

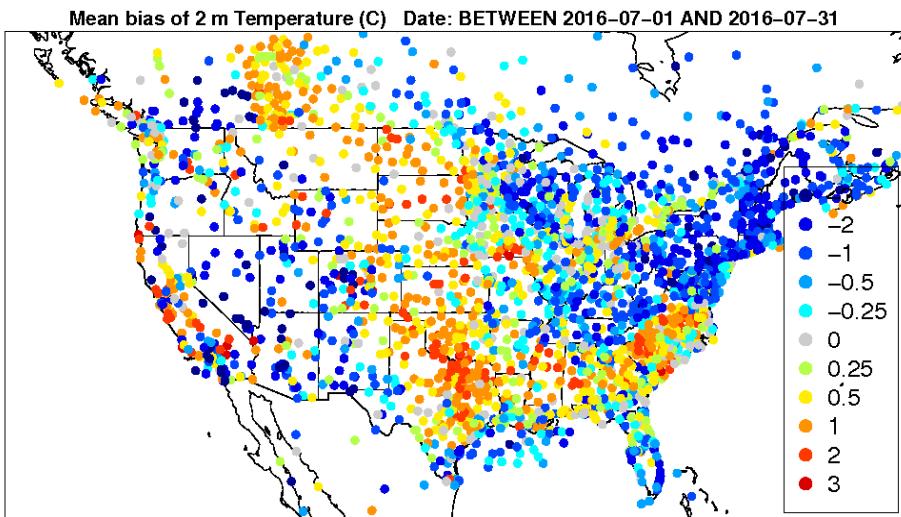
Comparison of 2016 WRF performances for LADCO and EPA runs

LADCO, July 25-Sep 10, 2018

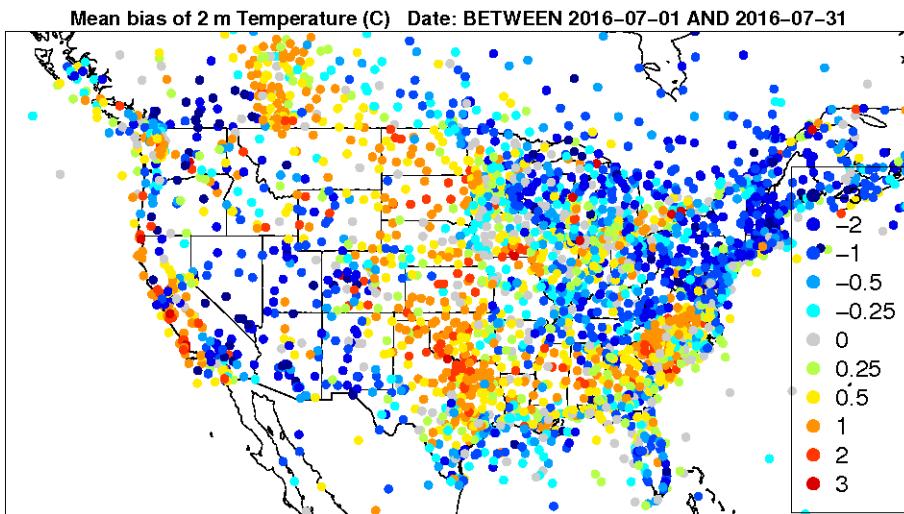
LADCO run: WRFv3.9.1

Domain: d01 (12 km)

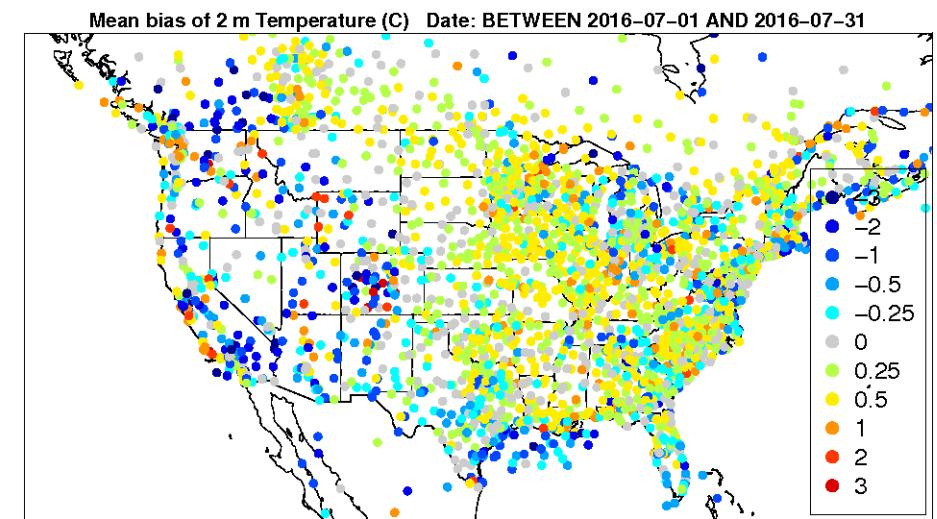
Jul 25, 2018



LADCO sens1: WRFv3.8



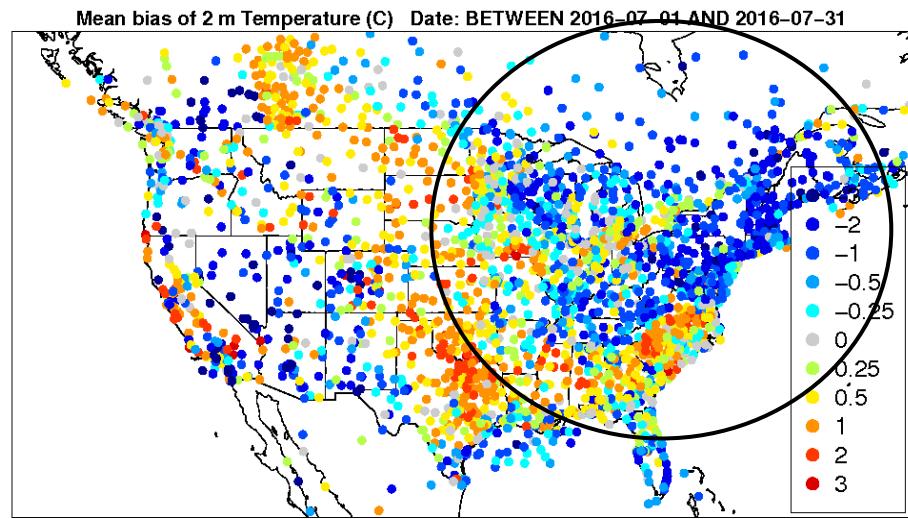
EPA run: WRFv3.8



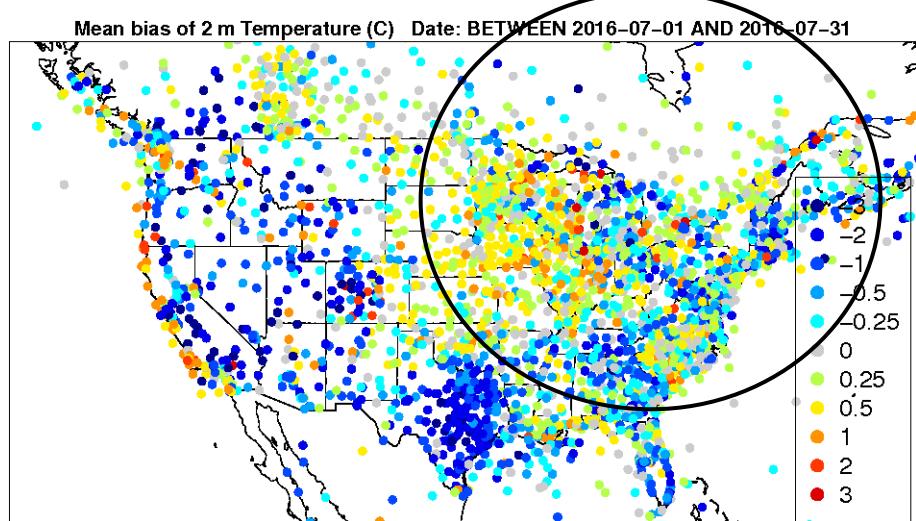
LADCO run: WRFv3.9.1

Domain: d01 (12 km)

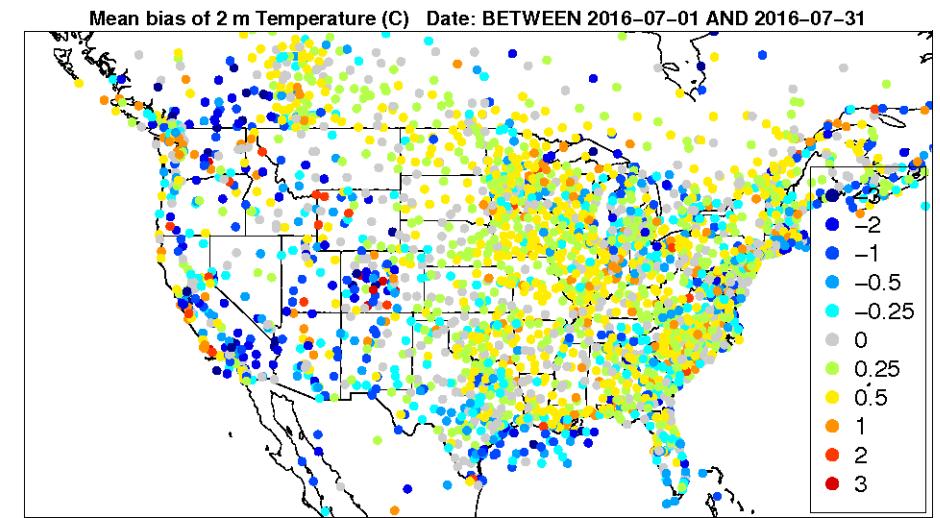
Aug 1, 2018



LADCO sens2: WRFv3.9 with EPA obs nudg and IPX WRF



EPA run: WRFv3.8



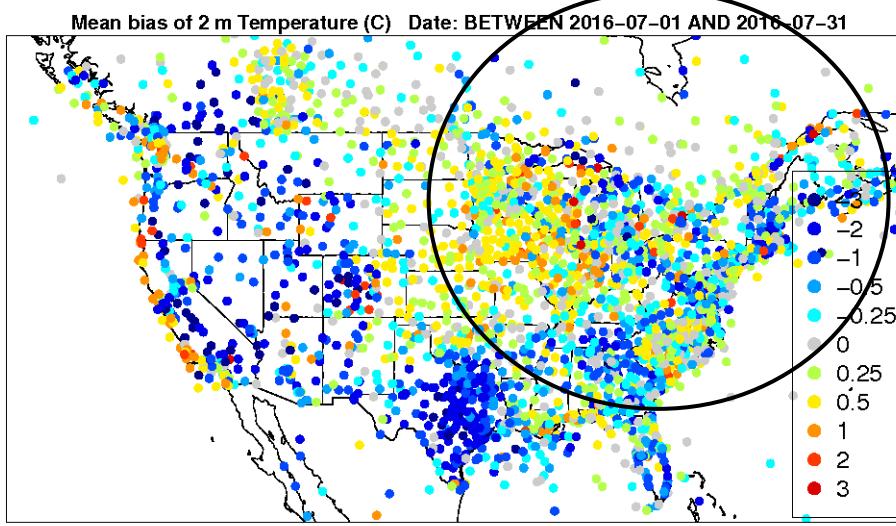
Sens2: Strong cold biases in the Midwest and Northeast was corrected to near-zero bias and very slight warm biases.

Domain: d01 (12 km)

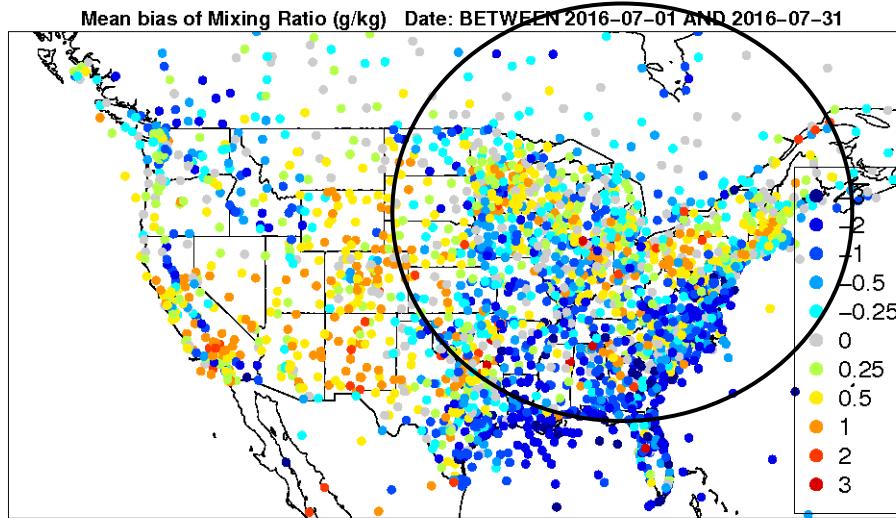
Sep 10, 2018

Sens2: WRFv3.9 with EPA obs nudg and IPX WRF

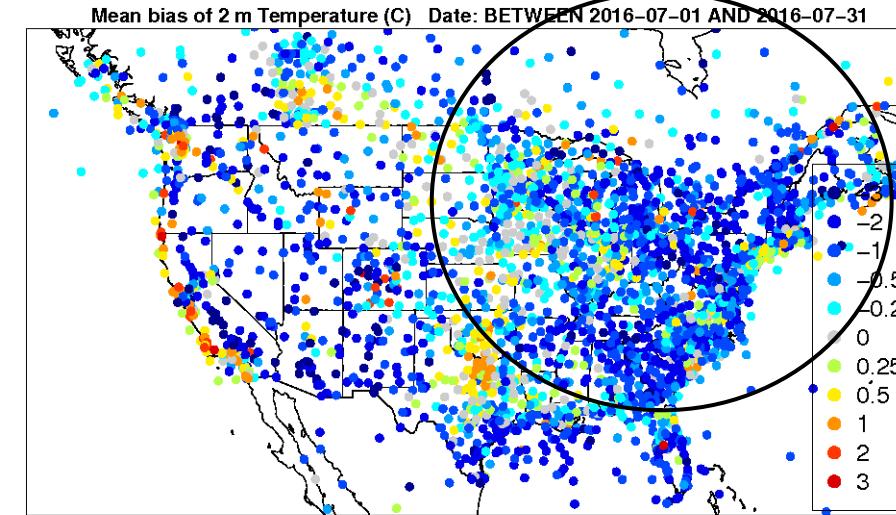
Temperature



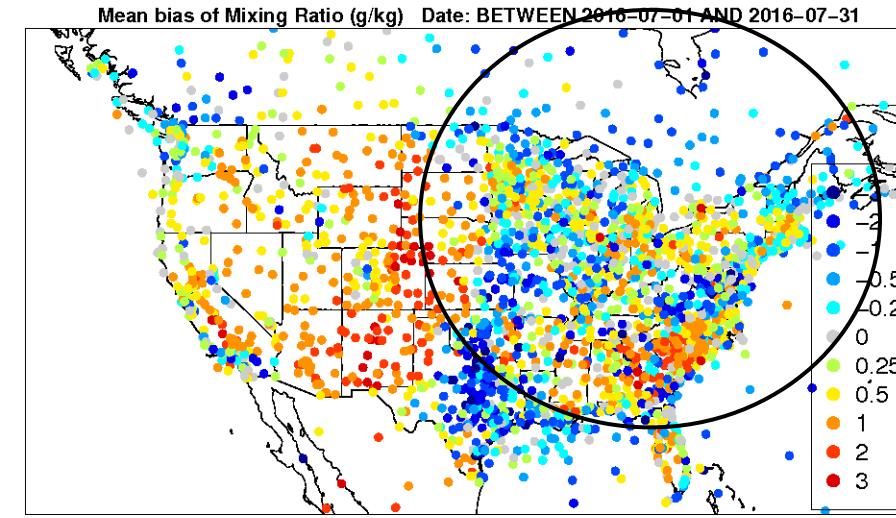
Specific Humidity



Sens3: WRFv3.9 with NOAA config



Sens2 to Sens3:
T shifted to cold bias
(around -1oC)

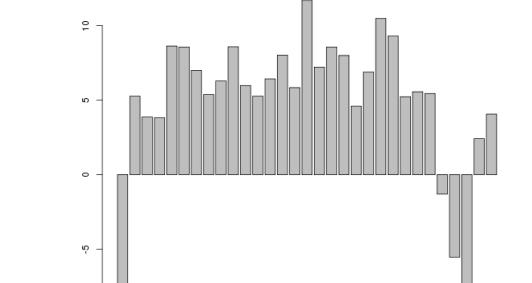
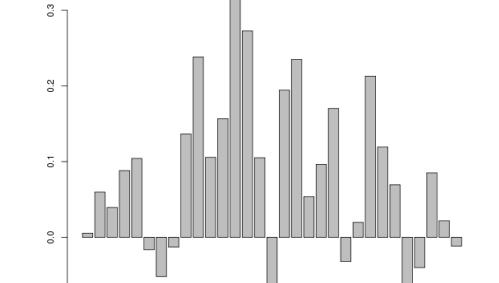
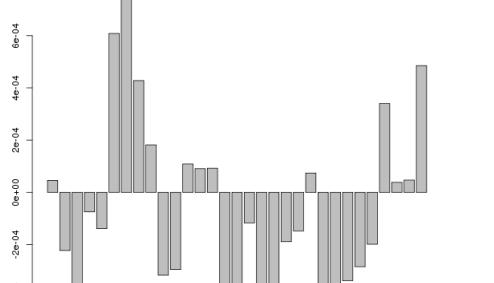
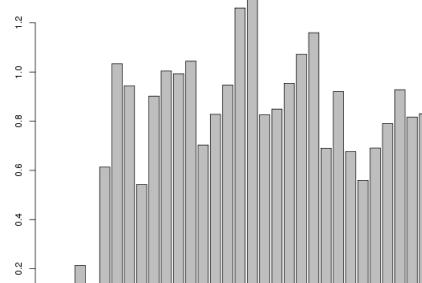
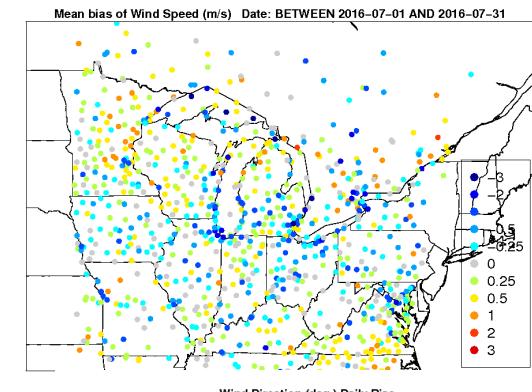
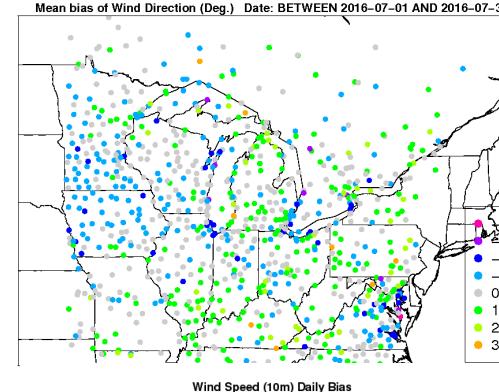
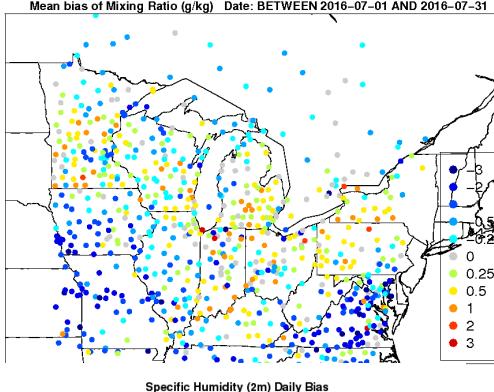
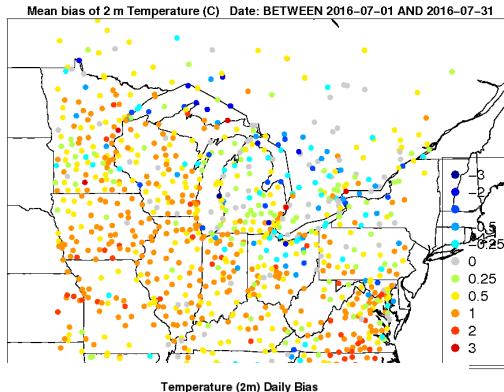


Sens2 to Sens3:
Q is still mixed bag in
the LADCO region.

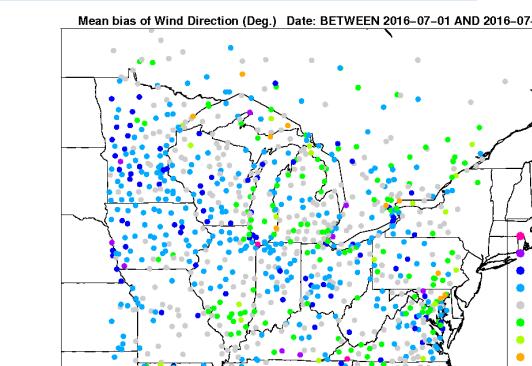
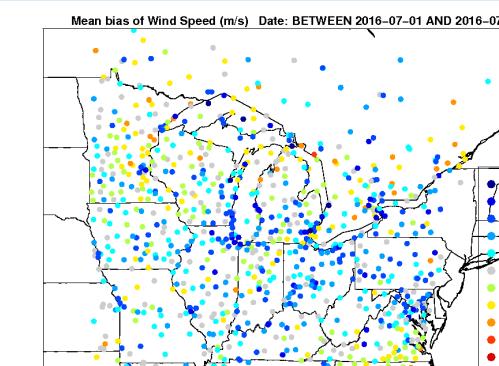
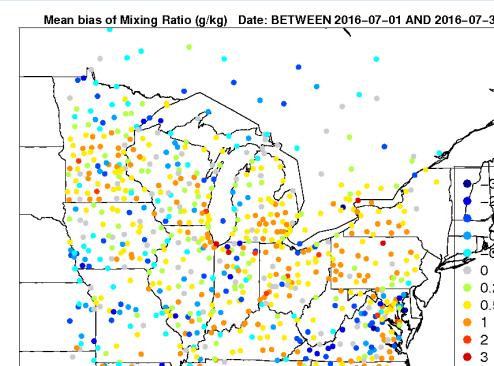
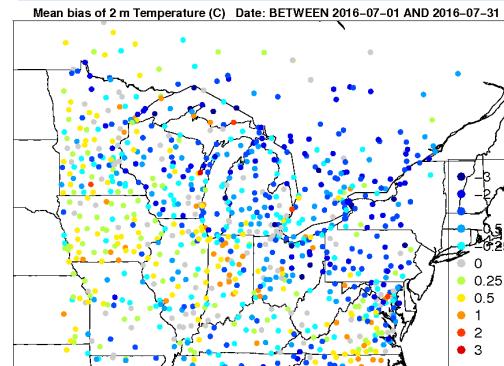
Domain: d02 (4 km)

Sep 10, 2018

Sens2: WRFv3.9 with EPA obs nudg and IPX WRF



Sens3: WRFv3.9 with NOAA config

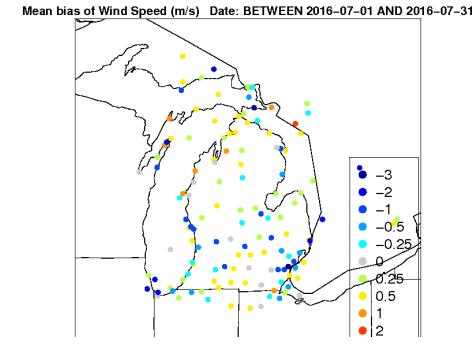
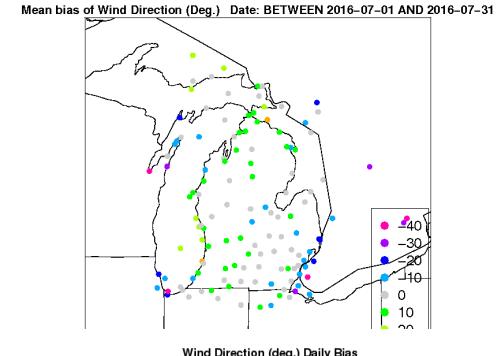
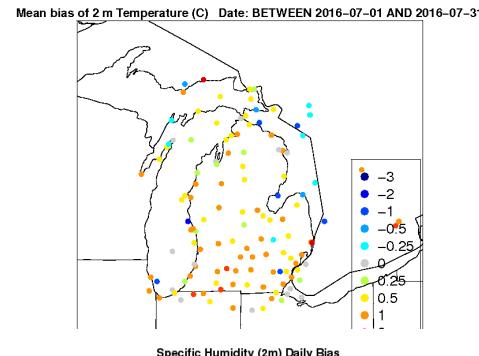
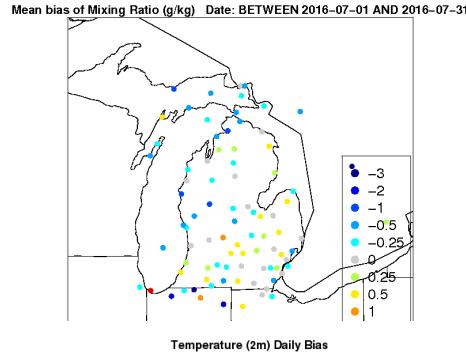


Domain: d03 (4/3 km)

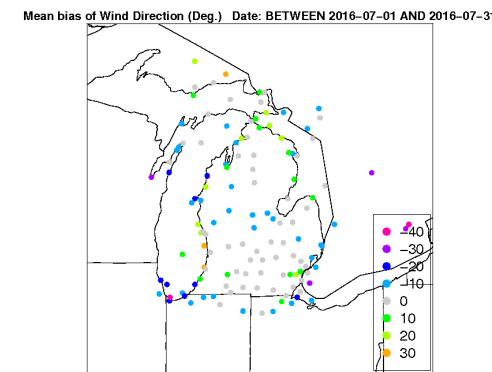
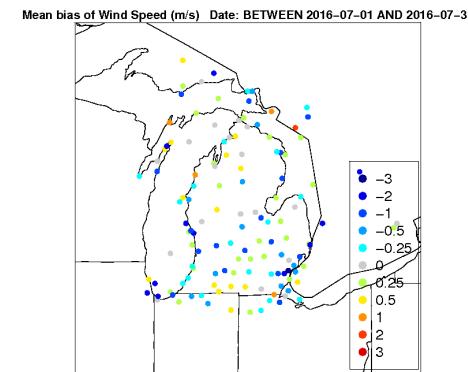
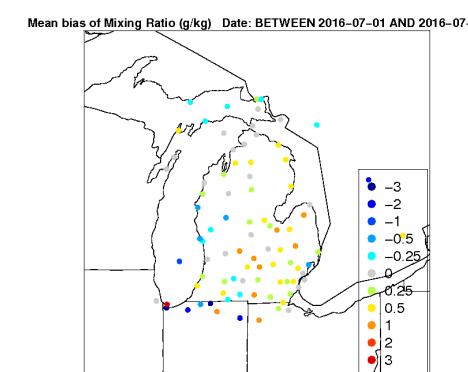
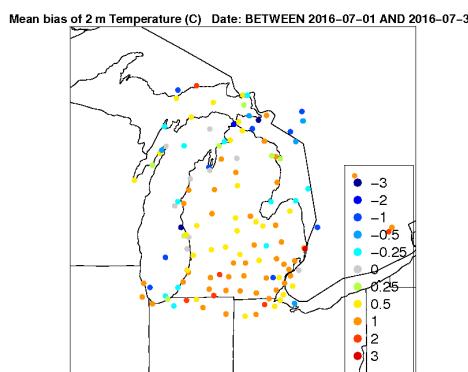
Sep 10, 2018

Sens2: WRFv3.9 with EPA obs nudg and IPX WRF

Why Domain 3 is over MI state, I thought it should be over the Lake Michigan?

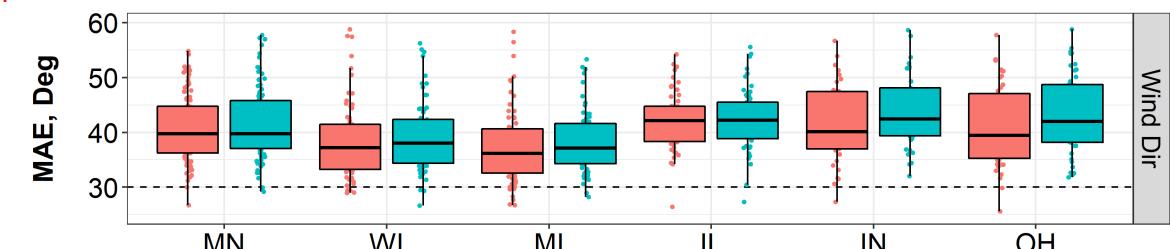
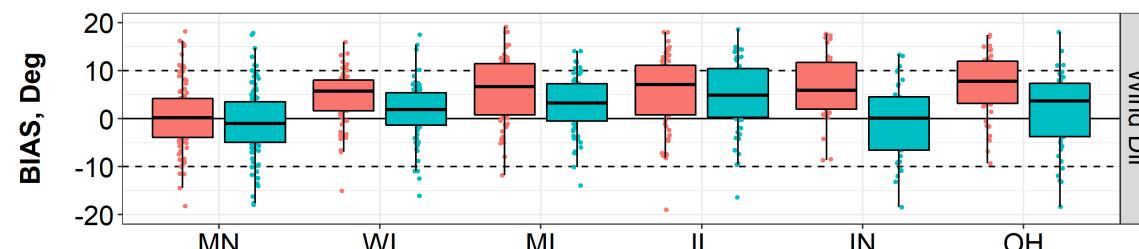
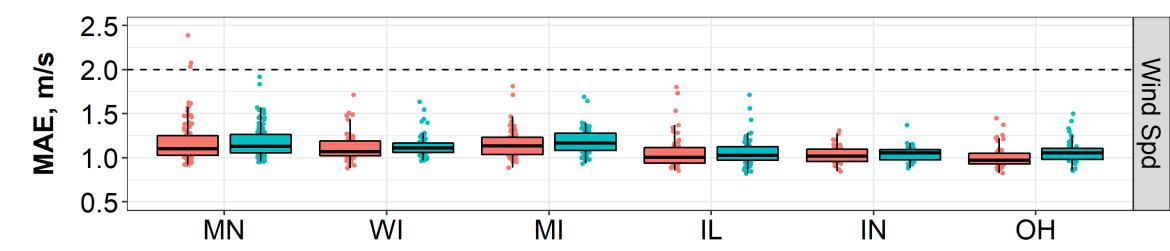
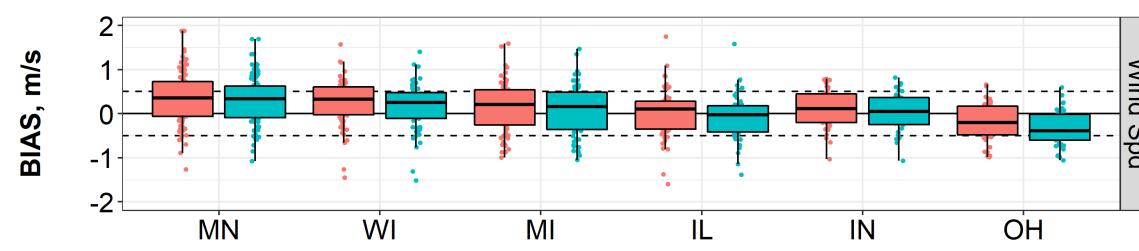
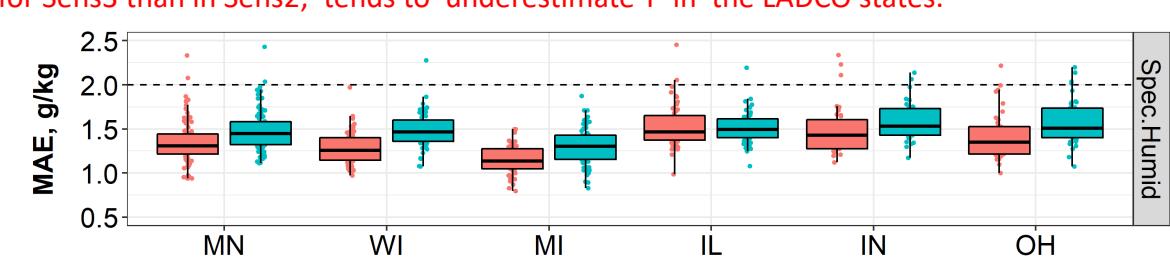
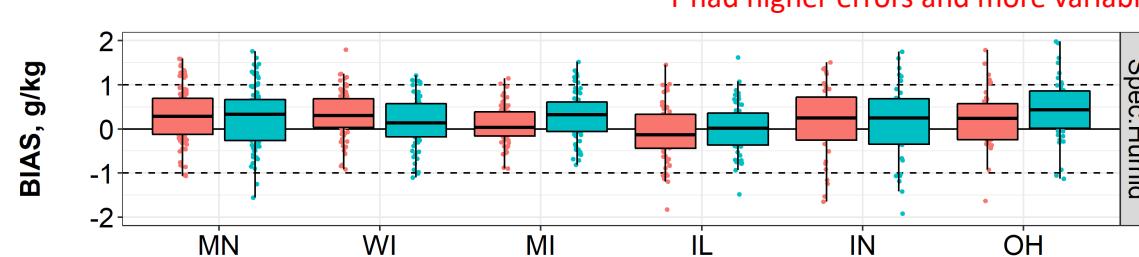
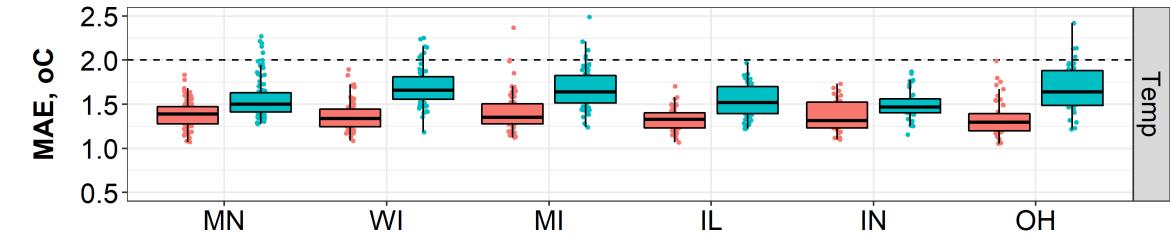
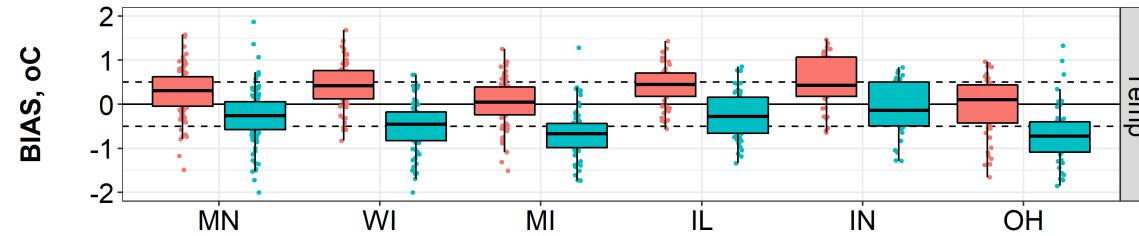


Sens3: WRFv3.9 with NOAA config



Domain: d01 (12 km)

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T had higher errors and more variability for Sens3 than in Sens2; tends to underestimate T in the LADCO states.

Errors for Q are slightly higher in sens3 than sens2. Biases are comparable for both sens2 and sens3.

WS errors and biases are comparable for both sens2 and sens3 within the benchmark.

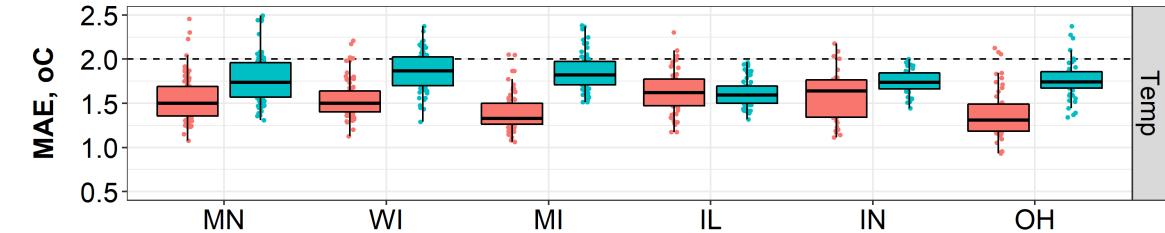
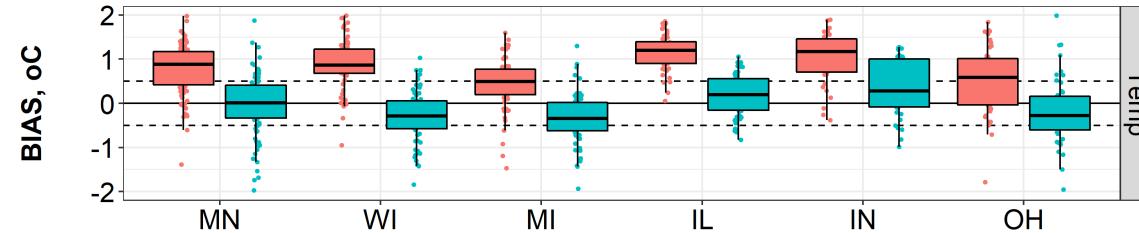
WD errors are way higher than acceptable criteria for both sens3 and sens2. in Sens 3 tends to low-biased as compared to sens3.

Config EPAobsNudge NOAAconfig

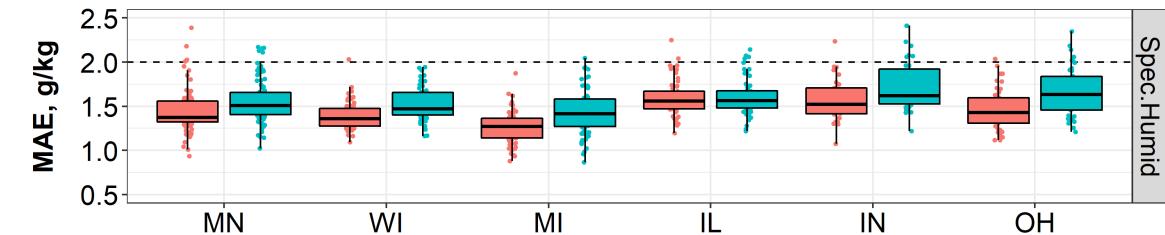
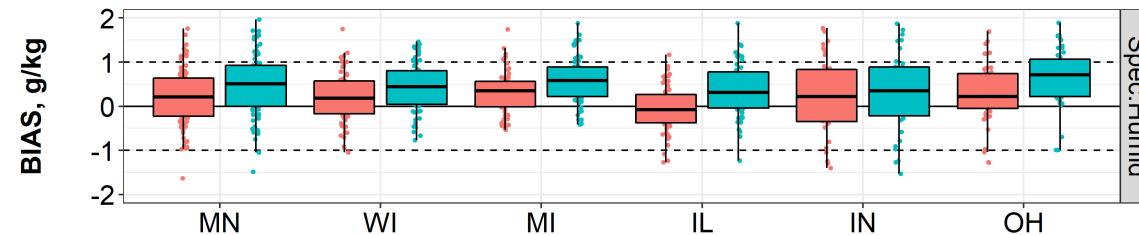
Config EPAobsNudge NOAAconfig

Domain: d02 (4 km)

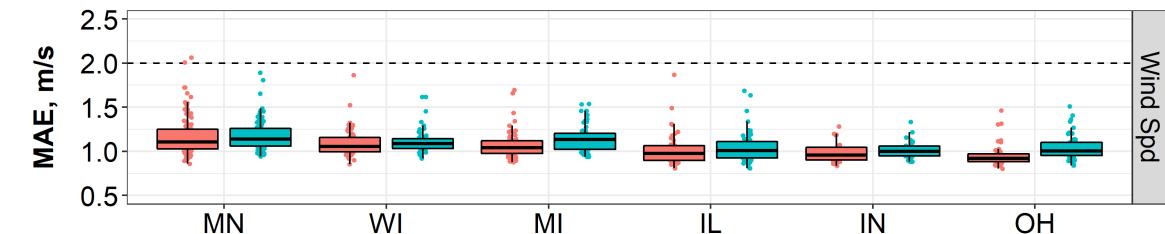
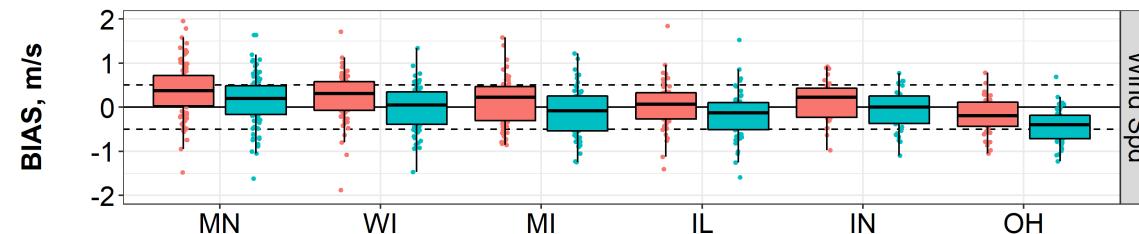
Sep 10, 2018



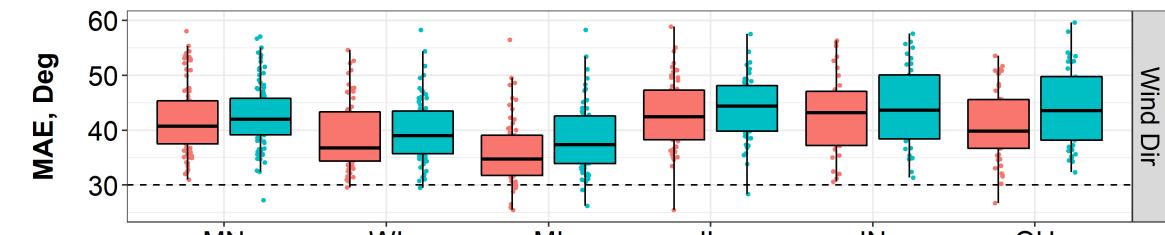
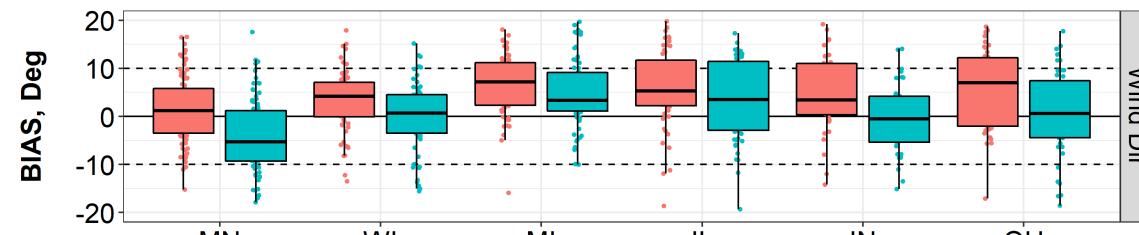
T had higher errors in Sens3 than in Sens2, specially in MN WI, MI. Bias is somewhat within the benchmark, but tends to be lower.



Q errors and bias are slightly higher in sens3 than sens2.



WS errors and biases are comparable for both sens2 and sens3 within the benchmark.



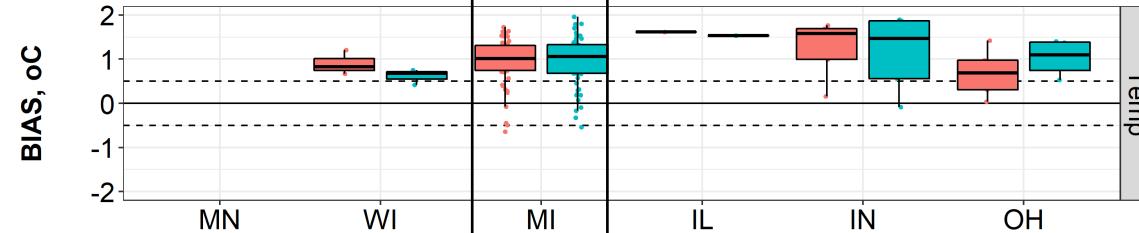
Although WD biases are comparable for the two cases, WD errors are still out of the criteria both cases.

Config EPAobsNudge NOAAconfig

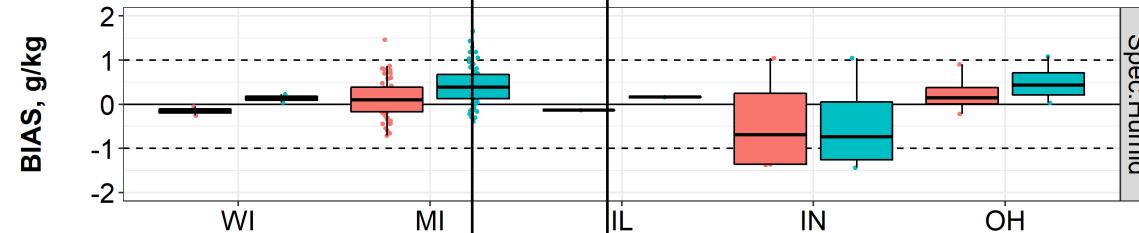
Config EPAobsNudge NOAAconfig

Domain: d01 (4/3 km)

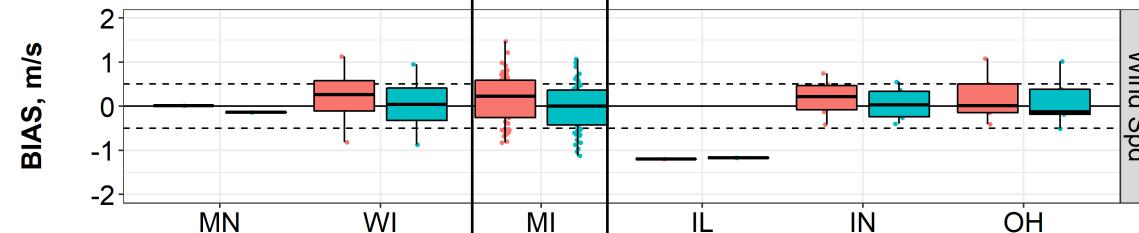
Sep 10, 2018



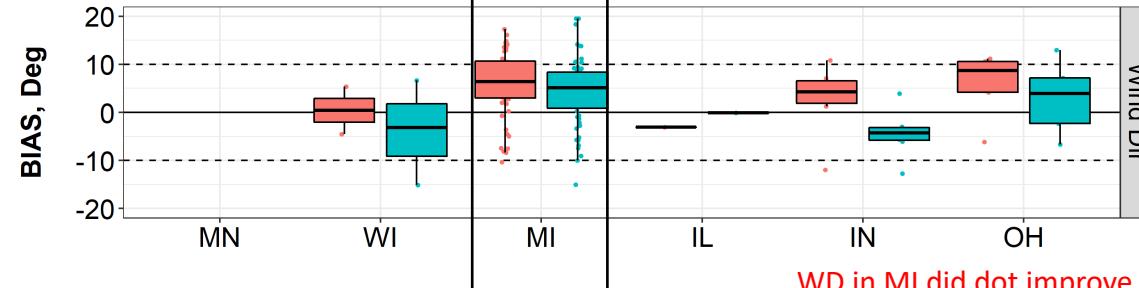
T errors is higher in Sens3 than in Sens2 in MI. The errors increase from coarse to finer domain(from d01 to d03).



Q errors and bias are slightly higher in sens3 than sens2.

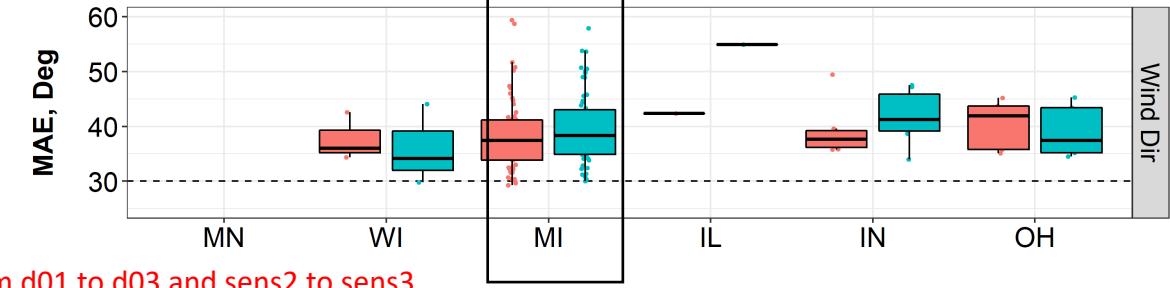
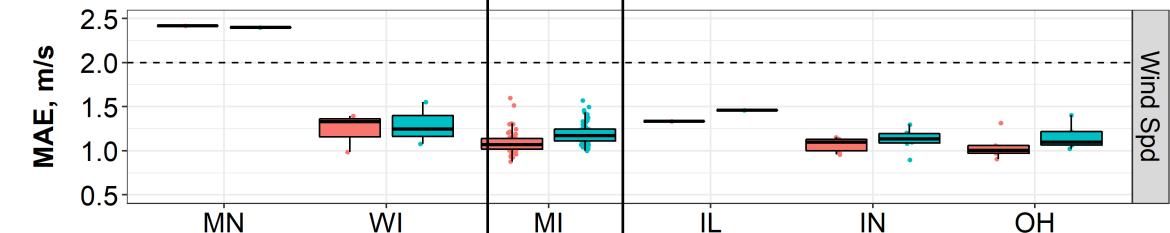
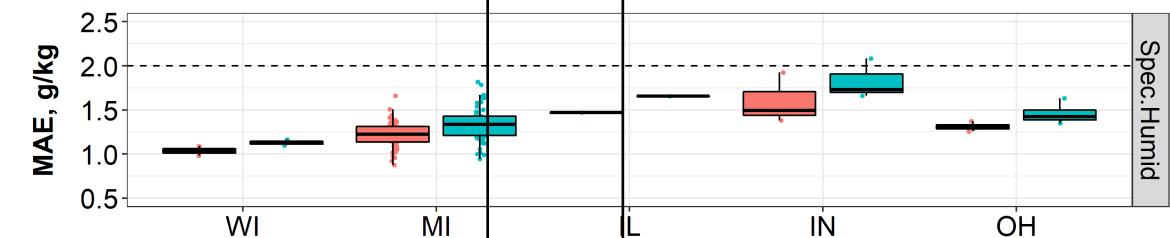
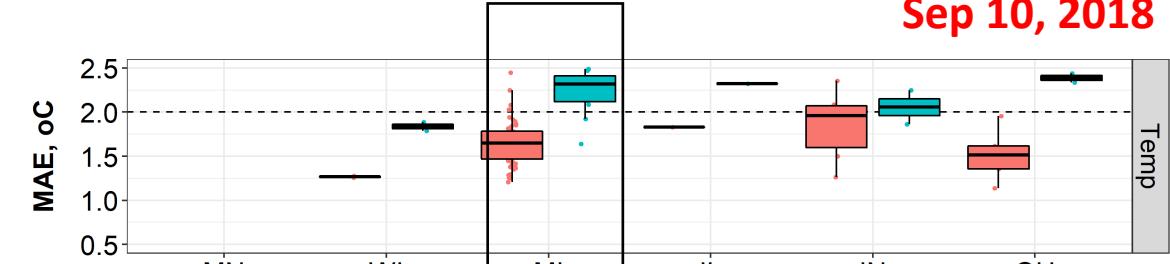


WS errors and biases the same as in d04.



WD in MI did not improve from d01 to d03 and sens2 to sens3.

Config EPAobsNudge NOAAconfig



Config EPAobsNudge NOAAconfig

Discussion Points

Domain 1 (12 km):

- In Sens2 (WRFv3.9 with EPA obs nudg and IPX WRF), strong T underestimation in the Midwest and Northeast on our first run was corrected to near-zero bias and slight warm biases.
- In Sens3 (WRFv3.9 with NOAA config), model underestimated T across the domain by average of 1oC. Q was overestimated in the West and Central Plains. No clear improvement was observed for Q in the LADCO region from sens2 to sens3.
- Sens 3 minimized T, WS and WD biases as compared to those in Sens 2. But, errors are higher for all examined variables, specially WD had huge errors for both sensitivities in the LADCO region.

Domain 2 (4 km):

- Sens 3 minimized T biases as compared to Sens 2 for d02 as well. But, errors are higher than those in Sens2. T underestimation in Sens 3 lead to slight overestimation in Q.

Domain 3 (4/3 km):

- Is Domain 3 is over MI state, Or over the Lake Michigan?
- Errors for T are increased as you go from coarse to finer domains. There is no noticeable reduction in errors and bias for Q, WS and WD in MI as you go to finer domains.

Overall, Sens3 did a poor job! If we go with Sens2 onward, we still need to nail down T and WD.

Any thought on a new sensitivity config?