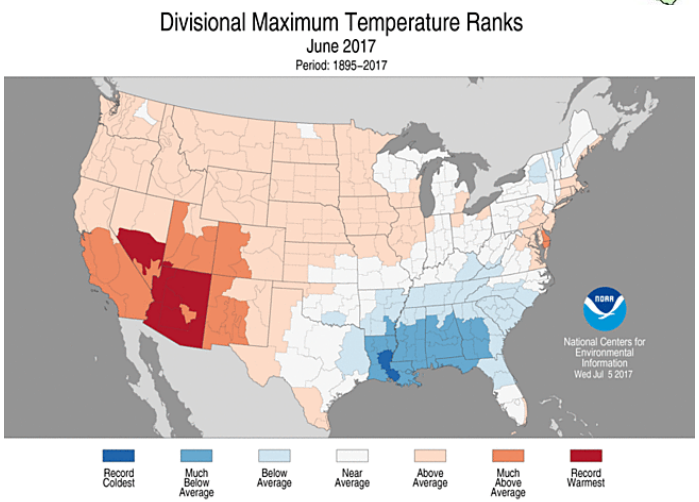
* Data used runs 4/15 – 4/30

Monthly BIAS – 8hr Ozone
June: 2017



June Bias (ppb)

- < -6
- -6 - -3
- -3 - 0
- 0 - 3
- 3 - 6
- 6 - 9
- > 9



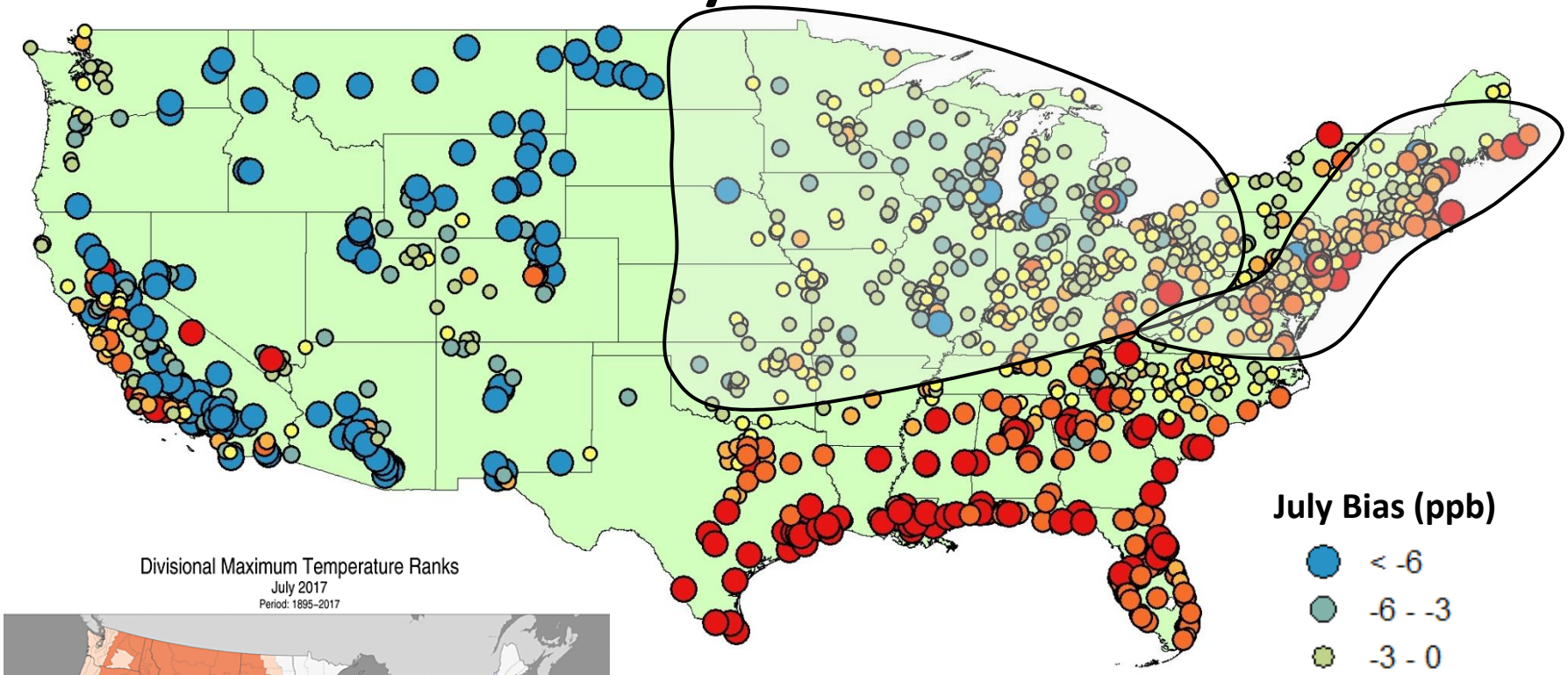
Gulf Coast & California Coast:
Land/Water Interface?
Temperature Dependence?

Continued underestimation Mid-West

2017 data is preliminary and subject to change

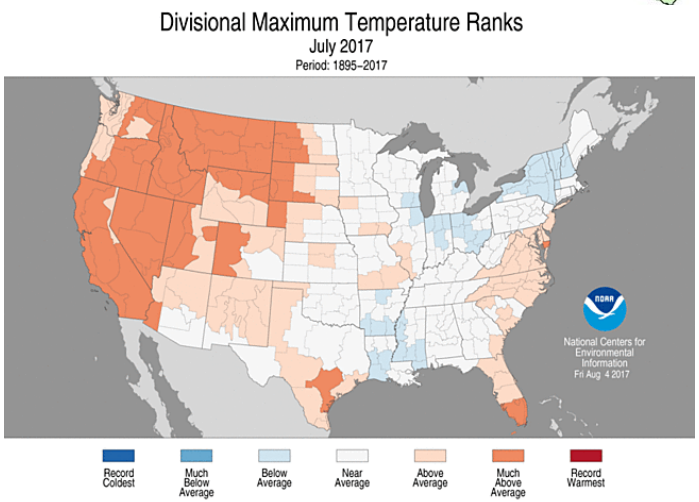
* Data used runs 4/15 – 4/30

Monthly BIAS – 8hr Ozone
July: 2017



July Bias (ppb)

- < -6
- -6 - -3
- -3 - 0
- 0 - 3
- 3 - 6
- 6 - 9
- > 9



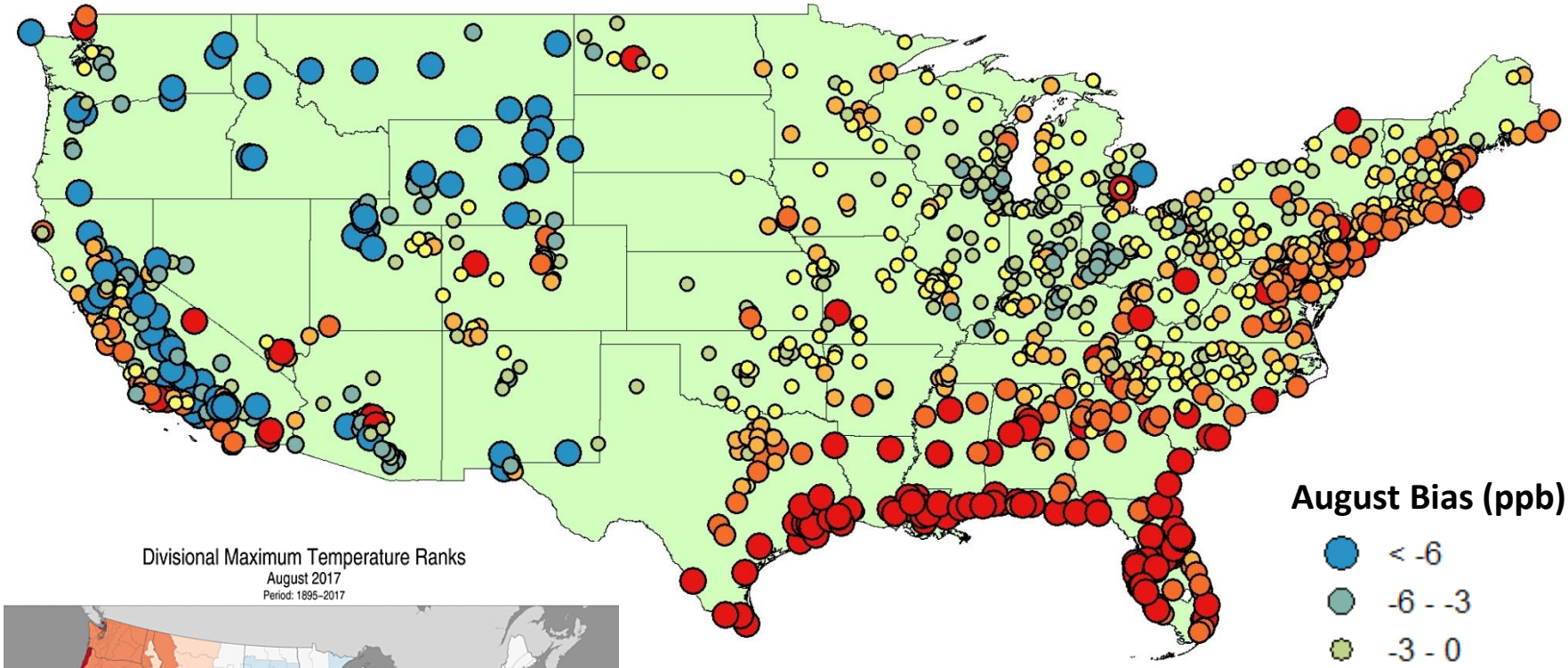
Significant improvements across Mid-West

Positive bias develops for Mid-Atlantic and Northeast

2017 data is preliminary and subject to change

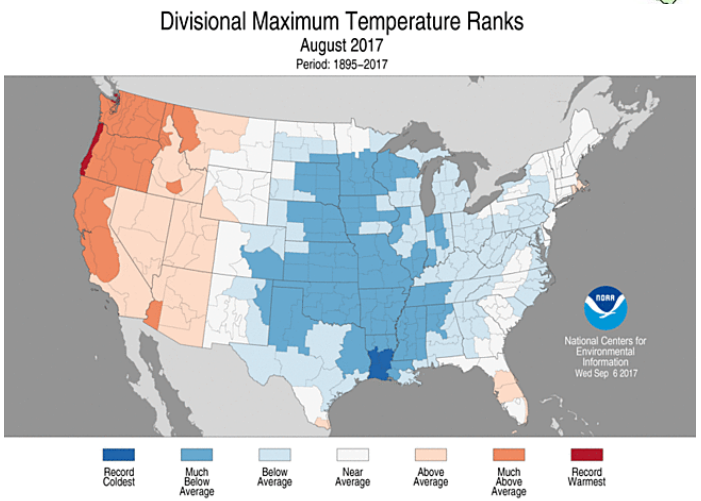
* Data used runs 4/15 – 4/30

Monthly BIAS – 8hr Ozone
August: 2017



August Bias (ppb)

- < -6
- -6 - -3
- -3 - 0
- 0 - 3
- 3 - 6
- 6 - 9
- > 9

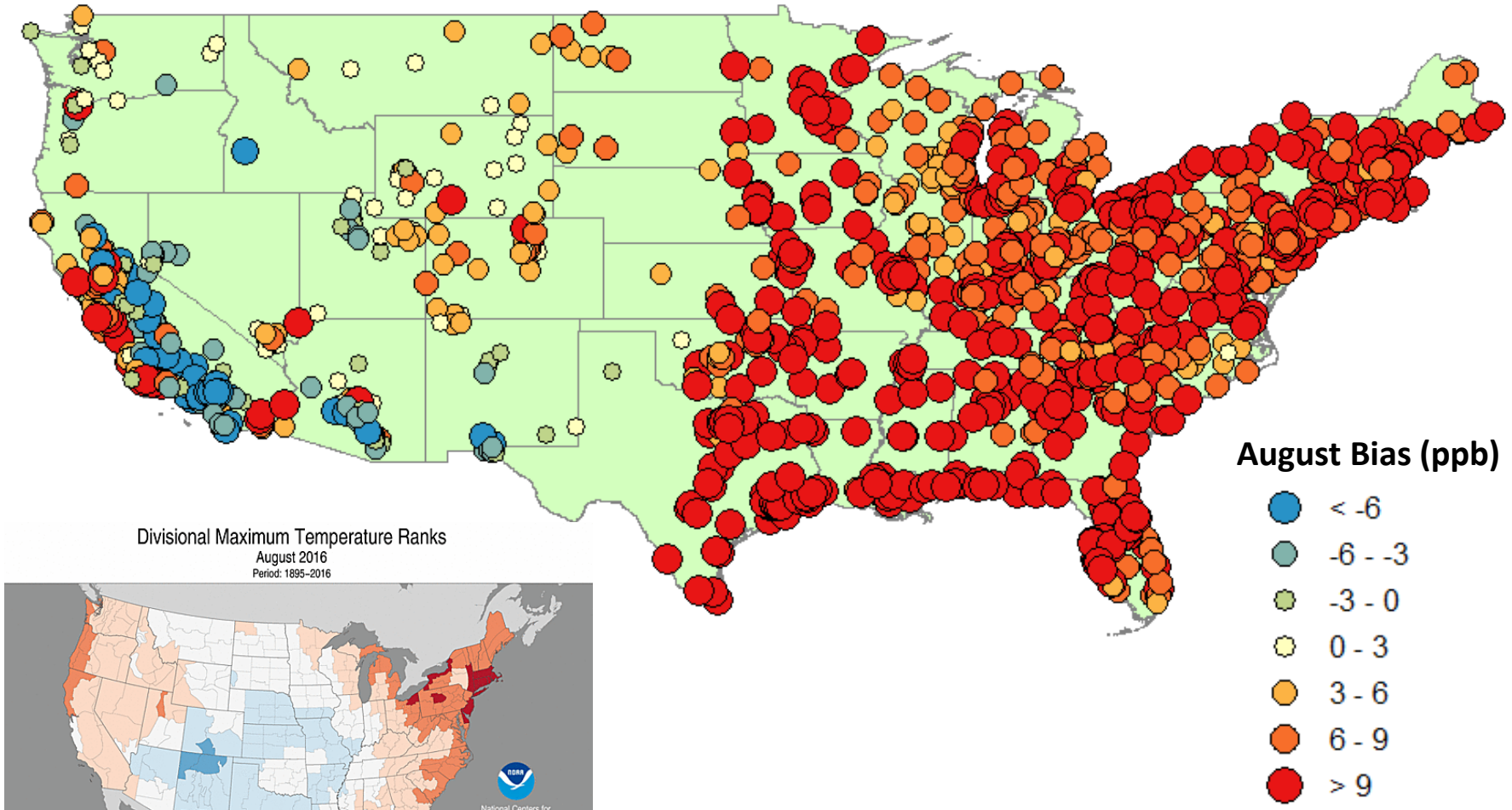


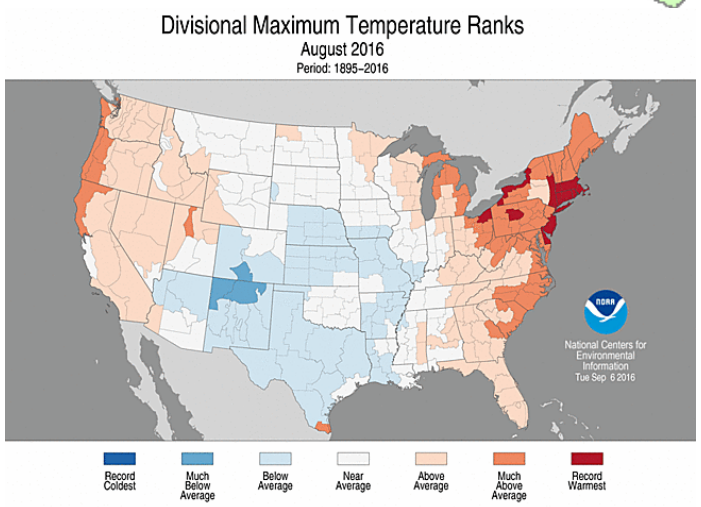
Similar biases trends to July

2017 data is preliminary and subject to change

* Data used runs 4/15 – 4/30

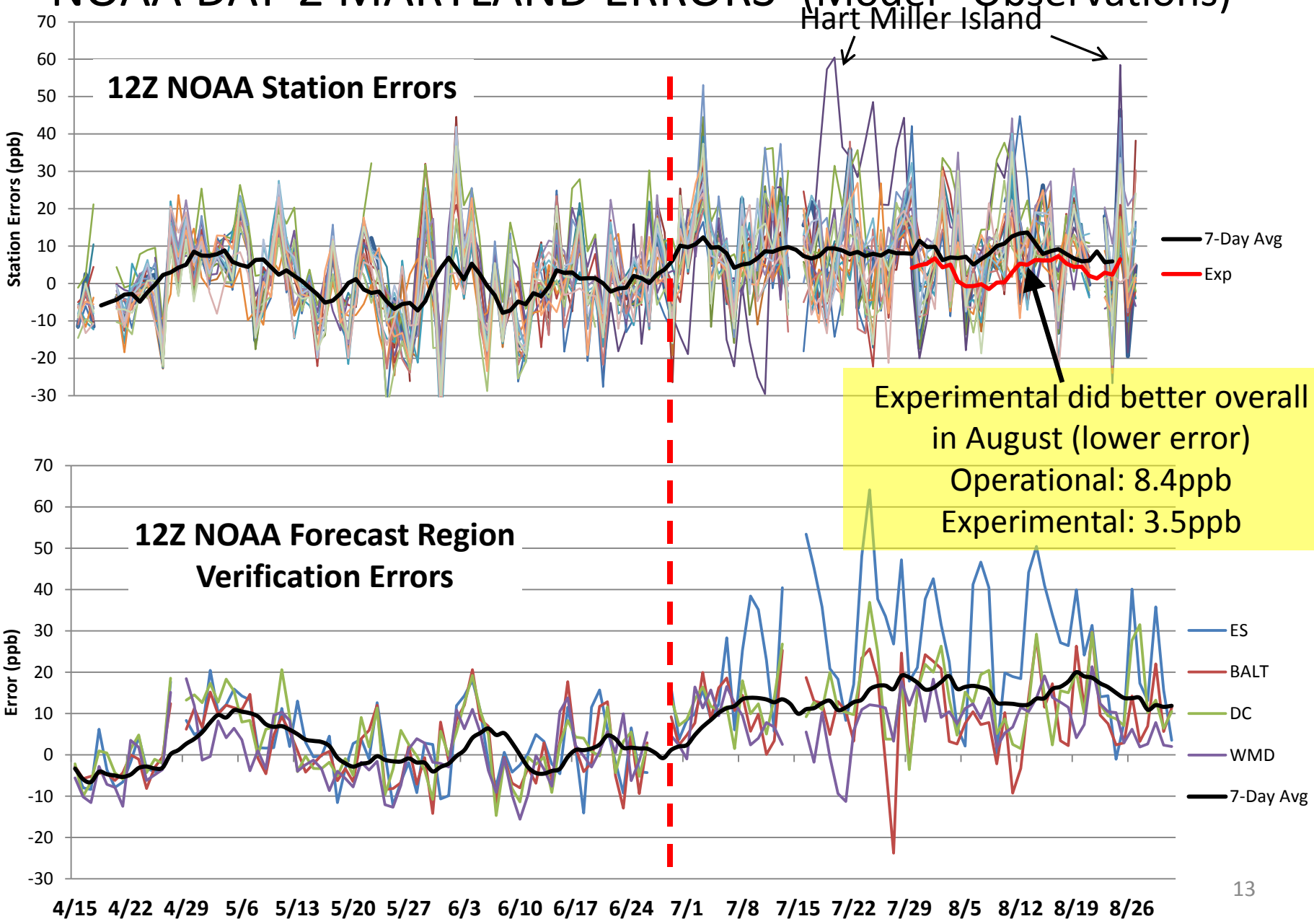
Monthly BIAS – 8hr Ozone
August: 2016



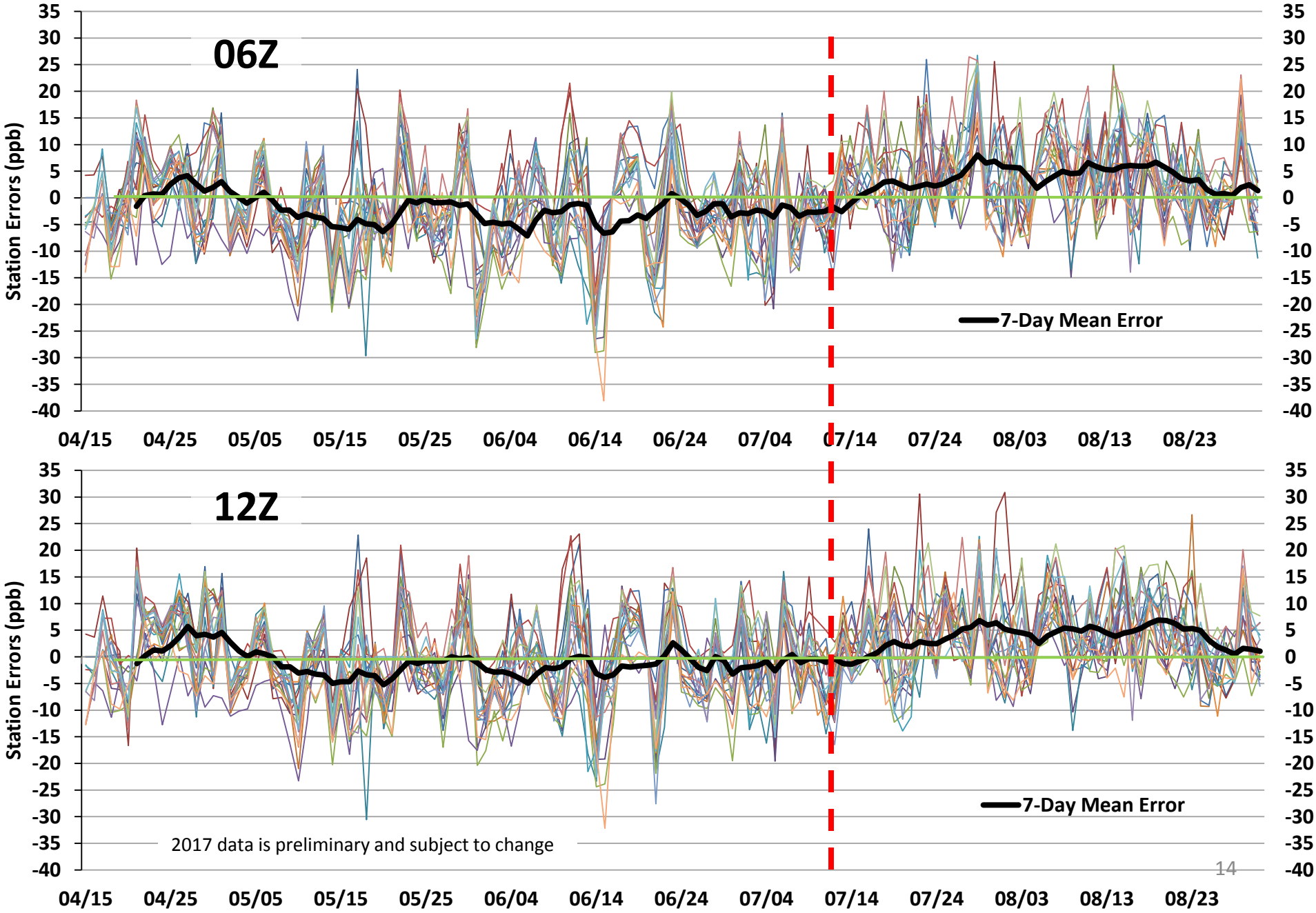


2016 MODEL PERFORMANCE

NOAA DAY-2 MARYLAND ERRORS (Model - Observations)



2017 MODEL PERFORMANCE: NOAA DAY-2 MARYLAND ERRORS (Model - Observations)



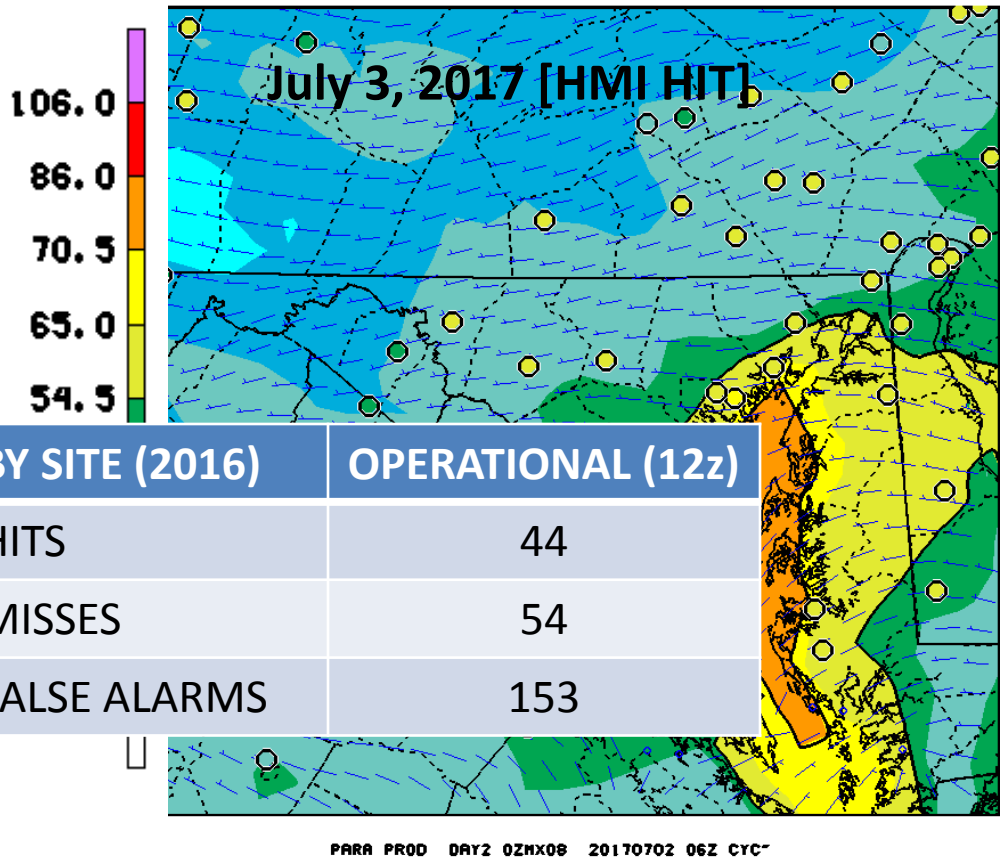
What About Exceedance Events?

By Day	06Z	12Z
HITS	13	14
MISSES	3	2
FALSE ALARMS	8	11

By Site (no HMI)	06Z	12Z
HITS	13	15
MISSES	27	23
FALSE ALARMS	15	27

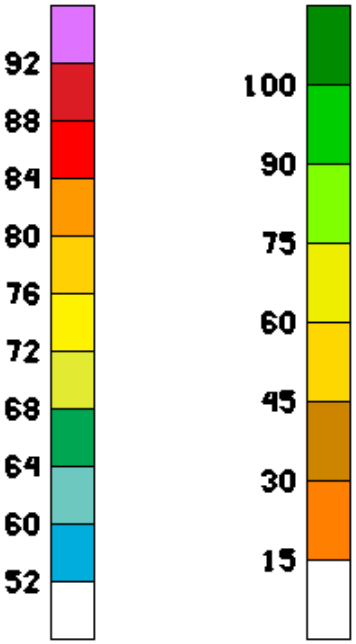
HMI (not included above)	06Z	12Z
HITS	8	11
MISSES	3	0
FALSE ALARMS	9	9

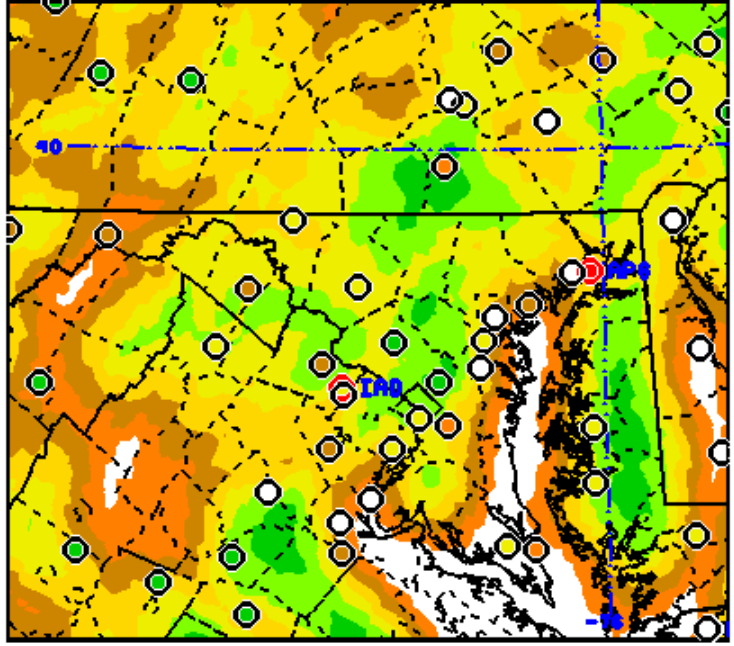
BY SITE (2016)	OPERATIONAL (12z)
HITS	44
MISSES	54
FALSE ALARMS	153



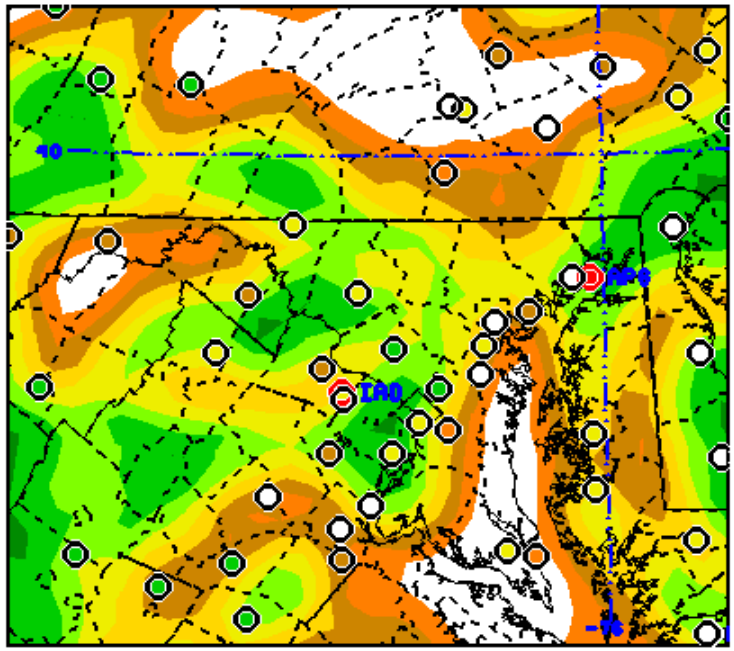
Total days above 70 in Maryland: 16*
Total season days: April 15 – Aug 31 (139 days)

* Through Aug 31; Preliminary Data, subject to change

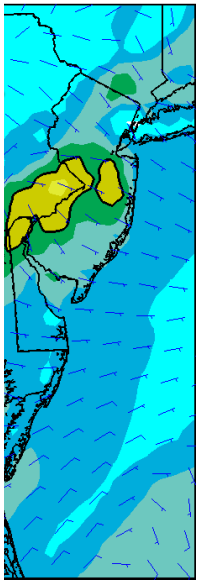




PROD NAM NEST SFC TOTAL CLOUD FRAC MD×× 170916/2100V009



PROD NAM SFC TOTAL CLOUD FRAC MD×× 170916/2100V009



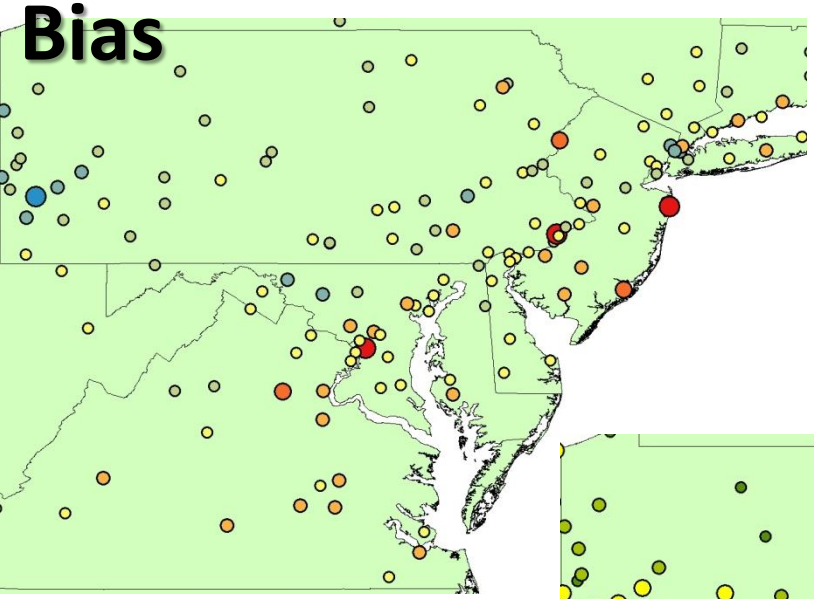
O3

1hr
69
59
56

* Through Aug 31; P
subject to change

2017 Seasonal Stats

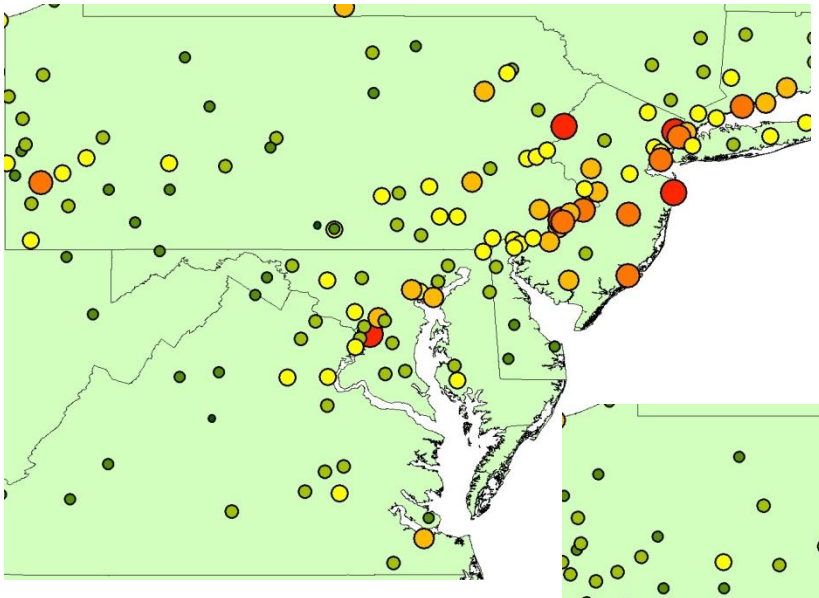
Bias



Bias Scale (ppb)

- < -6
- -6 - -3
- -3 - 0
- 0 - 3
- 3 - 6
- 6 - 9
- > 9

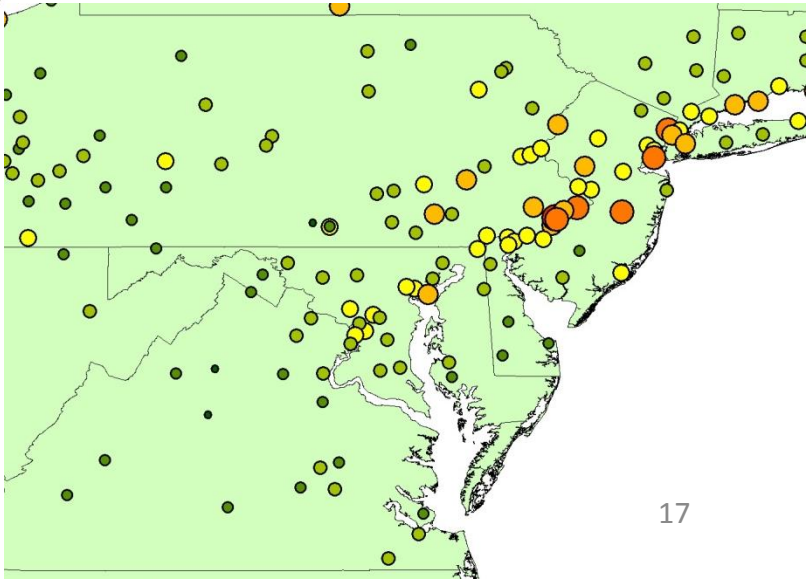
RMSE



RMSE/STDDEV Scale (ppb)

- < 6
- 6 - 7
- 7 - 8
- 8 - 9
- 9 - 10
- 10 - 11
- > 11

Standard Dev



* Through Aug 31; Preliminary Data, subject to change

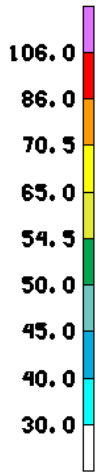
Case Study: Miss/FA

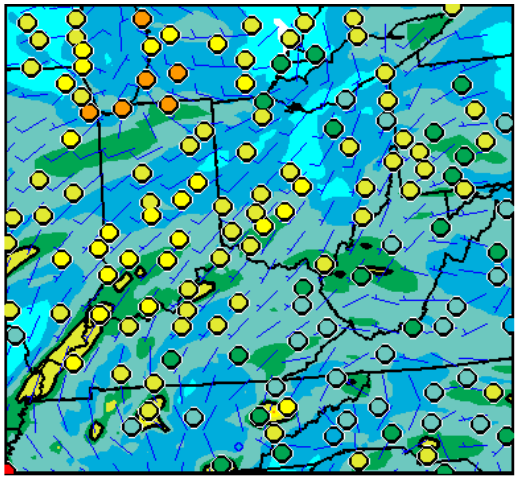
2 bunches:

6/10-6/15, 2017

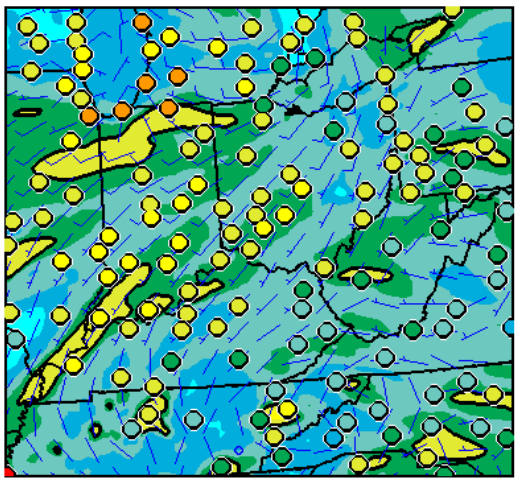
Long Range Transport – Smoke related??

Misses (10 of 12 misses at FH, Edgewood, Aldino, Millington, PG)





PARA 4X-DAY DAY2 OZMX08 20170608 12Z CYC

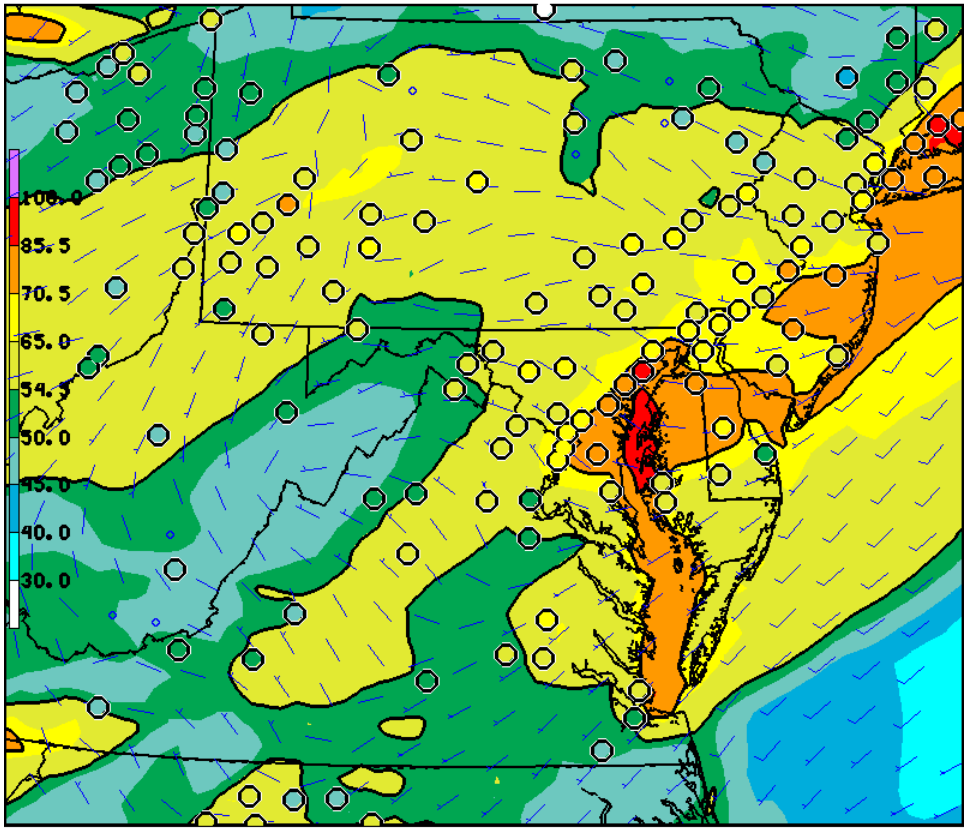


PROD DAY2 OZMX08 20170608 12Z CYC

7/17 – 7/22, 2017

Local Emissions + transport ?? Took time for the atmosphere to catch up to the model.

False Alarm (I-95 corridor, and BB focused)



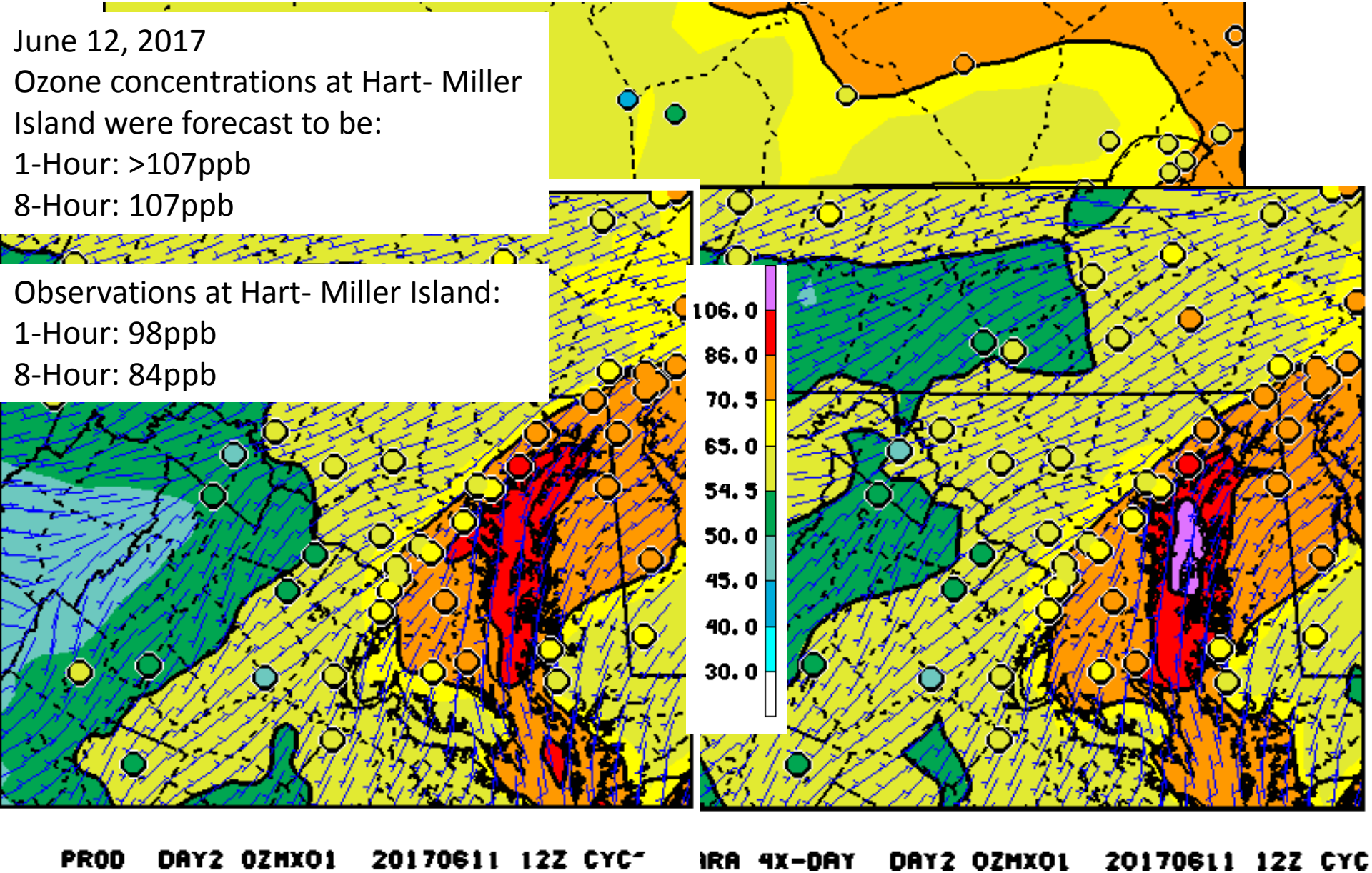
PARA PROD DAY2 OZMX08 20170719 06Z CYC

* Through Aug 31; Preliminary Data, subject to change

HART-MILLER ISLAND[1]

June 12, 2017
Ozone concentrations at Hart- Miller Island were forecast to be:
1-Hour: >107ppb
8-Hour: 107ppb

Observations at Hart- Miller Island:
1-Hour: 98ppb
8-Hour: 84ppb

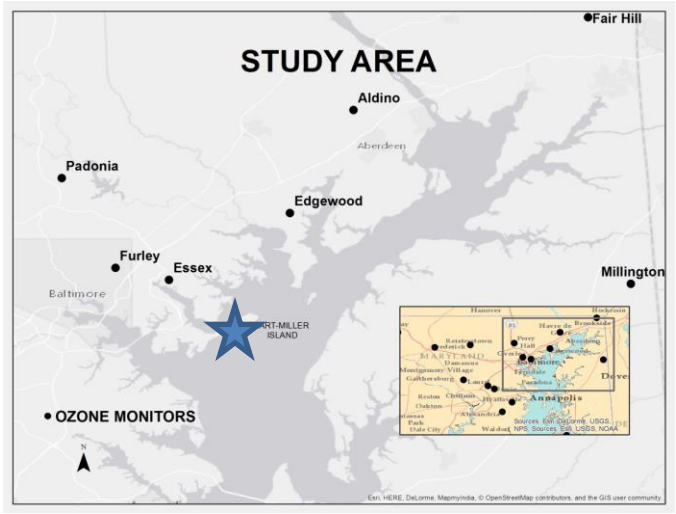


* Through Aug 31; Preliminary Data, subject to change

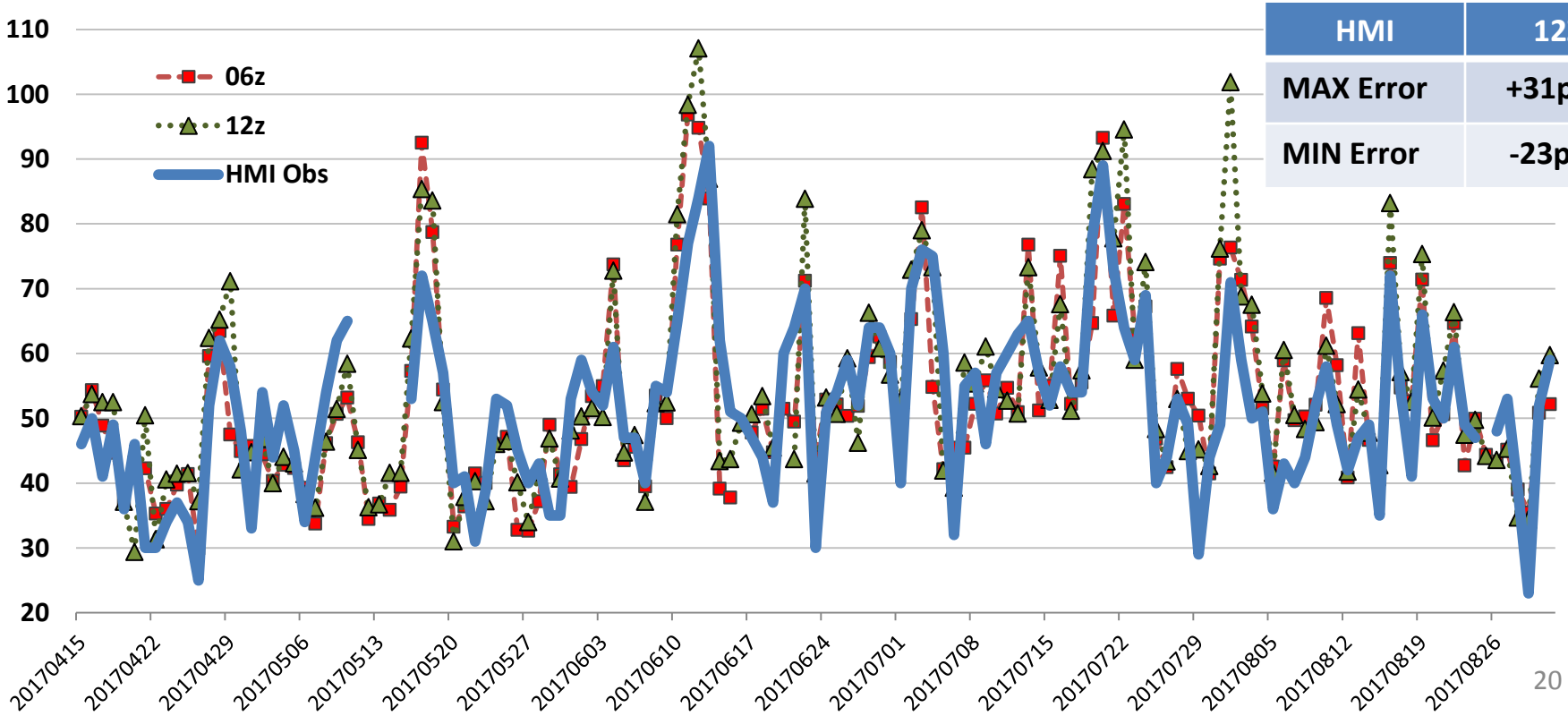
[1]This was a special purpose monitor

Hart-Miller Island

HMI	06Z	12Z
BIAS	1.2	2.9
RMSE	8.8	9.3
St. Dev	9	9.2



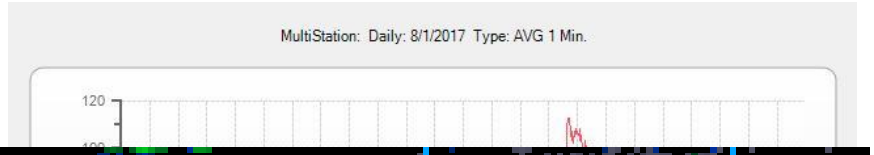
HMI	12Z
MAX Error	+31ppb
MIN Error	-23ppb

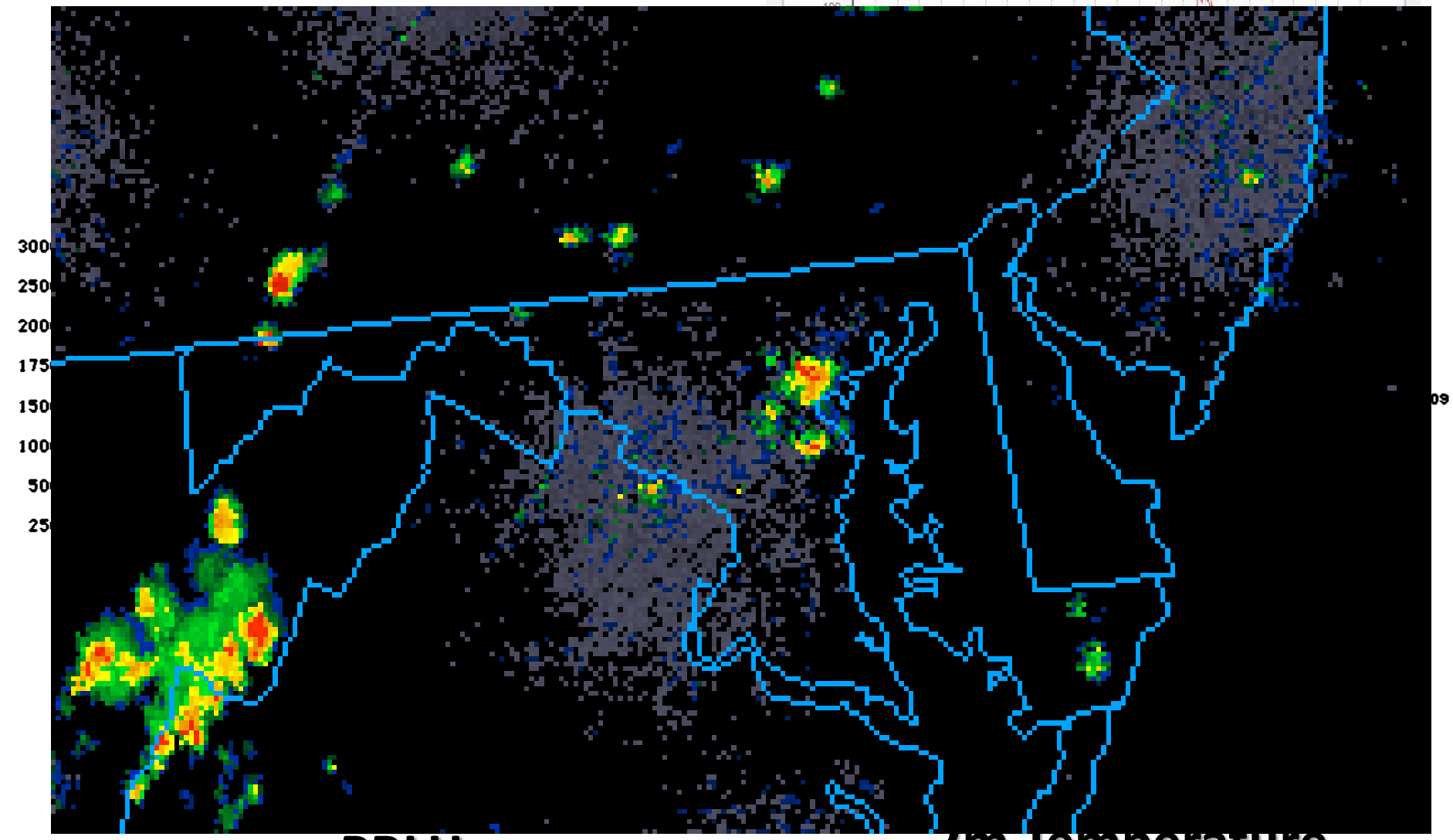


* Through Aug 31; Preliminary Data, subject to change

Higher Resolution

8/1 Essex would have exceeded due to BB.
Storms and BB not in 12km NAM model.



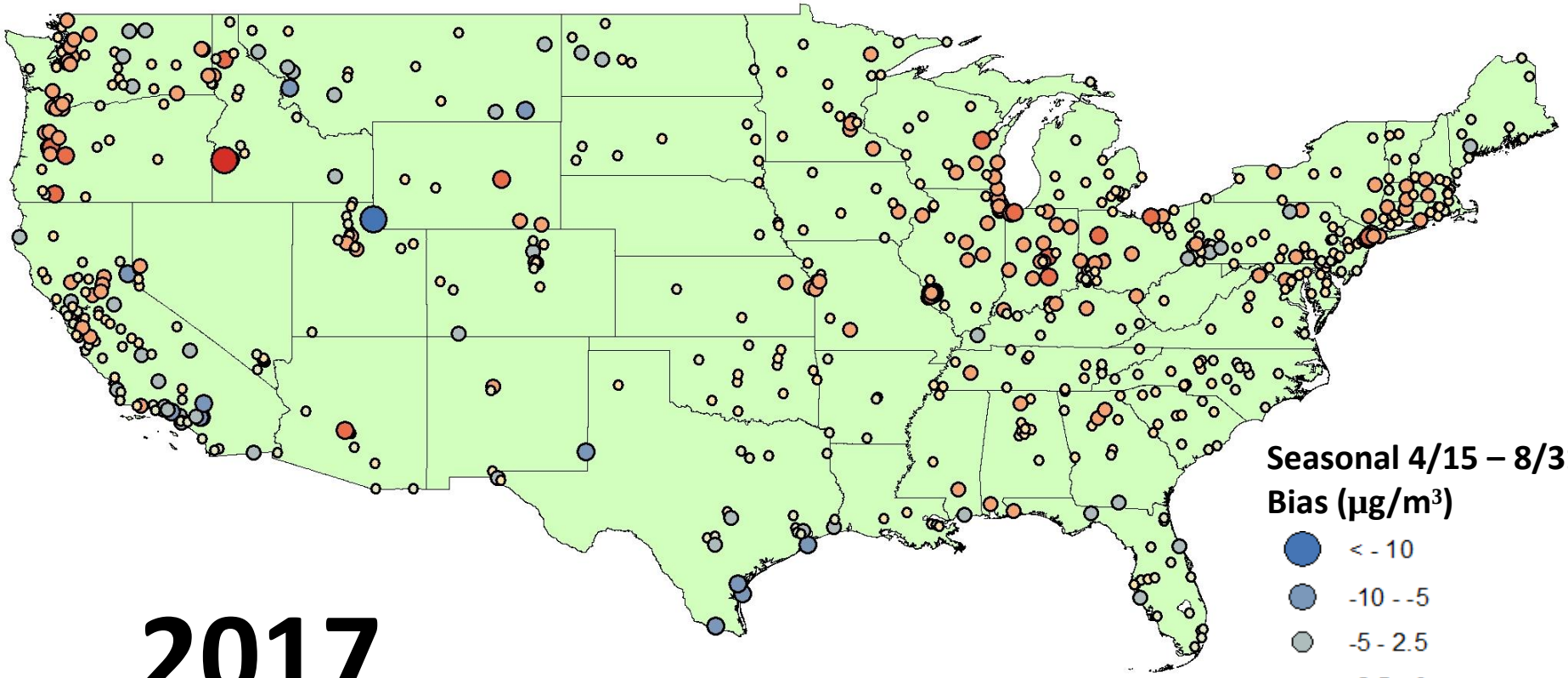


PBLH

2m Temperature

* Through Aug 31; Preliminary Data, subject to change

Seasonal BIAS – $PM_{2.5}$



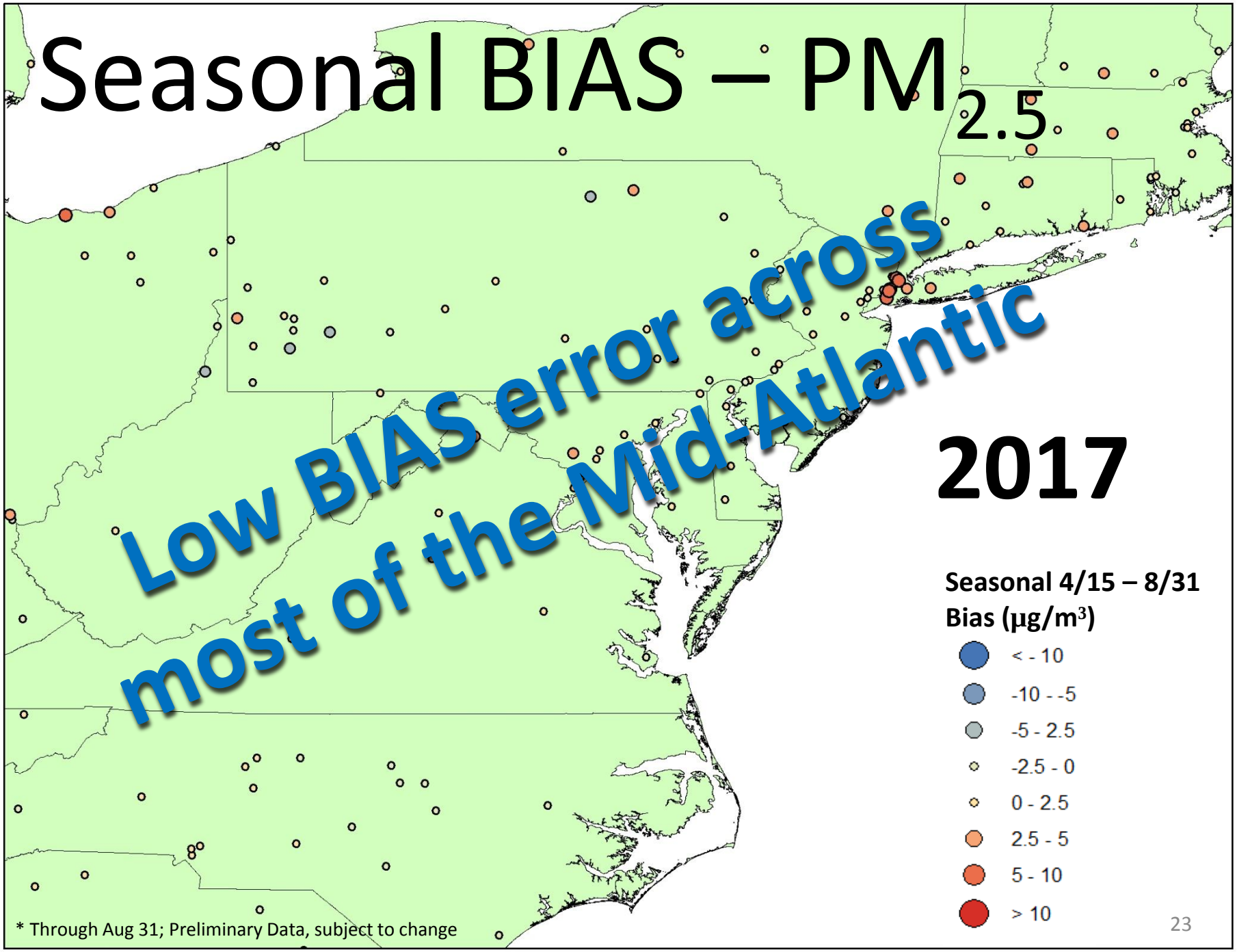
2017

\+ = Model Over-Predicted

\- = Model Under-Predicted

* Through Aug 31; Preliminary Data, subject to change

Seasonal BIAS – $PM_{2.5}$



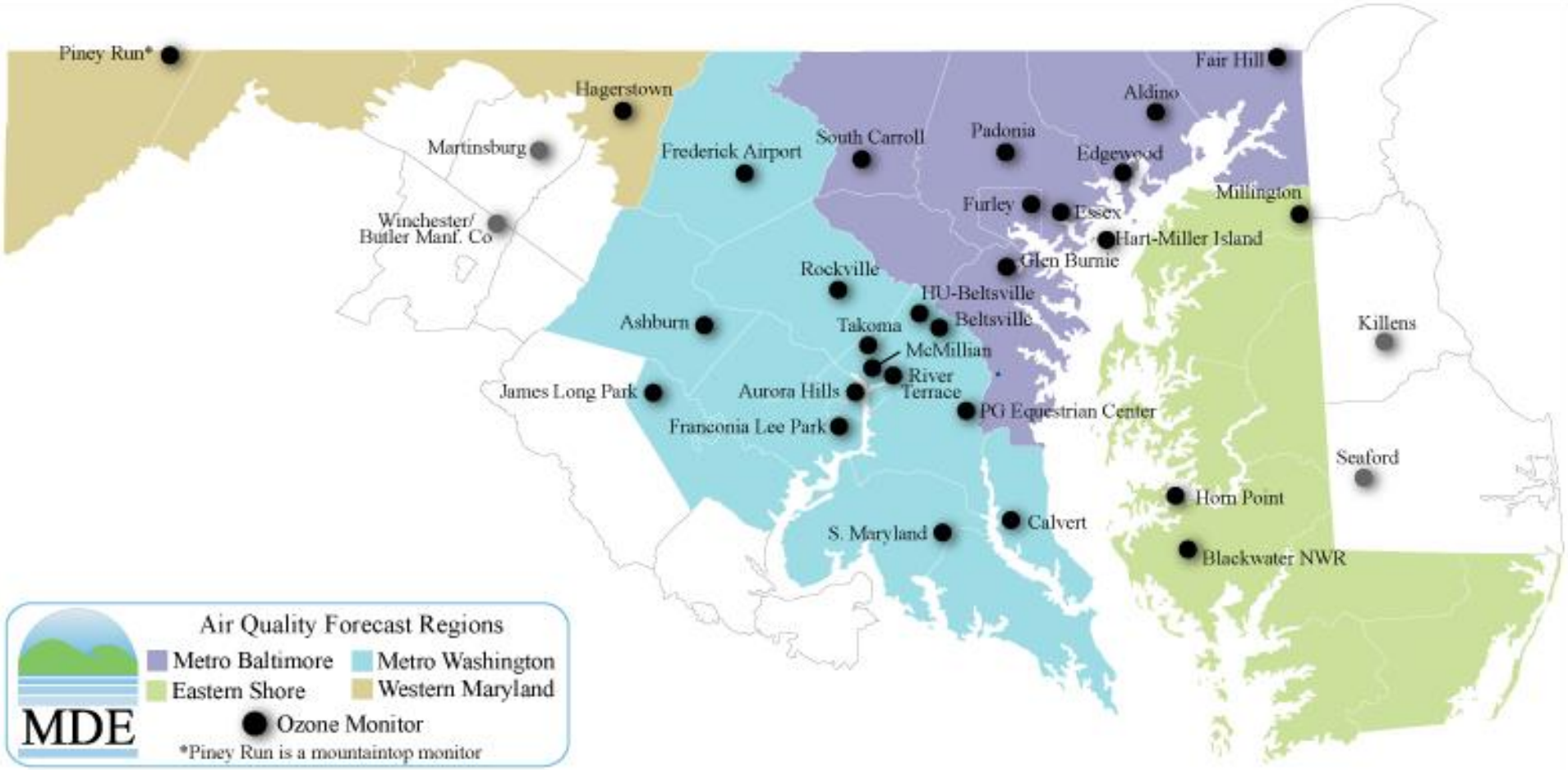
* Through Aug 31; Preliminary Data, subject to change

Summary Points

- MD is satisfied with performance and performance improvements in 2017
  - Caveats are that it was a much cooler year
- Mobile likely “too hot”.
  - Cause for late season high bias?
- Need high resolution near the Chesapeake Bay to adequately capture the emissions and dynamics
- False Alarms in model due to local effects (emissions) over done
- Misses were related to transport (smoke related??) in to or out of Maryland airshed and/or the Bay

Appendix

Forecast Regions & Ozone Monitors



*Hart-Miller Island is a Special Purpose Monitor

**Beltsville and Blackwater NWR are EPA CASTNET sites

26