



Maryland's 2018 Ozone Season NOAA Feedback

Joel Dreessen

James Boyle

September 27-28, 2018

AQ Forecaster Focus Group

College Park, Maryland





Overview

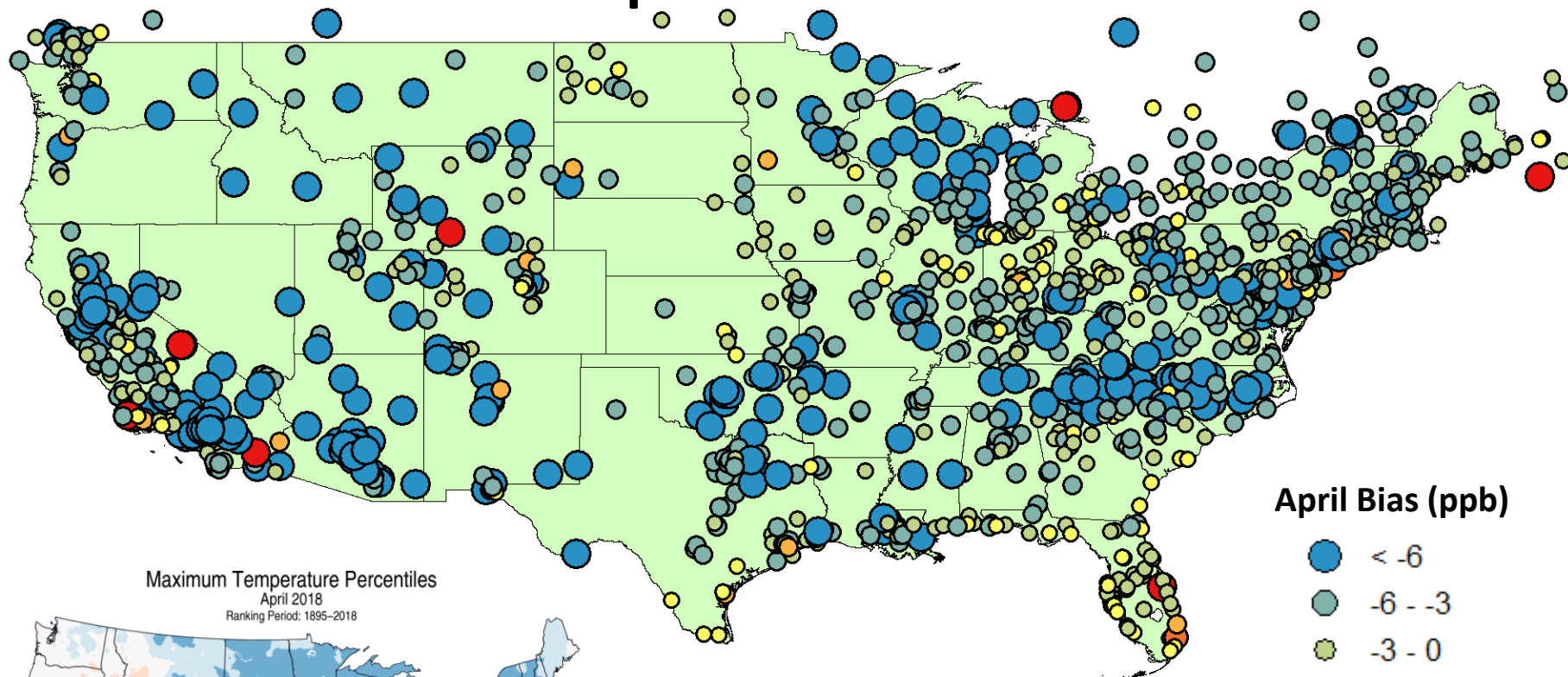
- National (Time and Space)
 - Forecast Bias
 - Forecast Trends

- Maryland/Mid-Atlantic
 - False Alarms/Misses/Hits
 - Specific Needs
 - Specific Cases to show need for:
 - <=4km Grid
 - Ozone Surges (both diurnally and day-to-day)
 - Gas phase chemistry?? (Do not include unless comparable)

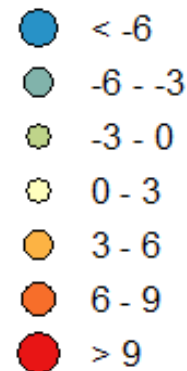


Monthly BIAS – 8hr Ozone

April: 2018

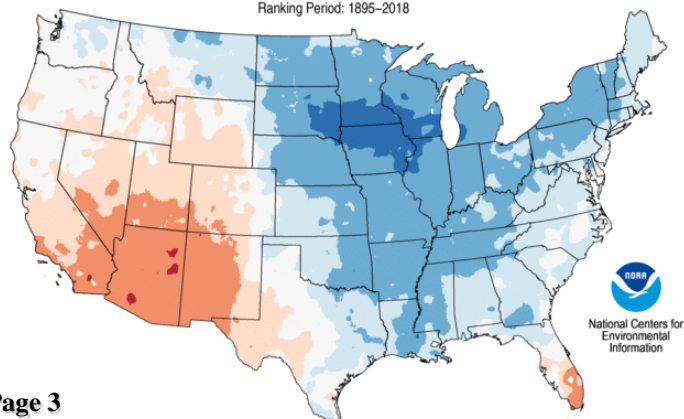


April Bias (ppb)



+ = Model Over predicted
- = Model Under predicted

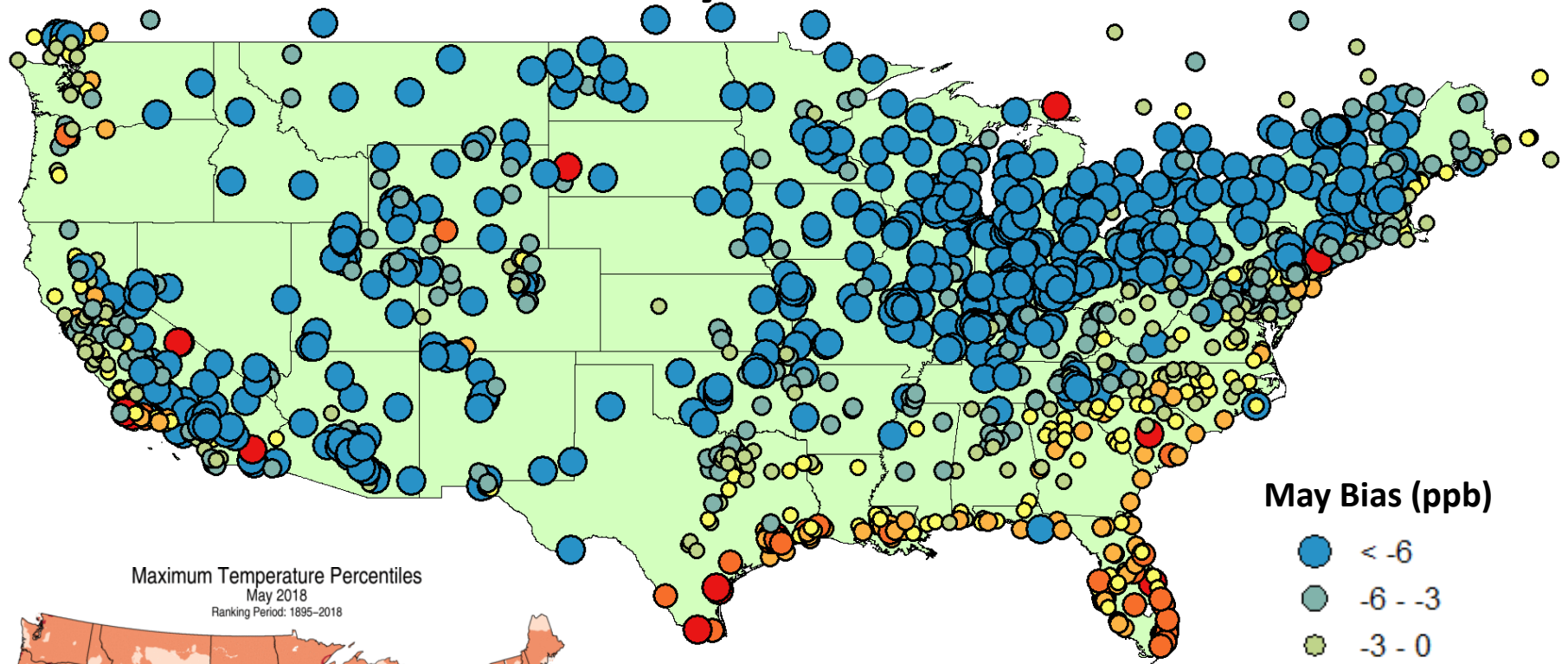
Maximum Temperature Percentiles
April 2018
Ranking Period: 1895–2018



**2018 data is preliminary*

Monthly BIAS – 8hr Ozone

May: 2018

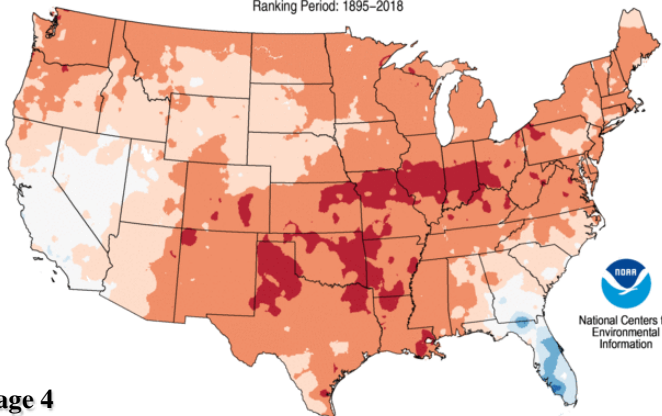


May Bias (ppb)

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

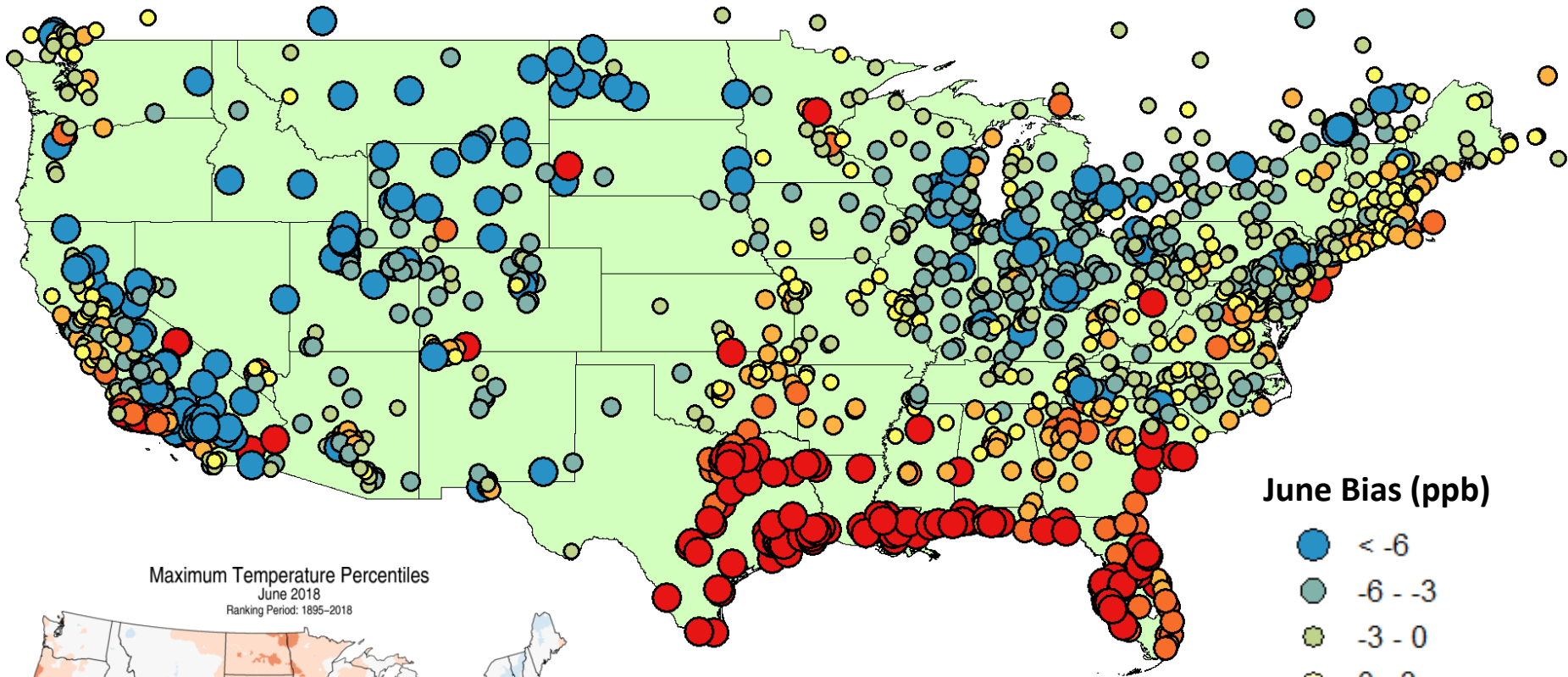
+ = Model Over predicted
- = Model Under predicted

Maximum Temperature Percentiles
May 2018
Ranking Period: 1895–2018

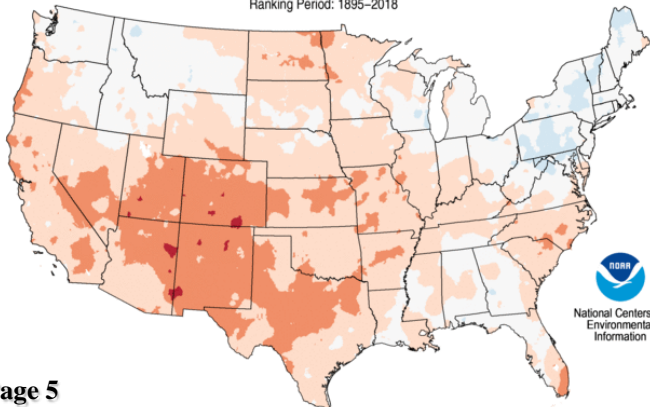


Monthly BIAS – 8hr Ozone

June: 2018



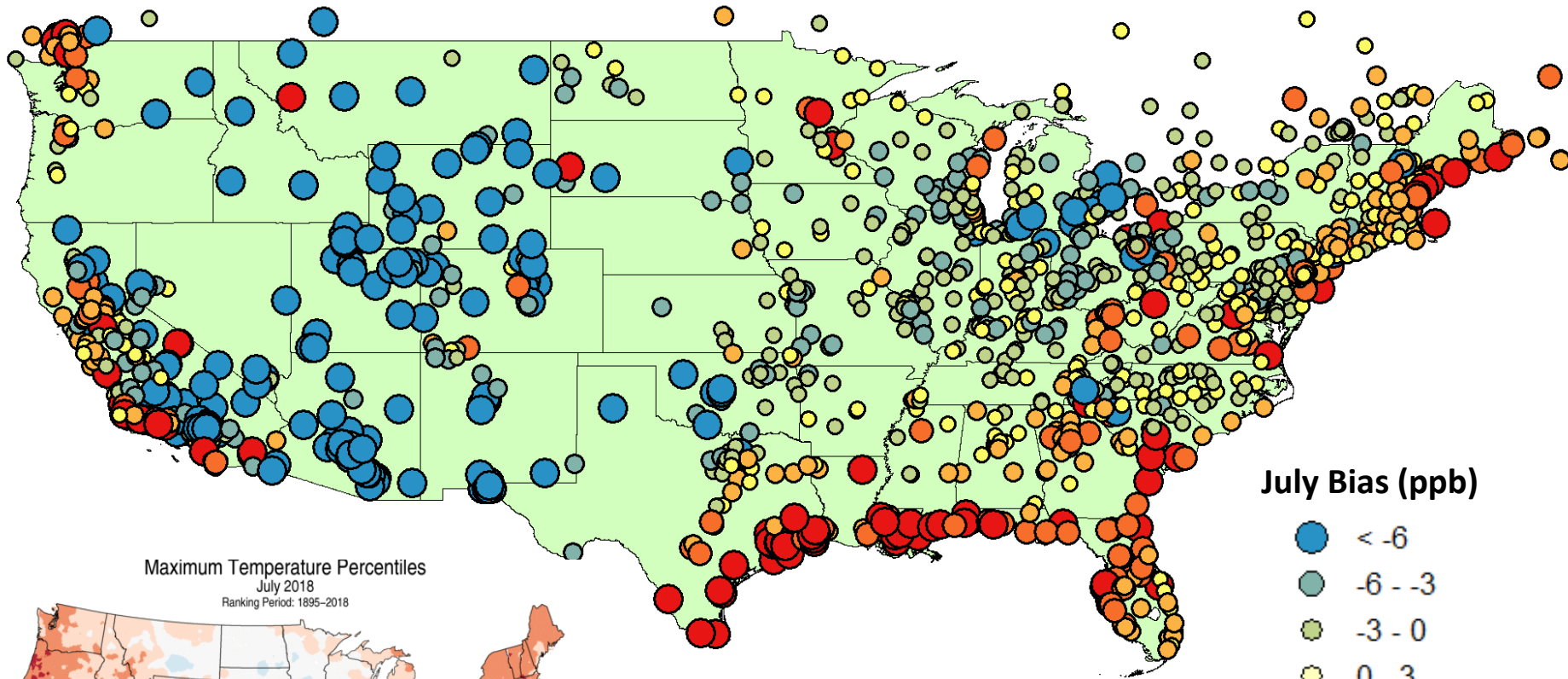
Maximum Temperature Percentiles
June 2018
Ranking Period: 1895–2018



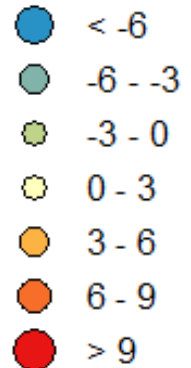
+ = Model Over predicted
- = Model Under predicted

Monthly BIAS – 8hr Ozone

July: 2018

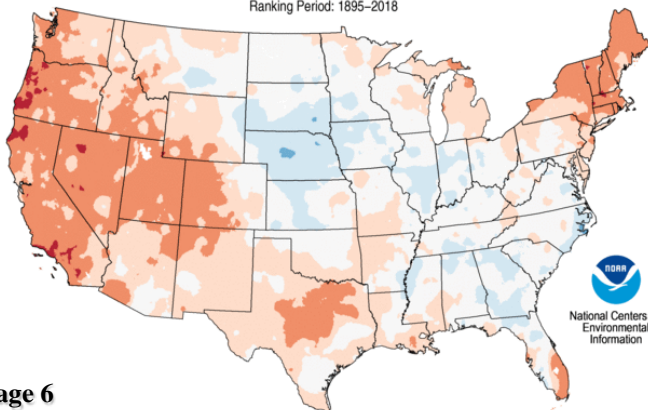


July Bias (ppb)



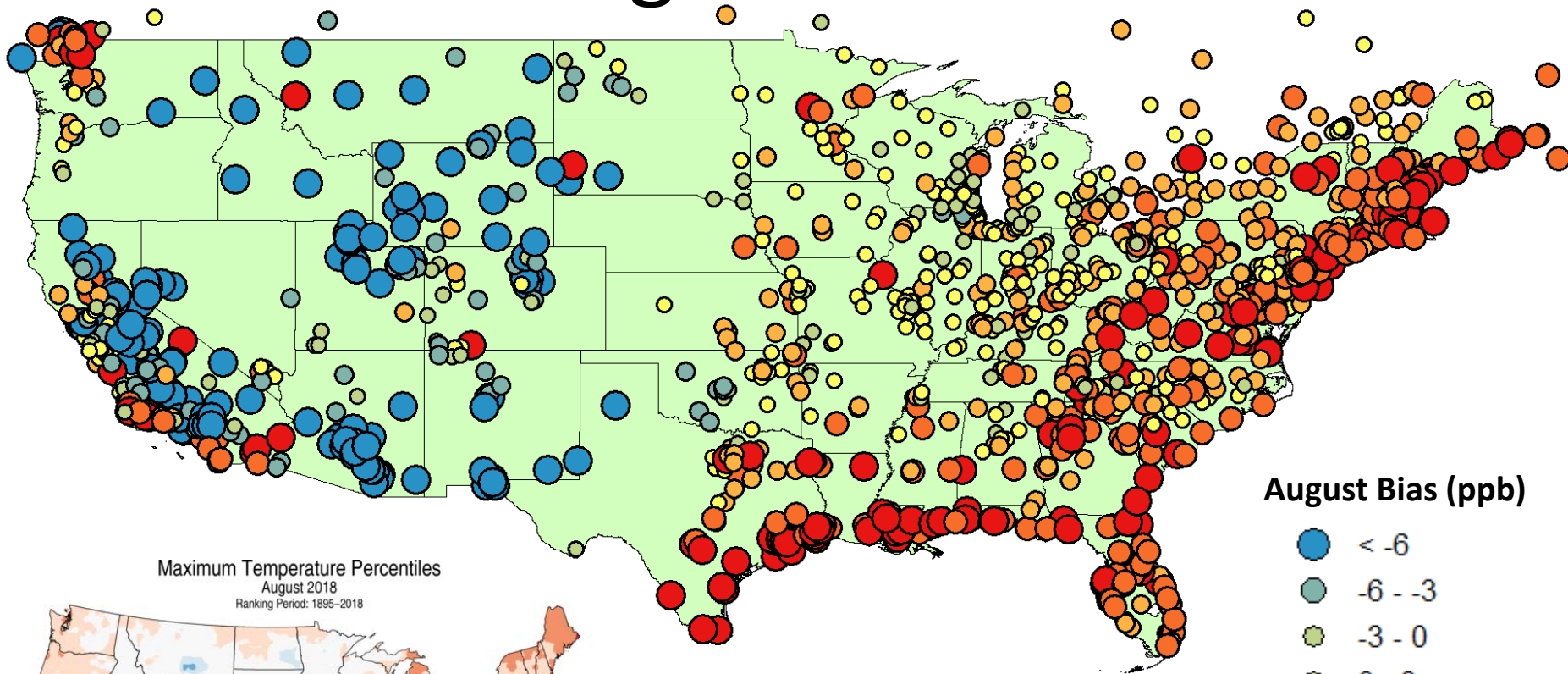
+ = Model Over predicted
- = Model Under predicted

Maximum Temperature Percentiles
July 2018
Ranking Period: 1895–2018

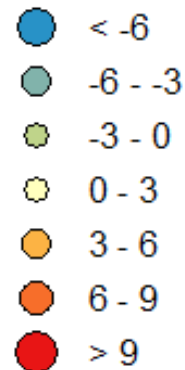


Monthly BIAS – 8hr Ozone

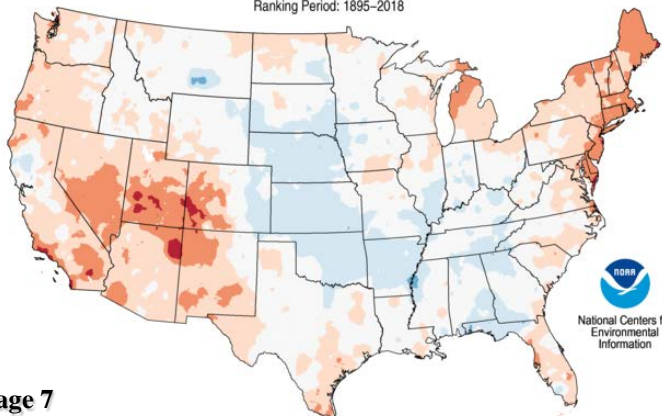
August: 2018



August Bias (ppb)

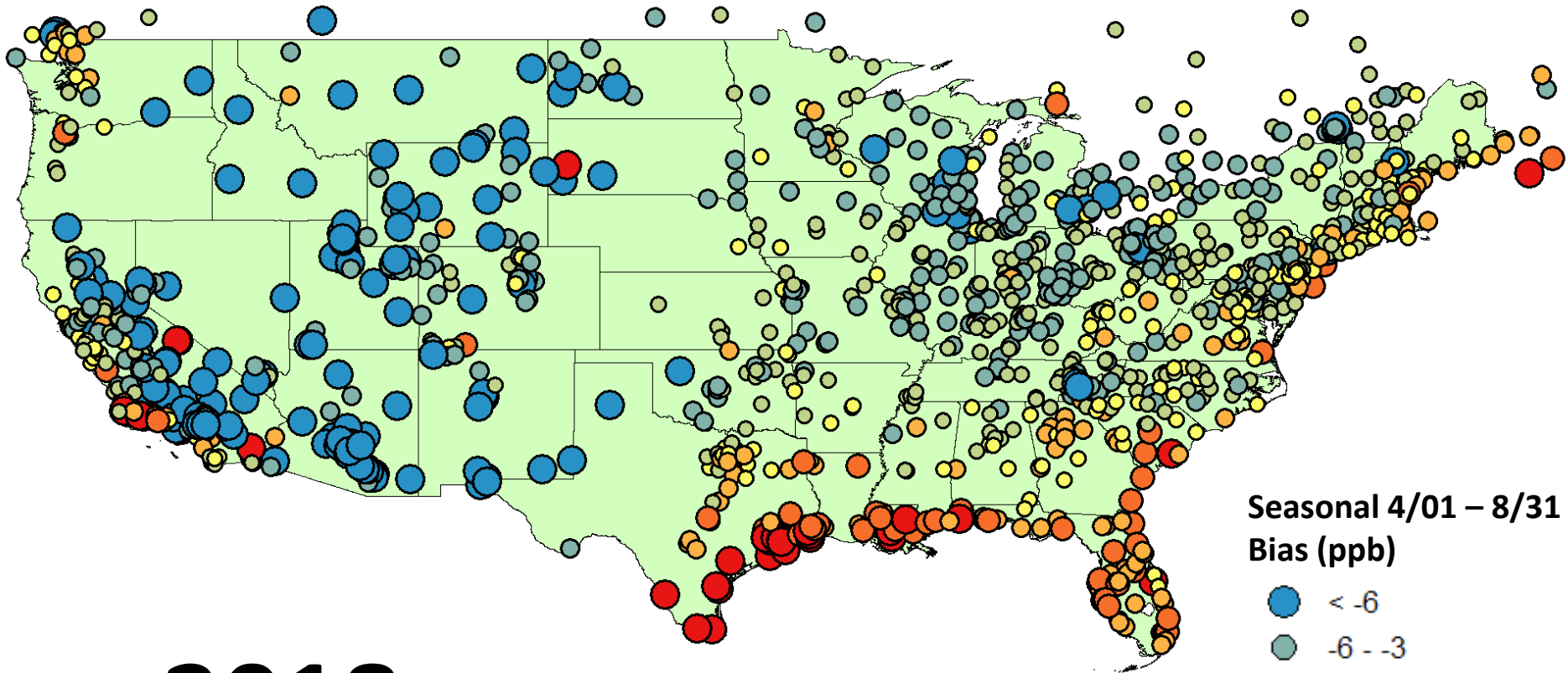


Maximum Temperature Percentiles
August 2018
Ranking Period: 1895-2018



+ = Model Over predicted
- = Model Under predicted

Seasonal BIAS – 8hr Ozone

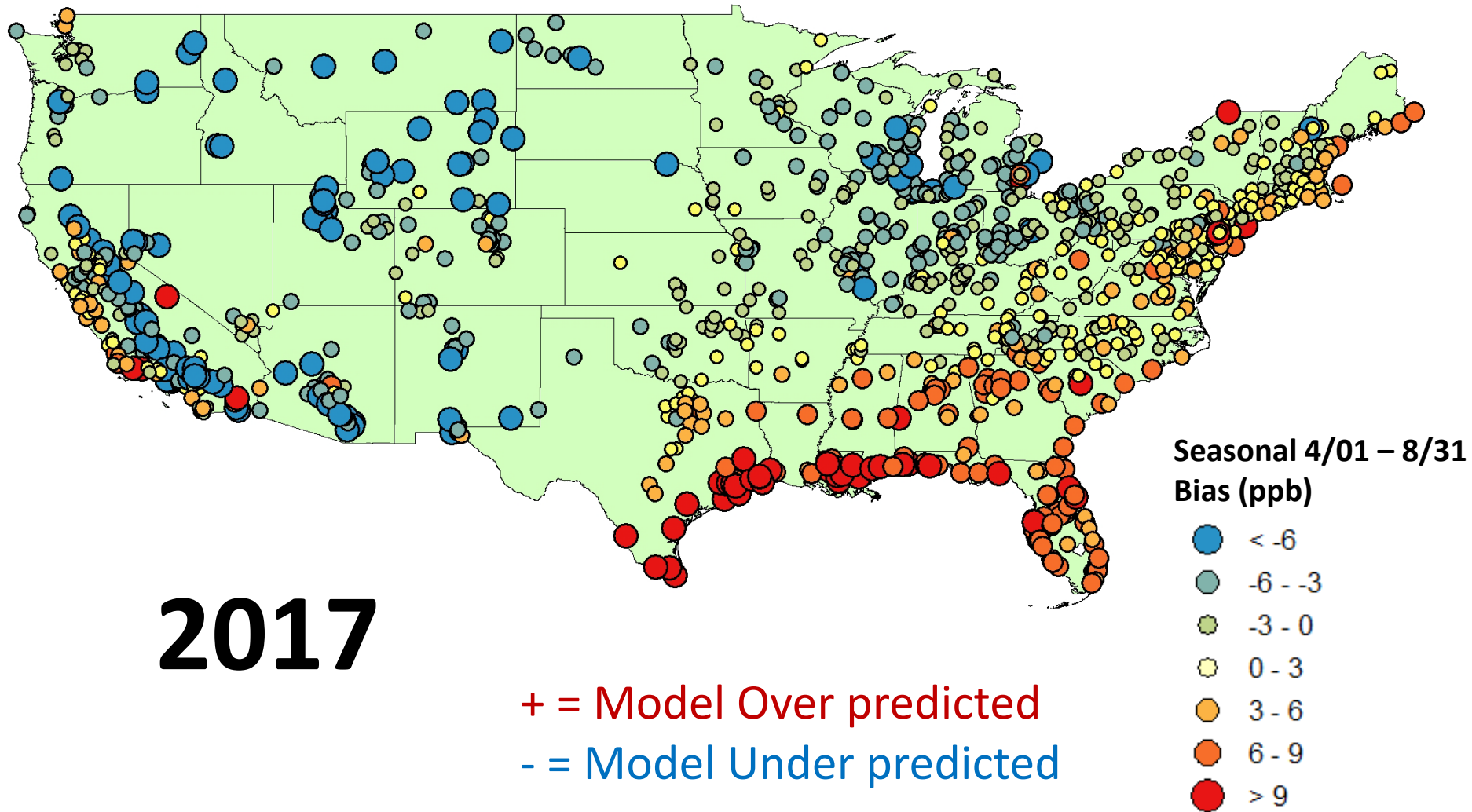


2018

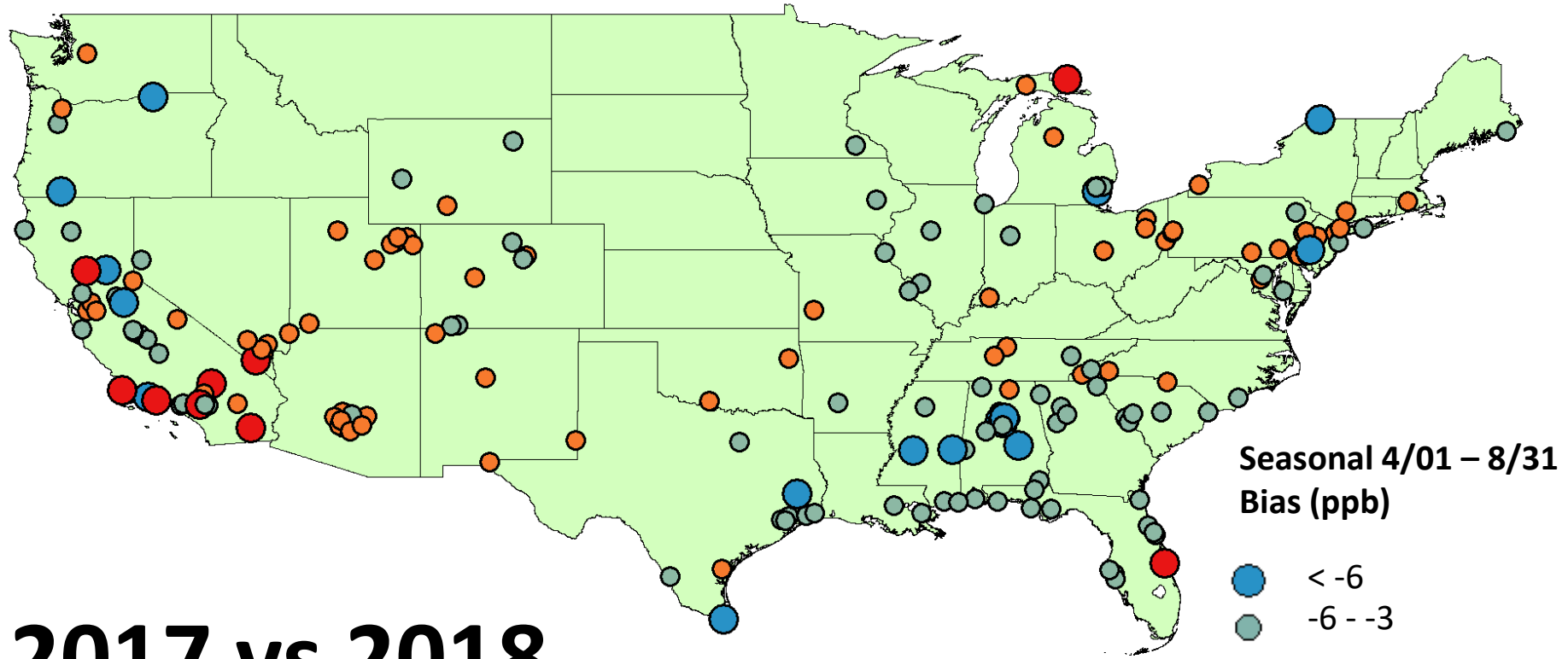
+ = Model Over predicted

- = Model Under predicted

Seasonal BIAS – 8hr Ozone

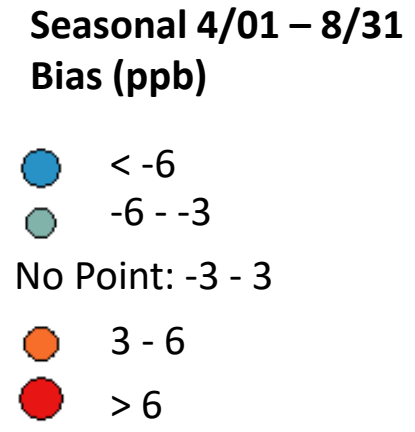


Seasonal BIAS – 8hr Ozone

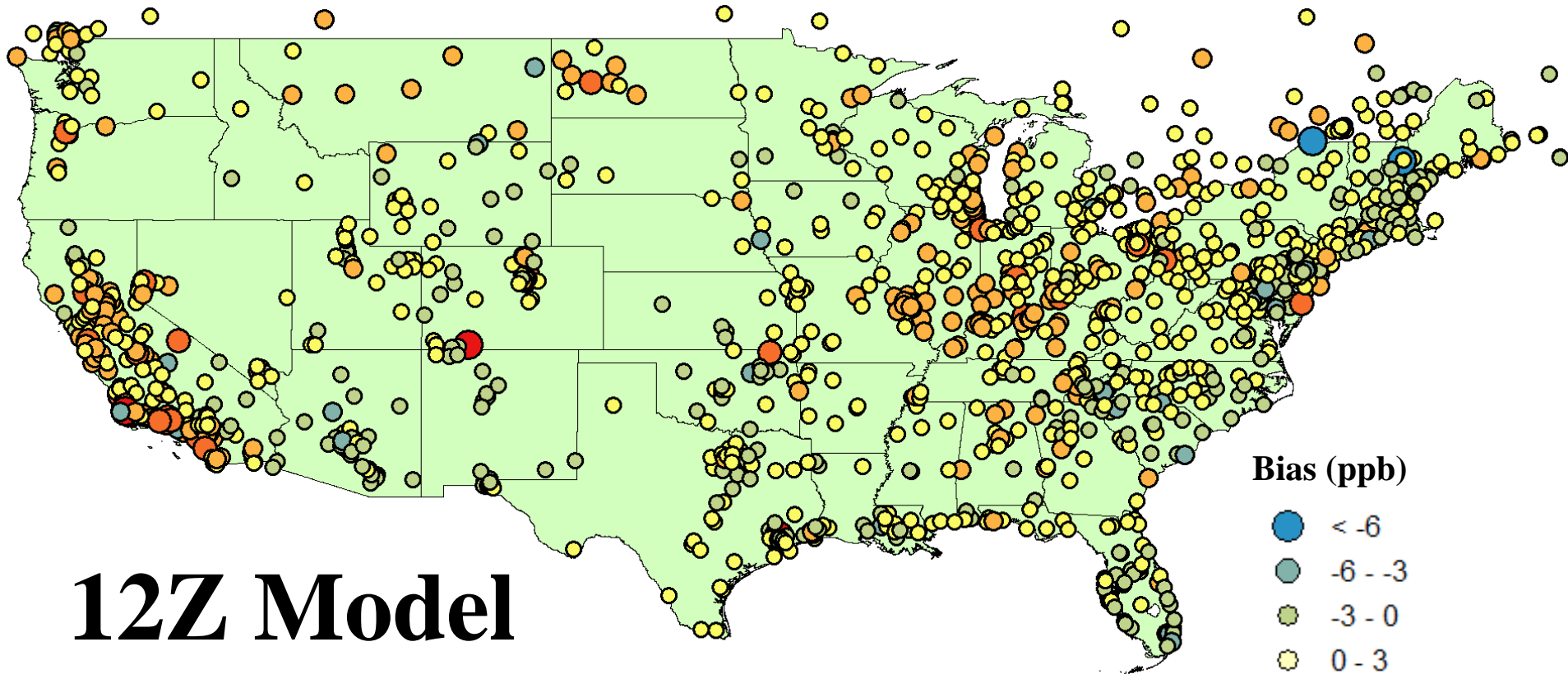


2017 vs 2018

+ = 2017 Outperformed
- = 2018 Outperformed



Bias Corrected – 8hr Ozone*



12Z Model

Run

+ = Model Over predicted

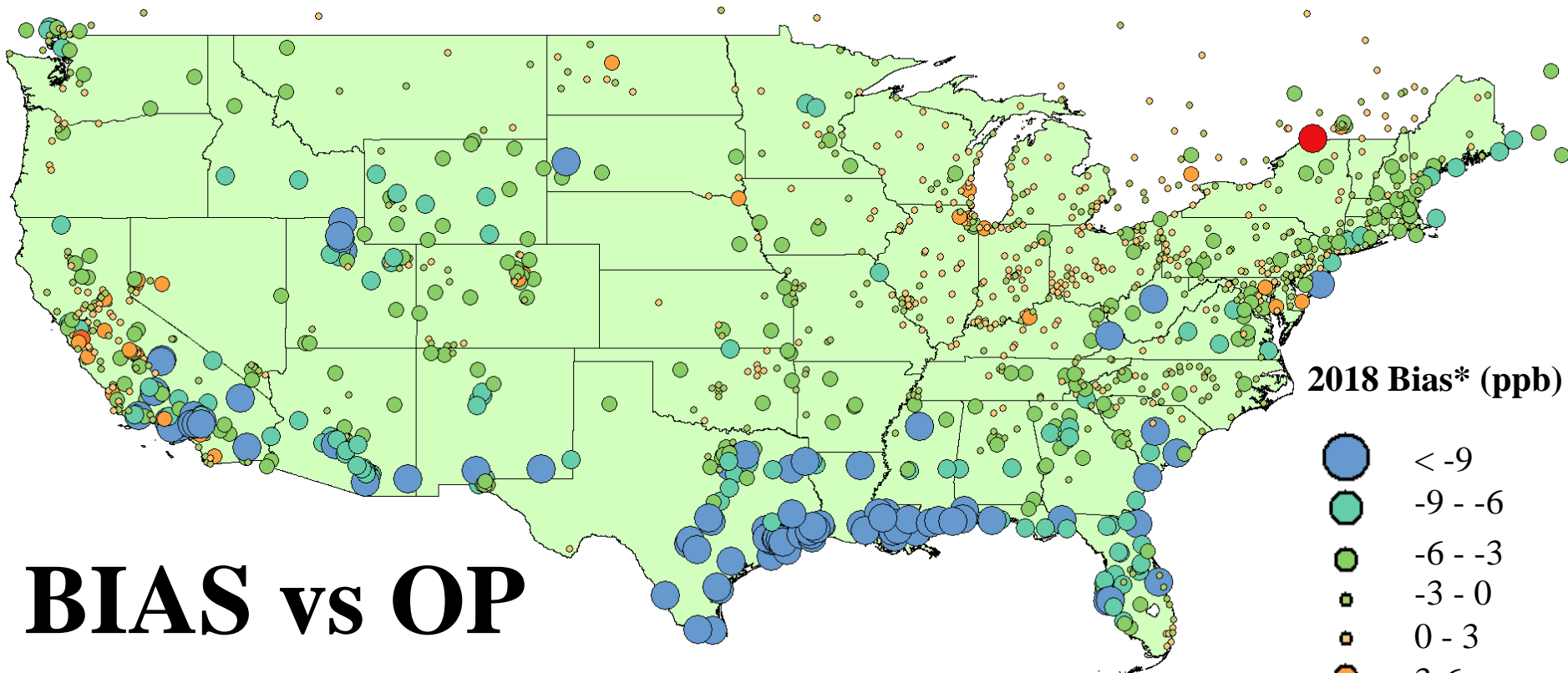
- = Model Under predicted

* 30 Days between 06/15 and 08/30



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BIAS vs Operational* – 8hr Ozone



2018 Bias* (ppb)

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

BIAS vs OP

12Z

+ = Operational Outperformed

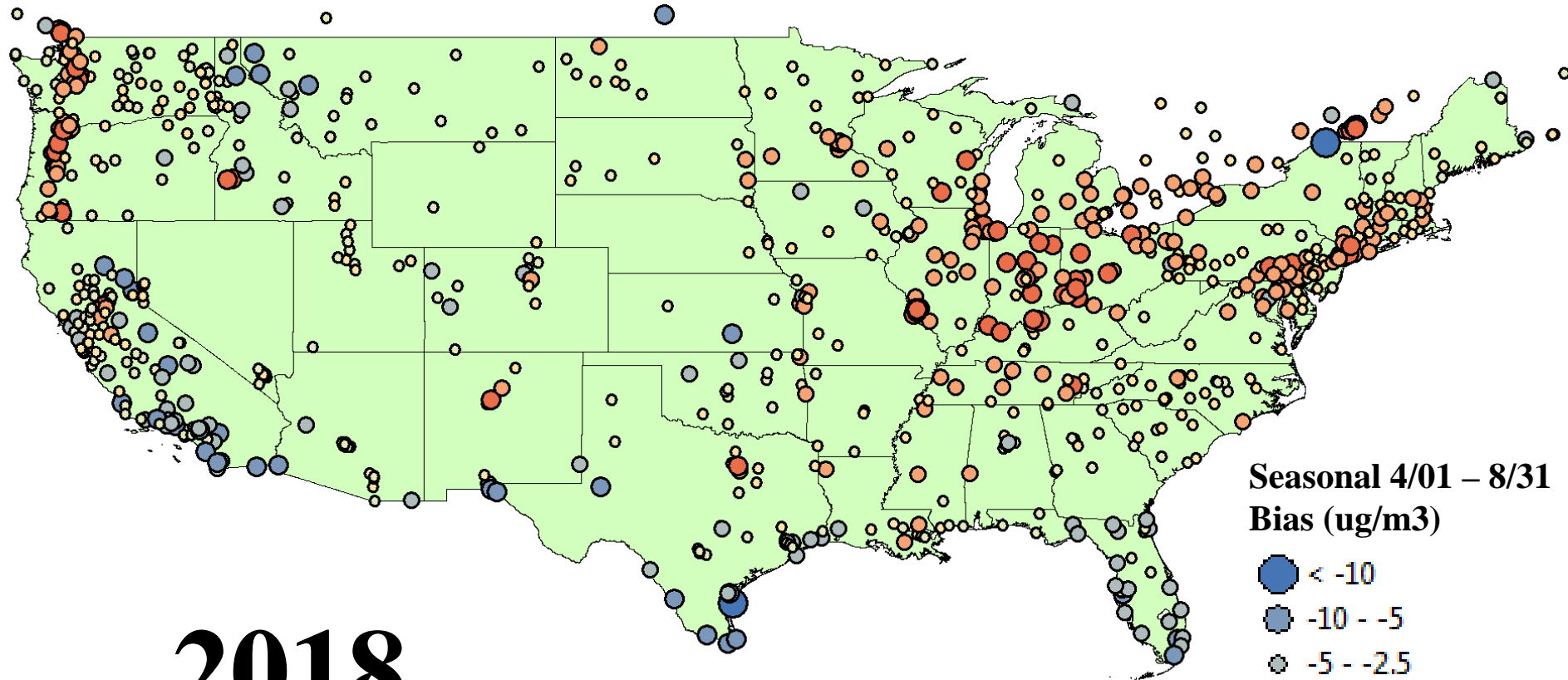
- = Bias Corrected Outperformed



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* Compared 30 Days between 06/15 and 08/30

Seasonal BIAS – PM2.5



2018

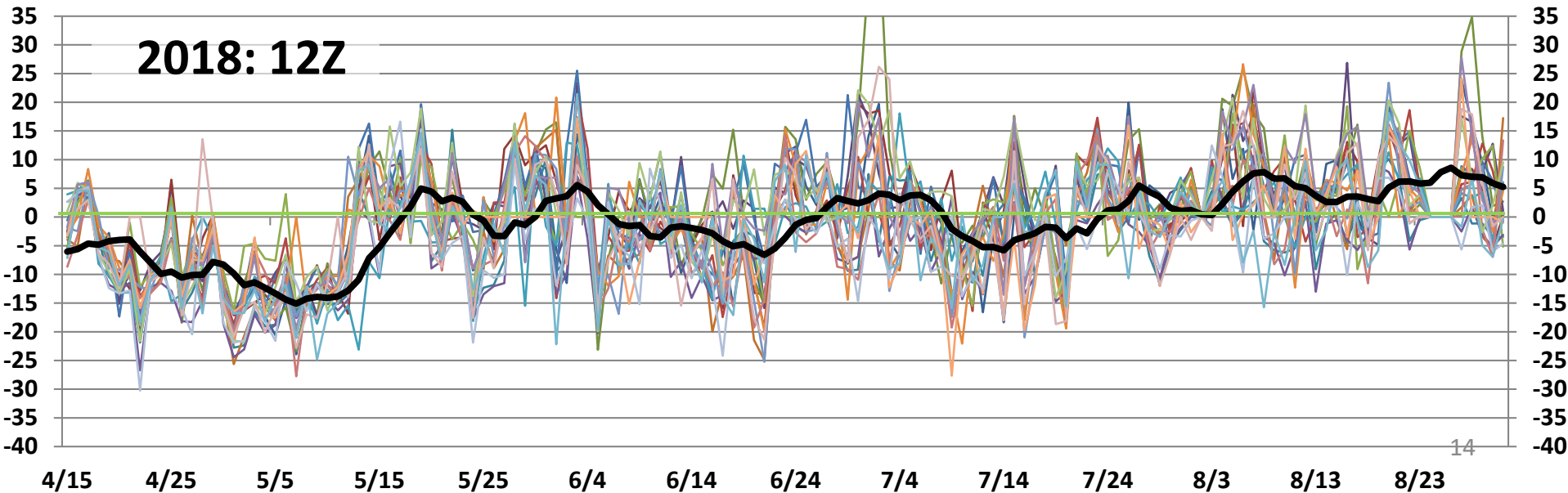
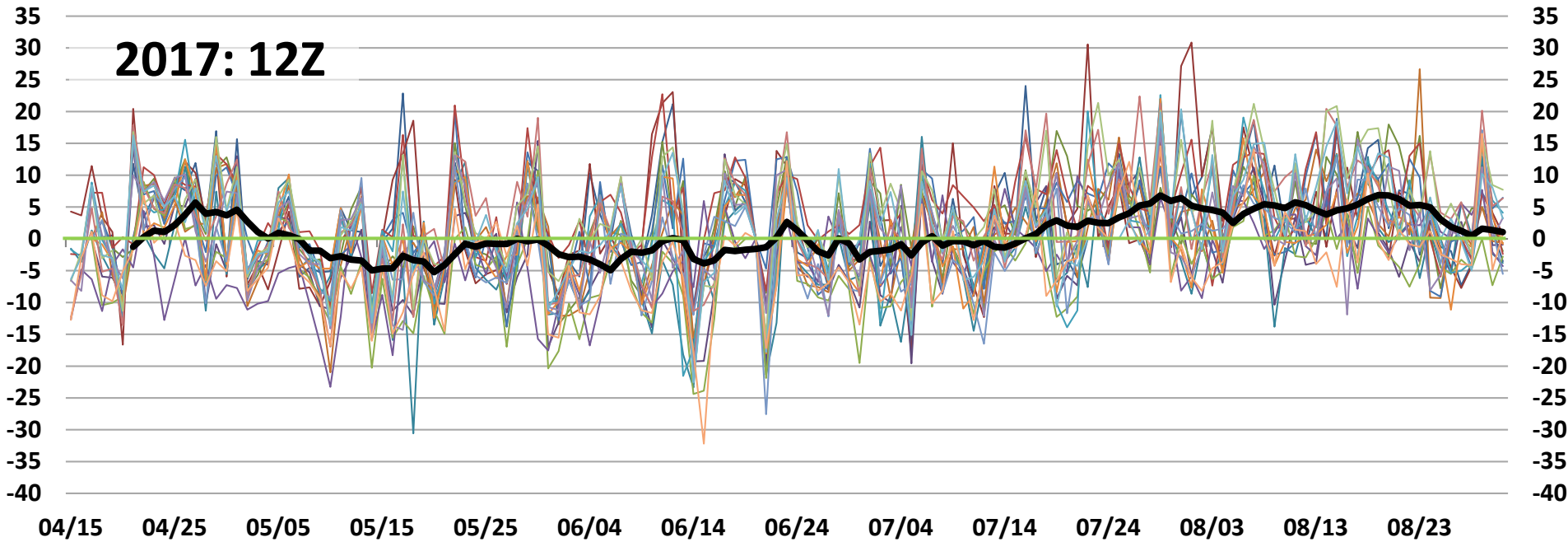
+ = Model Over predicted

- = Model Under predicted

Seasonal 4/01 – 8/31
Bias (ug/m3)

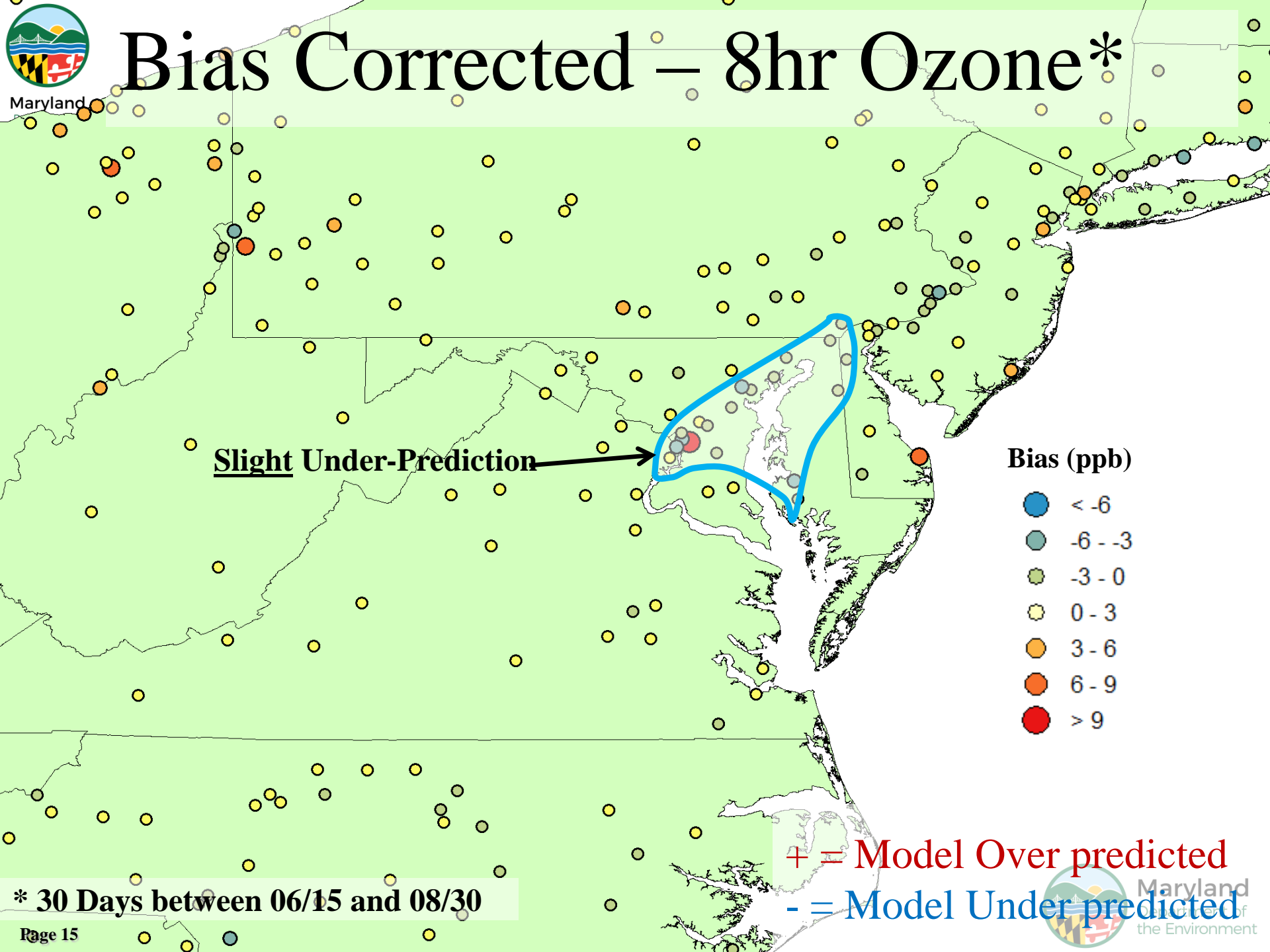


MODEL PERFORMANCE: NOAA DAY-2 MARYLAND ERRORS (Model - Observations)





Bias Corrected – 8hr Ozone*



Slight Under-Prediction →

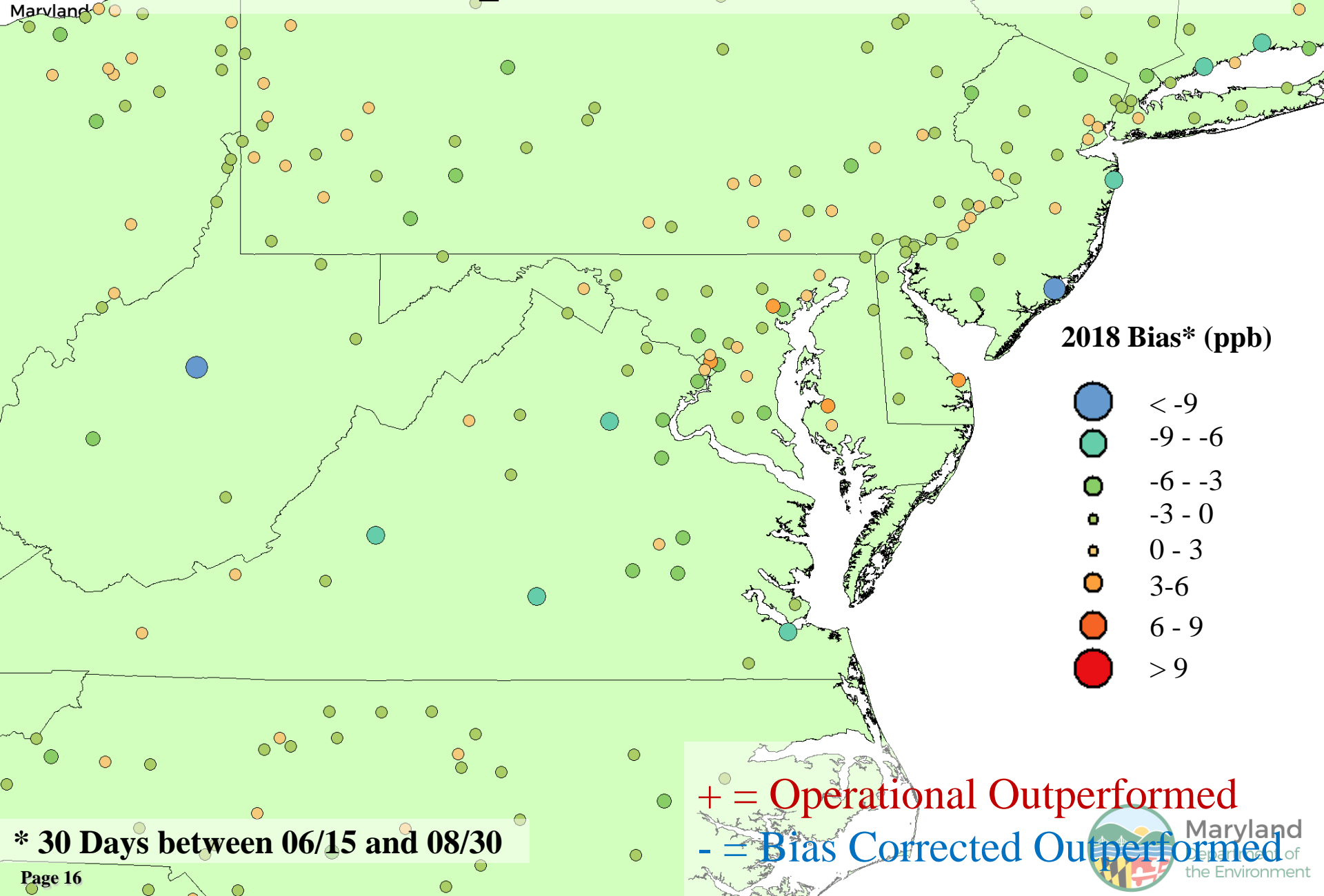
+ = Model Over predicted
- = Model Under predicted

* 30 Days between 06/15 and 08/30





BIAS vs Operational* – 8hr Ozone



2018 Bias* (ppb)

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

+ = Operational Outperformed

- = Bias Corrected Outperformed



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* 30 Days between 06/15 and 08/30



Stats

<u>FALSE ALARMS</u>							
06Z				12Z			
Max Forecast				Max Forecast			
Verification MD8AO by Region				Verification MD8AO by Region			
	Baltimo	58.8			Baltimo	38.9	
	DC	46.2			DC	53.3	
	ES	50.0			ES	66.7	
	WMD	NA			WMD	NA	
<u>MISS</u>							
06Z				12Z			
Max Forecast				Max Forecast			
Verification MD8AO by Region				Verification MD8AO by Region			
	Baltimo	47.1			Baltimo	40.0	
	DC	23.1			DC	33.3	
	ES	50.0			ES	66.7	
	WMD	NA			WMD	NA	
<u>HITS</u>							
06Z				12Z			
Max Forecast				Max Forecast			
Verification MD8AO by Region				Verification MD8AO by Region			
	Baltimo	46.7			Baltimo	60.0	
	DC	66.7			DC	66.7	
	ES	33.3			ES	33.3	
	WMD	NA			WMD	NA	

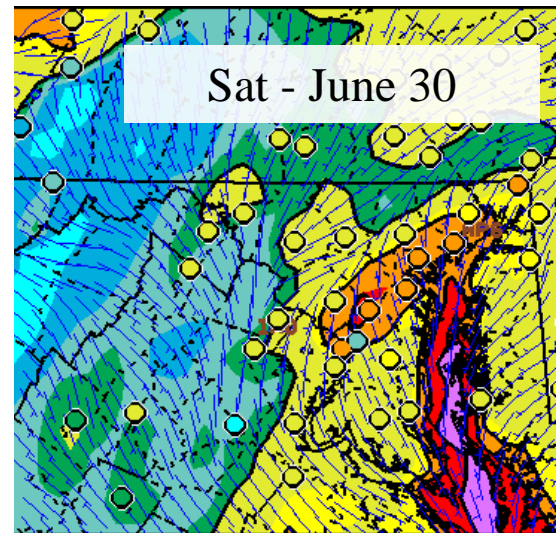
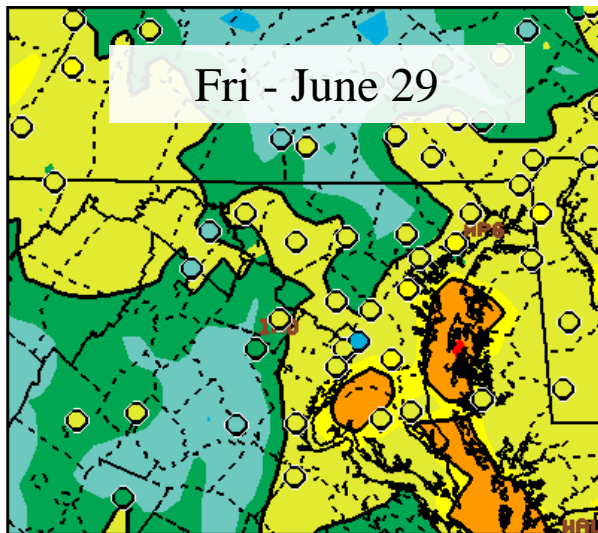
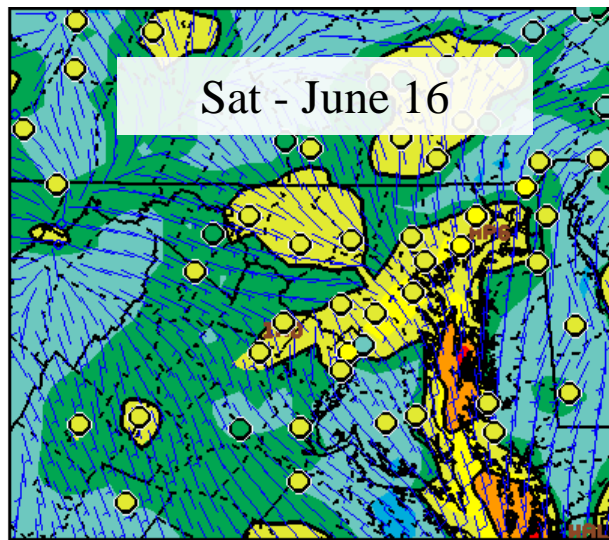




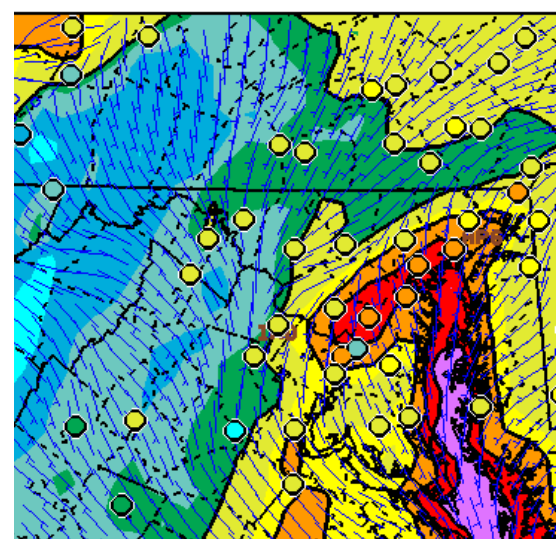
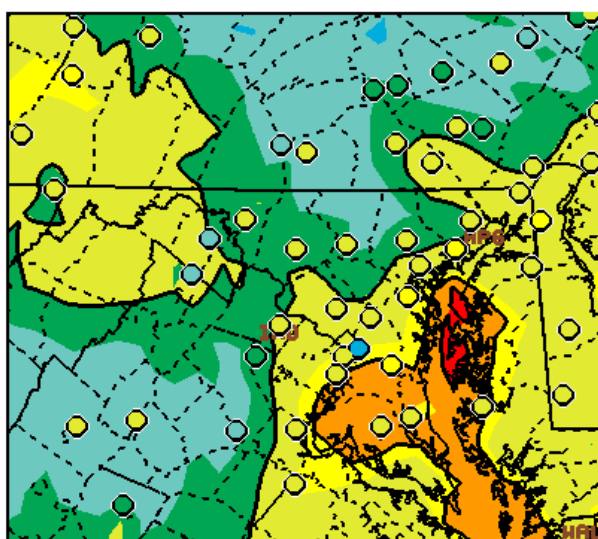
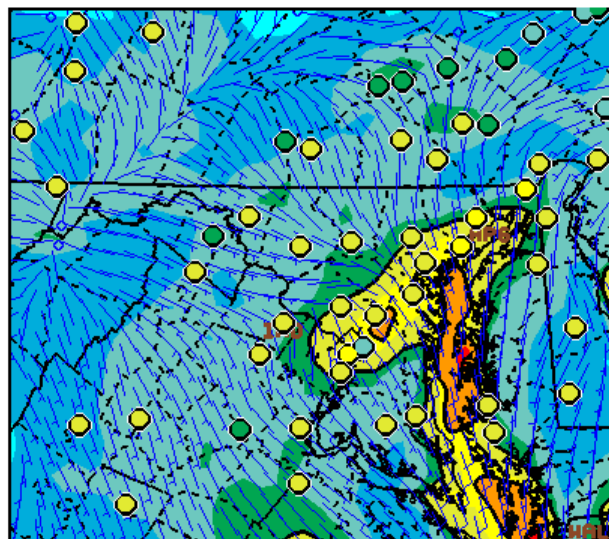
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False Alarms –

None till late June in DC; None in Baltimore till August!



ABCV8 BIAS COR V8 DAY2 OZMX08 (PPB) 20180615 IPRD BIAS COR V8 DAY2 OZMX08 (PPB) 20180628 12Z C8 BIAS COR V8 DAY2 OZMX08 (PPB) 20180629 12Z C8



PROD DAY2 OZMX08 (PPB) 20180615 12Z CYC~

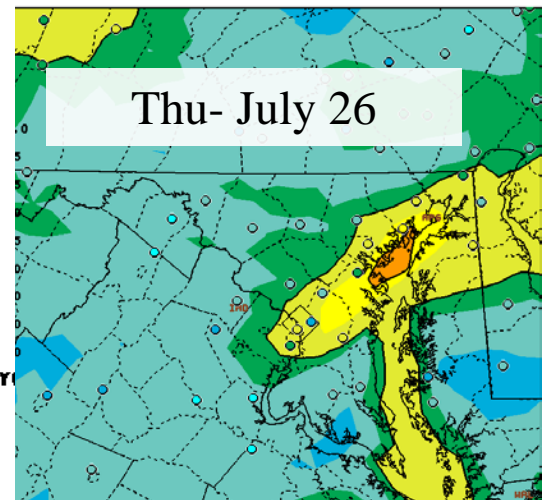
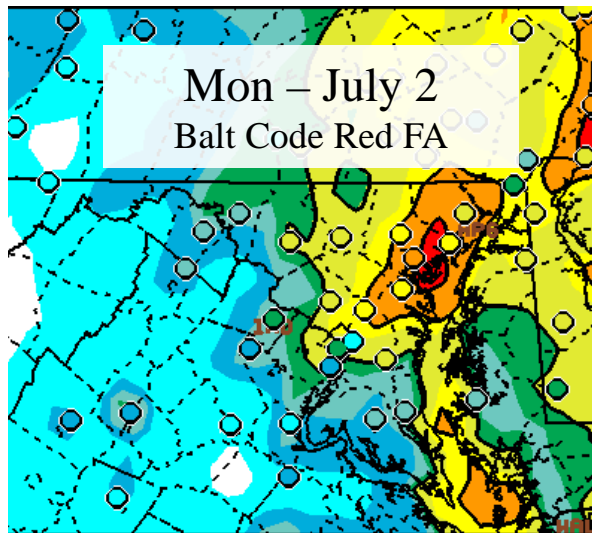
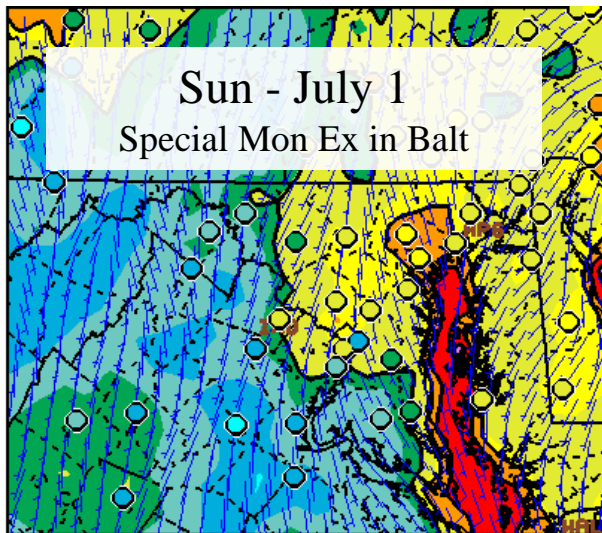
PROD DAY2 OZMX08 (PPB) 20180628 12Z CYC~

PROD DAY2 OZMX08 (PPB) 20180629 12Z C

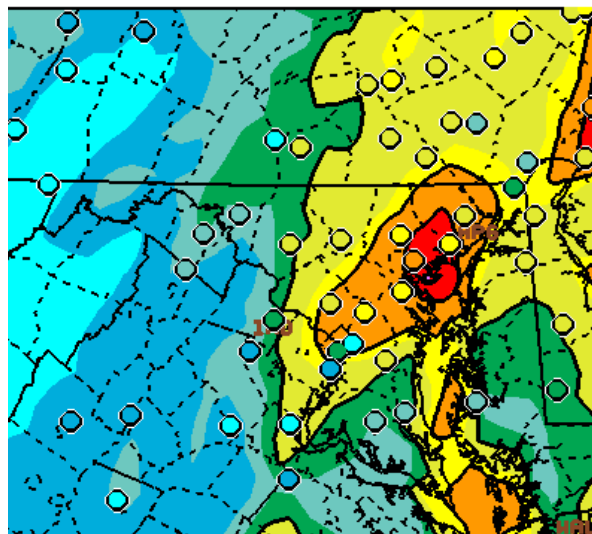
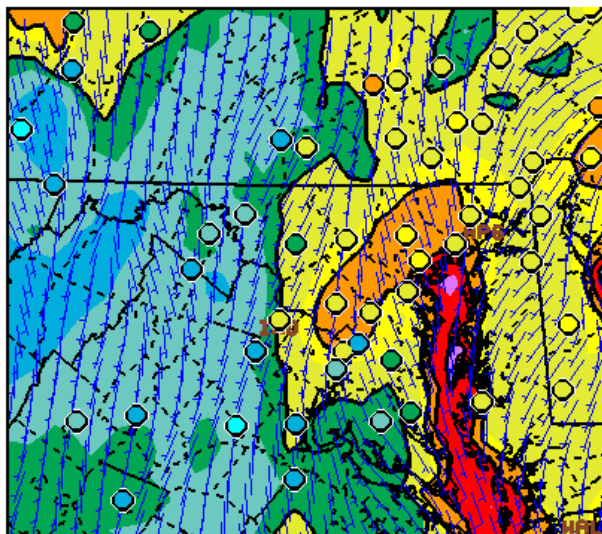


False Alarms –

None till late June in DC; Not Sig. in Baltimore till August!



ARABCYS BIAS COR V8 DAY2 OZMX08 (PPB) 20180630 12Z (BIAS COR V8 DAY2 OZMX08 (PPB) 20180701 12Z CYC



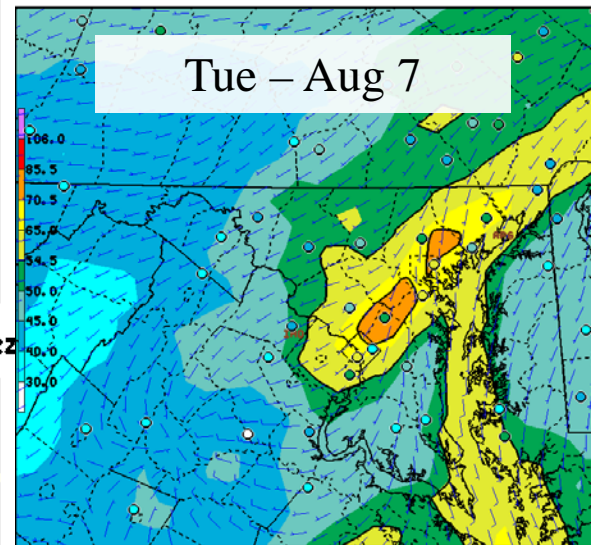
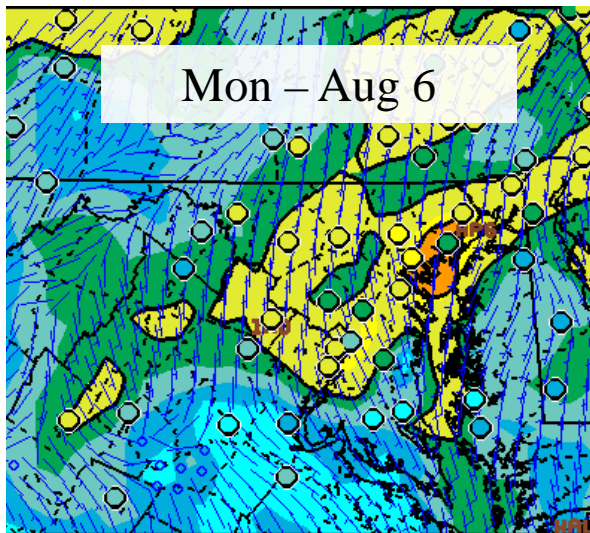
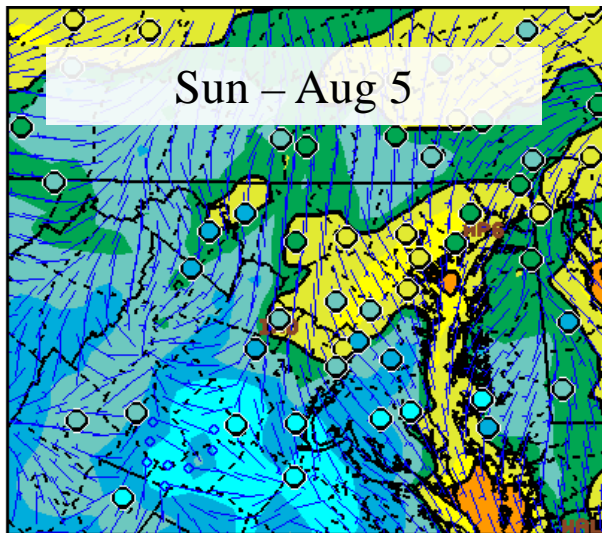
PROD DAY2 OZMX08 (PPB) 20180725 12Z CYC



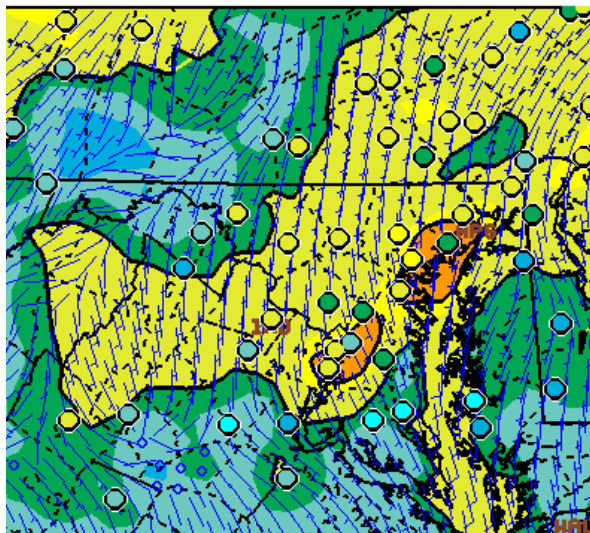
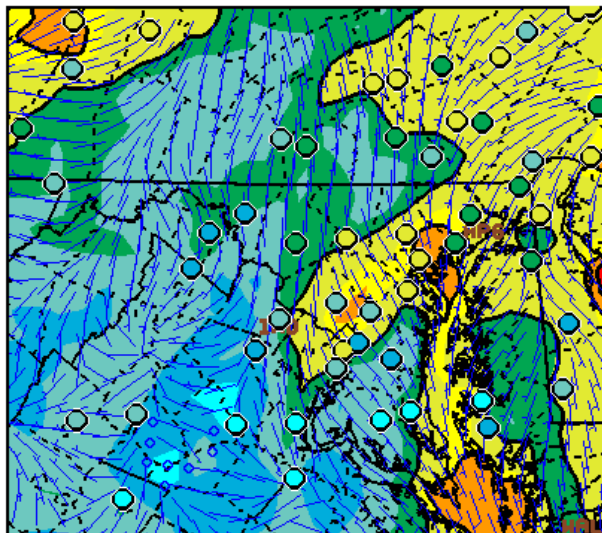


False Alarms –

First Days of EGU Pilot Program????



PROD BIAS COR V8 DAY2 OZHX08 (PPB) 20180804 12Z CYBIAS COR V8 DAY2 OZHX08 (PPB) 20180805 12Z



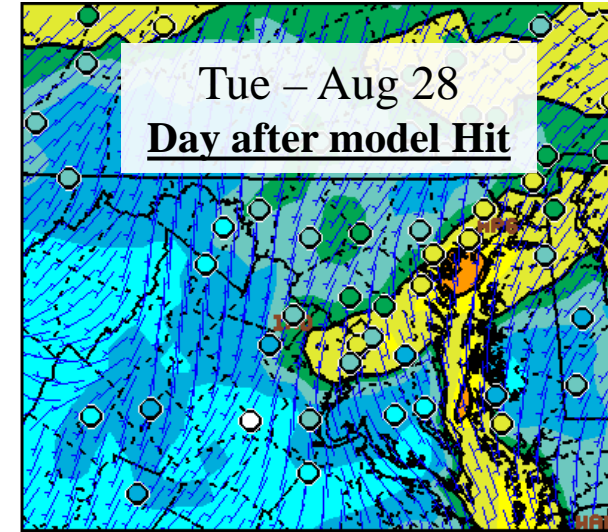
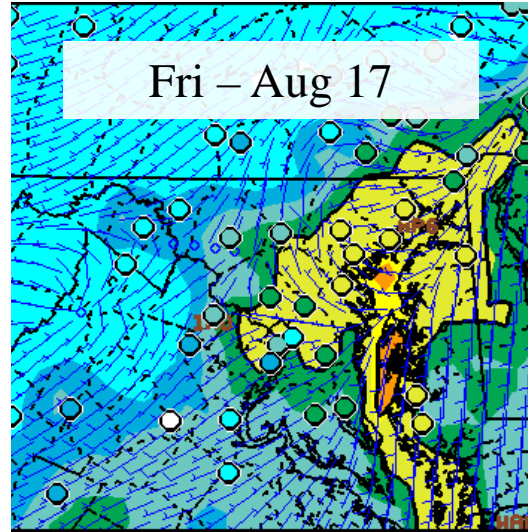
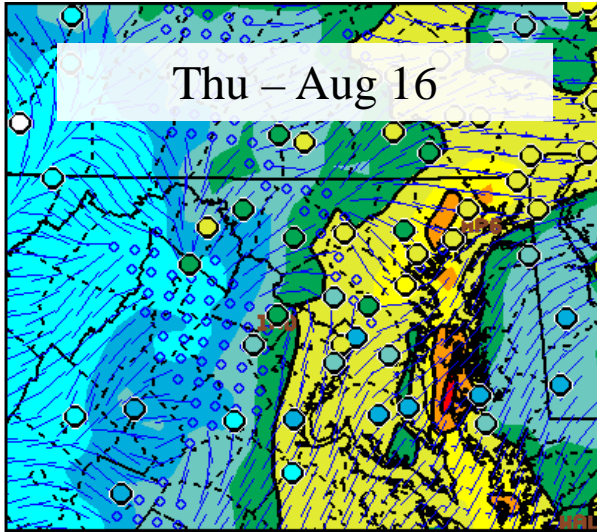
PROD DAY2 OZHX08 (PPB) 20180806 12Z CYC*



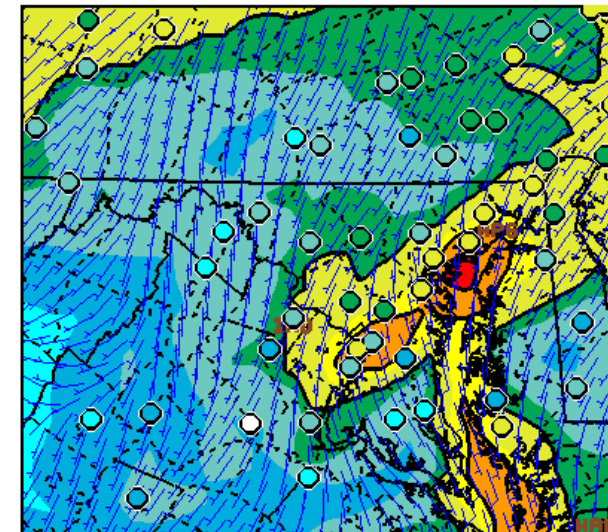
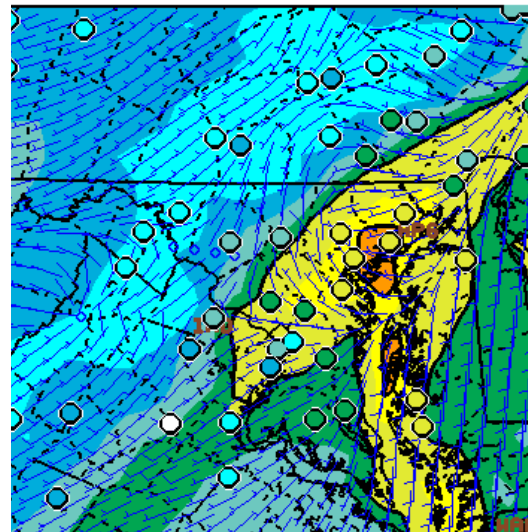
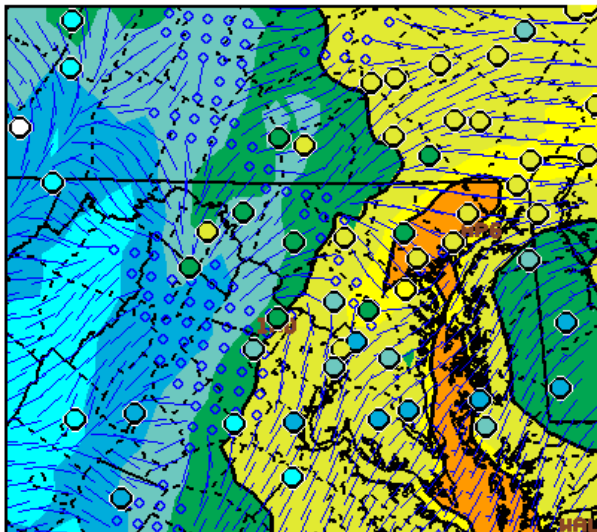


False Alarms –

First Days of EGU Pilot Program????



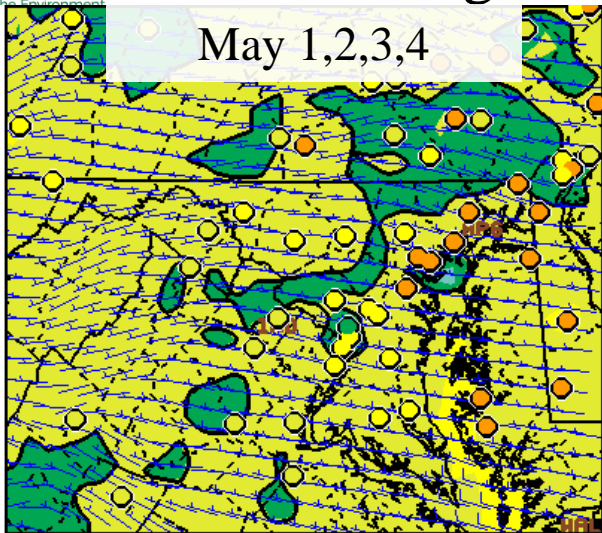
PROD BIAS COR V8 DAY2 OZMX08 (PPB) 20180815 06Z CY COR V8 DAY2 OZMX08 (PPB) 20180816 12Z CIP PAR5BC BIAS COR V8 DAY2 OZMX08 (PPB) 20180817 00Z



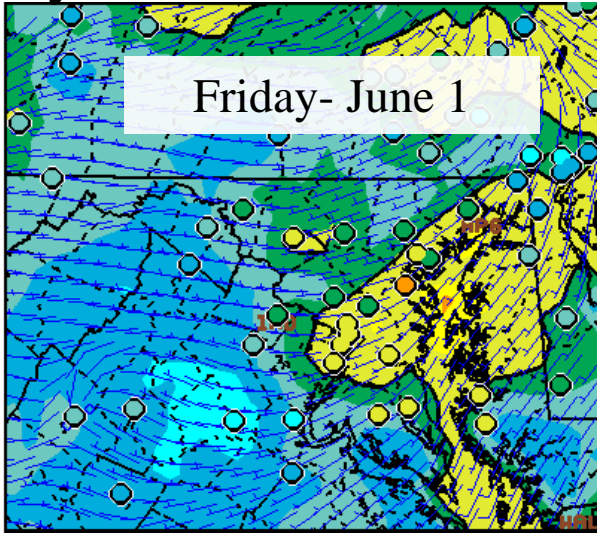


Misses — Exception of May, generally 1 monitor misses

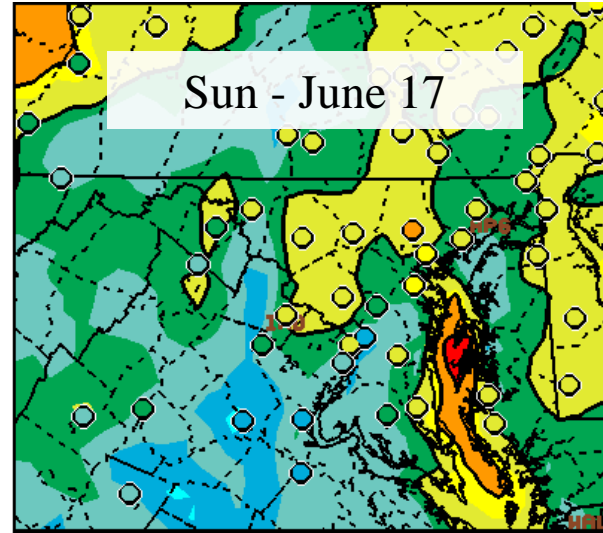
May 1,2,3,4



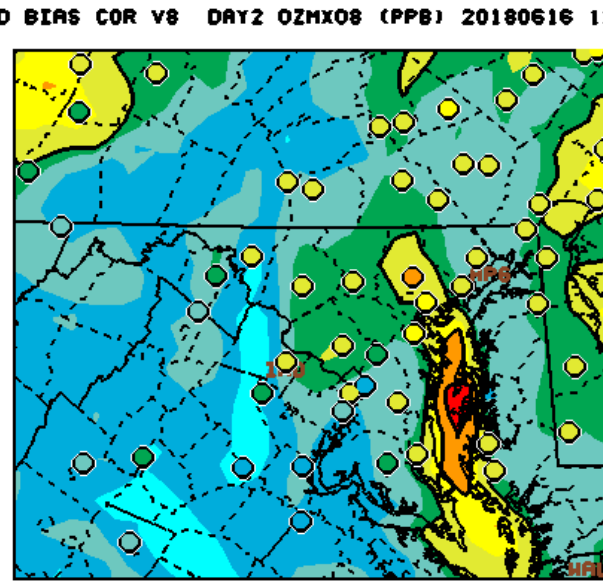
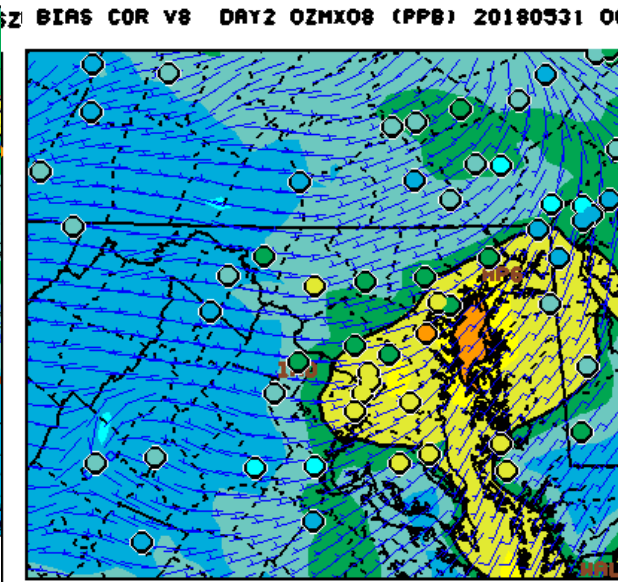
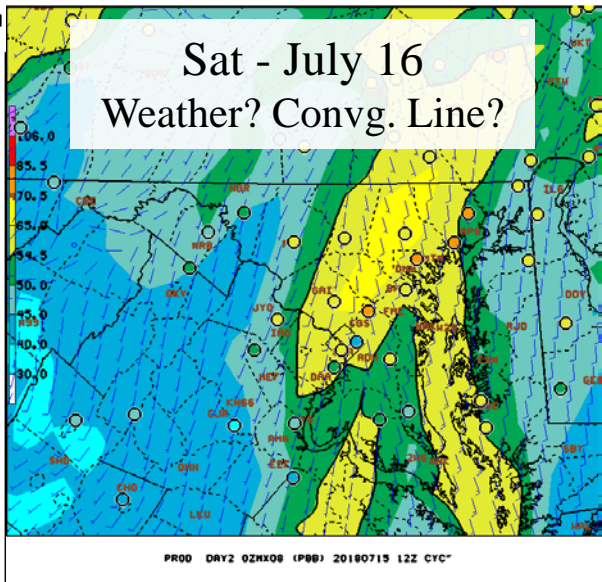
Friday- June 1



Sun - June 17



Sat - July 16
Weather? Convg. Line?



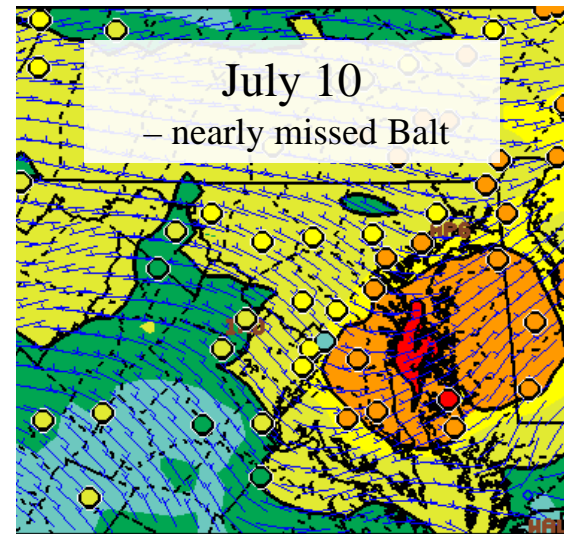
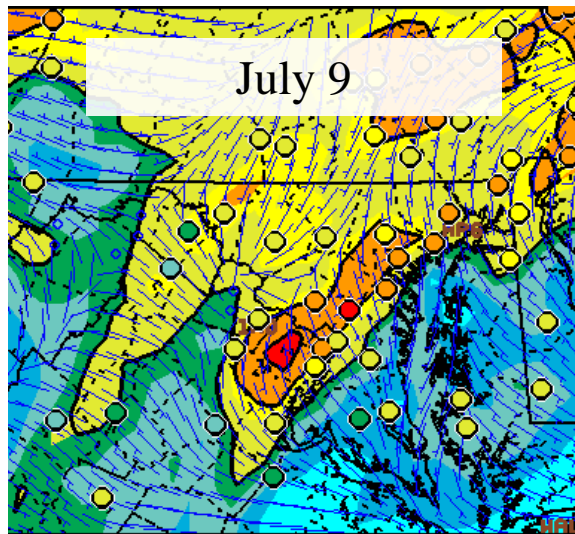
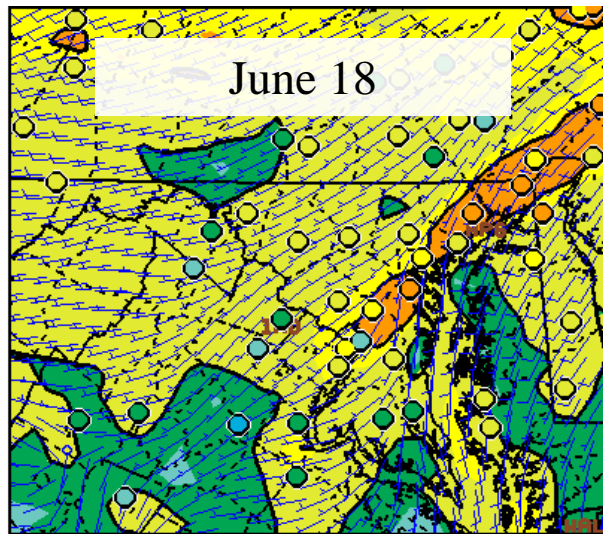
PROD DAY1 OZHX08 (PPB) 20180501 06Z CYC~

PROD DAY2 OZHX08 (PPB) 20180531 06Z CYC~

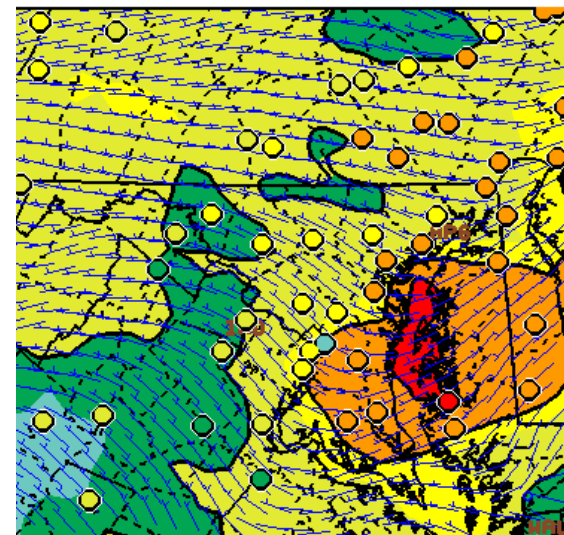
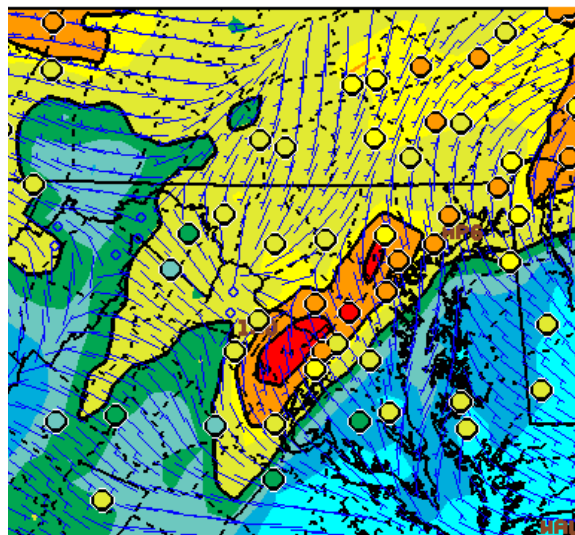
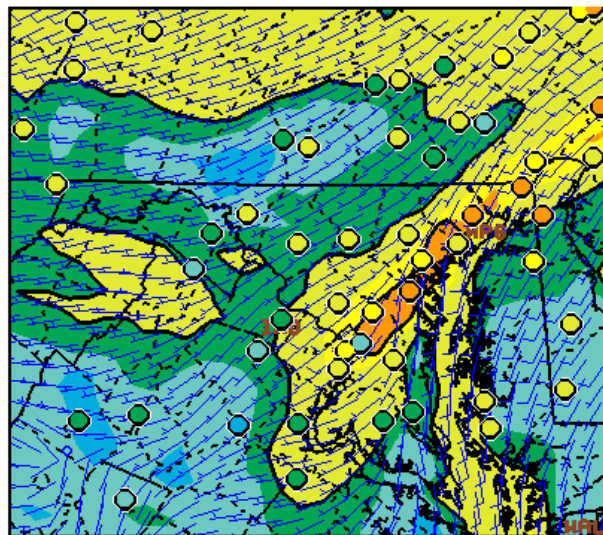
PROD DAY2 OZHX08 (PPB) 20180616 12Z CYC~



Hit Examples



RABCYS BIAS COR V8 DAY2 OZMX08 (PPB) 20180617 12Z:IAS6 COR V8 DAY2 OZMX08 (PPB) 20180708 12Z CYR6 COR V8 DAY2 OZMX08 (PPB) 20180709 06Z



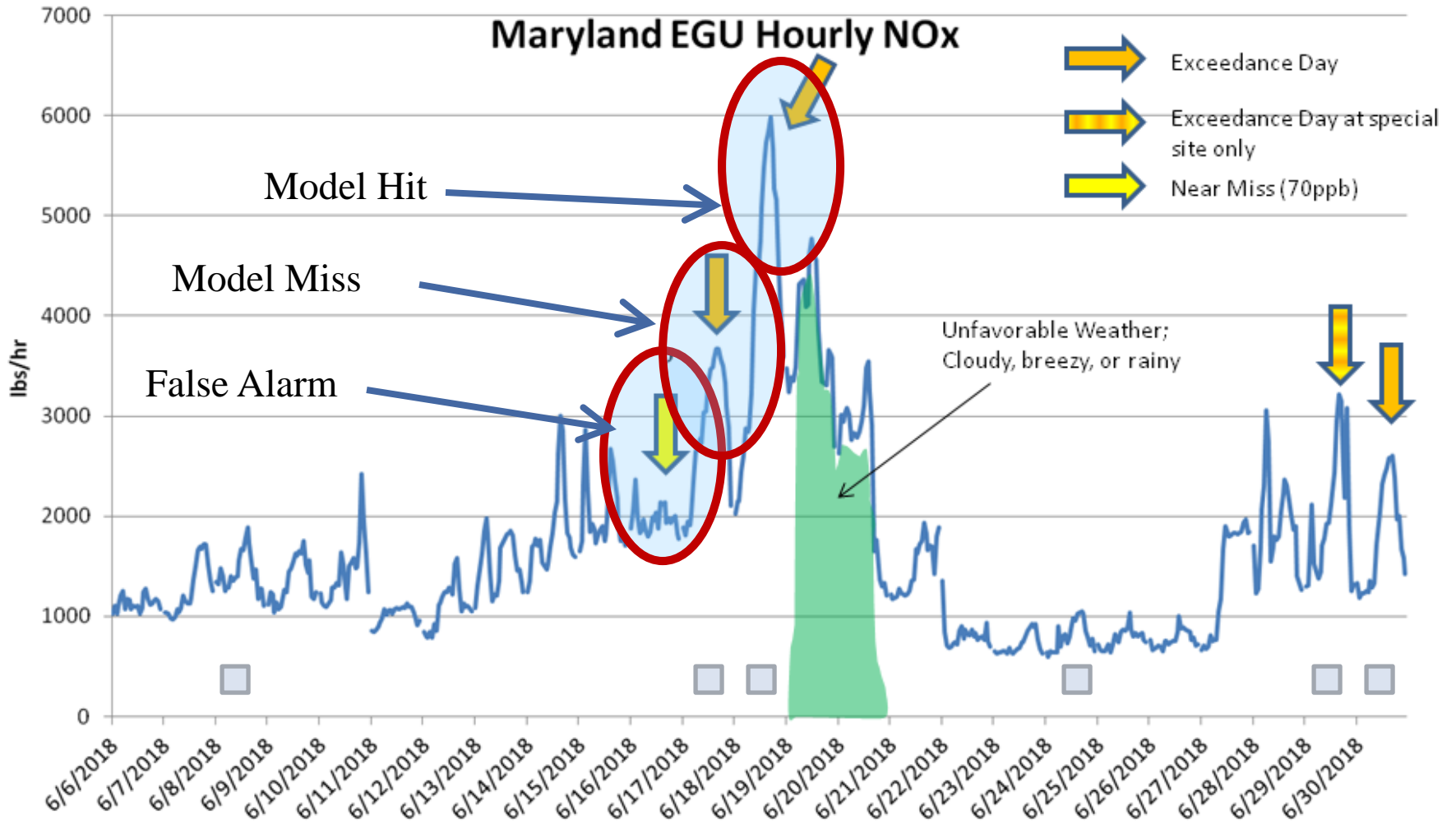
PRD0 DAY2 OZMX08 (PPB) 20180617 12Z CYC-

PRD0 DAY2 OZMX08 (PPB) 20180708 12Z CYC-

PRD0 DAY2 OZMX08 (PPB) 20180709 06Z CYC-



EGU NO_x During OWLETS-2



Intensive Days:

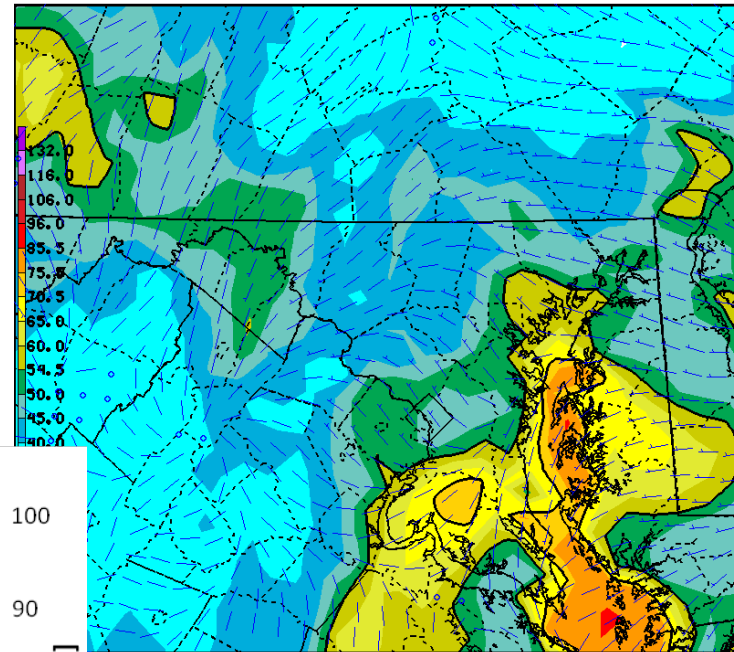
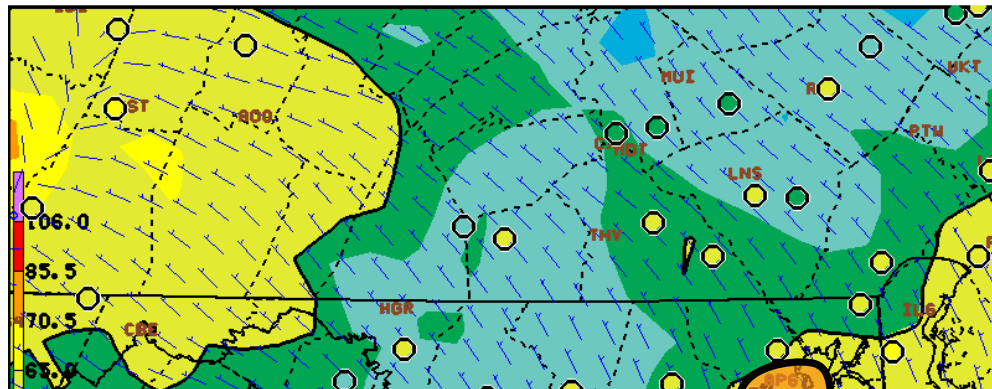
Maryland Needs

- 4km Grid (or smaller)
 - June 29, 2018 Forecast
 - Meteorology on August 6 12km NAM vs 3km NAM
- Ozone Surges (both diurnally and day-to-day)
 - August 27, 28, 2018
 - Ozone “moved”. Also no ozone from DC. Cars?
Doesn’t seem like they produced the ozone. Problem is
transitory in Baltimore.
- Gas phase chemistry??

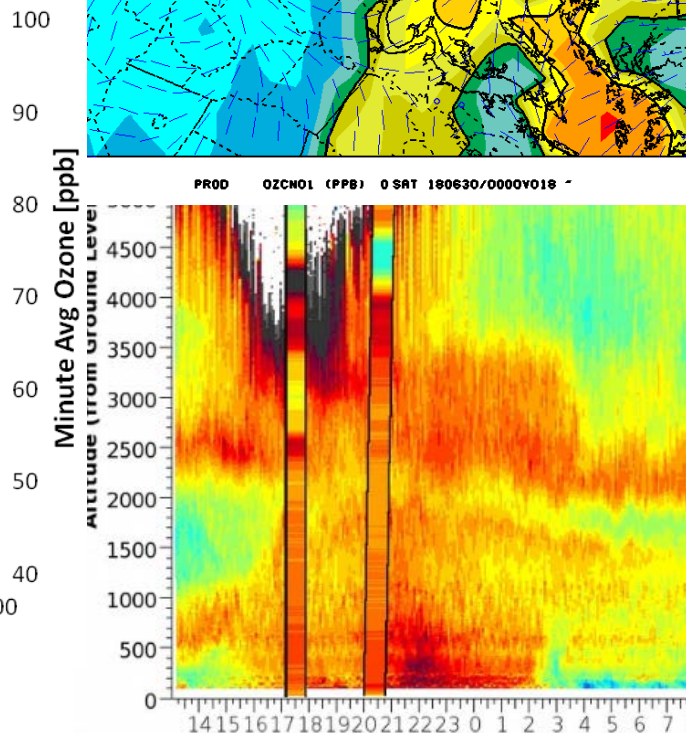
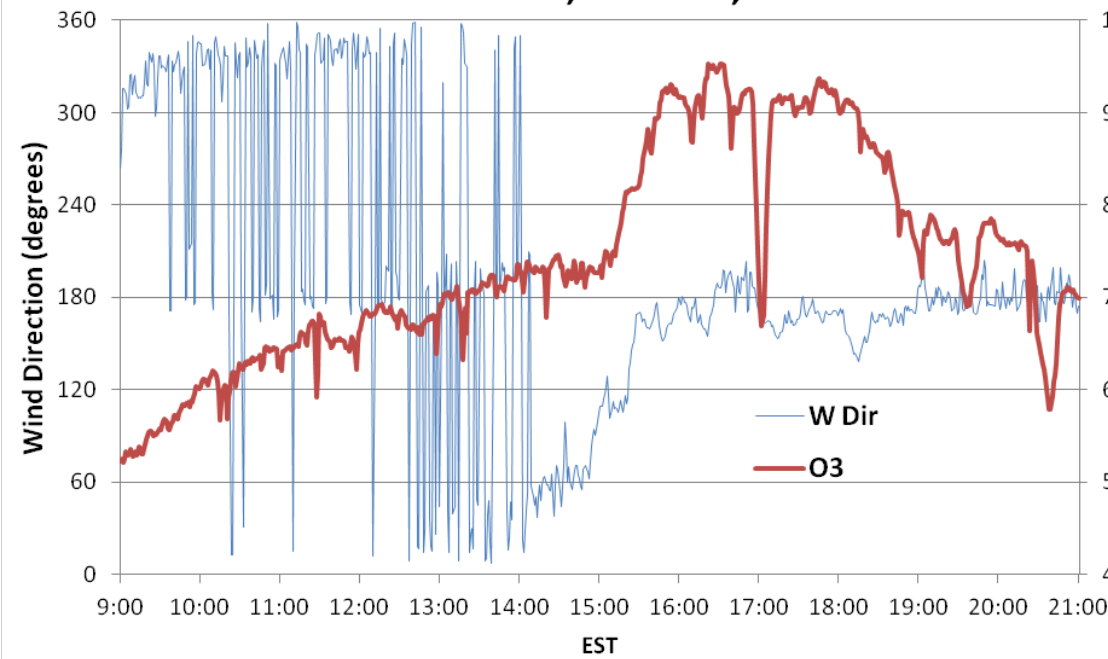


Need for Higher Res.: June 29, 2018

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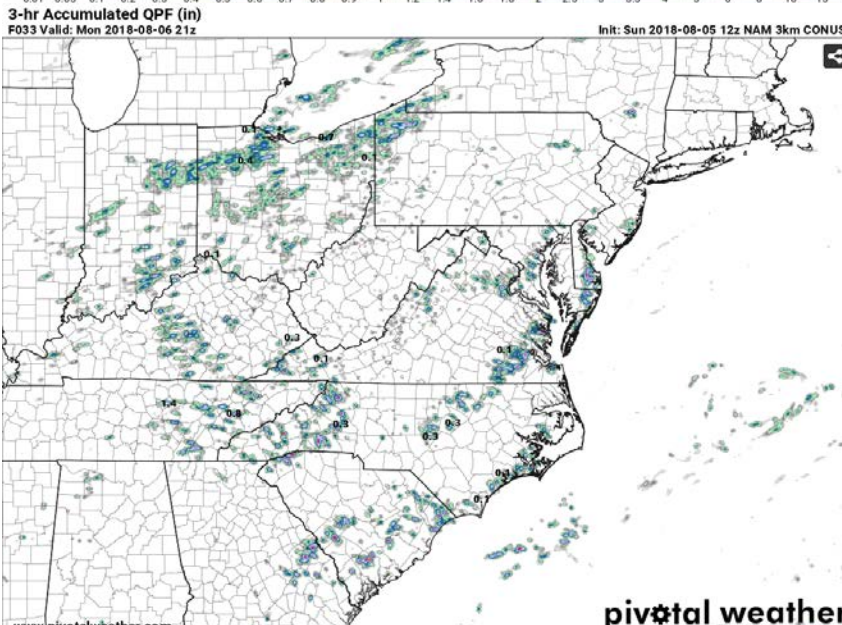
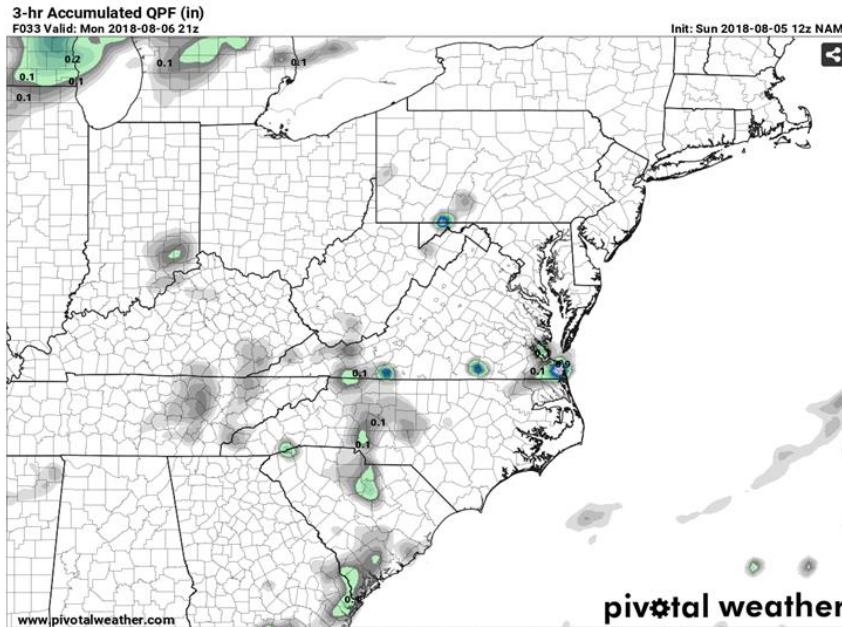
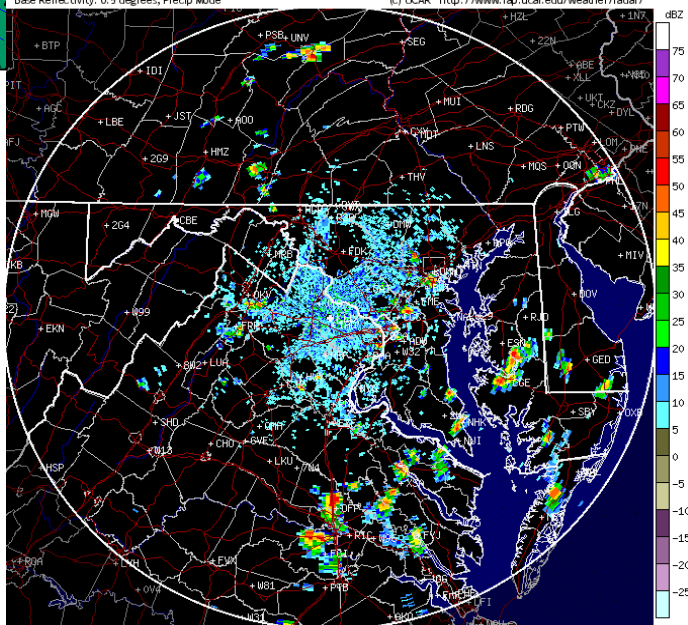
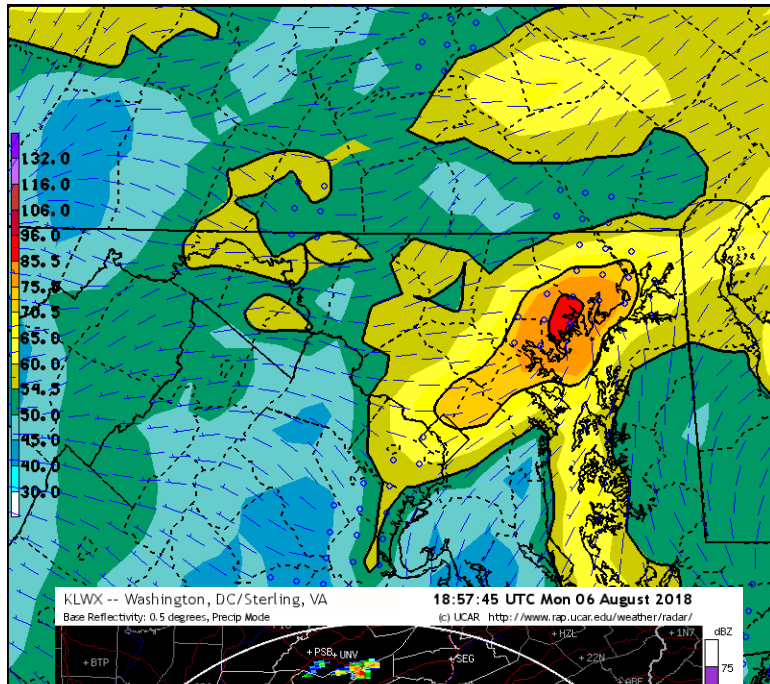
Hart-Miller Island; June 29, 2018





Maryland Department of the Environment

Need for Higher Res: Aug 6, 2018



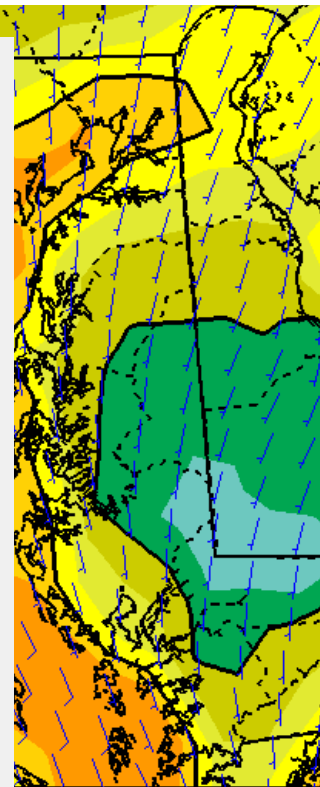
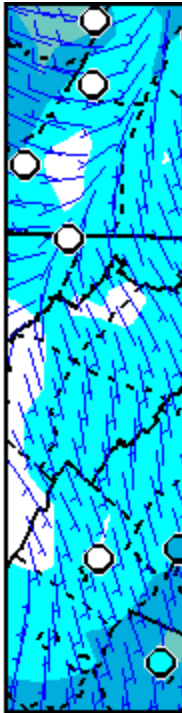
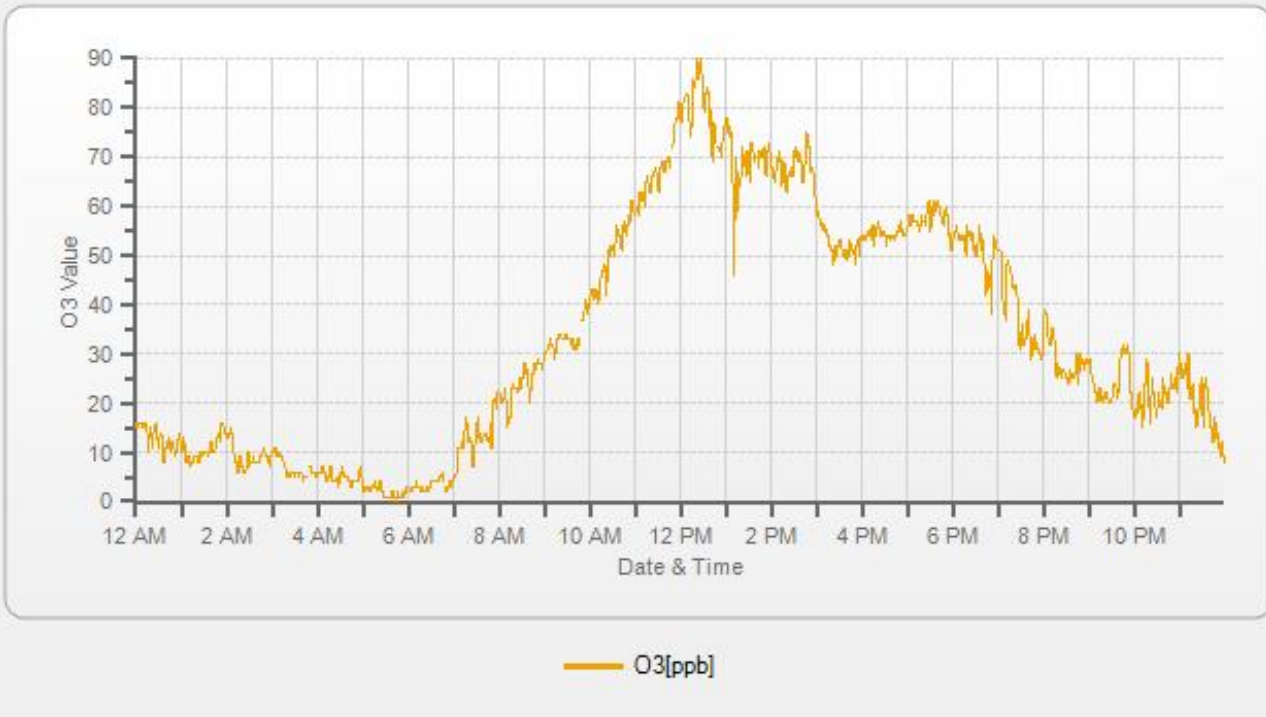


Ozone Transient

- Model hangs on to ozone a bit too long
- Ozone “bursts” that become transient



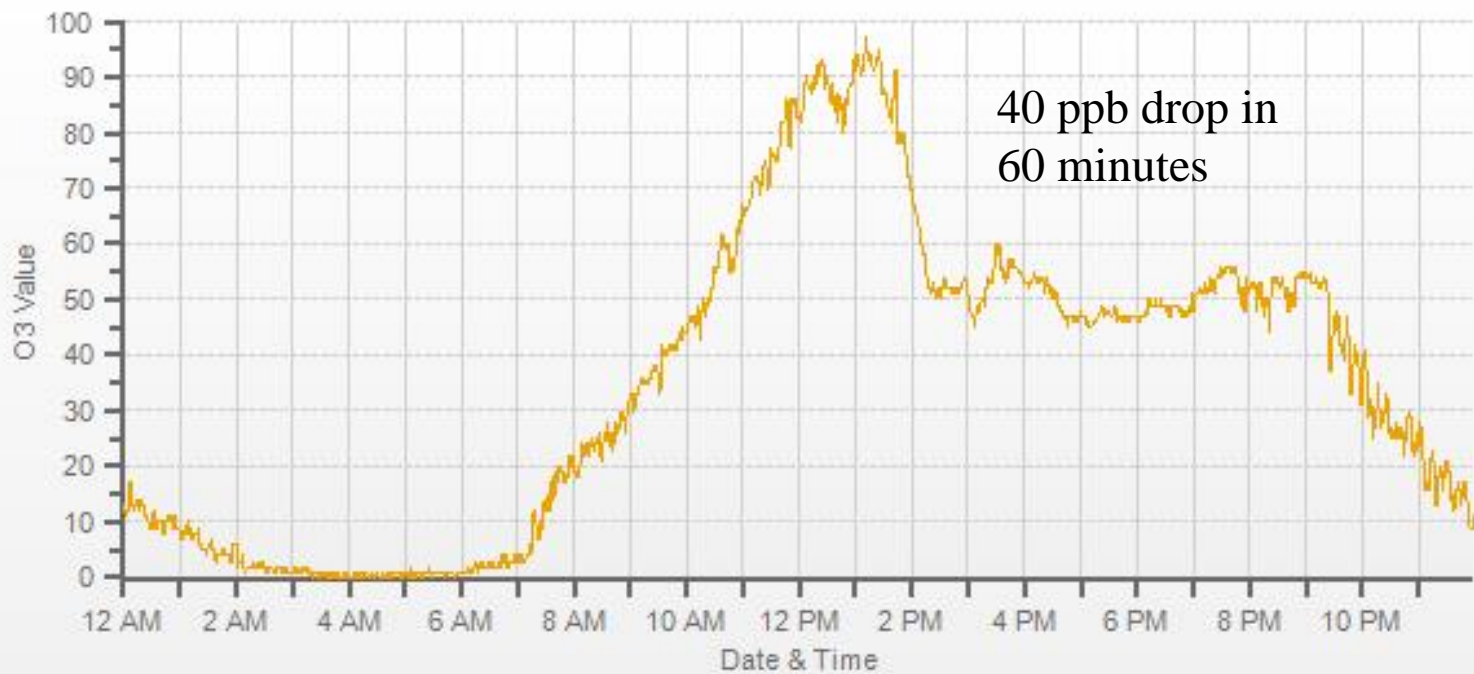
O3[ppb] Station: EDGEWOOD Daily: 8/16/2018 Type: AVG 1 Min. [1 Min.]





Ozone Transient

O3[ppb] Station: EDGEWOOD Daily: 8/28/2018 Type: AVG 1 Min. [1 Min.]

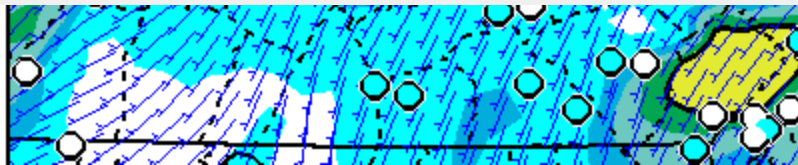


— O3[ppb]

014 P1

1300V039

40.0
30.0





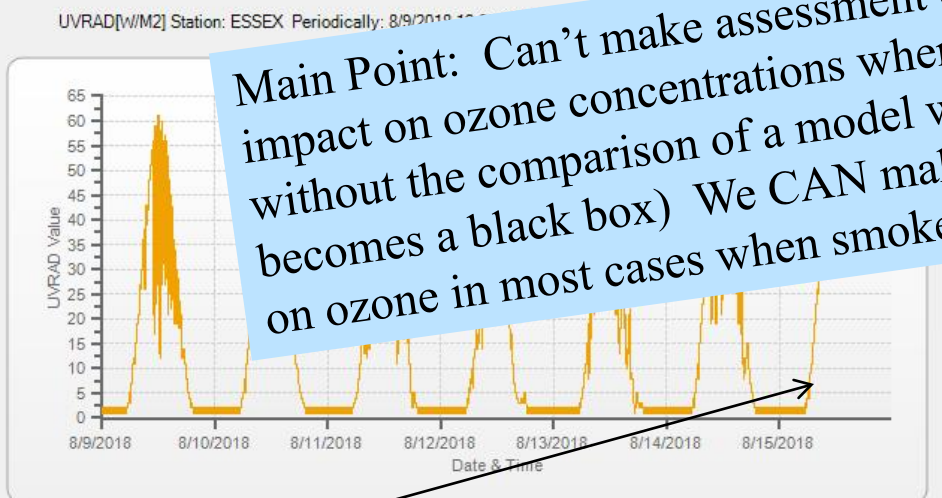
Smoke Considerations

□ Suggestion:

Do not include chemistry unless another model without chemistry is also run to verify smoke impacts

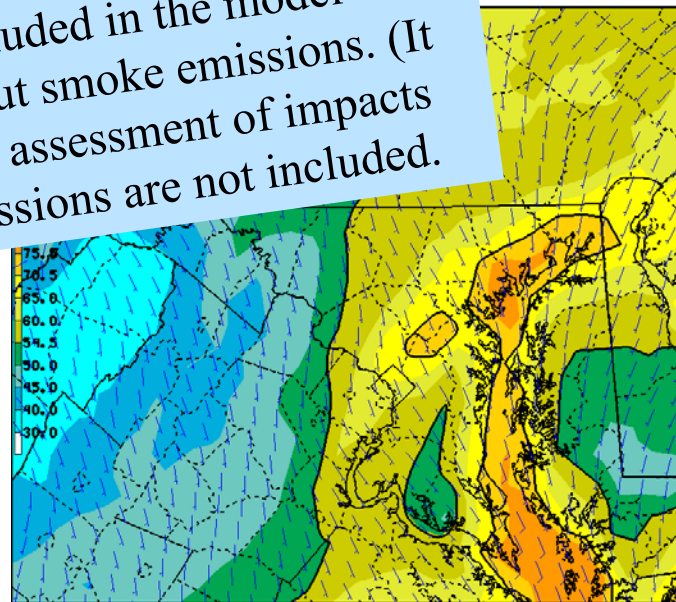
Main Point: Can't make assessment of gas phase chemistry's impact on ozone concentrations when included in the model without the comparison of a model without smoke emissions. (It becomes a black box) We CAN make an assessment of impacts on ozone in most cases when smoke emissions are not included.

Aug 16.



August 15, 2018

— UVRAD [W/M2]



PROD DRY1 OZHX08 (P88) 20180816 12Z CYC"

No exceedance. Smoke Screening?

This is a case where gas phase chemistry would have been great.

However, would be beneficial to see BOTH model with smoke chemistry and one without to assess whether smoke has positive or negative impact (if any).





Conclusions

- ❑ The Mid-Atlantic has gone through a time of transition, which has caused some trials for the model to adapt. Generally Maryland is pleased with the progress and guidance the NOAA model provides given the potential for extreme day-to-day fluctuations in ozone. Improvements in the operational model will make bias correction method an extraordinary tool.
- ❑ The Bias correction definitely did better than the operation model but was not always able to distinguish between exceedance and non-exceedance days
- ❑ Bias Correction advantage most seen around DC
- ❑ No BIAS forecast improvement with Bias model over the CB
- ❑ Main issues:
 - Day to day variability
 - Transient Nature of Ozone
 - Model resolution used





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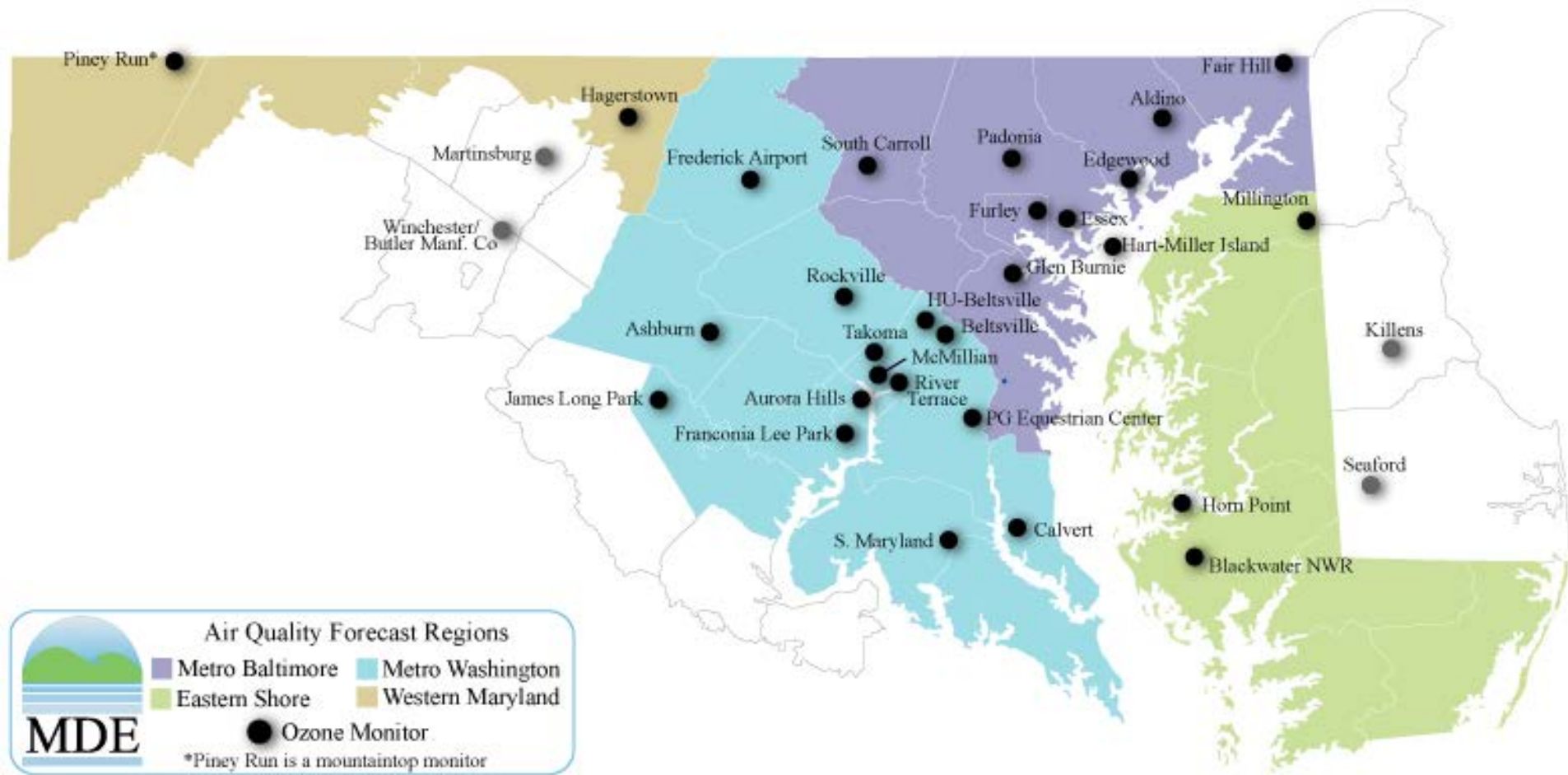
Appendix



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Forecast Regions & Monitors



Hart-Miller Island is a special purpose monitor

