Ozone Model Performance Evaluation
EPA's 2016v1 Modeling Platform
12km Modeling Domain

Final Report

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1.0 INTRODUCTION

An operational model evaluation was conducted for a 2016 base year CAMx v7.00beta6 simulation performed for the EPA continental 12km modeling domains defined by the United States Environmental Protection Agency (EPA) and shown by the red box in Figure 1. The purpose of this evaluation is to examine the ability of this 2016 air quality modeling platform to represent the magnitude and spatial and temporal variability of measured (i.e., observed) ozone concentrations within the modeling domain. The evaluation presented here is based on model simulations conducted by Alpine Geophysics using the EPA 2016fh emissions platform (7b6-2016fh-agmcmv.13x6.ag or 2016v1). This model evaluation for ozone focuses on comparisons of model predicted 8-hour daily maximum concentrations to the corresponding observed data at monitoring sites in the EPA Air Quality System (AQS).

At the time of this document's publication, these model simulations are known to be the first to be developed using this 2016 platform. All non-emissions CAMx model inputs were supplied by EPA and were used in the EPA 2016/2028 fg model simulations. The emissions were taken from the EPA "pre-merged" 2016fh/2016v1 platform distribution.

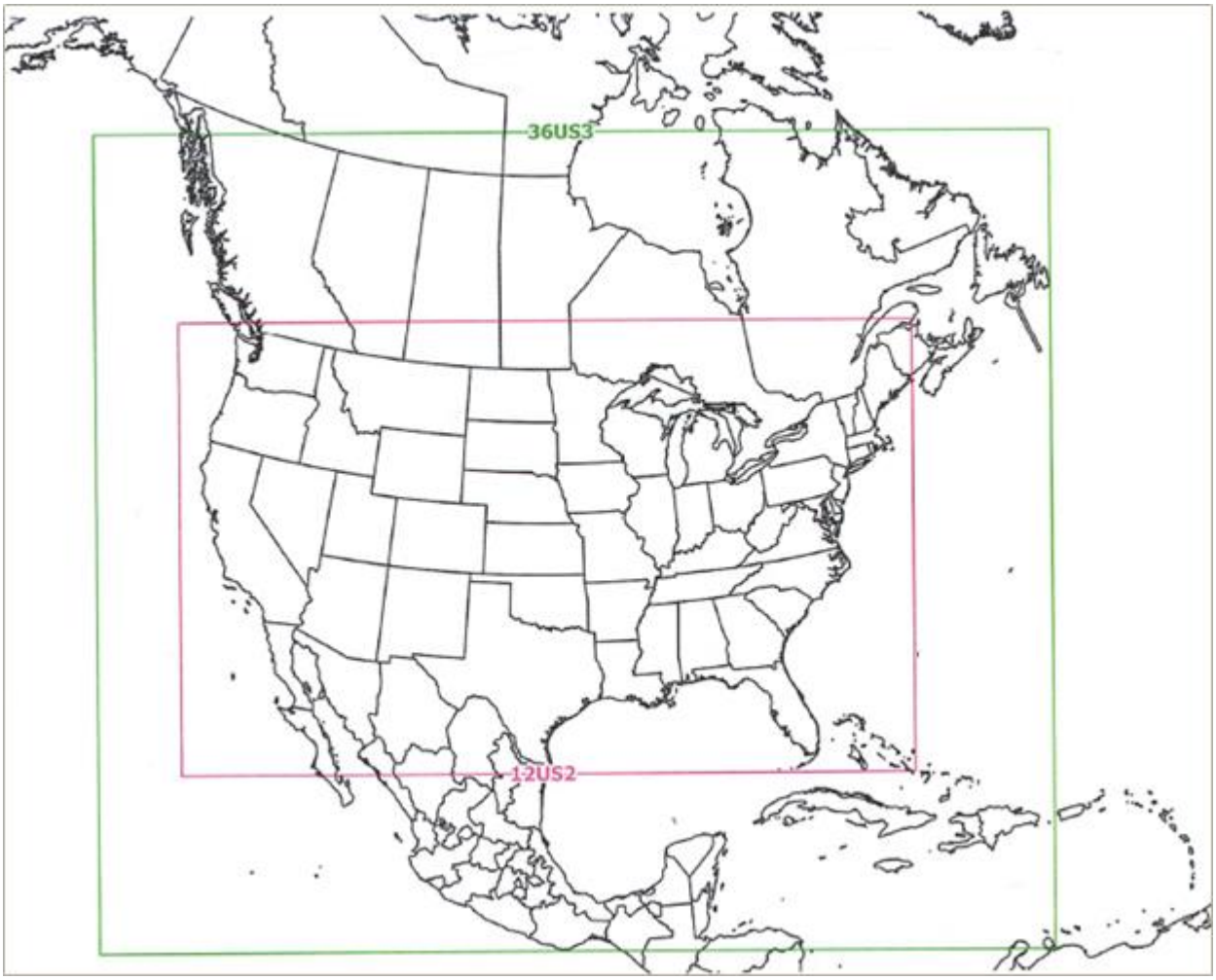

Figure 1. Map of 36/12km CAMx modeling domain.

Included in the evaluation are statistical measures of model performance based upon model-predicted versus observed concentrations that were paired in space and time. Model performance statistics were calculated for several spatial scales and temporal periods. Statistics were calculated for individual monitoring sites, and in aggregate for monitoring sites within states and regions of the 12km modeling domain.

For maximum daily average 8-hour (MDA8) ozone, model performance statistics were created for the periods May through September, for each season, and for the five month ozone season (May – September). The aggregate statistics by NOAA defined climate regions (Figure 2) are presented in this document with two additional sub regions; monitors along the Gulf of Mexico and those along the north eastern Interstate 95 corridor. Model performance statistics for MDA8 ozone for individual states and at individual monitoring sites based on days with observed values ≥ 60 ppb can be found as Appendix A to this document.

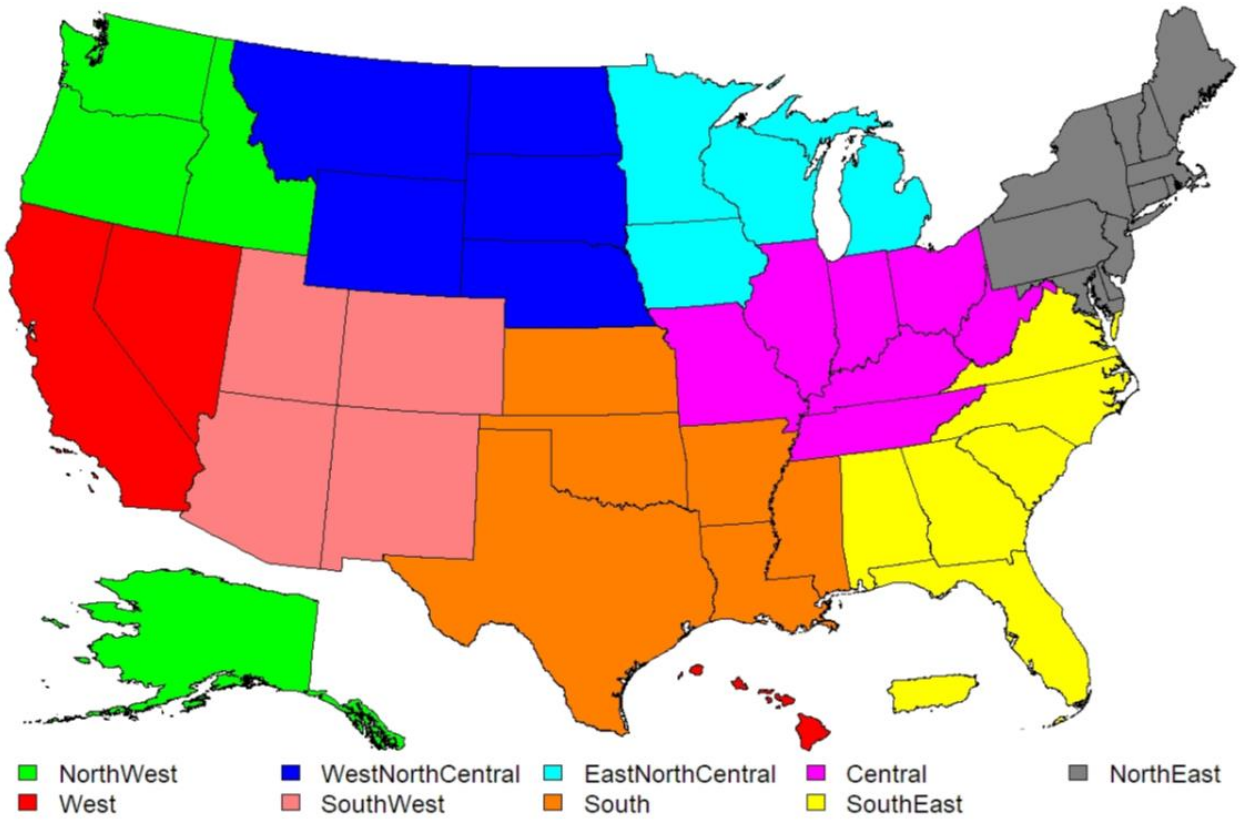

Figure 2. NOAA Climate Regions.

In addition to the above performance statistics, we prepared several graphical presentations of model performance for MDA8 ozone. These graphical presentations include:

1. spatial maps that show the mean bias and error as well as normalized mean bias and error calculated for MDA8 ≥ 60 ppb for May through September at individual AQS monitoring sites;

2. box plots that show the distribution of observations, model estimates, or performance metrics;
3. soccer plots that show both bias and error model performance on a single plot;
4. scatter plots that show the correlation of the predicted and observed MDA8 ozone concentrations for key sites in select areas for May through September; and
5. time series plots (May through September) of observed and predicted MDA8 ozone concentrations for key sites in select areas.

The Model Performance Evaluation, Analysis, and Plotting Software (MAPS) tool was used to calculate the model performance statistics used in this document (McNally and Tesche, 1993). For this evaluation we have selected the mean bias, mean error, normalized mean bias, and normalized mean error to characterize model performance, statistics which are consistent with the recommendations in Simon et al. (2012), the draft photochemical modeling guidance (U.S. EPA, 2014a), and EPA's recent performance evaluation of the 2016fe platform (EPA, 2019).

Mean bias (MB) is the average difference between predicted (P) and observed (O) concentrations for a given number of samples (n):

$$MB(ppb) = \frac{1}{n}\sum_{i=1}^{n}(P_i - O_i)$$

Mean error (ME) is the average absolute value of the difference between predicted and observed concentrations for a given number of samples:

$$ME(ppb) = \frac{1}{n}\sum_{i=1}^{n}|P_i - O_i|$$

Normalized mean bias (NMB) is the sum of the difference between predicted and observed values divided by the sum of the observed values:

$$NMB(\%) = \frac{\sum_1^n(P-O)}{\sum_1^n(O)} * 100$$

Normalized mean error (NME) is the sum of the absolute value of the difference between predicted and observed values divided by the sum of the observed values:

$$NME(\%) = \frac{\sum_1^n|P-O|}{\sum_1^n(O)} * 100$$

As described in more detail below, the model performance statistics indicate that the 12km 8-hour daily maximum ozone concentrations predicted by the 2016fh CAMx modeling platform closely reflect the corresponding 8-hour observed ozone concentrations in each region of the 12 km U.S. modeling domain from EPA's draft policy assessment for draft *Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards* (EPA, 2019). The acceptability of model performance was judged by considering the 2016 CAMx performance results in light of the range of performance found in recent regional ozone model applications (NRC, 2002;

Phillips et al., 2007; Simon et al., 2012; EPA, 2005; EPA, 2009; EPA, 2010, EPA, 2016, EPA, 2018). These other modeling studies represent a wide range of modeling analyses that cover various models, model configurations, domains, years and/or episodes, chemical mechanisms, and aerosol modules.

Overall, the ozone model performance results for the 2016fh 12km CAMx simulations are within the range found in other recent peer-reviewed and regulatory applications. The model performance results, as described in this document, demonstrate that the predictions from the 12km domain using the 2016fh modeling platform correspond closely to observed concentrations in terms of the magnitude, temporal fluctuations, and geographic differences for 8-hour daily maximum ozone.

Summer monthly tabular comparisons of Alpine's simulation with 2016fh as documented here compared to the 2016fg (*beta*) version of EPA's 2016 modeling platform run by Alpine using the same configuration is provided at the MJO level of detail in Appendix B.

2.0 RESULTS

The 8-hour ozone model performance bias and error statistics for the months May through September and ozone season (May – September) for each region and select states in the 12km modeling domain are provided in the following subsections. The statistics shown were calculated using data pairs on days with observed 8-hour ozone of ≥ 60 ppb or for all days with observed 8-hour ozone > 0 pbb.

In addition to statistical summaries, graphical displays of data are presented to allow for a fuller characterization of model performance.

Below are examples of the types of plots that are used in this evaluation.

- Spatial plots of model performance at monitor locations provide an overall picture of the geographic patterns in model performance. Any performance metric can be plotted in this manner and we include spatial plots of MB, ME, NMB, and NME. The markers are plotted at monitor locations with the color of the marker keyed to the value of the metric being presented. The following four figures provide the national picture of MB (Figure 3), ME (Figure 4), NMB (Figure 5), and NME (Figure 6), respectively. Additional detailed regional maps follow in relevant sections.

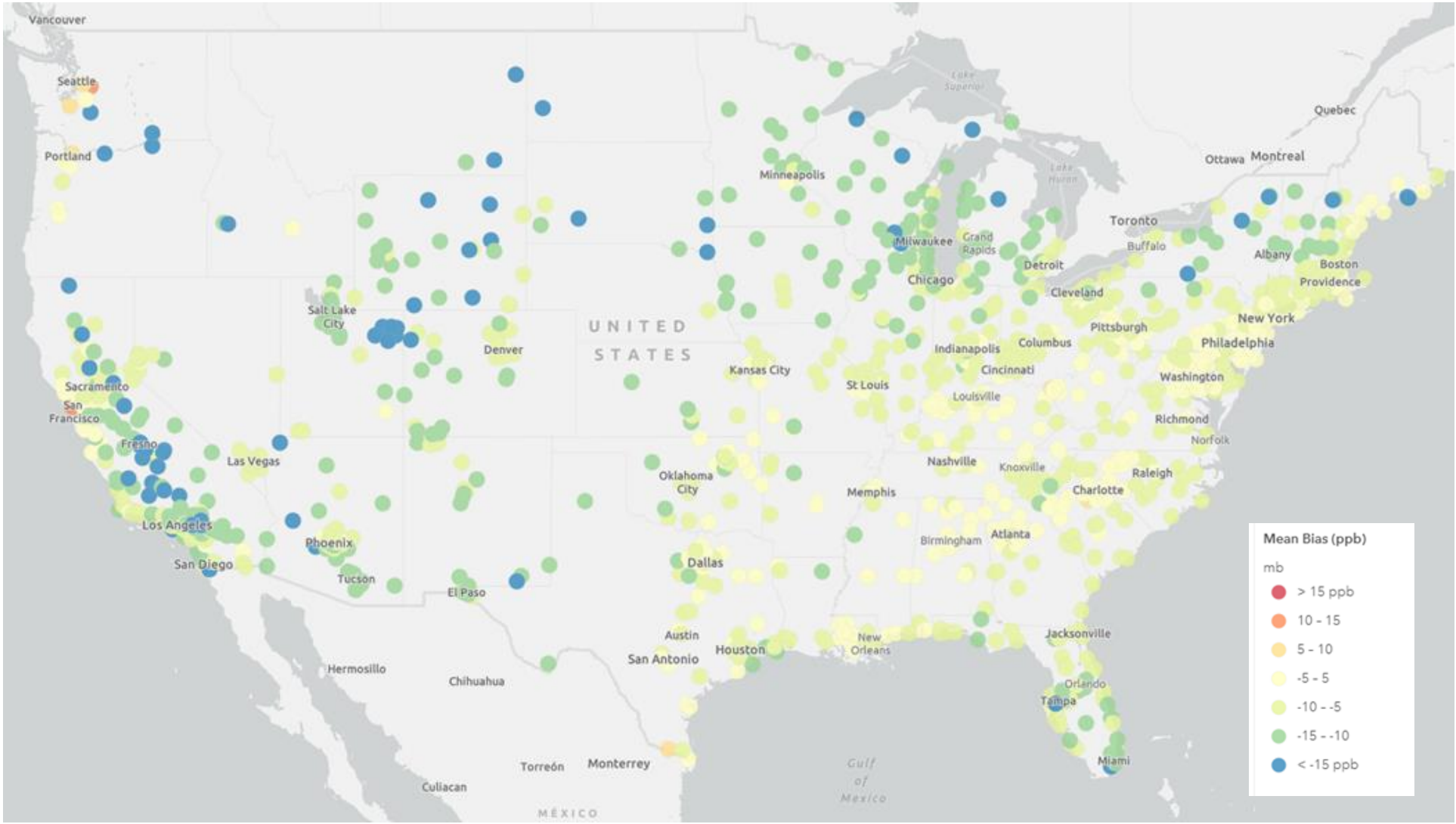

Figure 3. Mean Bias (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites.

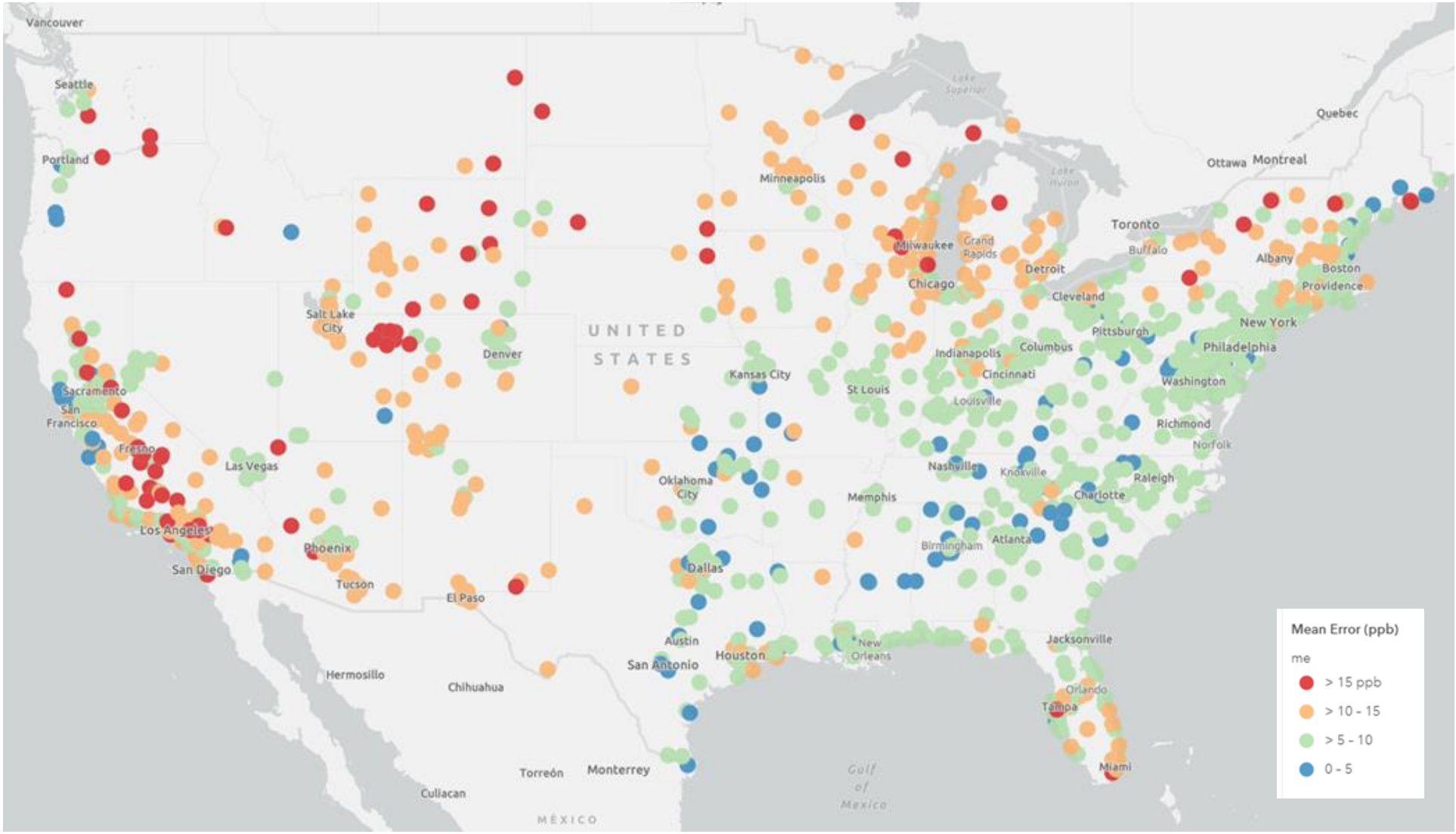

Figure 4. Mean Error (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites.

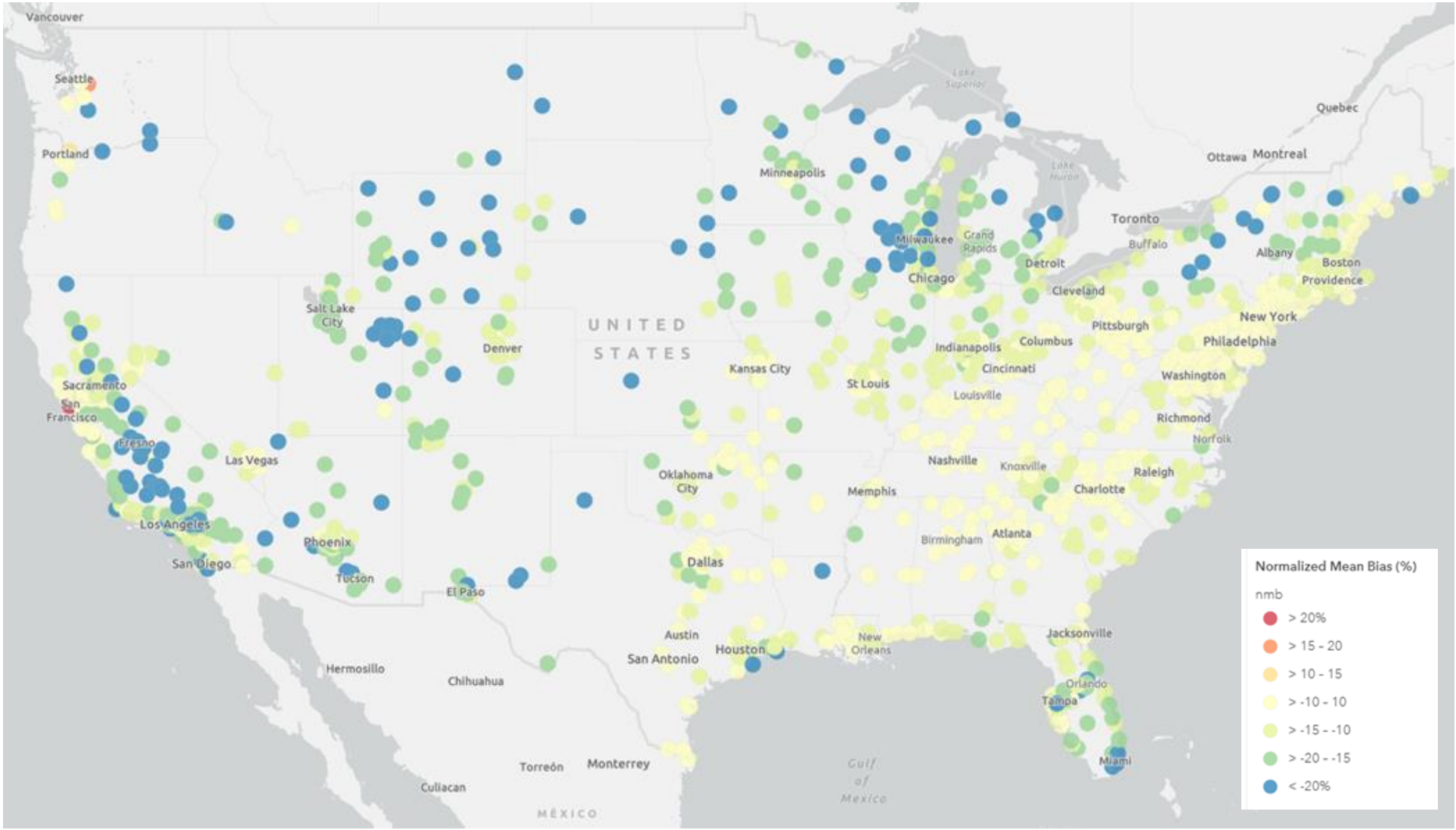

Figure 5. Normalized Mean Bias (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites.

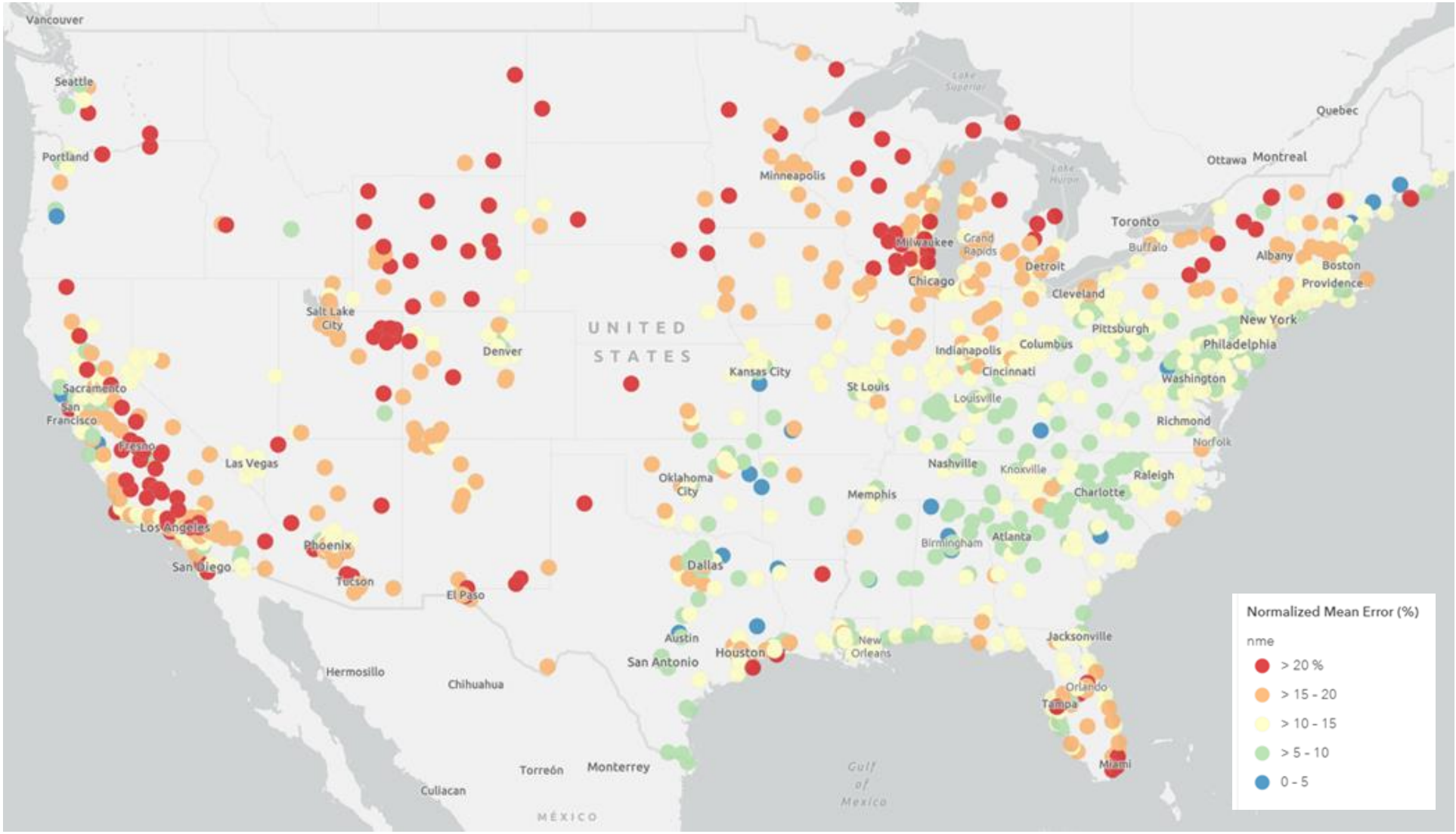

Figure 6. Normalized Mean Error (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites.

- Box plots show the distribution of observations, model estimates, or performance metrics. In this report, box plots in this evaluation are grouped by monthly observed and modeled concentrations by species, network, and region. Our box plots show several quantities: the 25% to 75% percentiles are represented by the lower and upper extent of the box, the median values by the line across the box, and outliers as points outside the box. The monthly box plots presented can be used to quickly visualize model performance across the ozone season, highlighting the monthly change in model performance.

- The soccer plot is so named because the dotted lines illustrating performance goals resemble a soccer goal. The error is plotted on the y-axis and the bias plotted on the x-axis. The plot is a convenient way to visualize both bias and error model performance on a single plot. As bias and error approach zero, the points are plotted closer to or within the "goal," represented by the dashed boxes. The size of the goal is developed from historical values of the metric from comparable modeling studies.

- Scatter plots present the time and space ordered pairs with observations on the x-axis and the model predicted concentrations on y-axis. These plots are useful for indicating trends of either over, or under prediction across the range of values. On these graphics each daily MDA8 concentration at every monitor in a region is plotted as a single ordered pair with the observed ozone on and horizontal axis and the corresponding model estimate on the vertical axis. A perfect model would show all points in a single line with a unit slope.

2.1 PERFORMANCE STATISTICS BY CLIMATE REGION AND MONTH

Central Region

The Central region is comprised of Illinois, Indiana, Kentucky, Missouri, Ohio, Tennessee, and West Virginia.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in the Central U.S. is within 6 ppb, except for high ozone days (≥ 60 ppb) in May (-11 ppb) and June (-7 ppb). The model tends to under predict ozone at high concentrations across most months of the ozone season in this region. Normalized mean error is within ~15%, except for all observation days (> 0 ppb) in July and August (~17%) and in May (~18%) for days ≥ 60 ppb. Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figure 7 through Figure 10. Higher mean and normalized mean error is shown in areas adjacent to Lake Michigan and in the northern latitudes of the region with noted under prediction in these same regions. Overall performance is best across all observed days in June and September and during July, August, and September at high concentrations.

Table 1. Performance statistics for MDA8 ozone by month and ozone season in the Central NOAA climate region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
Central	MAY	0	6618	-5.61	7.16	-11.93	15.24
Central	JUN	0	6432	-2.36	6.66	-4.43	12.53
Central	JUL	0	6608	5.04	7.29	11.42	16.54
Central	AUG	0	6639	4.20	6.81	10.43	16.92
Central	SEP	0	6432	2.99	5.16	7.18	12.36
Central	Ozone Season	0	32729	0.86	6.63	1.9	14.65
Central	MAY	60	616	-11.46	11.48	-17.55	17.58
Central	JUN	60	1597	-7.10	8.58	-10.72	12.97
Central	JUL	60	340	0.02	6.07	0.02	9.34
Central	AUG	60	262	-0.38	5.99	-0.57	9.08
Central	SEP	60	432	-1.22	5.22	-1.88	8.03
Central	Ozone Season	60	3247	-5.86	8.21	-8.91	12.50

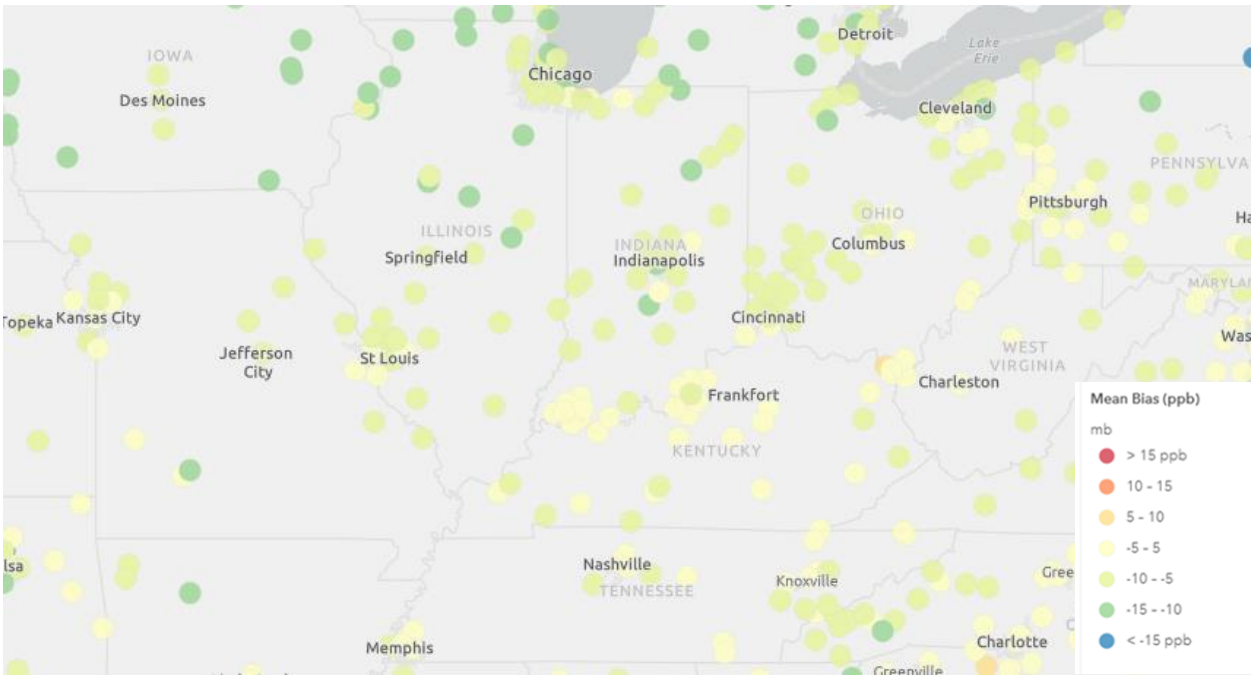

Figure 7. Mean Bias (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Central region.

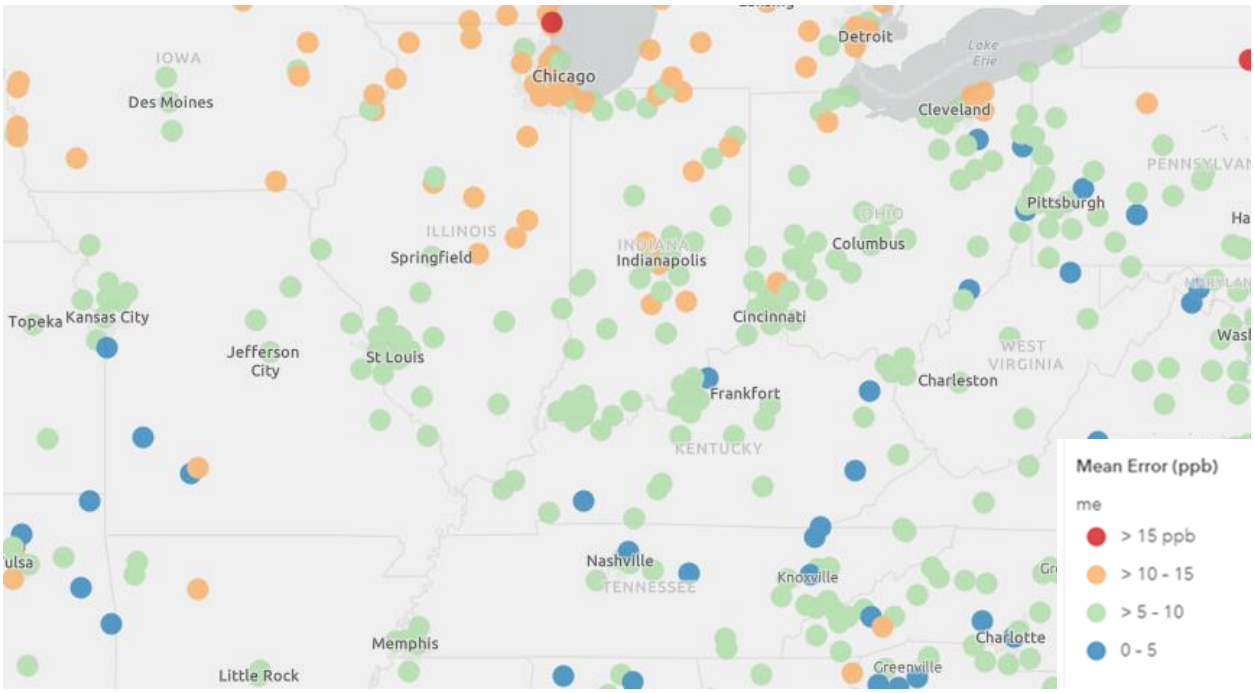

Figure 8. Mean Error (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Central region.

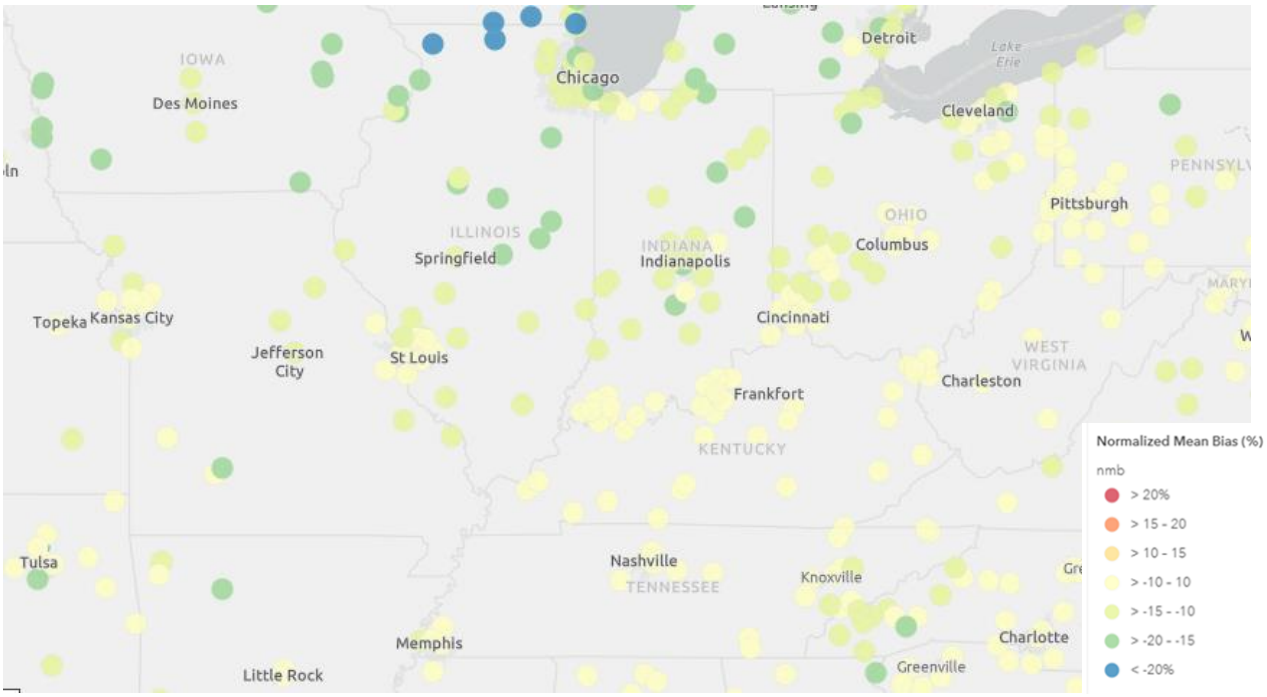

Figure 9. Normalized Mean Bias (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Central region.

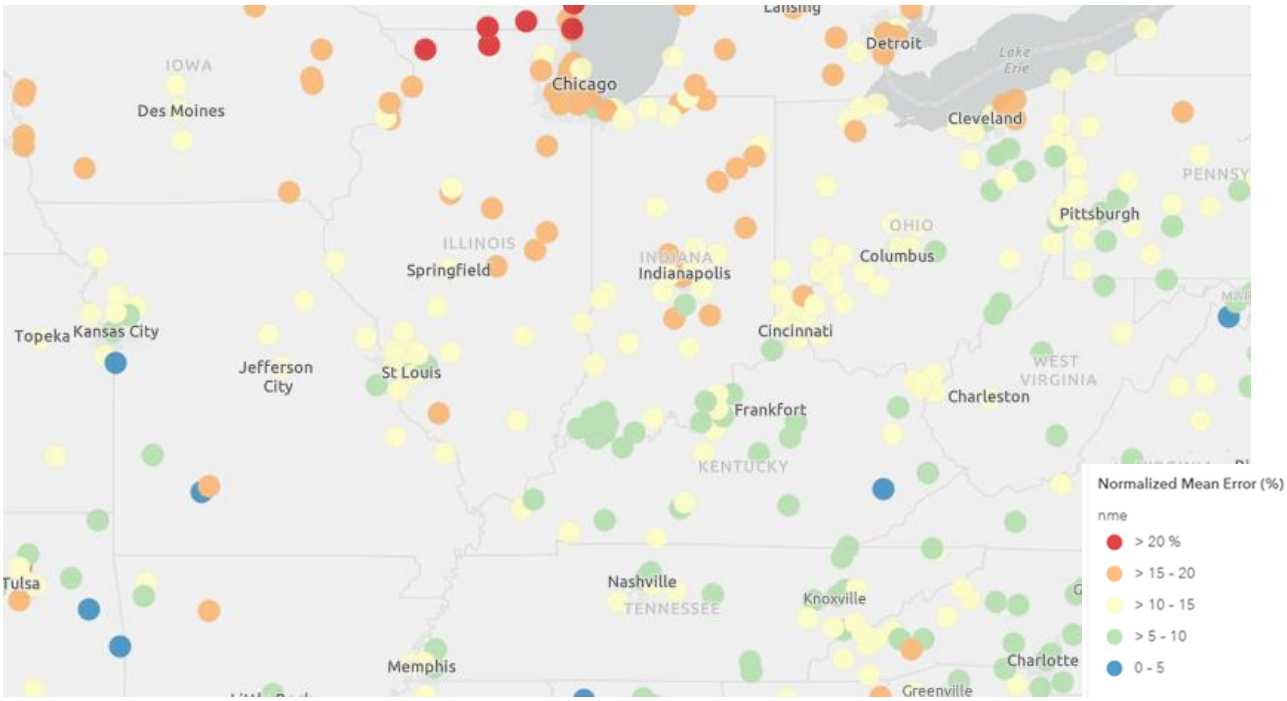

Figure 10. Normalized Mean Error (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Central region.

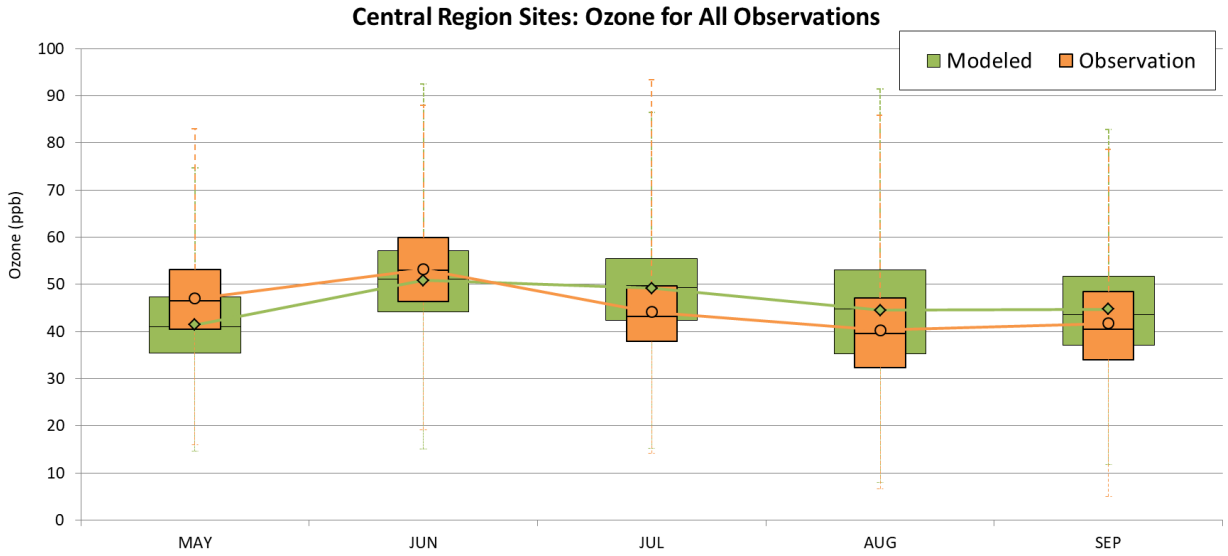

Figure 11. Boxplot comparisons of model predictions and AFS MDA8 observations for Central Region for May - September, 2016.

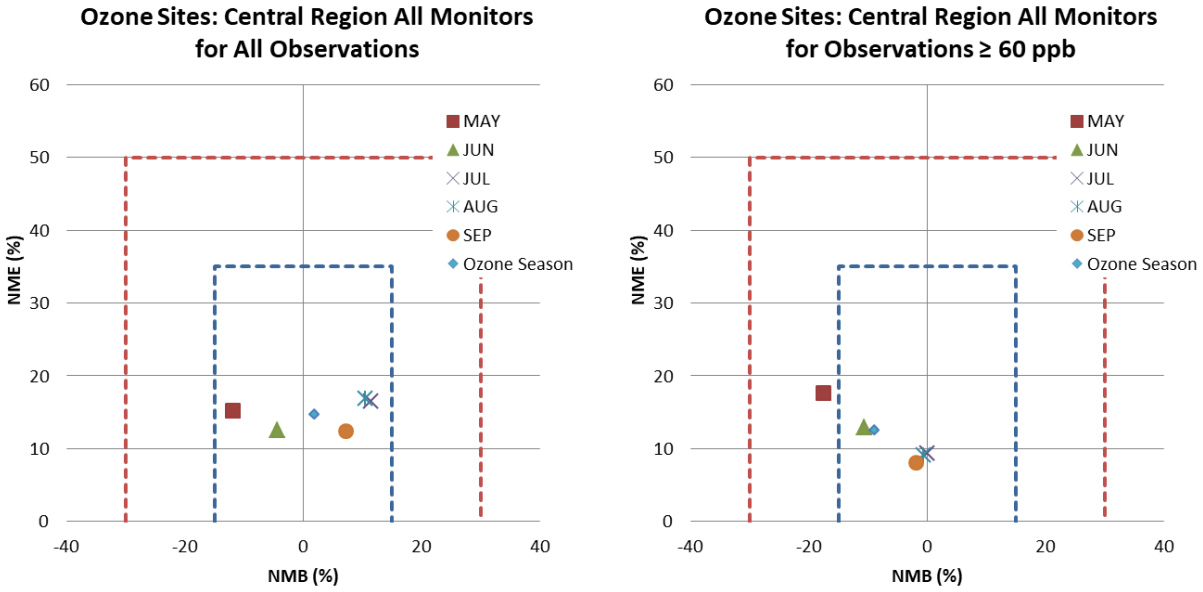

Figure 12. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for Central Region for months May – September and ozone season, 2016.

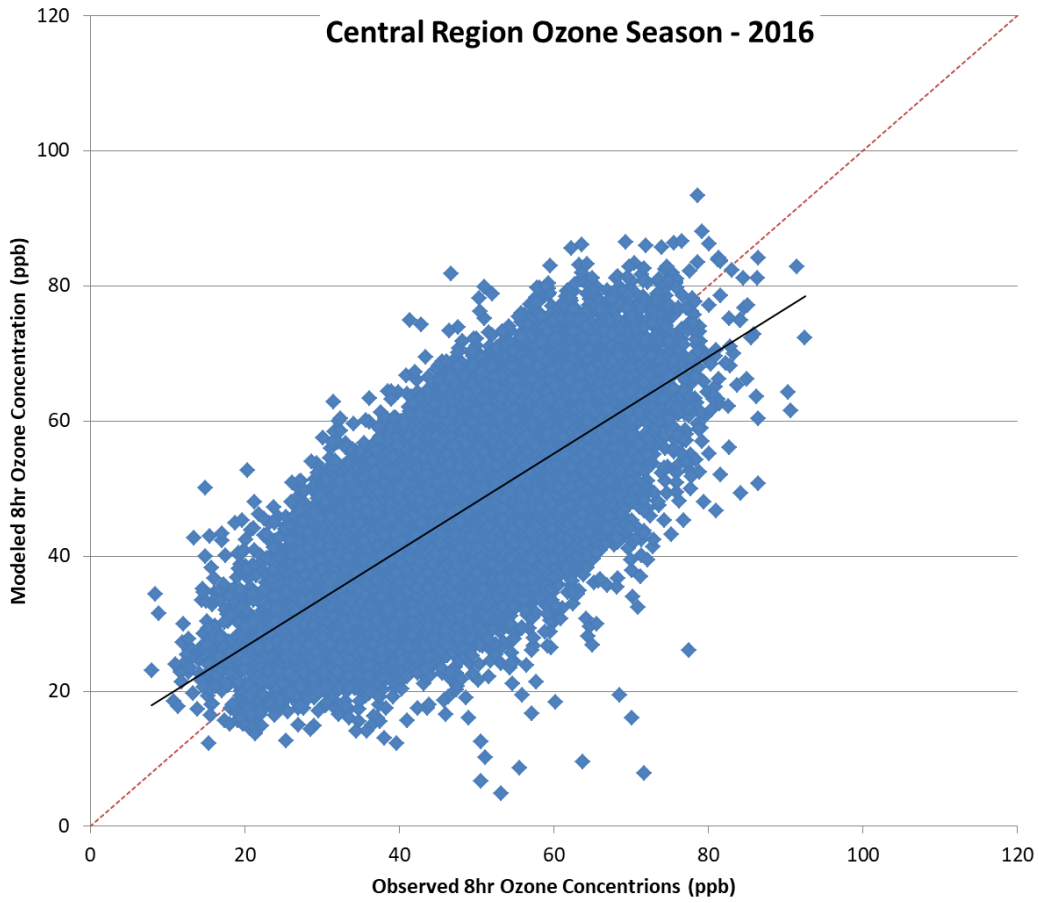

Figure 13. Scatter plot of MDA8 for May – September 2016 for Central AFS sites.

East-North-Central Region

The East-North-Central region is comprised of Iowa, Michigan, Minnesota, and Wisconsin.

In the East-North-Central region during the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in the East-North-Central U.S. is within 7 ppb, except for high ozone days (≥ 60 ppb) in May (-11 ppb) and June (-7 ppb). The model tends to under predict ozone at high concentrations across all months of the ozone season in this region with greatest under prediction in May (-15.25 ppb). Normalized mean error is within ~15% for the months July through September, and greater than 20% only in May (23%) for both all and high concentrations. Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figures 14 and 15. Higher mean and normalized mean error is shown in areas adjacent to Lakes Michigan and Superior with noted under prediction across the entire region. Overall performance is best across days in July, August, and September at both all and high concentrations.

Table 2. Performance statistics for MDA8 ozone by month and ozone season in the EastNorthCentral NOAA climate region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
EastNorthCentral	MAY	0	2925	-10.51	10.93	-22.16	23.04
EastNorthCentral	JUN	0	2819	-6.95	8.41	-14.27	17.26
EastNorthCentral	JUL	0	2900	0.88	5.39	2.14	13.06
EastNorthCentral	AUG	0	2939	2.19	5.27	5.58	13.47
EastNorthCentral	SEP	0	2840	1.55	3.85	4.56	11.32
EastNorthCentral	Ozone Season	0	14423	-2.56	6.78	-6.08	16.09
EastNorthCentral	MAY	60	350	-15.25	15.37	-23.19	23.36
EastNorthCentral	JUN	60	467	-11.98	12.09	-17.79	17.95
EastNorthCentral	JUL	60	140	-4.98	7.73	-7.56	11.72
EastNorthCentral	AUG	60	159	-5.76	7.36	-8.55	10.91
EastNorthCentral	SEP	60	22	-2.73	4.06	-4.29	6.38
EastNorthCentral	Ozone Season	60	1138	-11.08	11.75	-16.63	17.63

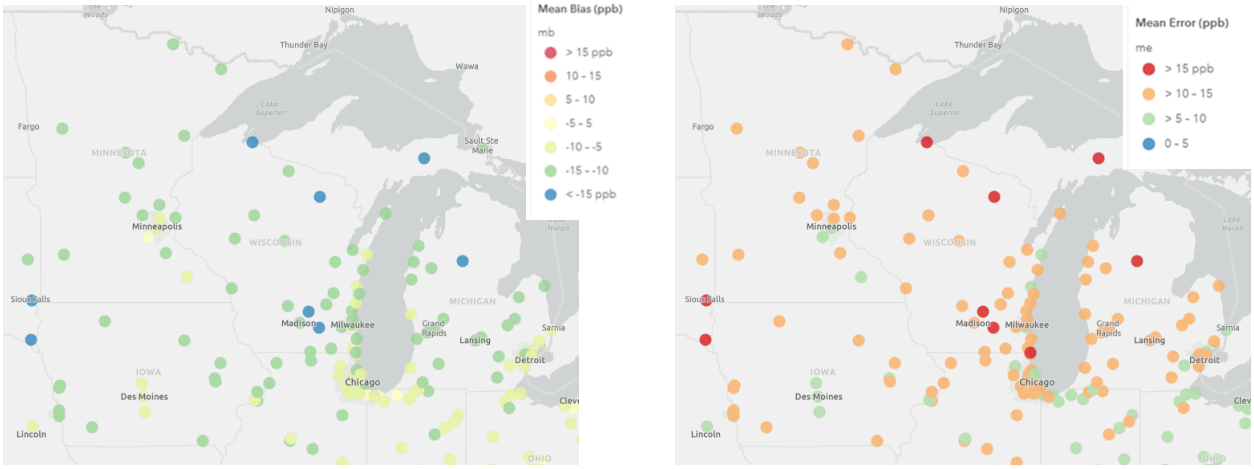

Figure 14. Mean Bias (ppb) [left] and Mean Error (ppb) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in East-North-Central region.

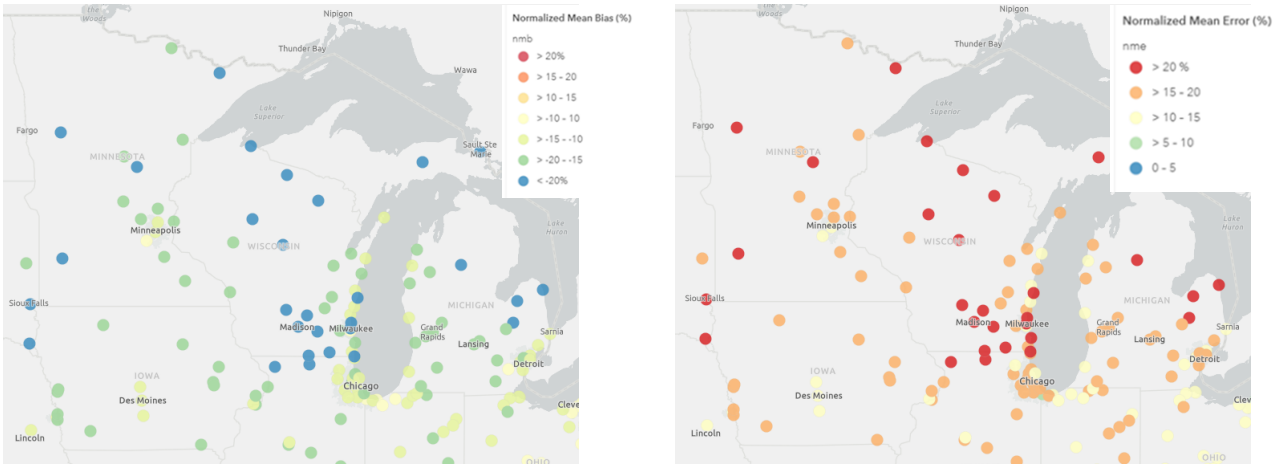

Figure 15. Normalized Mean Bias (%) [left] and Normalized Mean Error (%) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in in East-North-Central region.

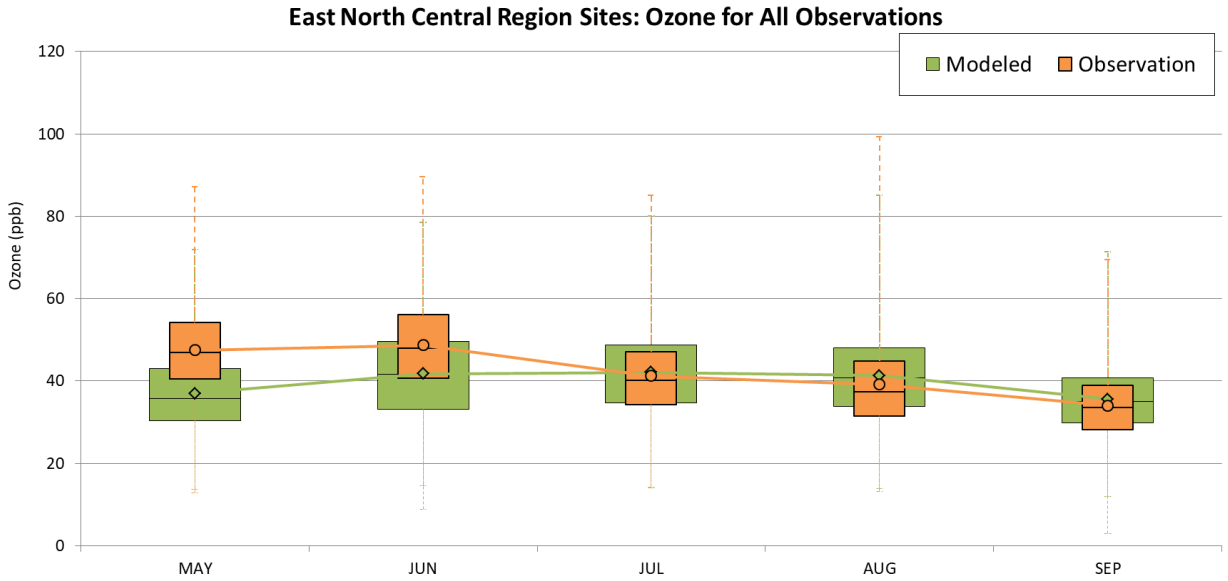

Figure 16. Boxplot comparisons of model predictions and AFS MDA8 observations for East-North-Central Region for May - September, 2016.

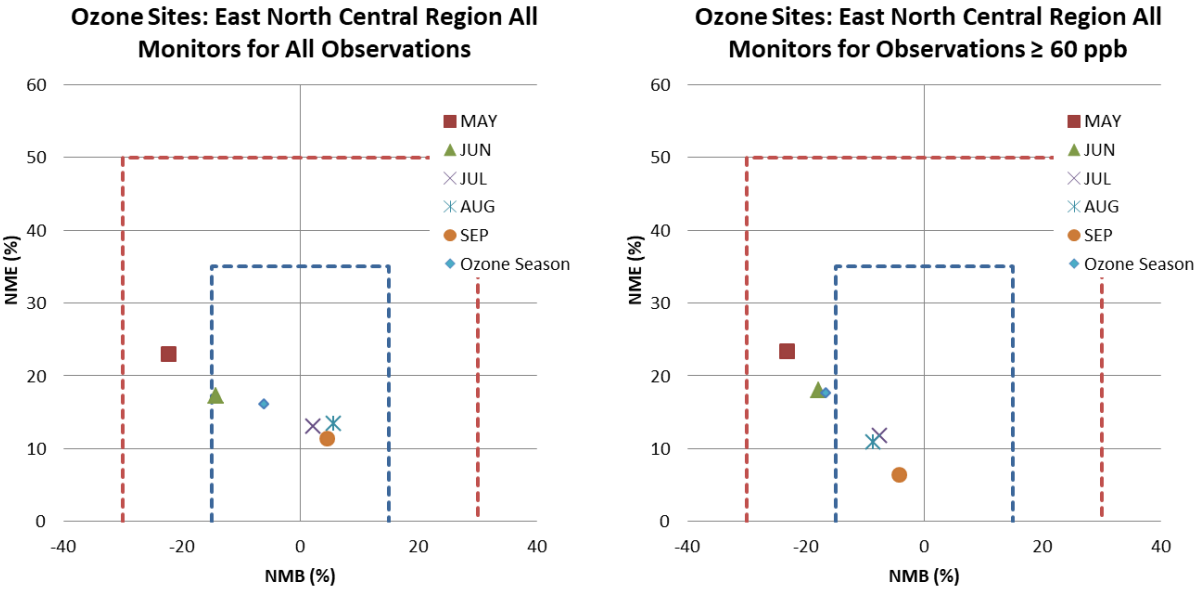

Figure 17. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for East-North-Central Region for months May – September and ozone season, 2016.

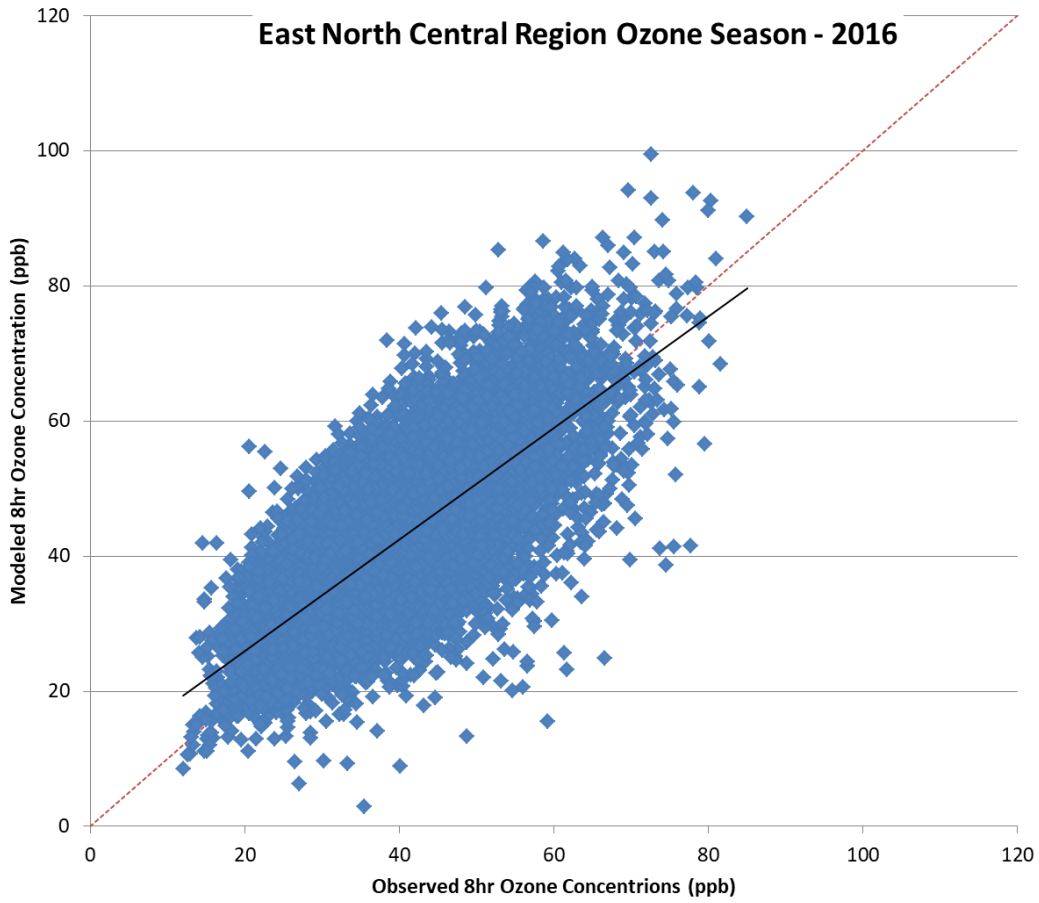

Figure 18. Scatter plot of MDA8 for May – September 2016 for East-North-Central AFS sites.

NorthEast Region

The NorthEast region is comprised of Connecticut, Washington D.C., Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in the Northeast U.S. is within 5 ppb, except for high ozone days (≥ 60 ppb) in May (-10.5 ppb) and June (-5.8 ppb). The model tends to slightly under predict ozone at high concentrations across all months of the ozone season in this region. Normalized mean error is within 15%, for all months except May for all observation days (-19%) and for days ≥ 60 ppb (-16%). Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figures 19 and 20. Higher mean (>10%) and normalized mean error (>15%) is shown in areas adjacent to the Long Island Sound and in latitudes north of New York City and throughout much of upstate New York with noted under prediction in these same regions. Overall performance in the region is best during July through September for both all observed days and at high concentrations.

Table 3. Performance statistics for MDA8 ozone by month and ozone season in the NorthEast NOAA climate region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
NorthEast	MAY	0	5893	-7.23	8.58	-15.99	18.97
NorthEast	JUN	0	5689	-2.6	6.46	-5.52	13.7
NorthEast	JUL	0	5882	3.2	6.55	6.74	13.78
NorthEast	AUG	0	5921	3.7	6.29	8.66	14.73
NorthEast	SEP	0	5751	1.6	5.08	4.12	13.11
NorthEast	Ozone Season	0	29136	-0.26	6.6	-0.58	14.91
NorthEast	MAY	60	655	-10.51	11.08	-15.01	15.83
NorthEast	JUN	60	831	-5.83	7.33	-8.93	11.23
NorthEast	JUL	60	957	-0.46	6.44	-0.68	9.63
NorthEast	AUG	60	391	-0.04	5.94	-0.06	9.11
NorthEast	SEP	60	344	-3.89	6.09	-5.82	9.12
NorthEast	Ozone Season	60	3178	-4.25	7.53	-6.36	11.26

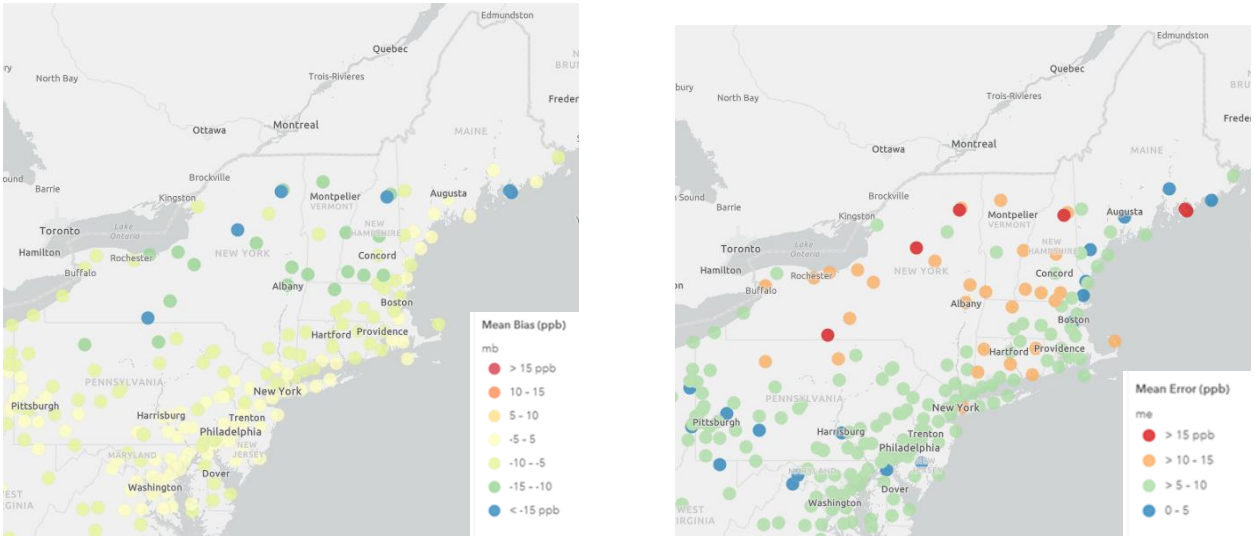

Figure 19. Mean Bias (ppb) [left] and Mean Error (ppb) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Northeast region.

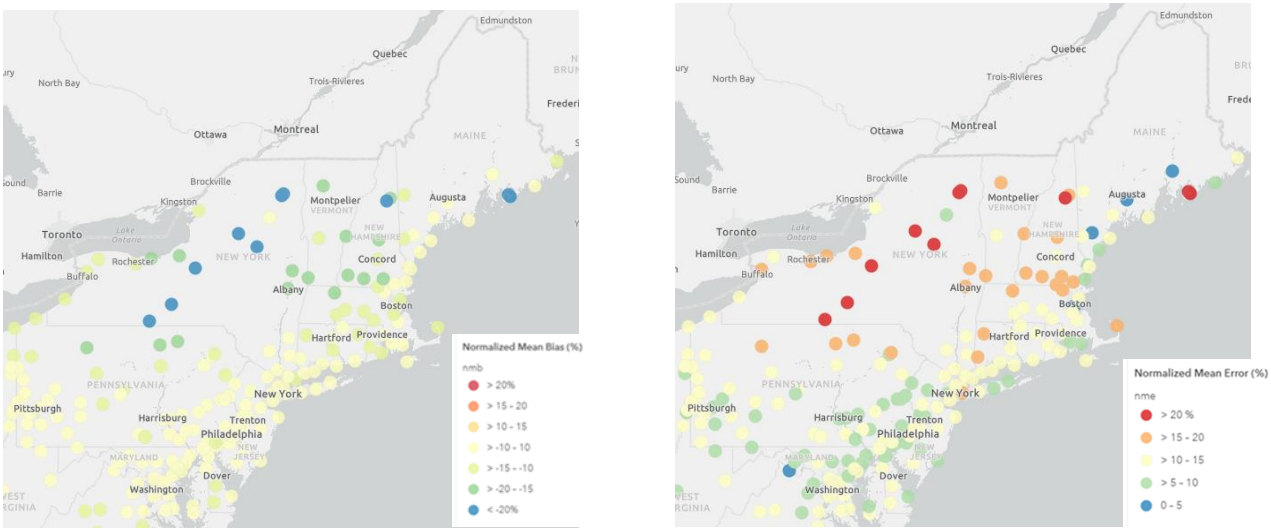

Figure 20.Normalized Mean Bias (%) [left] and Normalized Mean Bias (%) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Northeast region.

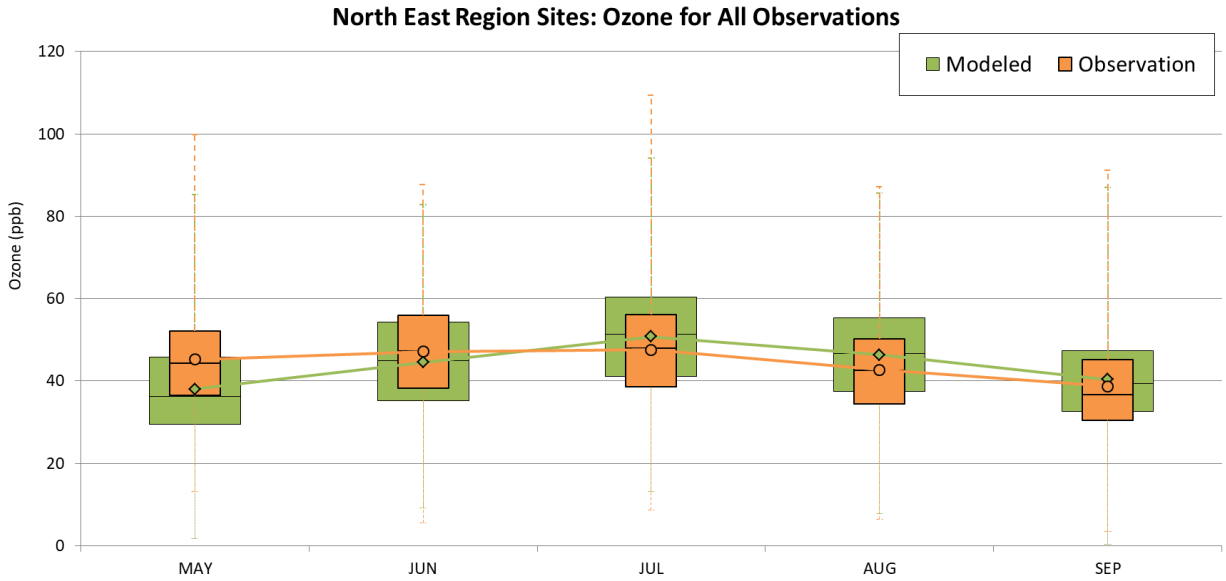

Figure 21. Boxplot comparisons of model predictions and AFS MDA8 observations for Northeast Region for May - September, 2016.

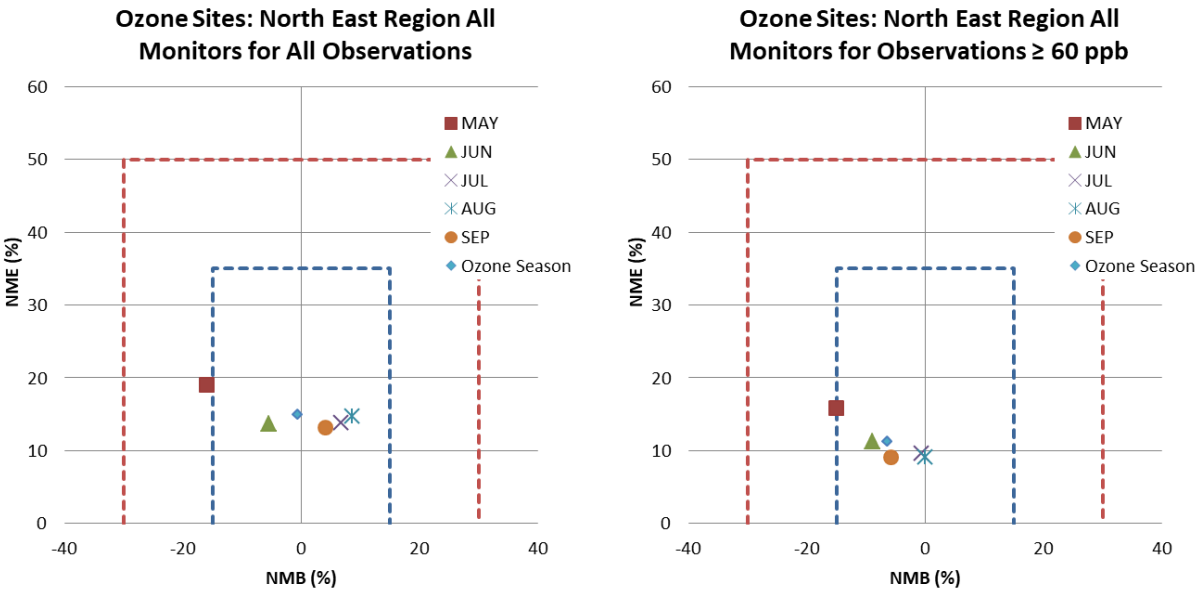

Figure 22. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for Northeast Region for months May – September and ozone season, 2016.

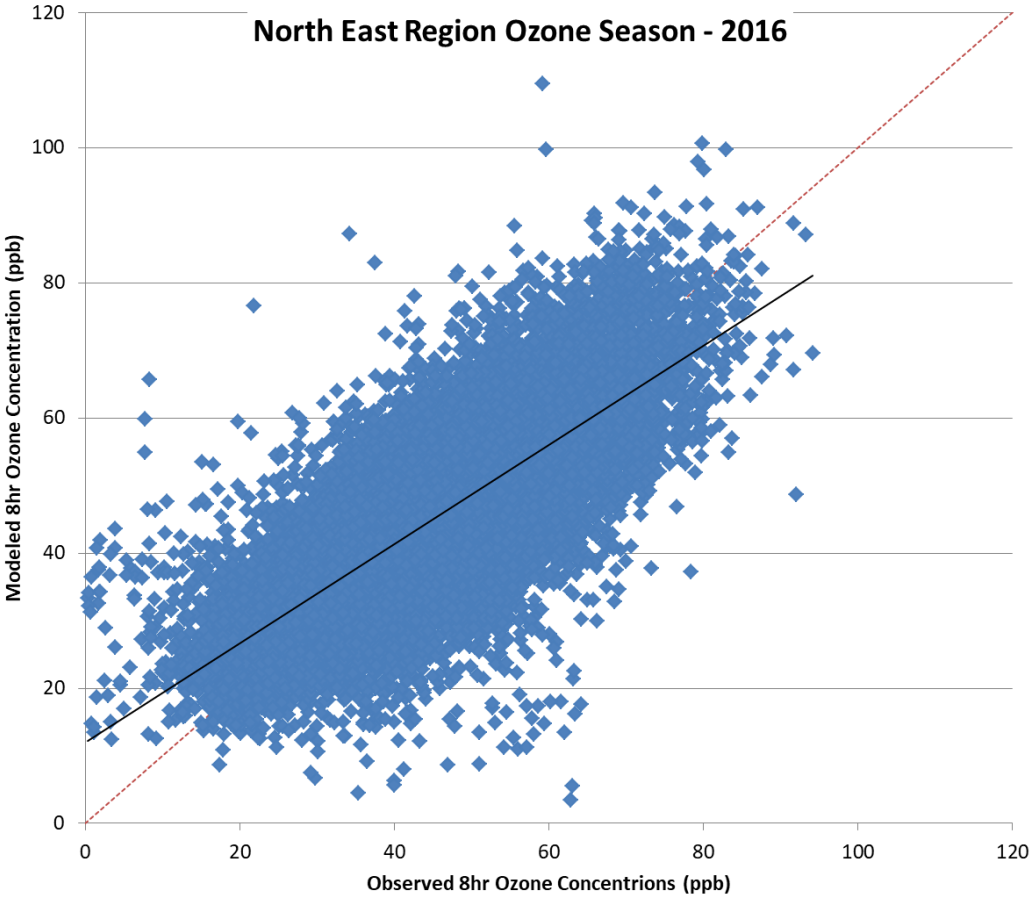

Figure 23. Scatter plot of MDA8 for May – September 2016 for Northeast AFS sites.

NorthWest Region

The NorthWest region is comprised of Alaska, Idaho, Oregon, and Washington. Note that statistics in this document do not include observations or predictions from Alaska.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in the Northwest U.S. is within 6 ppb. The total number of observations for high ozone days (≥ 60 ppb) is exceptionally small to make the statistics valuable. The model tends to under predict ozone at high concentrations across all months of the ozone season in this region. Normalized mean error is greater than 15% for both all observation days (> 0 ppb) and for days ≥ 60 ppb. Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figures 24 and 25. Higher mean and normalized mean error is shown in areas of high elevation in the region with noted under prediction in these same regions. Overall performance is best across all observed days in July, August, and September and generally poor across all months at high concentrations.

Table 4. Performance statistics for MDA8 ozone by month and ozone season in the NorthWest NOAA climate region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
NorthWest	MAY	0	846	-6.06	7.85	-14.8	19.16
NorthWest	JUN	0	835	-4.07	7.33	-10.17	18.29
NorthWest	JUL	0	849	-0.25	5.29	-0.7	15.08
NorthWest	AUG	0	834	1.17	6.07	2.96	15.32
NorthWest	SEP	0	807	1.98	5.55	6.25	17.54
NorthWest	Ozone Season	0	4171	-1.48	6.42	-3.94	17.12
NorthWest	MAY	60	6	-15.35	15.35	-24.96	24.96
NorthWest	JUN	60	27	-11.12	13.39	-16.95	20.43
NorthWest	JUL	60	6	-10.33	10.33	-16.13	16.13
NorthWest	AUG	60	47	-7.18	10.07	-11.03	15.45
NorthWest	SEP	60	2	-22.20	22.20	-35.55	35.55
NorthWest	Ozone Season	60	88	-9.50	11.74	-14.64	18.09

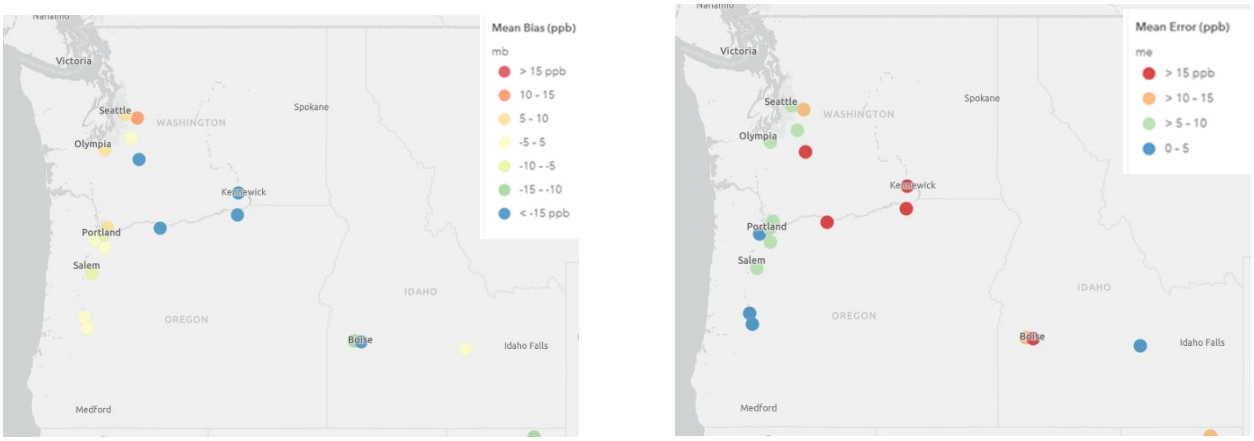

Figure 24. Mean Bias (ppb) [left] and Mean Error (ppb) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Northwest region.

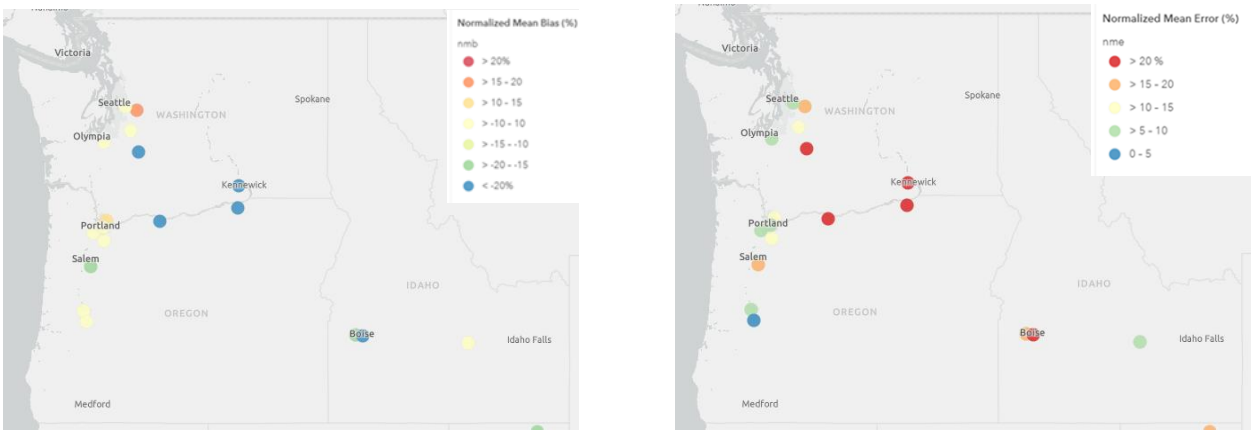

Figure 25. Normalized Mean Bias (%) [left] and Normalized Mean Error (%) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Northwest region.

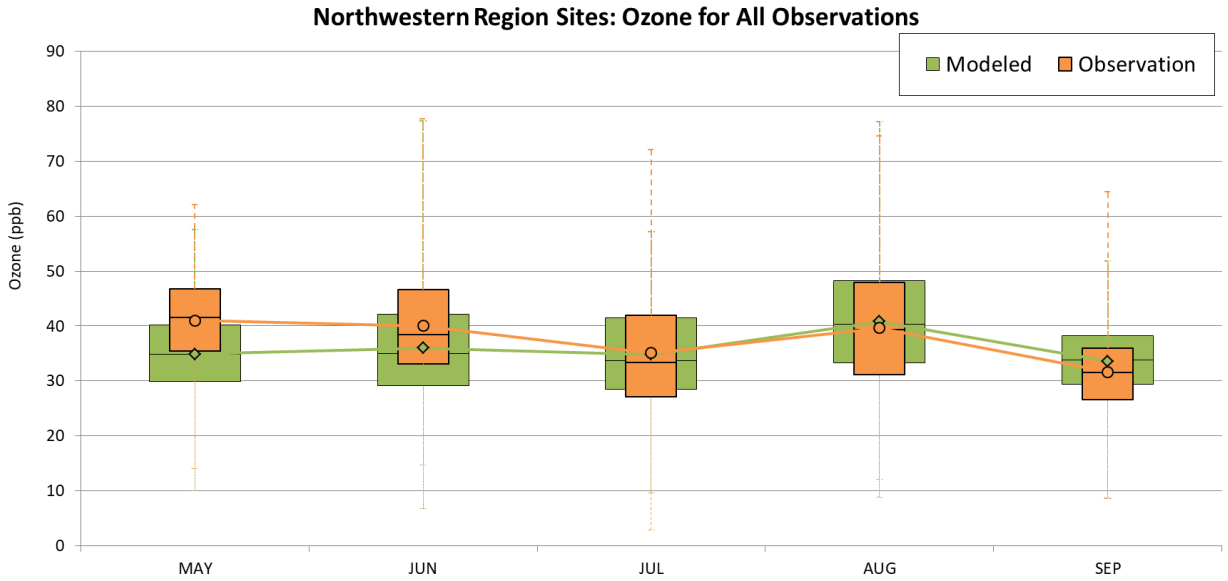

Figure 26. Boxplot comparisons of model predictions and AFS MDA8 observations for Northwest Region for May - September, 2016.

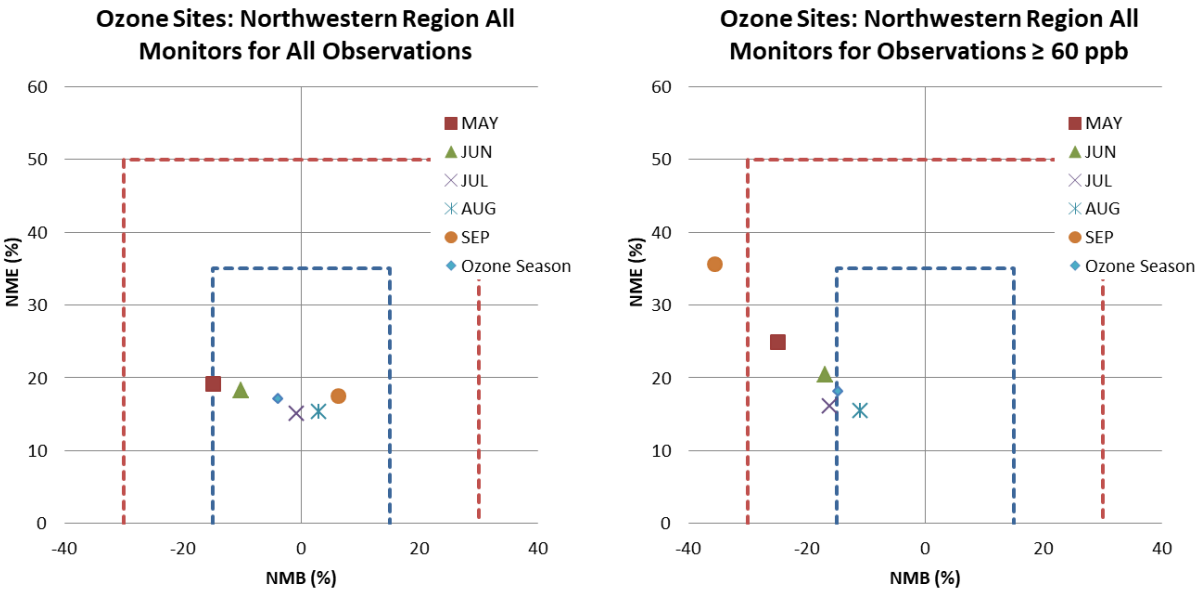

Figure 27. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for Northwest Region for months May – September and ozone season, 2016.

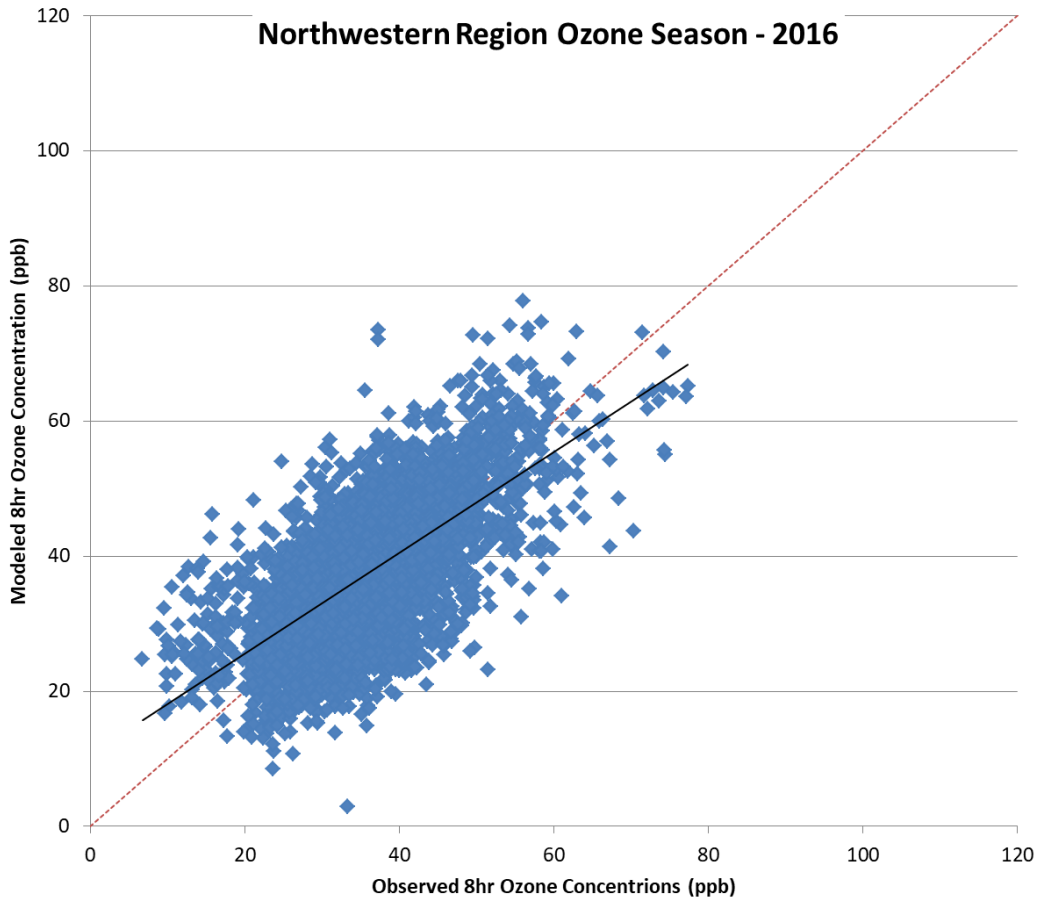

Figure 28. Scatter plot of MDA8 for May – September 2016 for Northwestern AFS sites.

South Region

The South region is comprised of Arkansas, Kansas, Louisiana, Mississippi, Oklahoma, and Texas.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in the South region is within 3 ppb for all observed ozone days. High ozone days (≥ 60 ppb) show greater negative bias (-11.3 ppb in Aug to -4.59 in Jun) across all months of the ozone season. As in other regions, the model tends to under predict ozone at high concentrations across all months of the ozone season. Normalized mean error is within ~15%, except for all observation days (> 0 ppb) in July (~17%) and August (~19%) and in Jul (15.4%) and August (20.6%) for days ≥ 60 ppb. Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figures 29 and 30. Higher mean and normalized mean error is scattered across the region with highest values along the Gulf Coast and international border with Mexico. Overall performance is good across all months for all observed days and best during June and September at high concentrations.

Table 5. Performance statistics for MDA8 ozone by month and ozone season in the South NOAA climate region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
South	MAY	0	4469	-2.17	6.72	-4.87	15.03
South	JUN	0	4385	0.66	6.49	1.55	15.26
South	JUL	0	4457	2.01	6.32	5.45	17.12
South	AUG	0	4511	1.06	6.83	2.94	19.01
South	SEP	0	4417	1.97	5.49	4.96	13.85
South	Ozone Season	0	22239	0.7	6.37	1.76	15.96
South	MAY	60	297	-9.00	9.36	-13.96	14.52
South	JUN	60	389	-4.59	6.99	-7.01	10.66
South	JUL	60	114	-6.21	10.04	-9.56	15.47
South	AUG	60	62	-11.31	13.50	-17.26	20.61
South	SEP	60	150	-4.69	7.13	-7.28	11.08
South	Ozone Season	60	1012	-6.49	8.45	-9.99	13.00

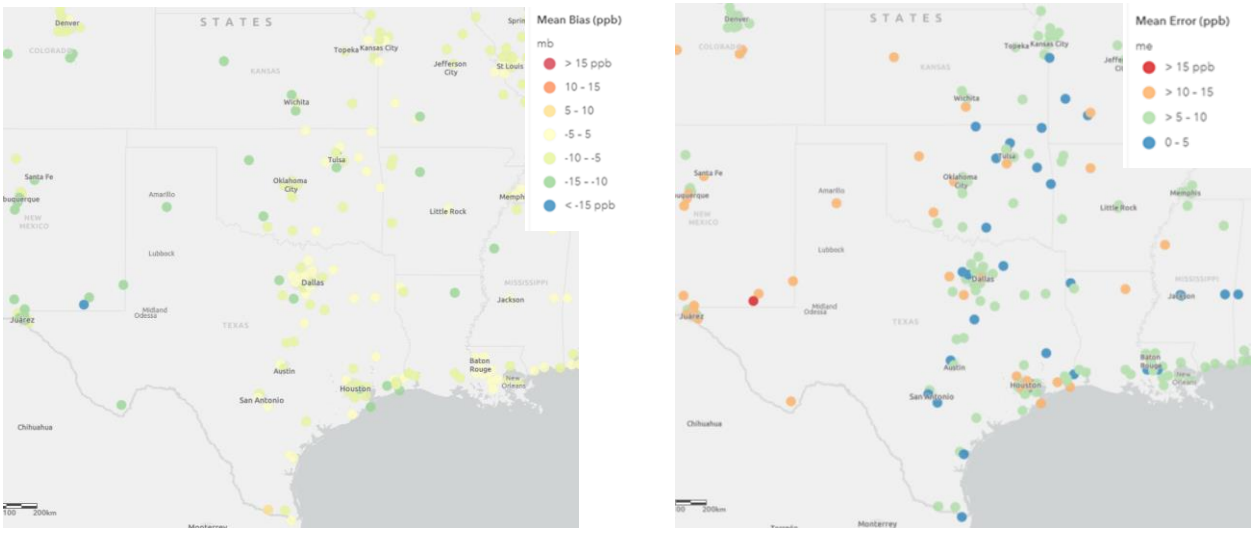

Figure 29. Mean Bias (ppb) [left] and Mean Error (ppb) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in South region.

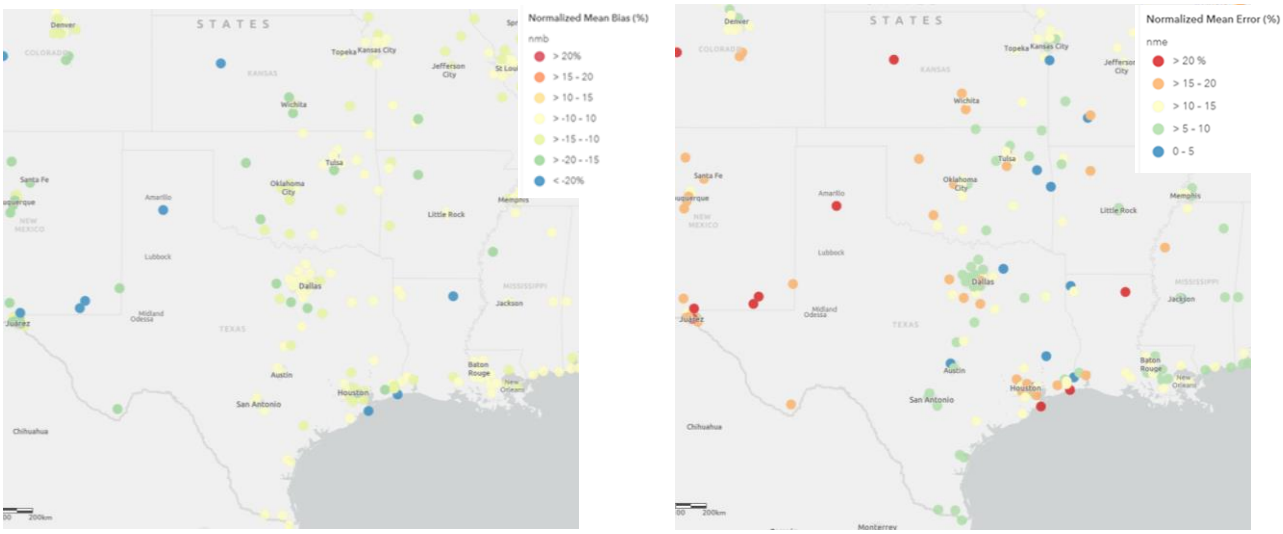

Figure 30. Normalized Mean Bias (%) [left] and Normalized Mean Error (%) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in South region.

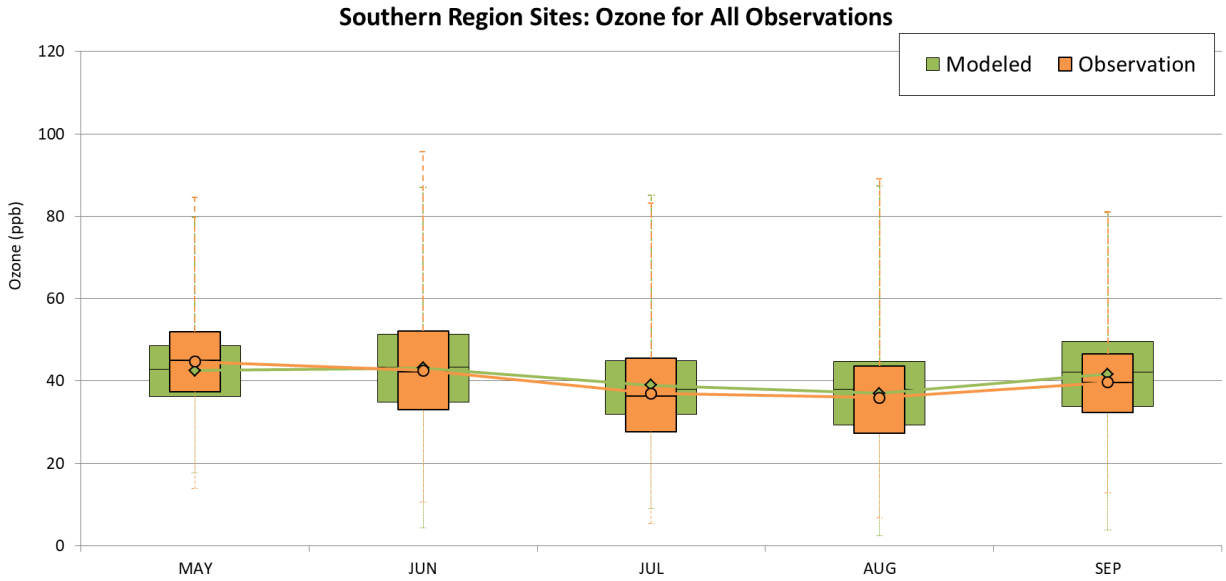

Figure 31. Boxplot comparisons of model predictions and AFS MDA8 observations for South Region for May - September, 2016.

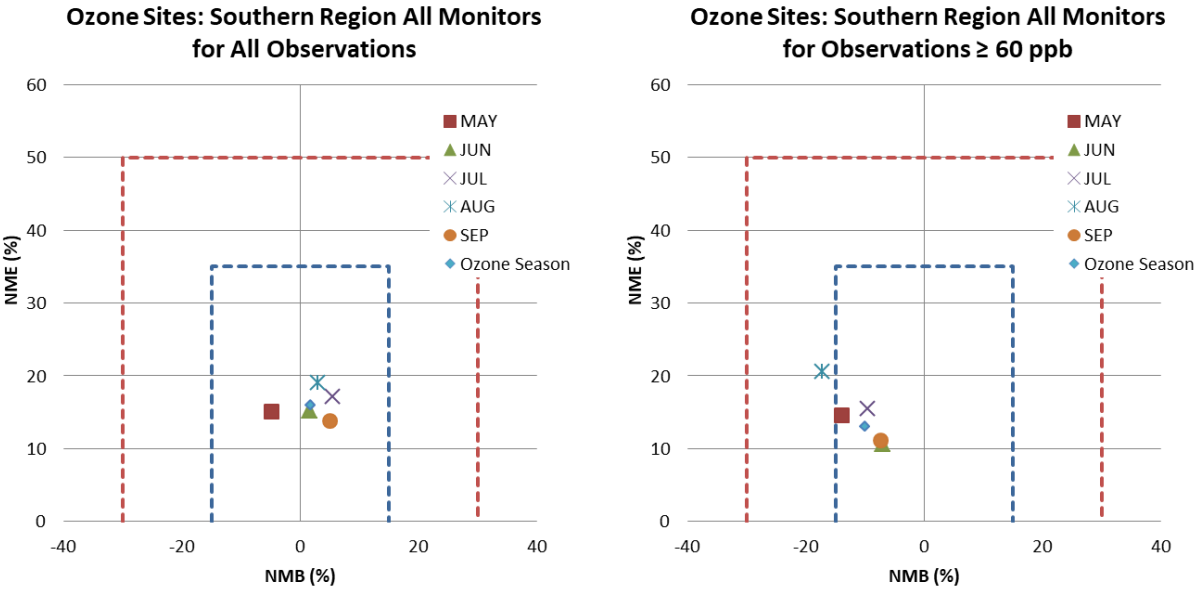

Figure 32. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for South Region for months May – September and ozone season, 2016.

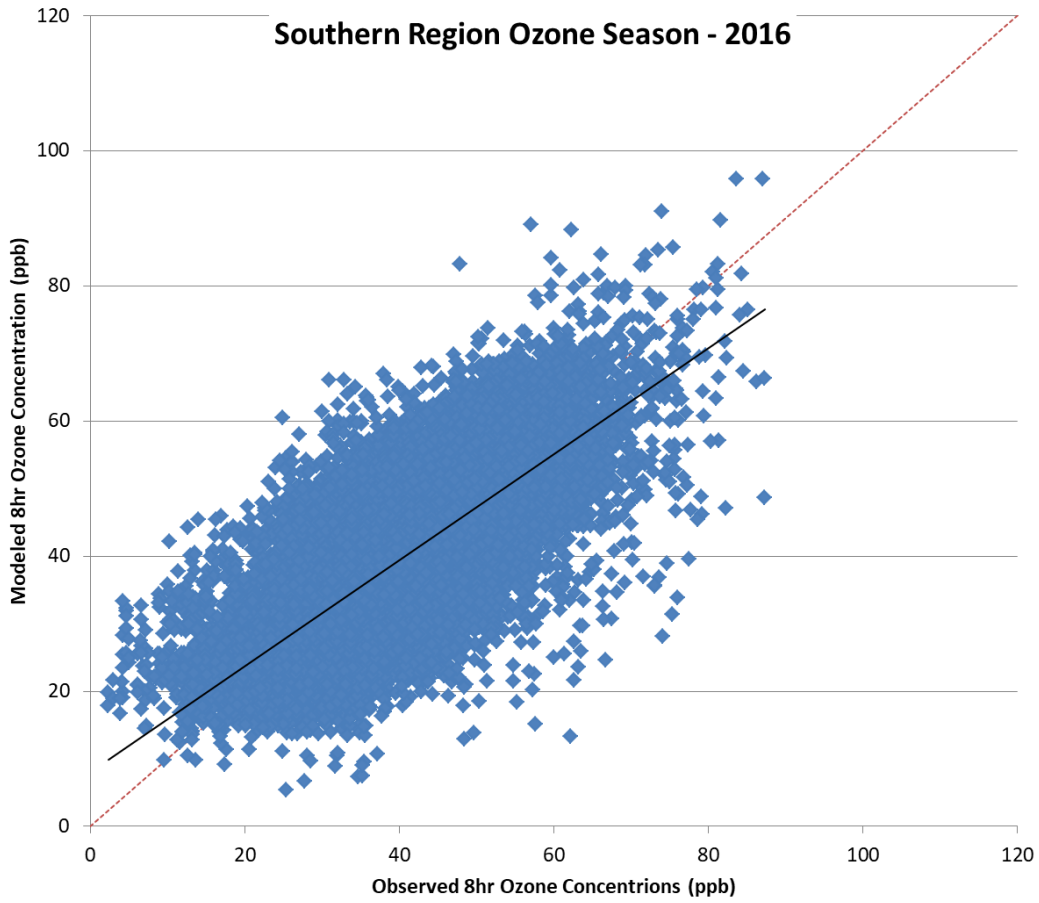

Figure 33. Scatter plot of MDA8 for May – September 2016 for Southern AFS sites.

SouthEast Region

The SouthEast region is comprised of Alabama, Florida, Georgia, North Carolina, South Carolina, and Virginia.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in the SouthEast U.S. is within 5 ppb, except for high ozone days (≥ 60 ppb) in May (-7.75 ppb). The model tends to slightly under predict ozone at high concentrations across all months of the ozone season in this region. Normalized mean error is within ~15% in all months for high ozone concentration days, and for all but July (16%) and August (17%) for all observation days (> 0 ppb). Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figures 34 and 35. Higher mean and normalized mean error is shown in Florida and areas along the coastal waters. Overall performance is best across all observed days in May, June, and September and during July, August, and September at high concentrations.

Table 6. Performance statistics for MDA8 ozone by month and ozone season in the SouthEast NOAA climate region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
SouthEast	MAY	0	5630	-2.82	5.66	-6.02	12.1
SouthEast	JUN	0	5427	-0.09	5.35	-0.19	11.93
SouthEast	JUL	0	5650	3.86	6.43	10.02	16.69
SouthEast	AUG	0	5694	2.45	6.07	7.07	17.53
SouthEast	SEP	0	5478	2.25	6.06	5.76	15.54
SouthEast	Ozone Season	0	27879	1.14	5.92	2.79	14.53
SouthEast	MAY	60	567	-7.75	8.33	-11.93	12.84
SouthEast	JUN	60	516	-2.90	6.11	-4.43	9.32
SouthEast	JUL	60	160	-0.28	6.46	-0.44	9.98
SouthEast	AUG	60	85	-0.25	6.95	-0.39	10.86
SouthEast	SEP	60	180	-2.36	5.38	-3.69	8.40
SouthEast	Ozone Season	60	1508	-4.23	6.94	-6.51	10.69

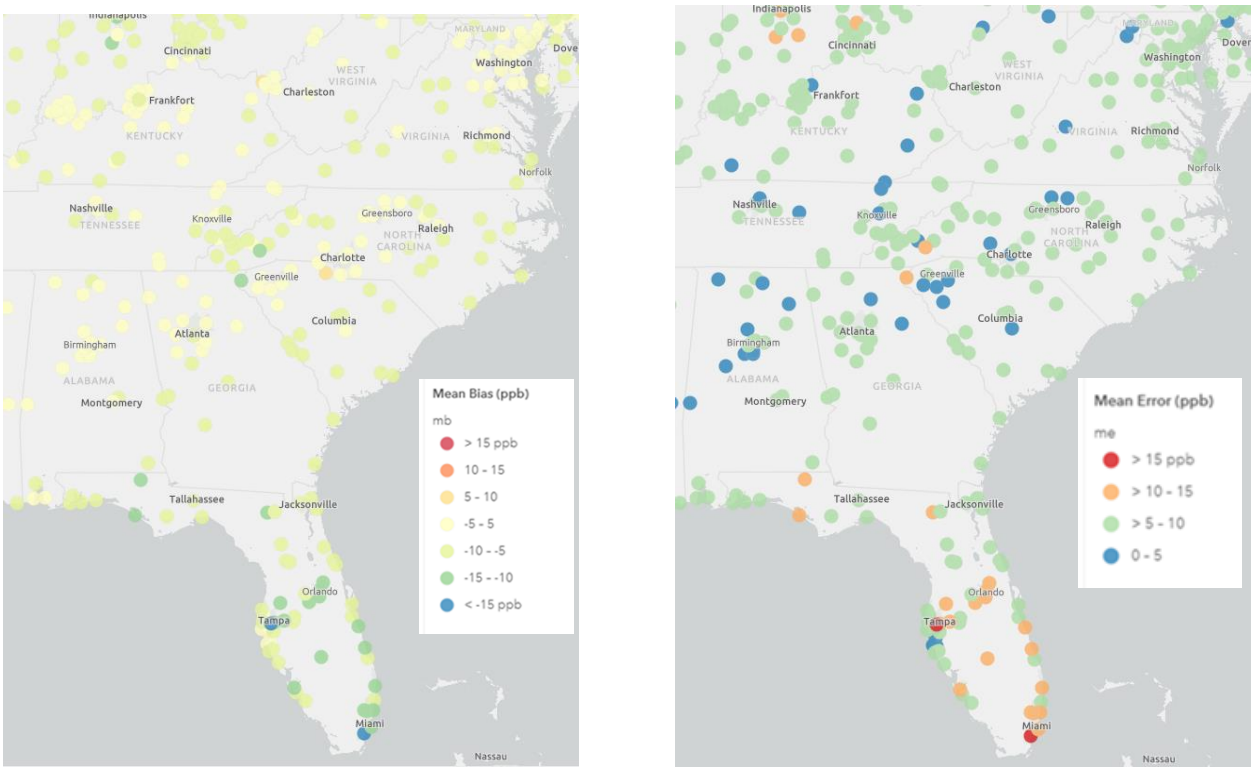

Figure 34. Mean Bias (ppb) [left] and Mean Error (ppb) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Southeast region.

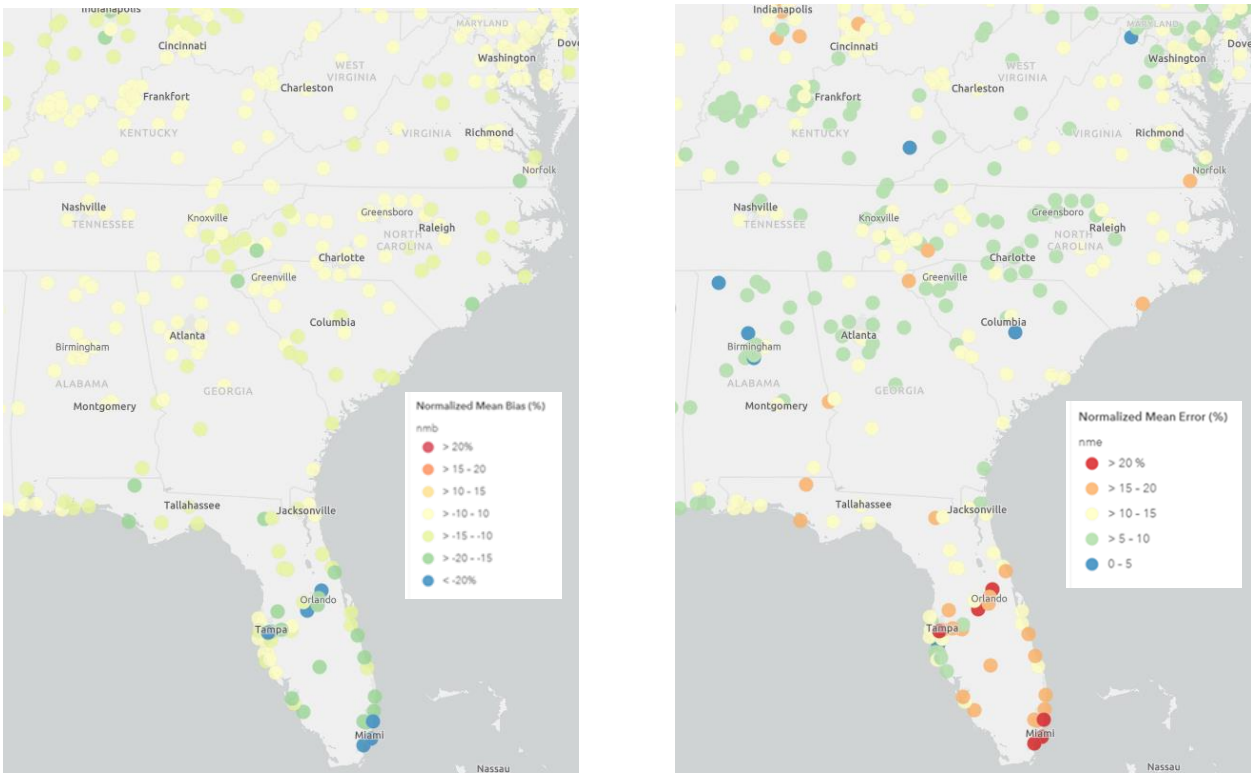

Figure 35. Normalized Mean Bias (%) [left] and Normalized Mean Error (%) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Southeast region.

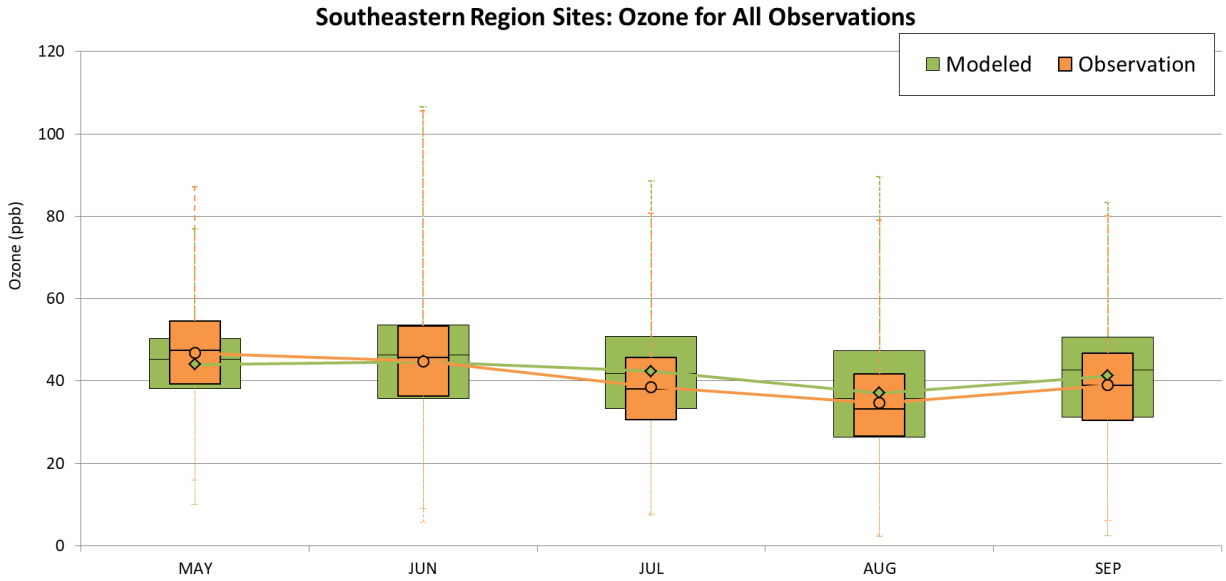

Figure 36. Boxplot comparisons of model predictions and AFS MDA8 observations for Southeastern Region for May - September, 2016.

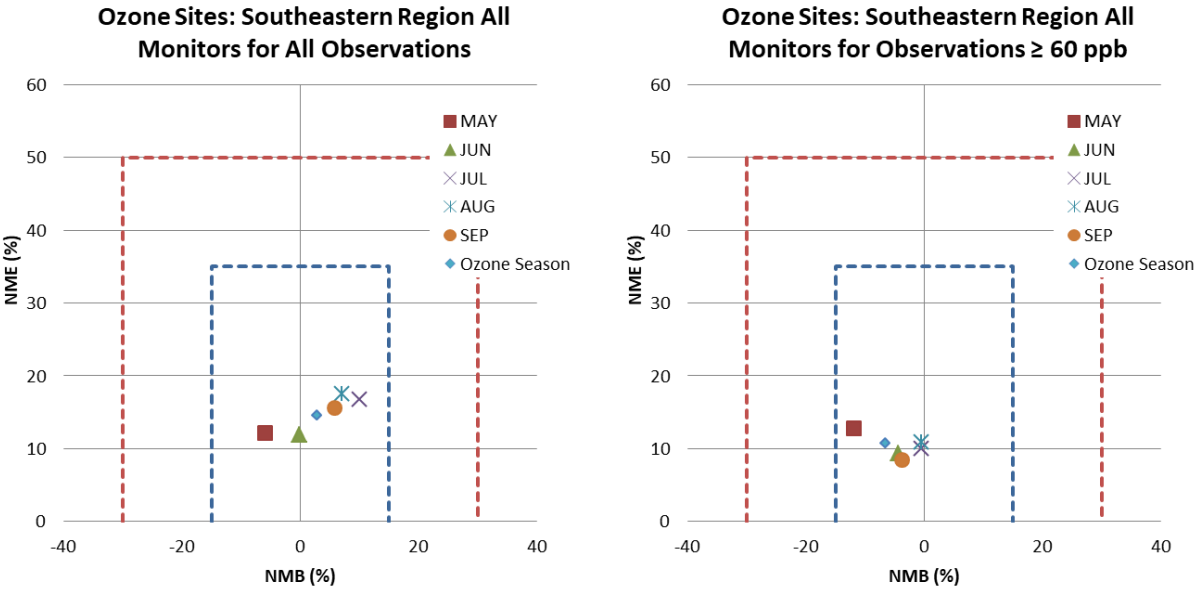

Figure 37. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for Southeastern Region for months May – September and ozone season, 2016.

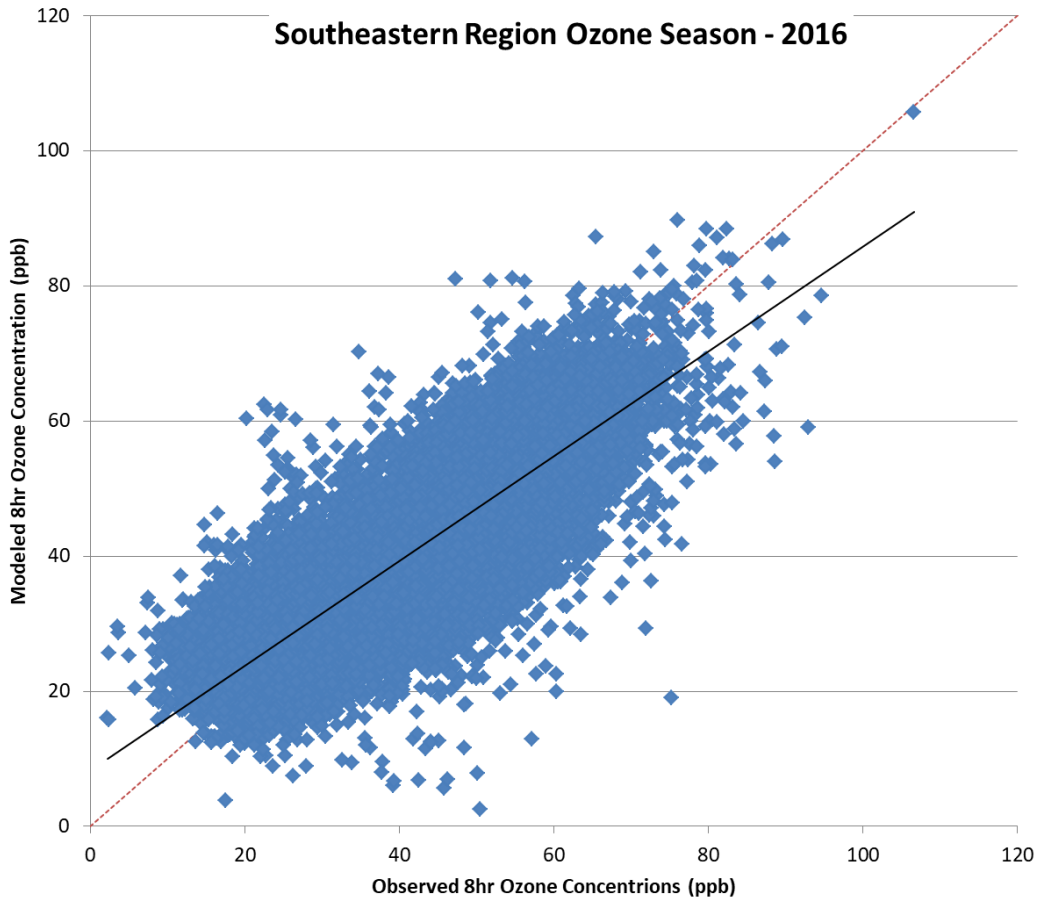

Figure 38. Scatter plot of MDA8 for May – September 2016 for Southeastern AFS sites.

SouthWest Region

The SouthWest region is comprised of Arizona, Colorado, New Mexico, and Utah.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in the South West region is within 5 ppb across all ozone days except in May (-8.24 ppb). For high ozone days (≥ 60 ppb) mean bias is with 10 ppb except in May (-11.5 ppb). The model tends to under predict ozone at all concentrations across most months of the ozone season in this region. Normalized mean error is within ~15%, except for all observation days (> 0 ppb) in May (~16%) and in May (~18%) and July (~16%) for days ≥ 60 ppb. Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figures 39 and 40. Higher mean and normalized mean error is shown in areas around the Uinta Basin and in the southern latitudes of the region in proximity to the international border with Mexico. There is noted under prediction from the model across the entire region. Overall performance is best across all observed days in June and September and during June and August at high concentrations.

Table 7. Performance statistics for MDA8 ozone by month and ozone season in the SouthWest NOAA climate region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
SouthWest	MAY	0	4034	-8.24	8.95	-15.07	16.37
SouthWest	JUN	0	3956	-2.53	6	-4.61	10.9
SouthWest	JUL	0	4126	-4.62	7.03	-8.56	13.02
SouthWest	AUG	0	4146	-3.9	6.62	-7.42	12.59
SouthWest	SEP	0	4038	0.74	5.02	1.69	11.56
SouthWest	Ozone Season	0	20300	-3.72	6.73	-7.16	12.95
SouthWest	MAY	60	970	-11.51	11.75	-17.98	18.35
SouthWest	JUN	60	951	-5.70	7.76	-8.71	11.86
SouthWest	JUL	60	912	-10.00	10.67	-15.36	16.39
SouthWest	AUG	60	607	-7.21	8.61	-11.18	13.36
SouthWest	SEP	60	33	-8.81	8.94	-14.05	14.25
SouthWest	Ozone Season	60	3473	-8.75	9.80	-13.50	15.13

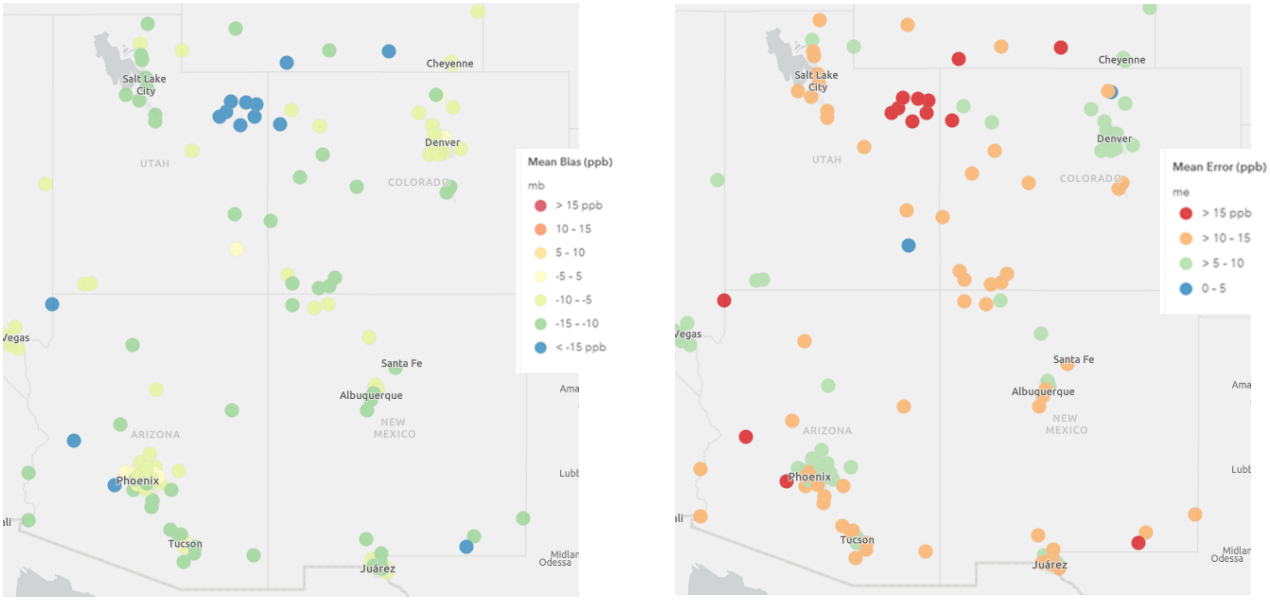

Figure 39. Mean Bias (ppb) [left] and Mean Error (ppb) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Southwest region.

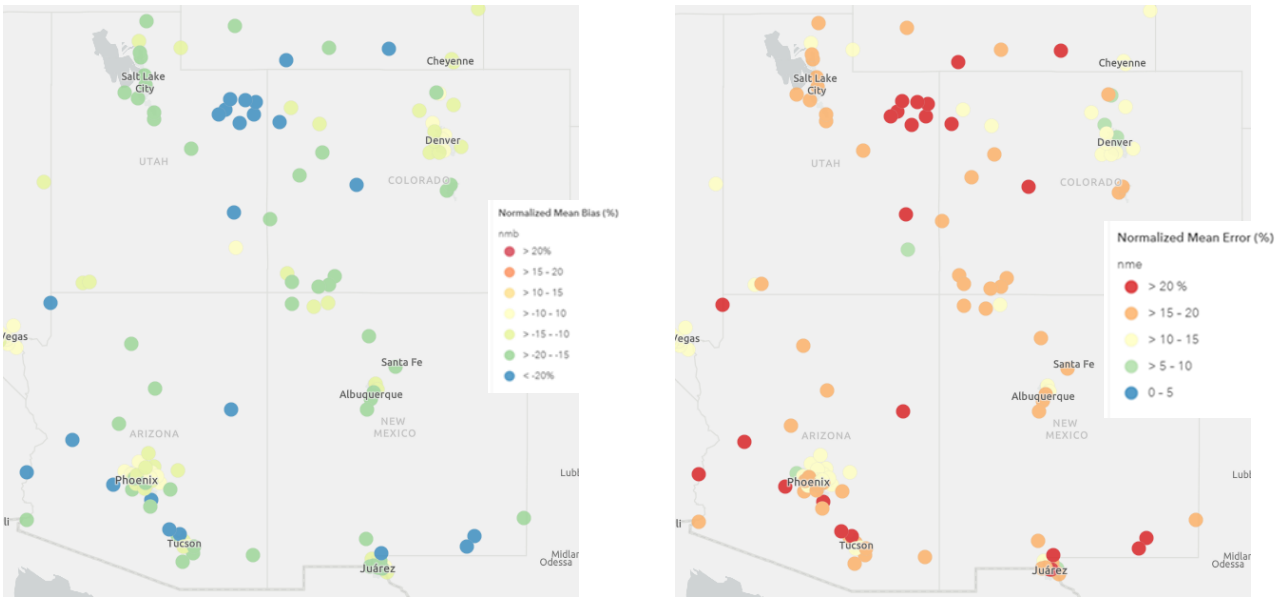

Figure 40. Normalized Mean Bias (%) [left] and Normalized Mean Error (%) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Southwest region.

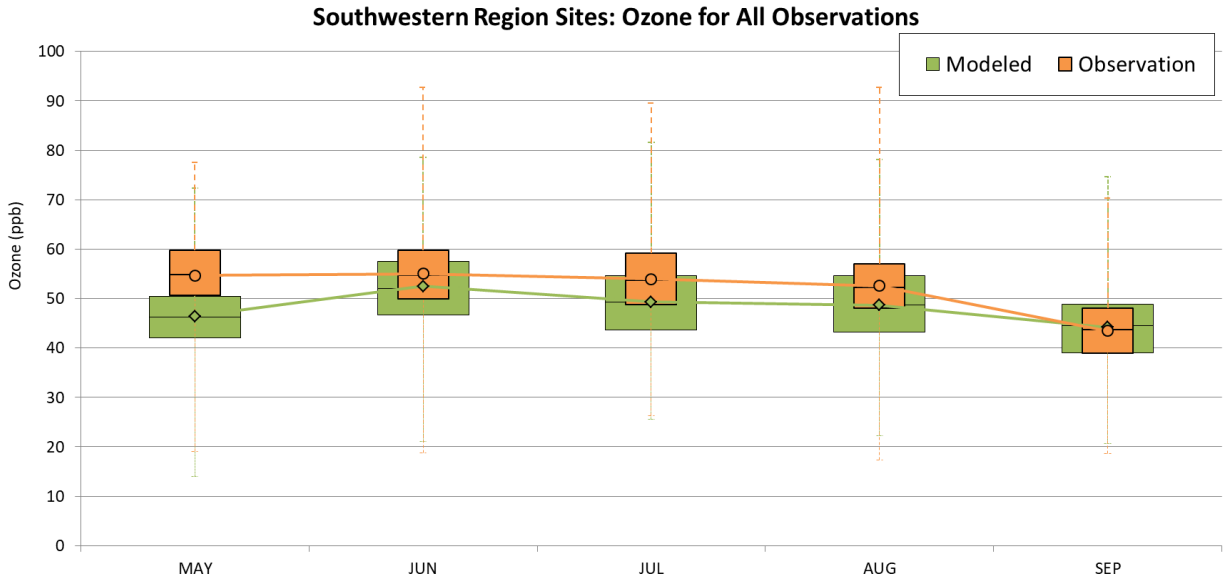

Figure 41. Boxplot comparisons of model predictions and AFS MDA8 observations for Southwestern Region for May - September, 2016.

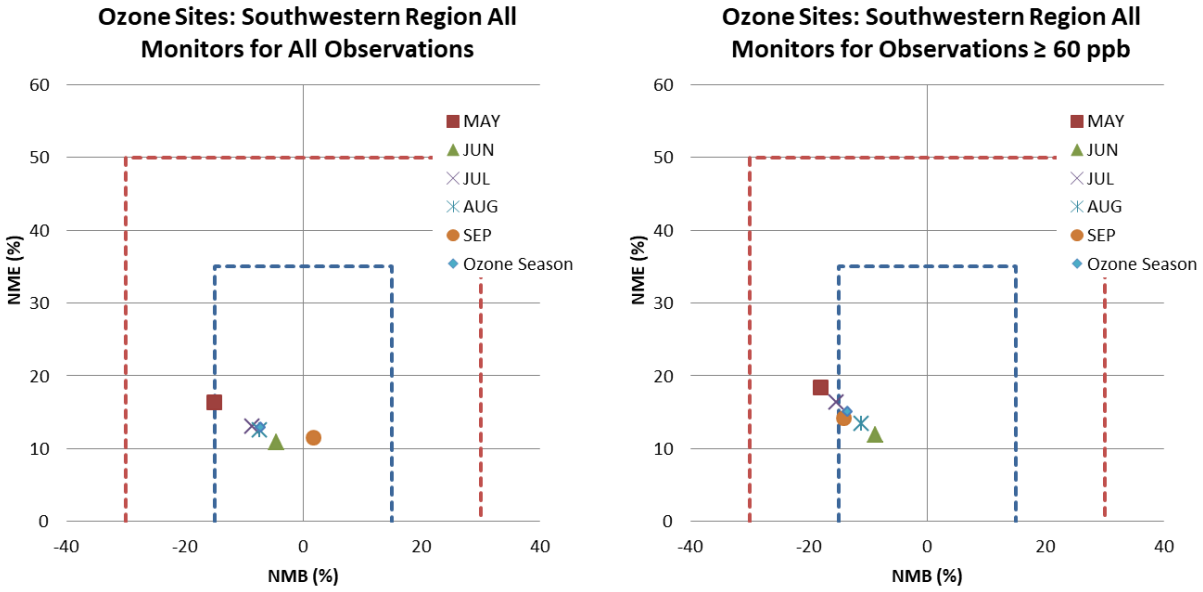

Figure 42. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for Southwestern Region for months May – September and ozone season, 2016.

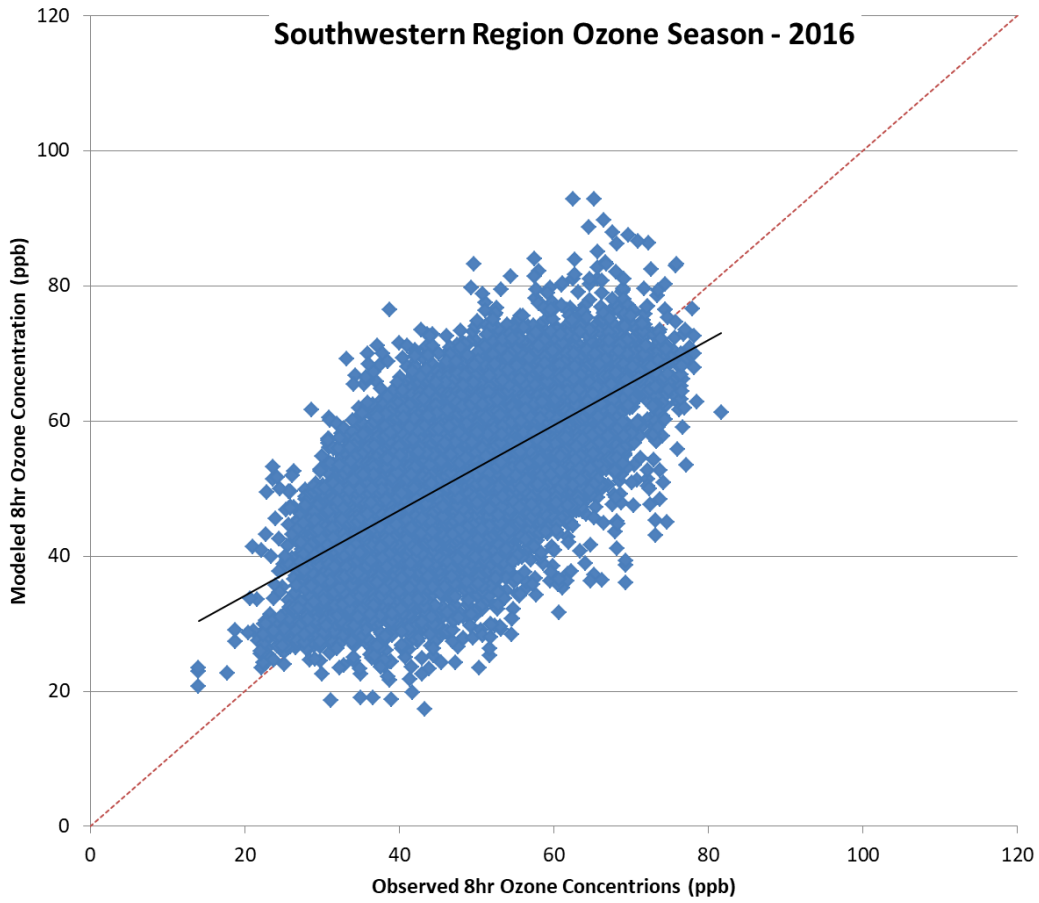

Figure 43. Scatter plot of MDA8 for May – September 2016 for Southwestern AFS sites.

West Region

The West region is comprised of California, Hawaii and Nevada. Note that statistics in this document do not include observations or predictions from Hawaii.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in the Central U.S. is within 5 ppb, except for May during all ozone days (> 0 ppb). On high ozone days (≥ 60 ppb) no month has a mean bias of greater than -11 ppb with most months at ~-12 ppb. The model significantly under predicts ozone at high concentrations across all months of the ozone season in this region. Normalized mean error is within ~15% only in September for all observation days (> 0 ppb) and less than 20% in all other months for both all and high observation days. Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figure 44 and 45. High mean and normalized mean error is shown across most of California with the exception of regions around San Francisco. Overall performance is best across all observed days in September and typically outside of NMB goals during all months at high concentrations.

Table 8. Performance statistics for MDA8 ozone by month and ozone season in the West NOAA climate region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
West	MAY	0	6242	-6.07	7.46	-12.85	15.8
West	JUN	0	6057	-4.84	8.53	-9.05	15.96
West	JUL	0	6305	-4.91	8.24	-9.23	15.5
West	AUG	0	6329	-4.11	8.4	-7.63	15.61
West	SEP	0	6047	-3.23	6.88	-6.6	14.06
West	Ozone Season	0	30980	-4.64	7.91	-9.03	15.4
West	MAY	60	863	-12.64	12.66	-19.34	19.37
West	JUN	60	1987	-11.10	11.93	-15.56	16.72
West	JUL	60	2340	-12.39	12.90	-17.24	17.95
West	AUG	60	2360	-12.21	12.94	-17.17	18.19
West	SEP	60	1189	-12.32	12.86	-18.00	18.79
West	Ozone Season	60	8739	-12.06	12.66	-17.13	17.98

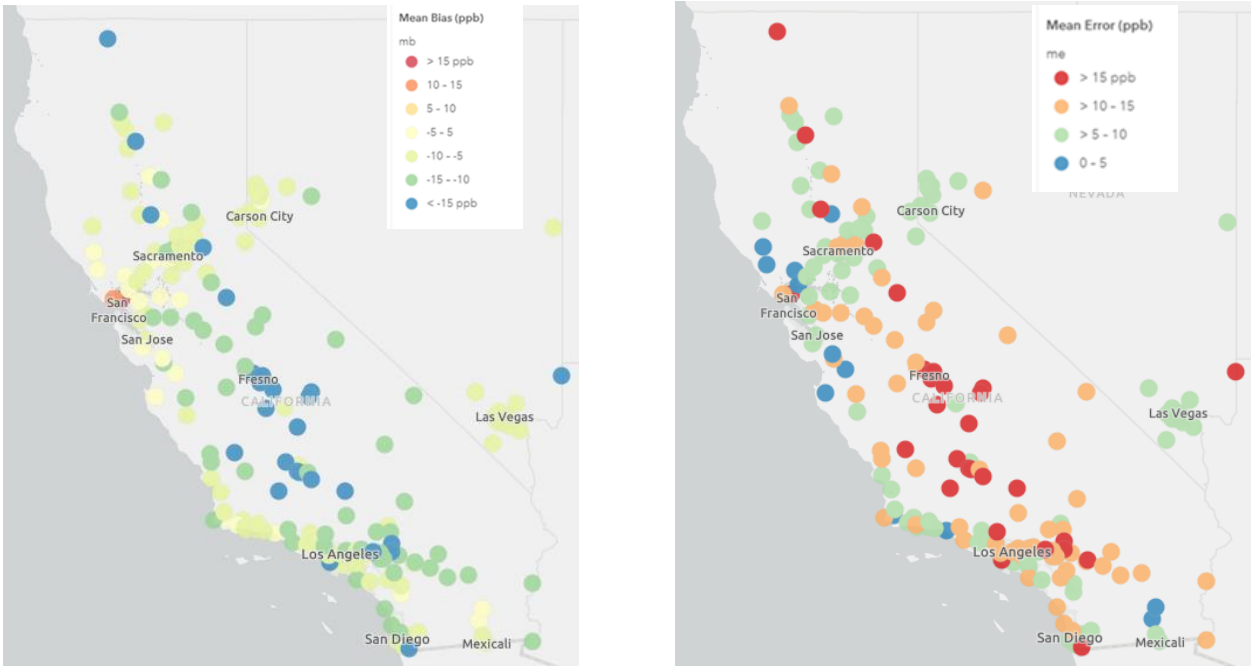

Figure 44. Mean Bias (ppb) [left] and Mean Error (ppb) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in West region.

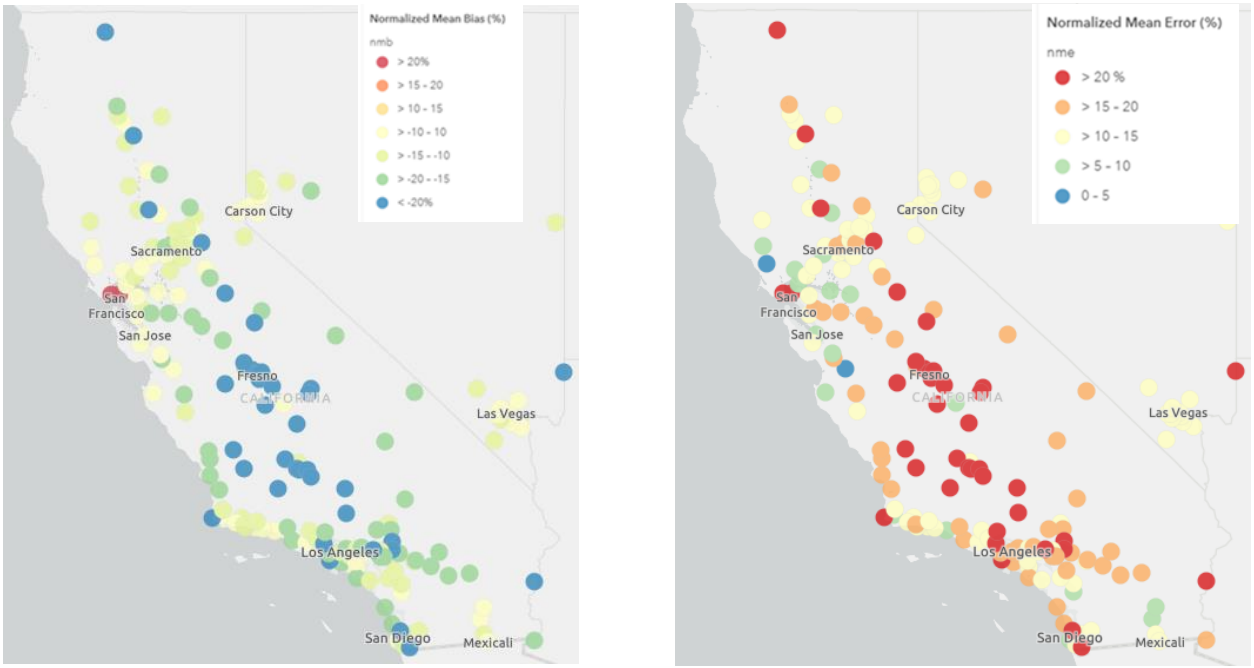

Figure 45. Normalized Mean Bias (%) [left] and Normalized Mean Error (%) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in West region.

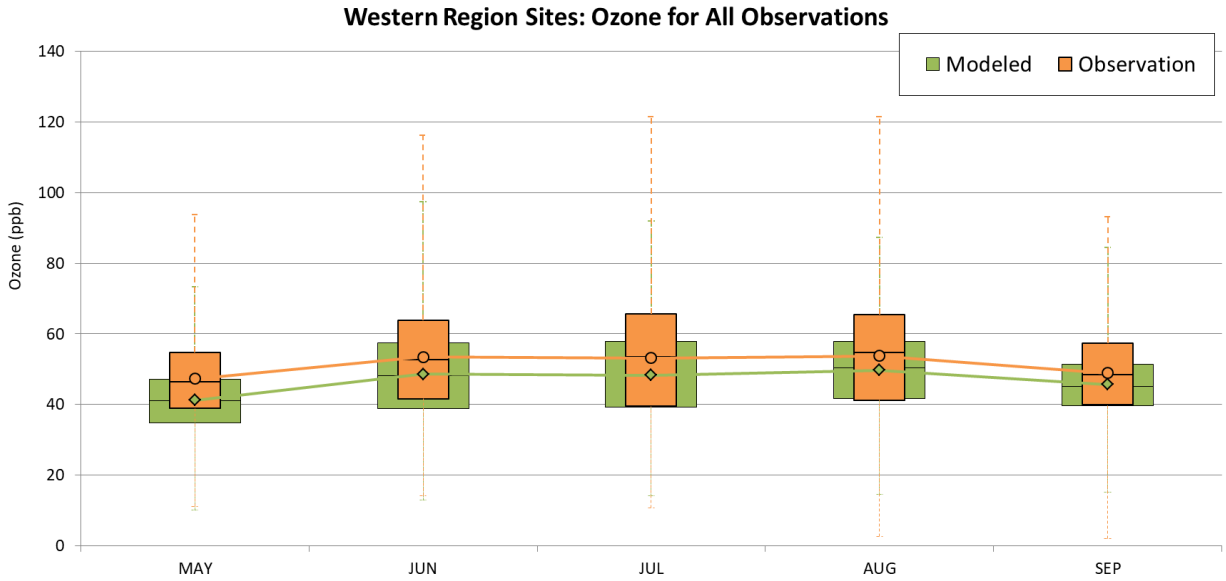

Figure 46. Boxplot comparisons of model predictions and AFS MDA8 observations for West Region for May - September, 2016.

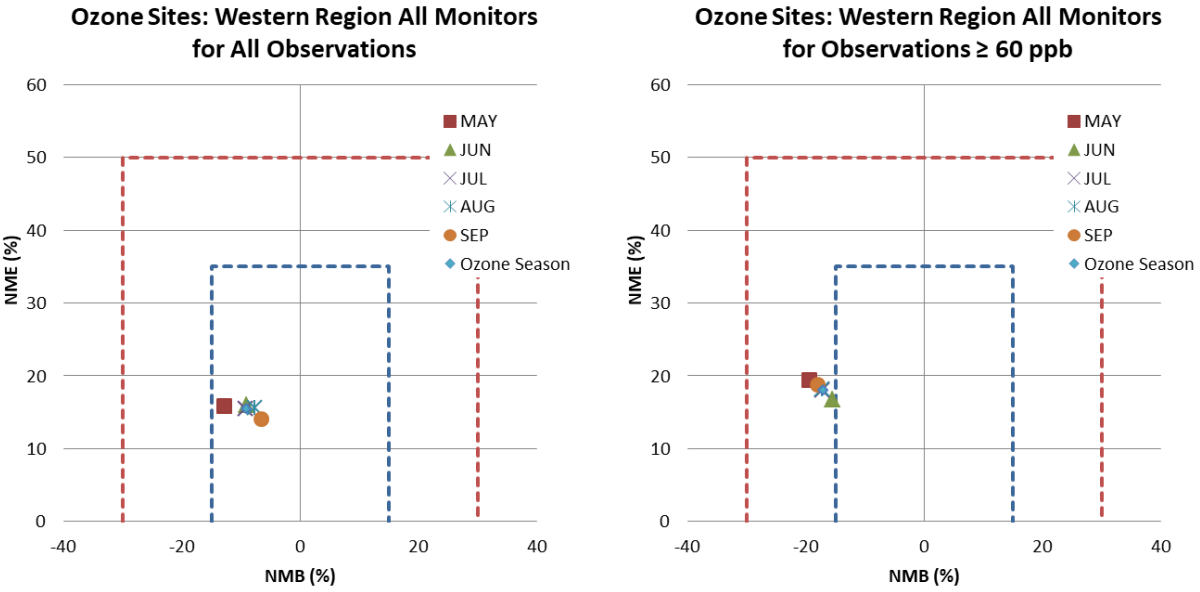

Figure 47. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for Western Region for months May – September and ozone season, 2016.

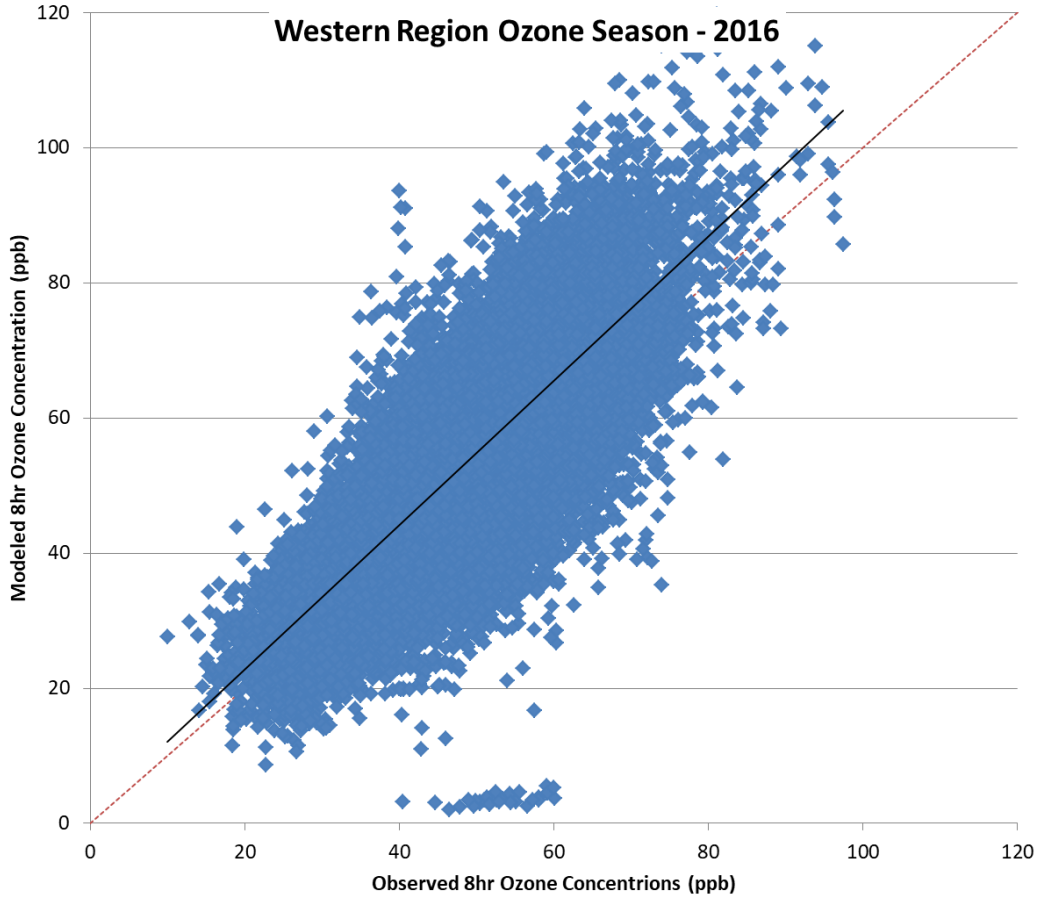

Figure 48. Scatter plot of MDA8 for May – September 2016 for Western AFS sites.

WestNorthCentral Region

The WestNorthCentral region is comprised of Montana, North Dakota, Nebraska, South Dakota, and Wyoming.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in the WestNorthCentral U.S. is within 6 ppb, except for May (-9.32 ppb) on all observed days. Due to limited high ozone days (≥ 60 ppb) in the region during the season, mean bias ranges from -8.42 ppb August to -18.49 ppb in May. No high ozone observations were recorded in September in this region. The model tends to under predict ozone at all concentrations (all and high) across all months of the ozone season in this region. Normalized mean error is within ~15%, except for all observation days (> 0 ppb) in May (~21%) and in May (~30%) and July (~19%) for days ≥ 60 ppb. Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figures 49 and 50. Higher mean and normalized mean error is shown across most of the domain with under prediction noted across the entire region. Overall performance is best across all observed days in July, August, and September and typically outside of NMB goals during all months at high concentrations.

Table 9. Performance statistics for MDA8 ozone by month and ozone season in the WestNorthCentral NOAA climate region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
WestNorthCentral	MAY	0	1723	-9.32	9.93	-19.73	21.03
WestNorthCentral	JUN	0	1657	-5.22	6.74	-10.7	13.81
WestNorthCentral	JUL	0	1689	-2.97	5.27	-6.4	11.34
WestNorthCentral	AUG	0	1736	-2.58	4.79	-5.7	10.58
WestNorthCentral	SEP	0	1654	-0.59	3.8	-1.66	10.63
WestNorthCentral	Ozone Season	0	8459	-4.16	6.12	-9.3	13.68
WestNorthCentral	MAY	60	65	-18.49	18.49	-29.67	29.67
WestNorthCentral	JUN	60	78	-9.45	9.45	-14.85	14.86
WestNorthCentral	JUL	60	28	-11.80	11.80	-19.16	19.16
WestNorthCentral	AUG	60	63	-8.42	9.48	-13.46	15.15
WestNorthCentral	SEP	60	0	-	-	-	-
WestNorthCentral	Ozone Season	60	234	-11.96	12.25	-19.07	19.53

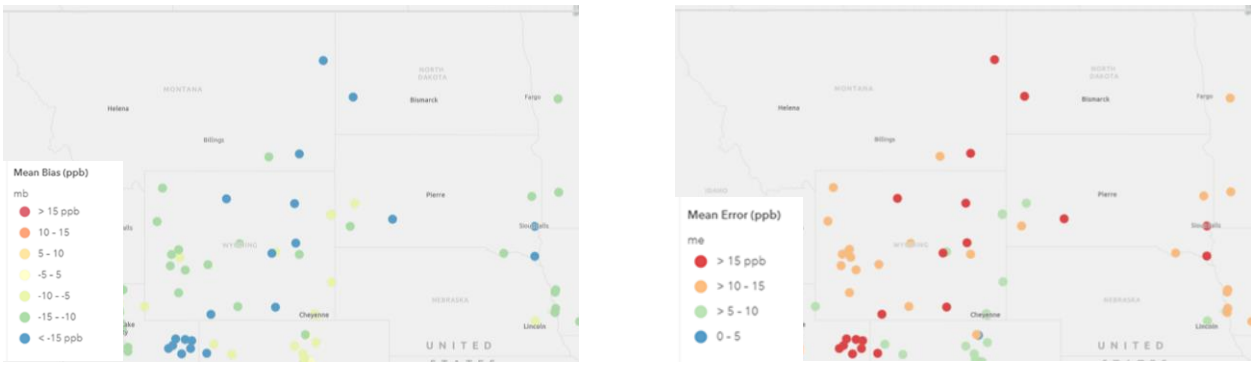

Figure 49. Mean Bias (ppb) [left] and Mean Error (ppb) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in West-North-Central region.

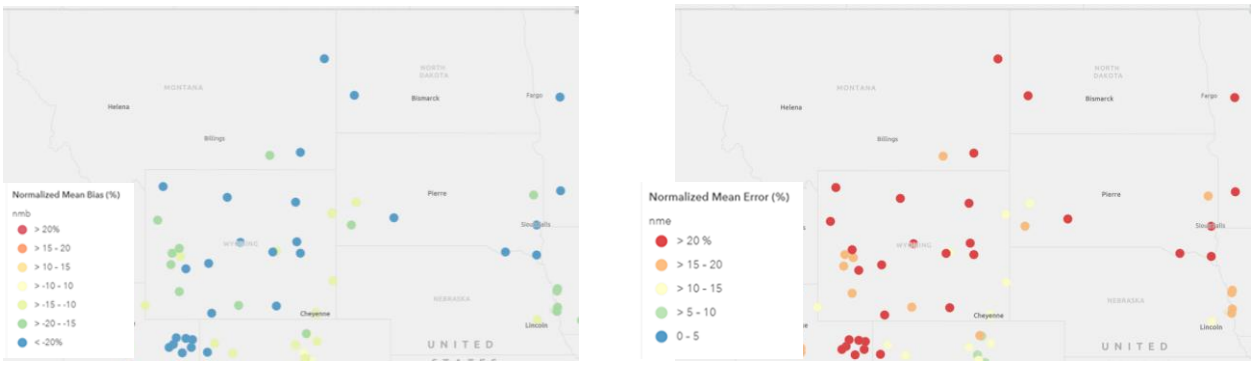

Figure 50. Normalized Mean Bias (%) [left] and Normalized Mean Error (%) [right] of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in West-North-Central region.

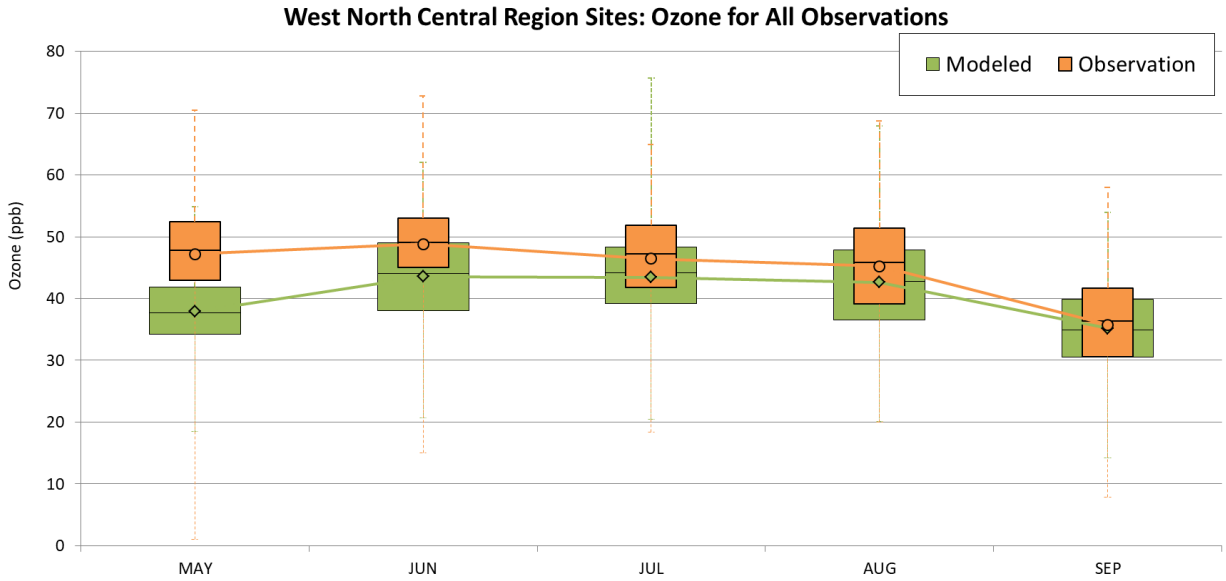

Figure 51. Boxplot comparisons of model predictions and AFS MDA8 observations for West-North-Central Region for May - September, 2016.

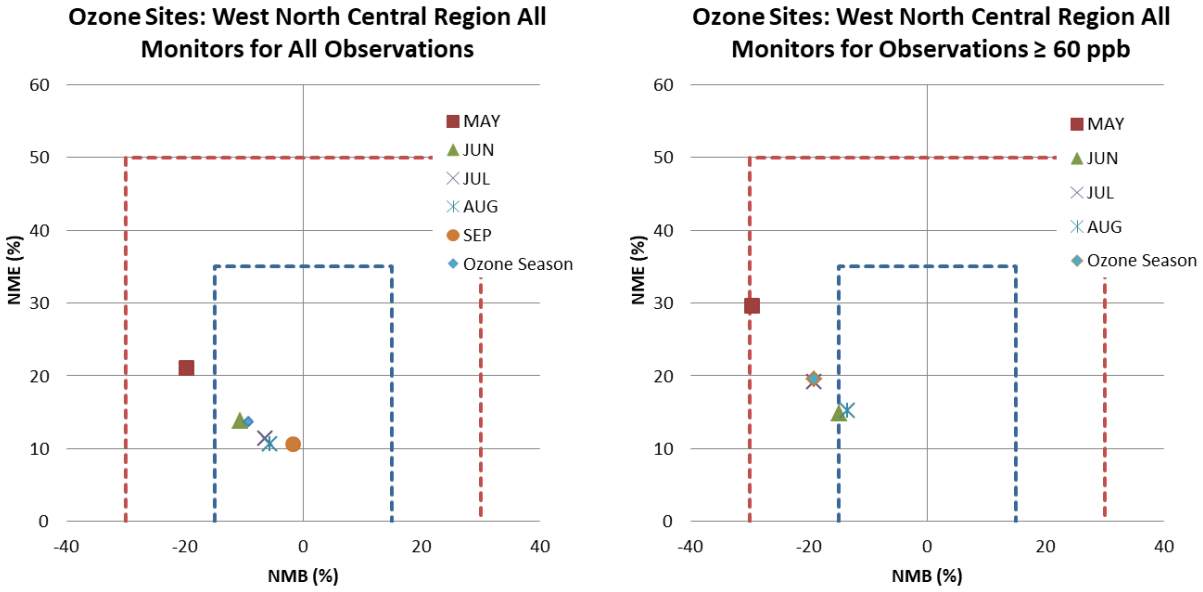

Figure 52. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for West-North-Central Region for months May – September and ozone season, 2016.

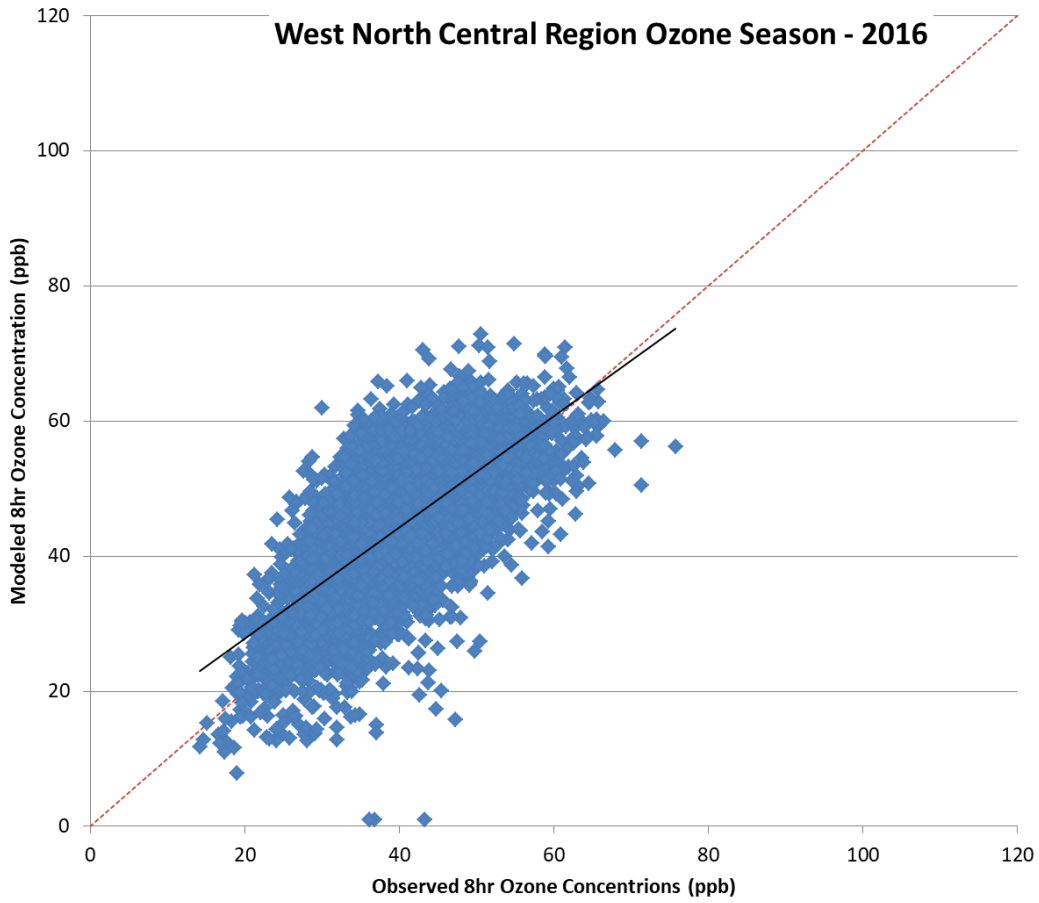

Figure 53. Scatter plot of MDA8 for May – September 2016 for West-North-Central AFS sites.

Gulf Coast Region

The Gulf Coast region is comprised of monitors located in Texas and Louisiana that border the Gulf of Mexico coastline. A map of the monitors included in this region is provided in Figure A.

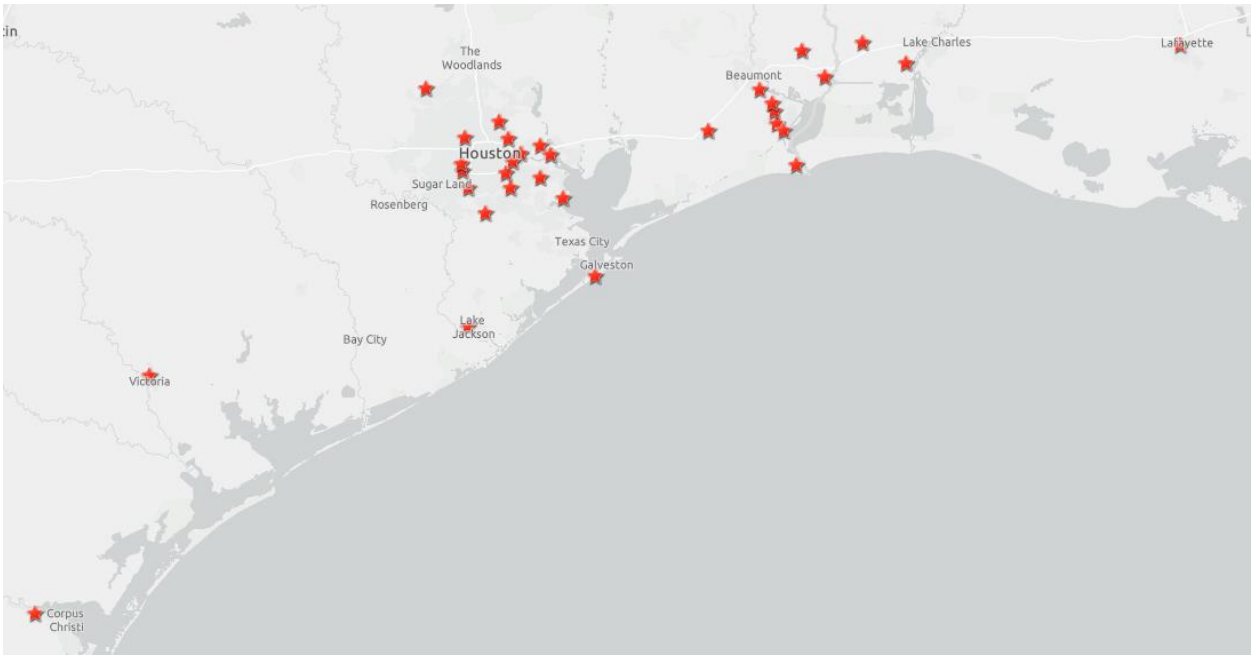

Figure 54. AQS monitoring sites in Gulf Coast region.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in this Gulf Coast region is within 5 ppb, except for May (-10.34 ppb) and August (-14.19) on high ozone days (≥ 60 ppb). The model tends to slightly over predict ozone at all concentrations (> 0 ppb) except in May (-2.10 ppb) and under predict at high concentrations (≥ 60 ppb) for all months of the ozone season in this region. Normalized mean error is within 15% for all observation days (> 0 ppb) and for high ozone days ≥ 60 ppb. Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figures B through E. Lower mean and normalized mean error is shown in areas inland along the shipping channel and to the eastern side of the metro Houston area. Higher mean and normalized mean error is seen along the coastline on outside of the beltline of the metro Houston area. Overall performance is best across all observed days in May, June, and September and June, July, and September at high concentrations.

Table 10. Performance statistics for MDA8 ozone by month and ozone season in the Gulf Coast region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
Gulf Coast	MAY	0	915	-2.10	7.85	-4.90	18.28
Gulf Coast	JUN	0	881	1.16	7.77	3.16	21.22
Gulf Coast	JUL	0	928	3.52	7.04	12.09	24.22
Gulf Coast	AUG	0	920	2.27	8.22	7.63	27.64
Gulf Coast	SEP	0	893	2.81	7.36	7.64	20.01
Gulf Coast	Ozone Season	0	4537	1.53	7.65	4.38	21.86
Gulf Coast	MAY	60	80	-10.34	10.55	-15.84	16.17
Gulf Coast	JUN	60	47	-4.18	8.58	-6.51	13.36
Gulf Coast	JUL	60	19	-4.90	13.39	-7.35	20.11
Gulf Coast	AUG	60	6	-14.19	14.19	-21.17	21.17
Gulf Coast	SEP	60	40	-4.86	6.84	-7.42	10.44
Gulf Coast	Ozone Season	60	192	-7.27	9.69	-11.15	14.86

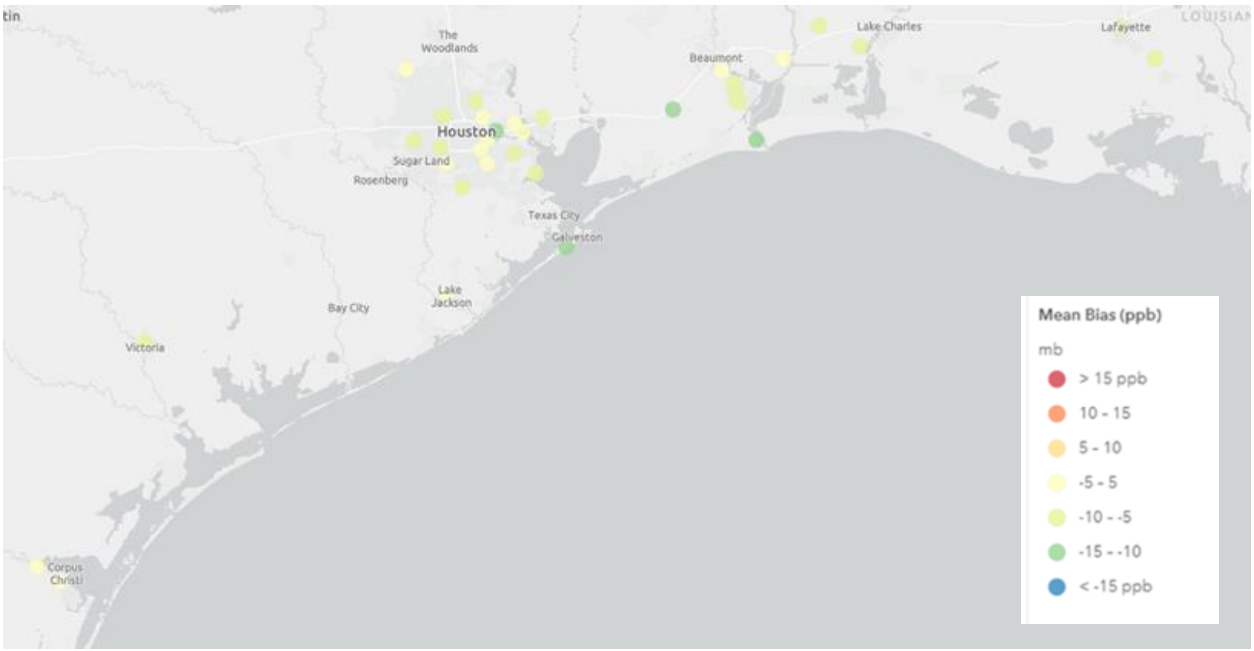

Figure 55. Mean Bias (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Gulf Coast region.

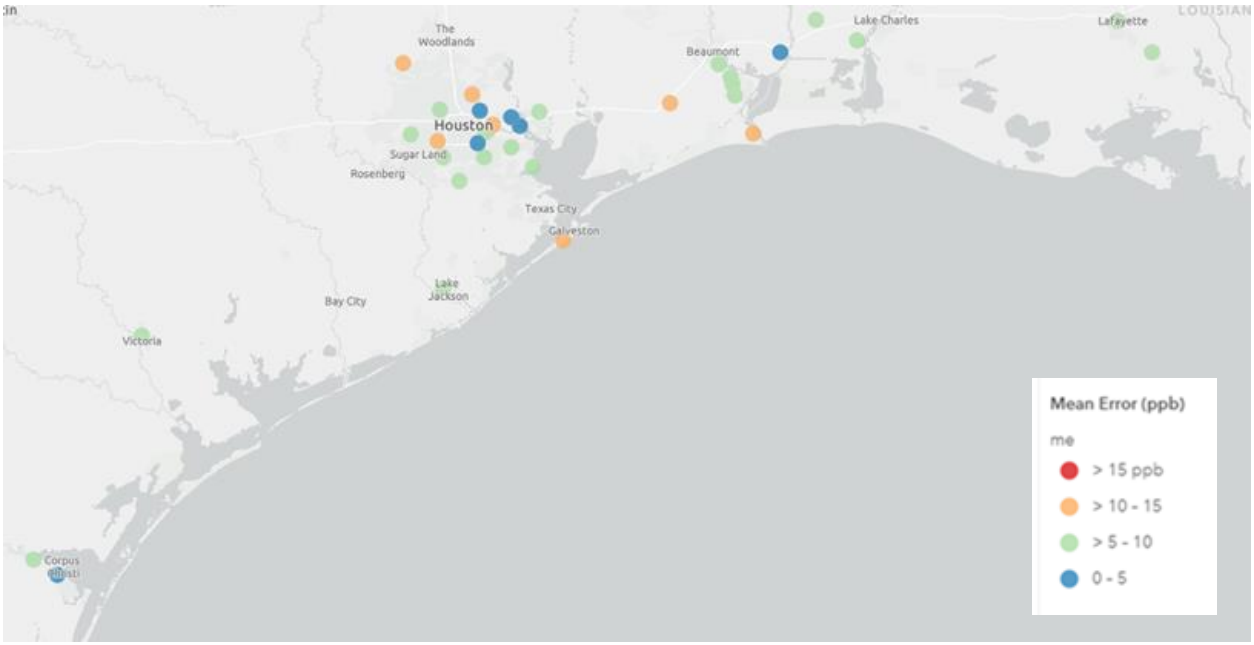

Figure 56. Mean Error (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Gulf Coast region.

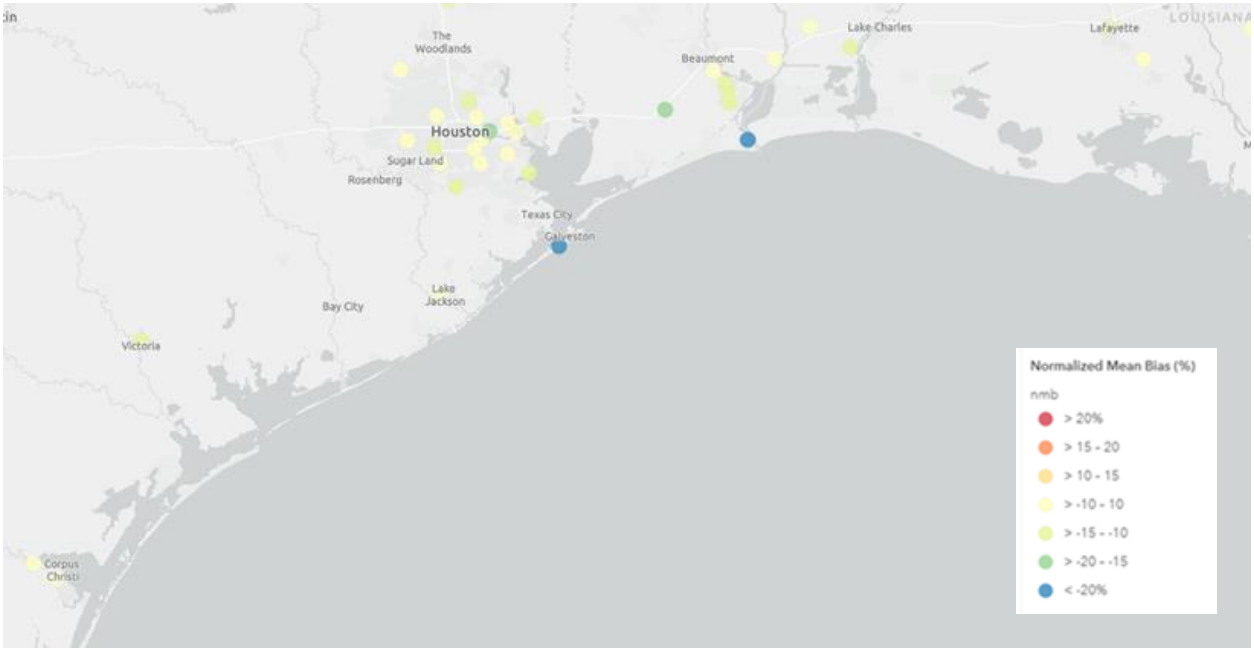

Figure 57. Normalized Mean Bias (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Gulf Coast region.

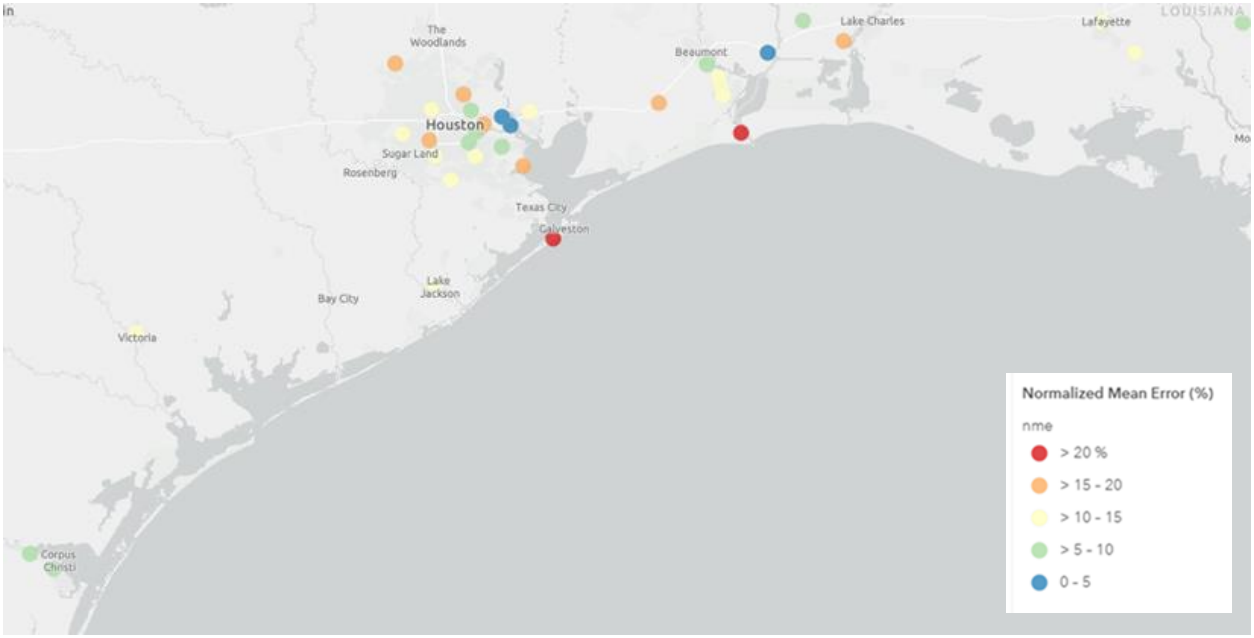

Figure 58. Normalized Mean Error (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in Gulf Coast region.

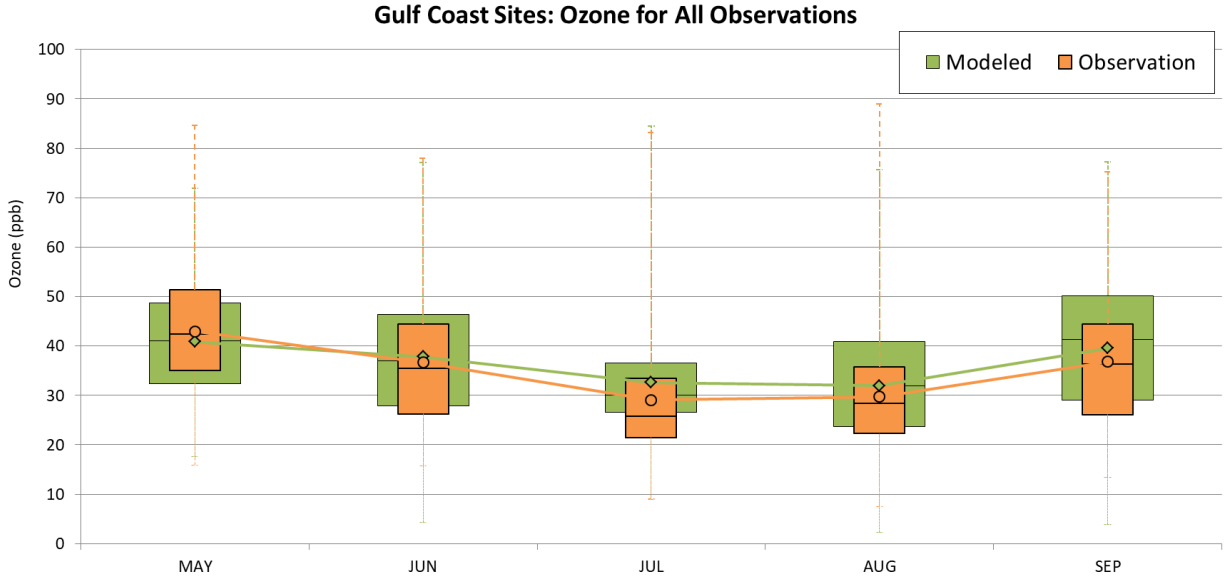

Figure 59. Boxplot comparisons of model predictions and AFS MDA8 observations for Gulf Coast Region for May - September, 2016.

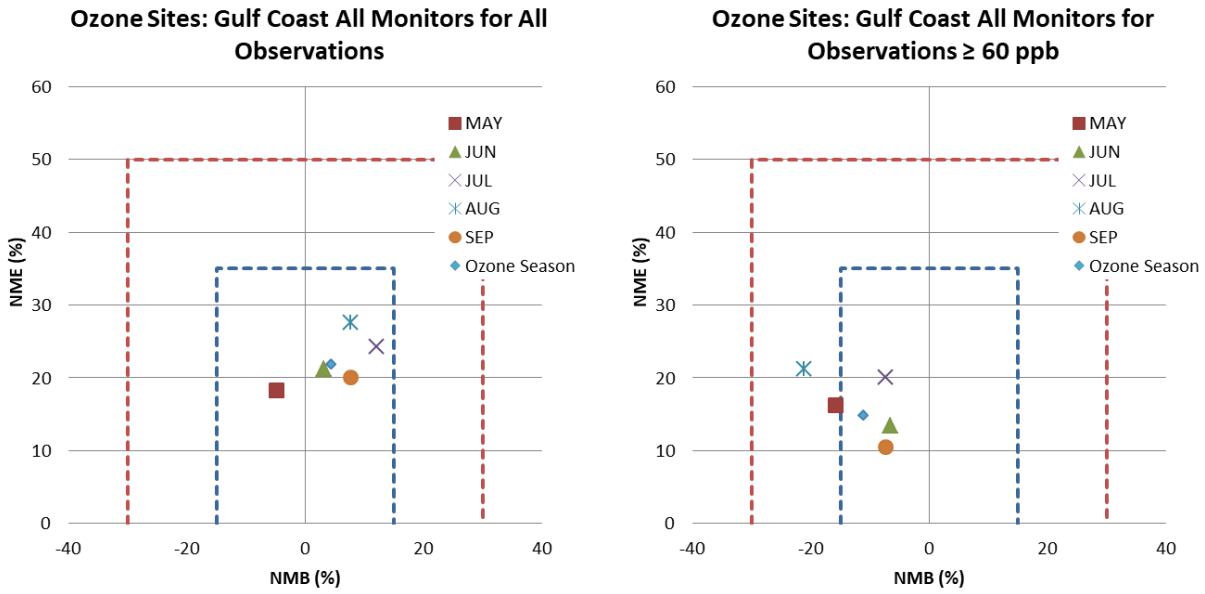

Figure 60. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for Gulf Coast Region for months May – September and ozone season, 2016.

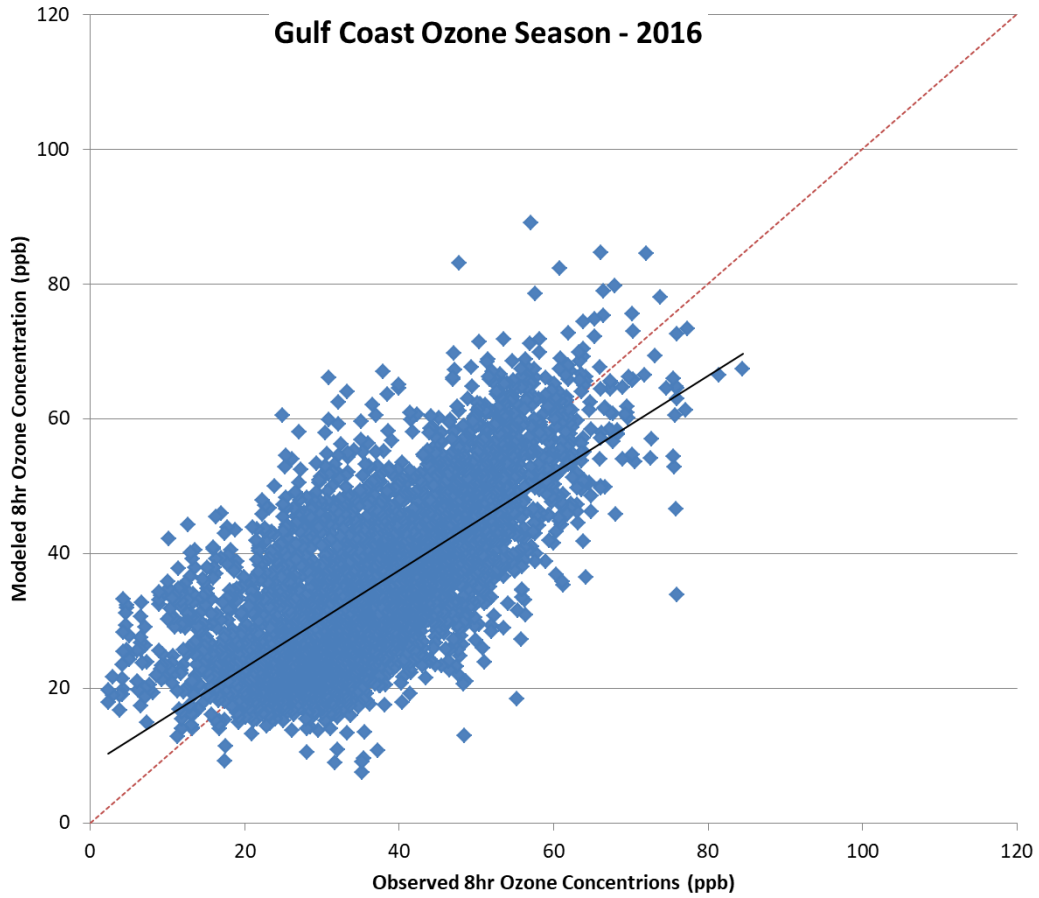

Figure 61. Scatter plot of MDA8 for May – September 2016 for Gulf Coast AFS sites.

Interstate 95 Region

The Interstate 95 (I-95) region is comprised of monitors located in the northeastern U.S. that border the I-95 corridor between Baltimore, Maryland and New London, Connecticut. A map of the monitors included in this region is provided in Figure A.

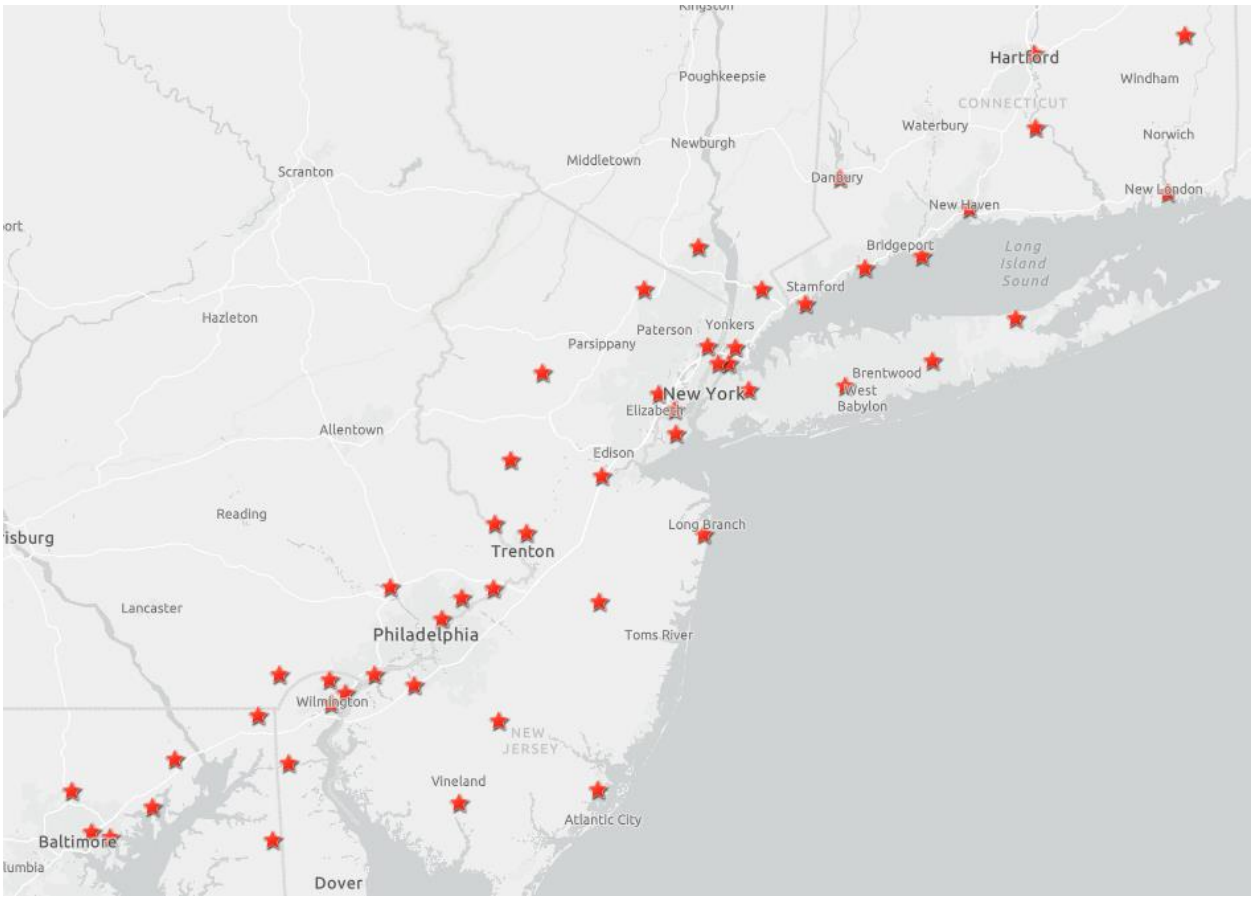

Figure 62. AQS monitoring sites in I-95 region.

During the ozone season of 2016, mean bias for maximum daily 8-hour average (MDA8) ozone concentrations in this I-95 region is within 5 ppb, except for May (-7.76 ppb) across all observations and May (-8.56 ppb), June (-6.18 ppb), and September (-5.17 ppb) on high ozone days (≥ 60 ppb). Normalized mean error is within 15% for high ozone days ≥ 60 ppb and for all observation days (> 0 ppb) except in May (19.82%). Spatial maps of mean bias, mean error, normalized mean bias, and normalized mean error are shown in Figures B through E. Lower mean and normalized mean error is shown in areas inland along the Delaware Bay and to the eastern side of the Baltimore / Washington DC metro area. Higher mean and normalized mean error is seen along the coastline of the Long Island Sound and in downwind locations from New York City, mainly in Connecticut. Overall performance is best across all observed days in June through September and in July and August at high concentrations.

Table 11. Performance statistics for MDA8 ozone by month and ozone season in the I-95 region in 12km domain based on data at AQS network sites.

Region	Month/Season	Observation Limit (ppb)	# of Obs	MB (ppb)	ME (ppb)	NMB (%)	NME (%)
I-95 Corridor	MAY	0	1538	-7.76	8.97	-17.15	19.82
I-95 Corridor	JUN	0	1502	-3.28	6.73	-6.42	13.17
I-95 Corridor	JUL	0	1541	4.11	7.32	7.78	13.84
I-95 Corridor	AUG	0	1558	3.67	7.01	7.8	14.91
I-95 Corridor	SEP	0	1519	0.58	5.76	1.43	14.13
I-95 Corridor	Ozone Season	0	7658	-0.51	7.16	-1.08	15.11
I-95 Corridor	MAY	60	211	-8.56	9.28	-11.76	12.75
I-95 Corridor	JUN	60	326	-6.18	7.53	-9.33	11.37
I-95 Corridor	JUL	60	447	0.78	6.63	1.16	9.79
I-95 Corridor	AUG	60	189	-1.03	6.97	-1.56	10.55
I-95 Corridor	SEP	60	144	-5.17	6.99	-7.63	10.31
I-95 Corridor	Ozone Season	60	1317	-3.35	7.37	-4.93	10.84

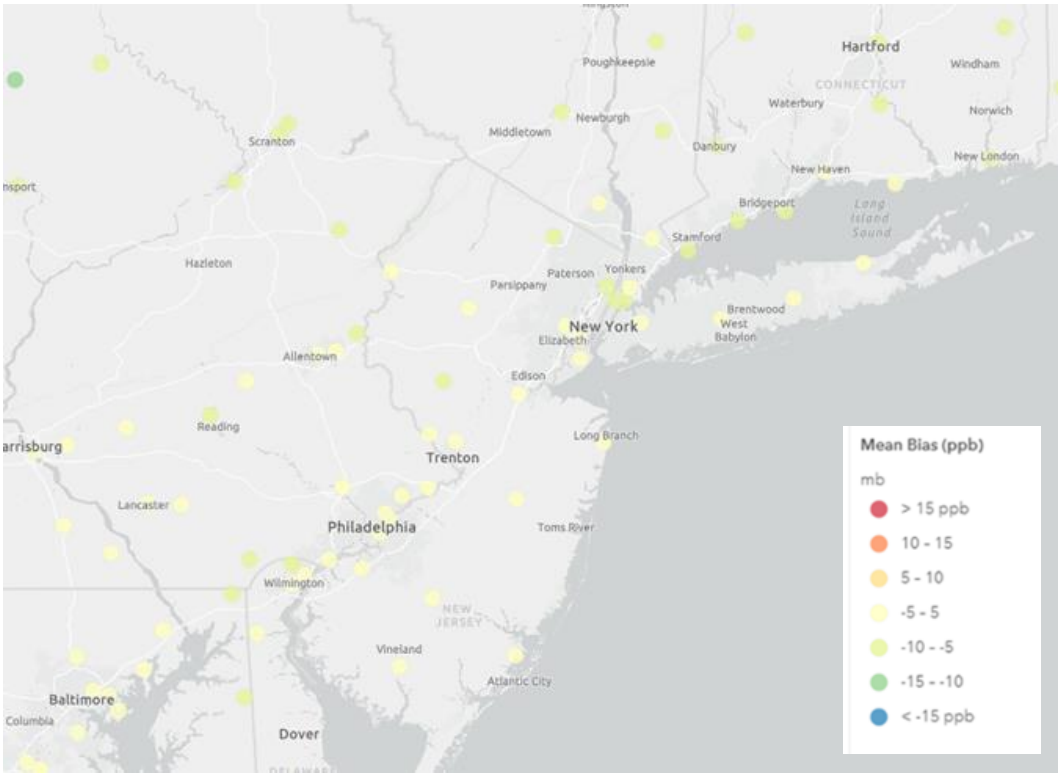

Figure 63. Mean Bias (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in I-95 region.

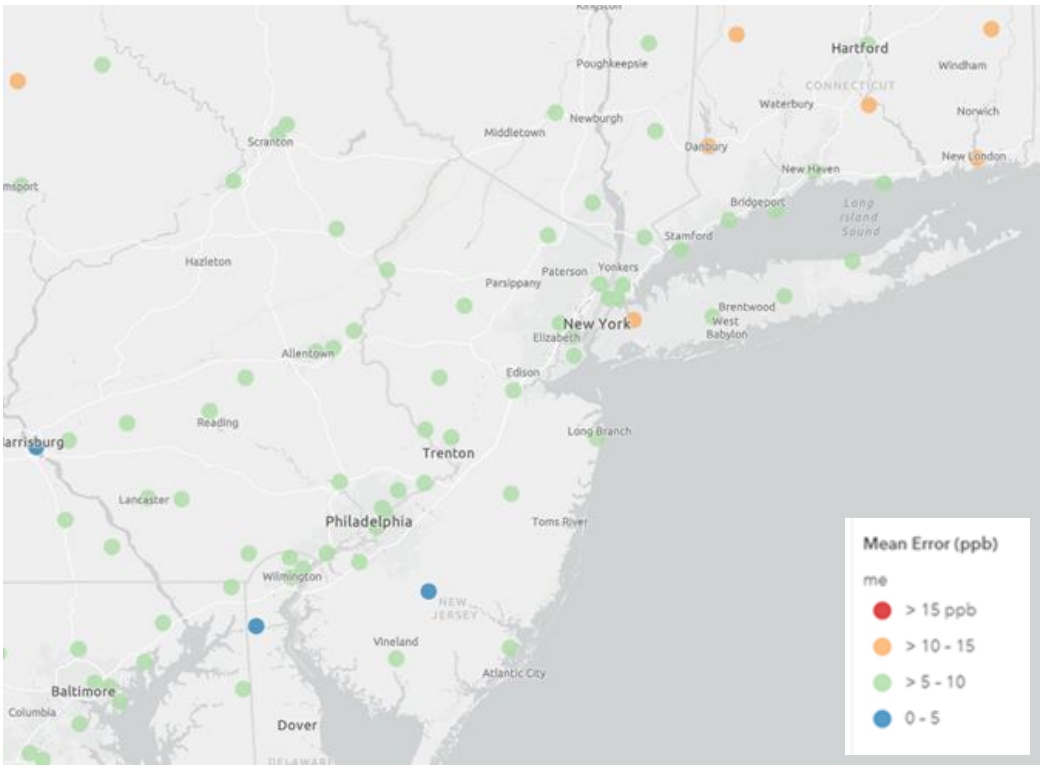

Figure 64. Mean Error (ppb) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in I-95 region.

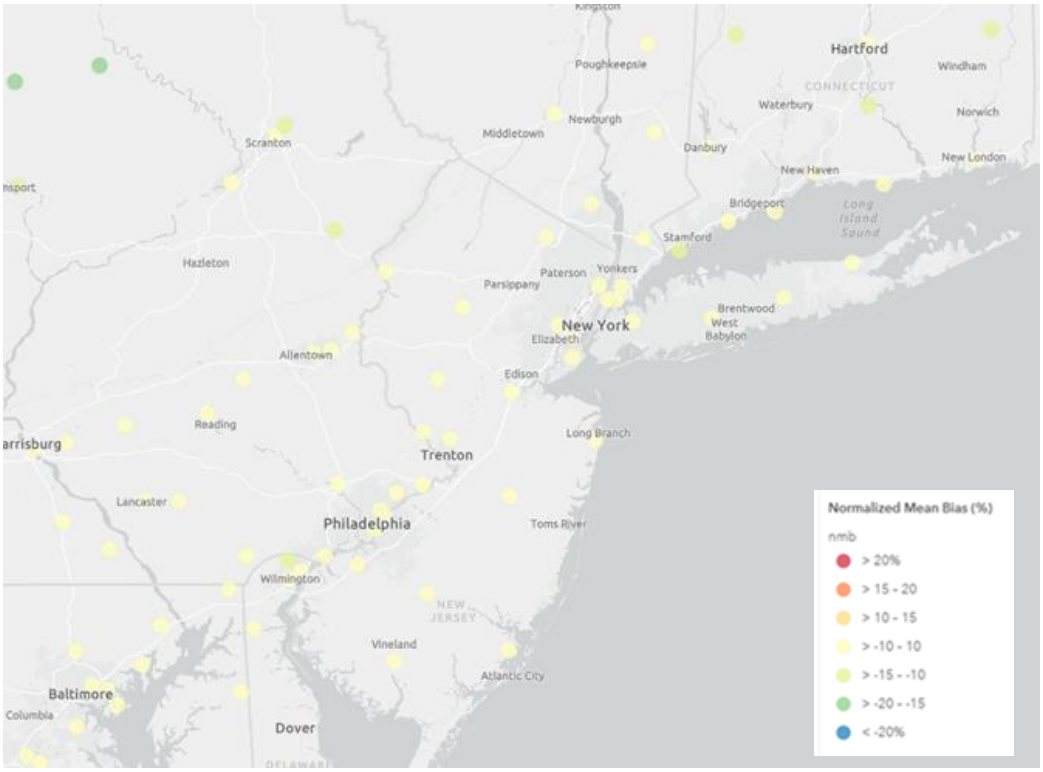

Figure 65. Normalized Mean Bias (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in I-95 region.

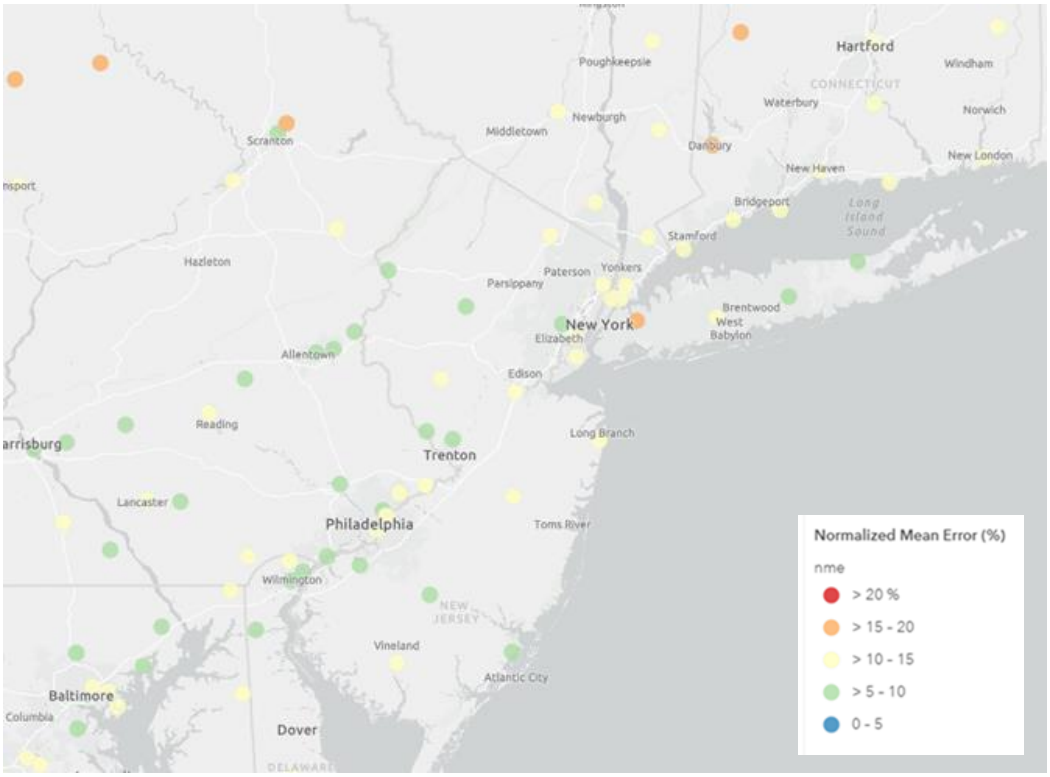

Figure 66. Normalized Mean Error (%) of MDA8 ozone ≥ 60 ppb over the period May-September 2016 at AQS monitoring sites in I-95 region.

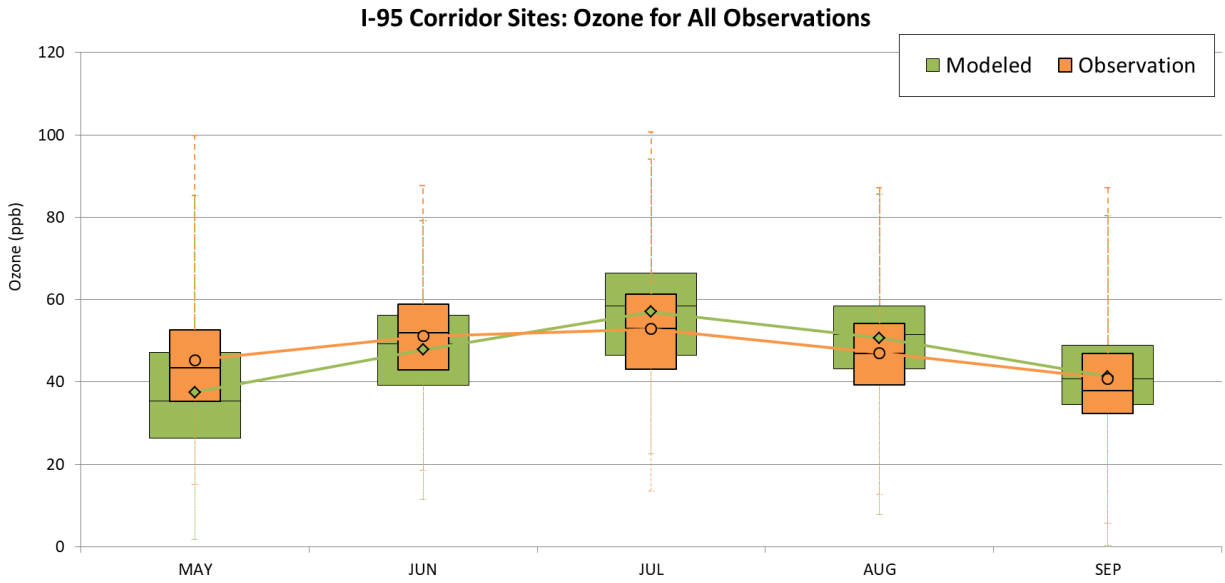

Figure 67. Boxplot comparisons of model predictions and AFS MDA8 observations for I-95 Region for May - September, 2016.

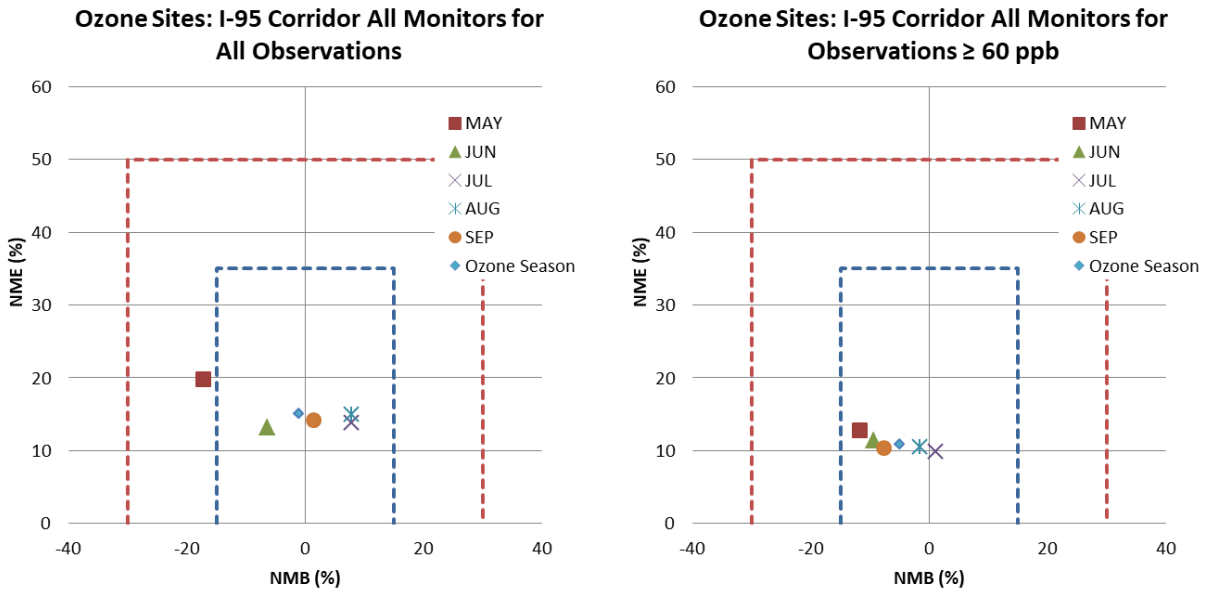

Figure 68. Soccer plot comparisons of MDA8 observations > 0 ppb [left] and ≥ 60 ppb [right] for I-95 Region for months May – September and ozone season, 2016.

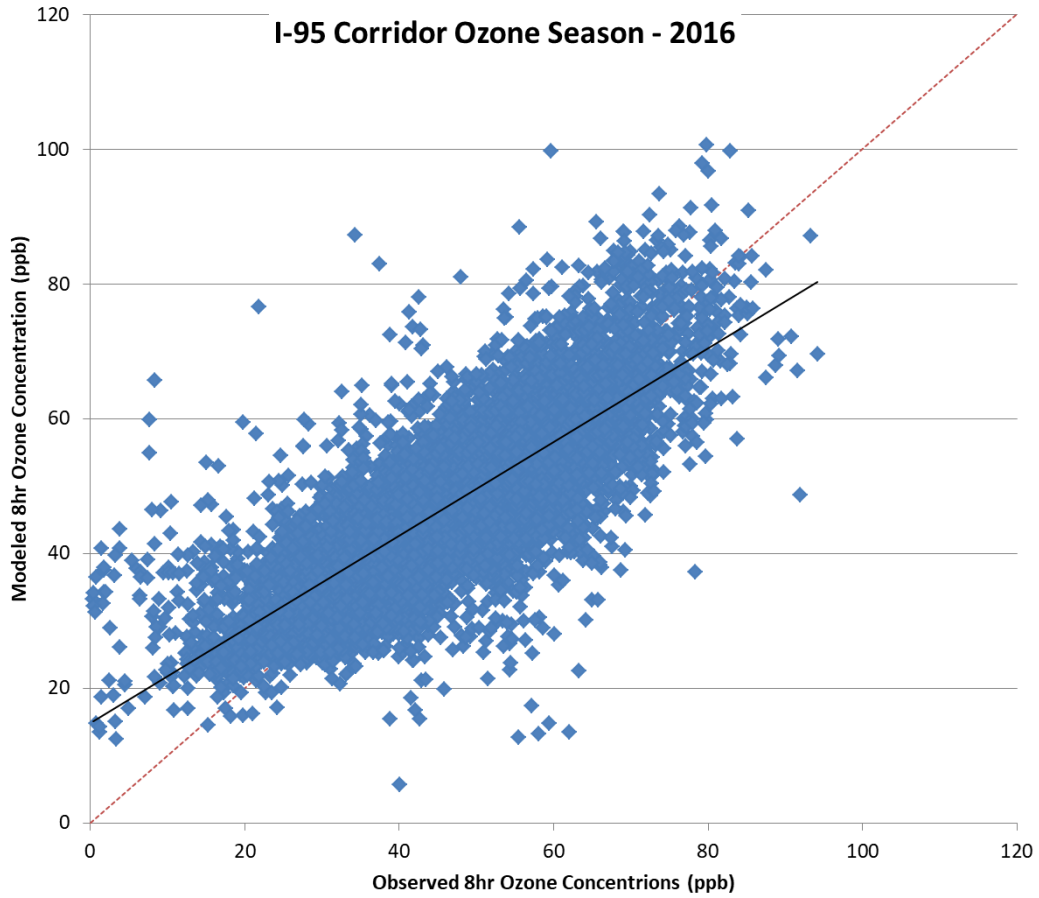

Figure 69. Scatter plot of MDA8 for May – September 2016 for I-95 AFS sites.

2.2 TIME SERIES AND CONCENTRATION CORRELATION PLOTS BY MONITOR

In addition to the above analysis of regional model performance, we also examined how well the modeling platform replicates day to day fluctuations in observed 8-hour daily maximum concentrations using data for select sites identified in key regions of the modeling domain.

Table 12. Monitoring sites included in the ozone time series and correlation plot analysis.

Region	AIRS Monitor ID	State	County
Central	170971007	Illinois	Lake
	170317002	Illinois	Cook
	291831002	Missouri	Saint Charles
East-North-Central	260050003	Michigan	Allegan
	261210039	Michigan	Muskegon
	551170006	Wisconsin	Sheboygan
	550590019	Wisconsin	Kenosha
North East	90019003	Connecticut	Fairfield
	90070007	Connecticut	Middlesex
	240150003	Maryland	Cecil
	240251001	Maryland	Harford
	360850067	New York	Richmond
	361192004	New York	Westchester
	420170012	Pennsylvania	Bucks
	421010024	Pennsylvania	Philadelphia
South	481210034	Texas	Denton
	482010024	Texas	Harris
	481671034	Texas	Galveston
South East	131210055	Georgia	Fulton
	131510002	Georgia	Henry
South West	80590011	Colorado	Jefferson
	80350004	Colorado	Douglas

For this site-specific analysis we present the time series of observed and predicted 8-hour daily maximum concentrations by site and a correlation plot of observed versus modeled ozone concentrations over the period May through September 2016.

The results, as shown in Figures 54 through 97, indicate that the modeling platform generally replicates the day-to-day variability in ozone during this time period at these sites. That is, days with high modeled concentrations are generally also days with high measured concentrations and, conversely, days with low modeled concentrations are also days with low measured concentrations in most cases.

At all monitors presented, the model systemically over predicts ozone concentrations on low observation days and especially during the ends (May and September) of the ozone season. This is demonstrated clearly in the early period of the episode in Figures 54, 56, 60, 64, 66, 88,

and 94 where the blue line (modeled concentrations), while following peak trends, are demonstrably higher than observed (red line) concentrations. Exceptions during mid-season occur in late July at the Harris, Texas monitor (Figure 86) and both Colorado monitors (Figures 94 and 96) where phantom episodes (modeled high ozone during low observation periods) are generated.

In contrast, the model tends to under predict ozone on high concentration days with the exceptions seen at monitors in Wisconsin along the Lake Michigan shoreline, Middlesex monitor in Connecticut along the Long Island Sound, Galveston 99th Street monitor along the Gulf Coast in Texas, and high elevation monitors in Colorado.

Both monitors in metro Atlanta demonstrate good performance with low bias across the range of observed ozone concentrations.

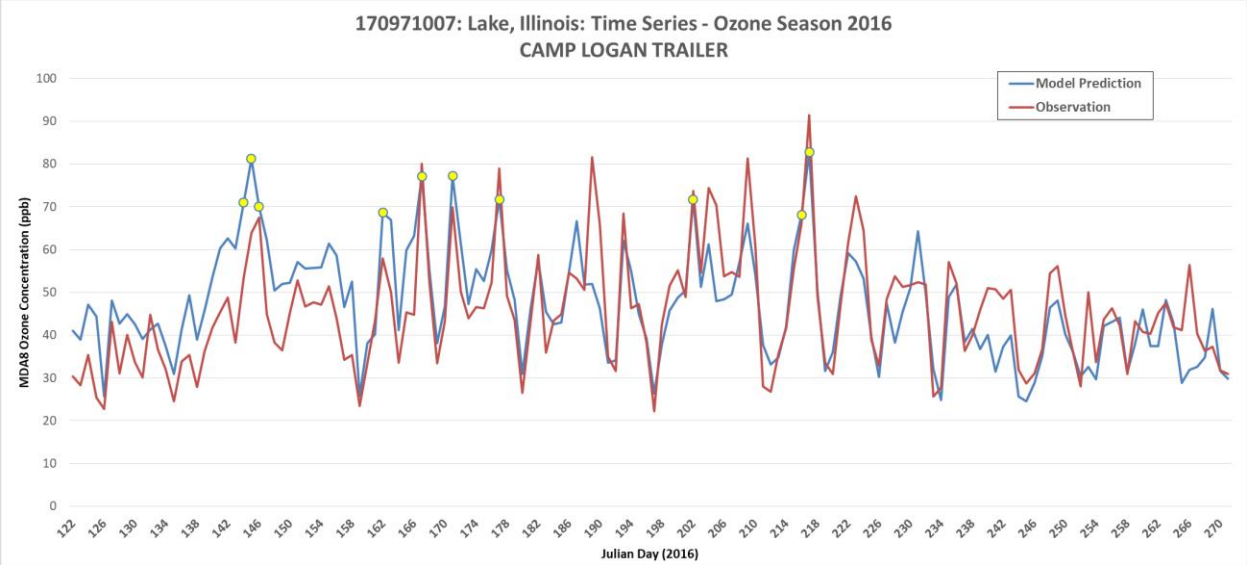

Figure 70. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 170971007. Yellow dots indicate top modeled values.

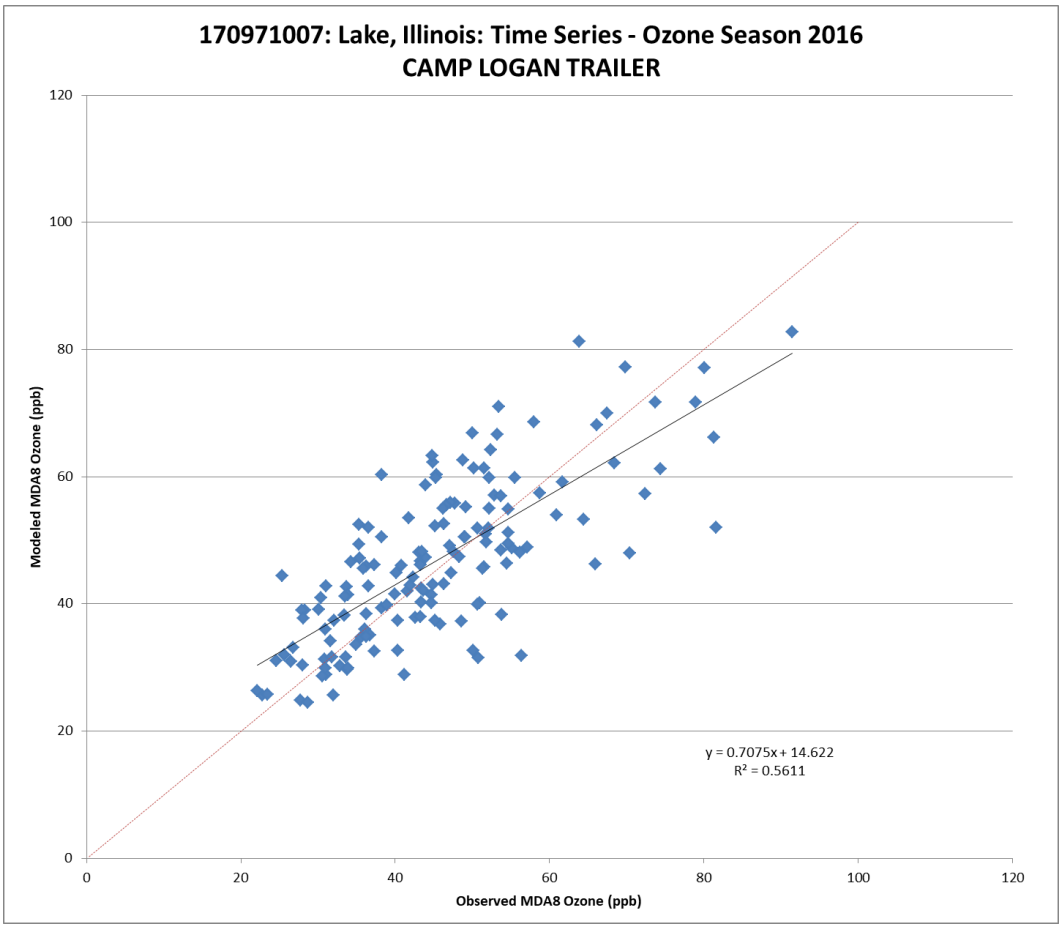

Figure 71. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 170971007.

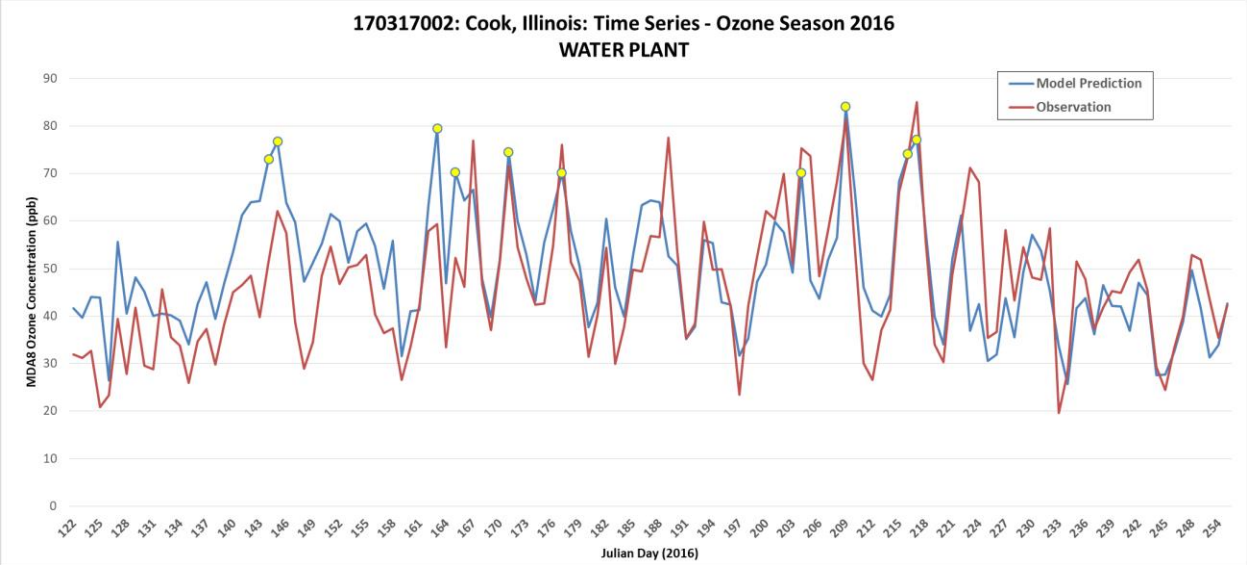

Figure 72. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 170317002. Yellow dots indicate top modeled values.

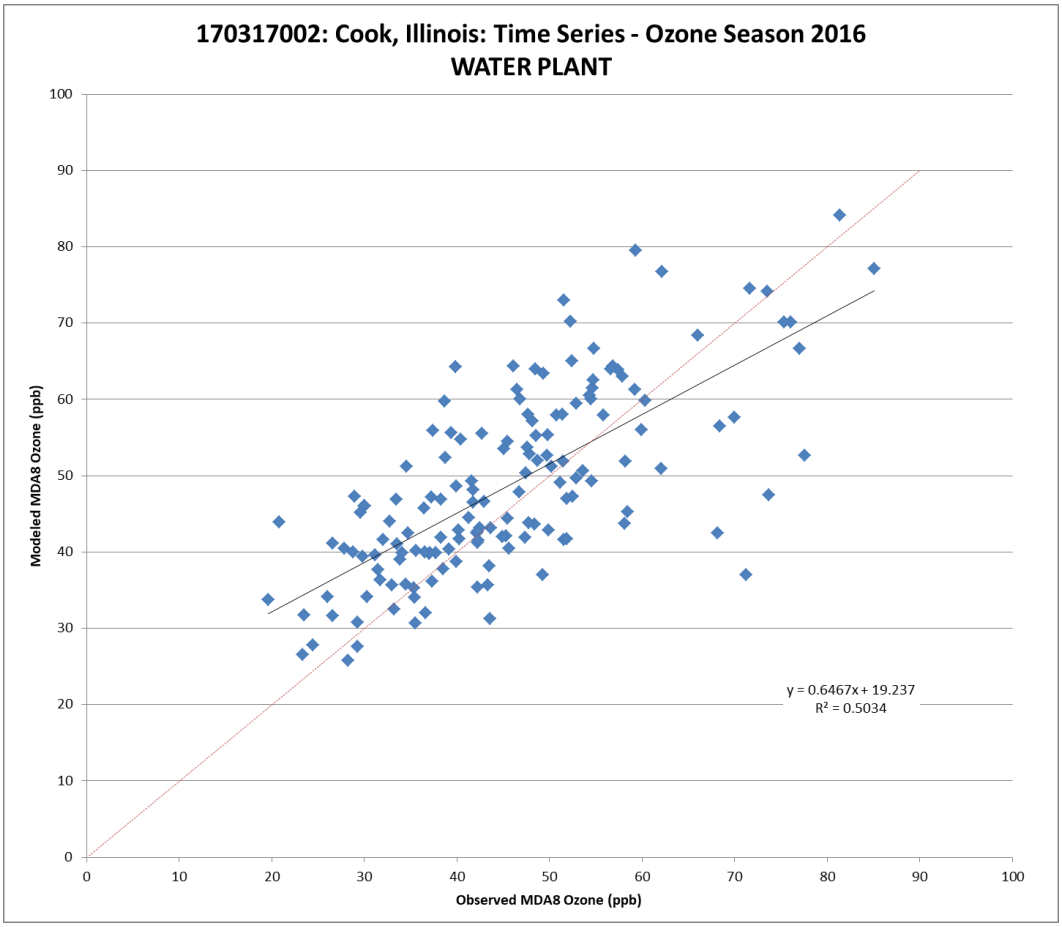

Figure 73. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 170317002.

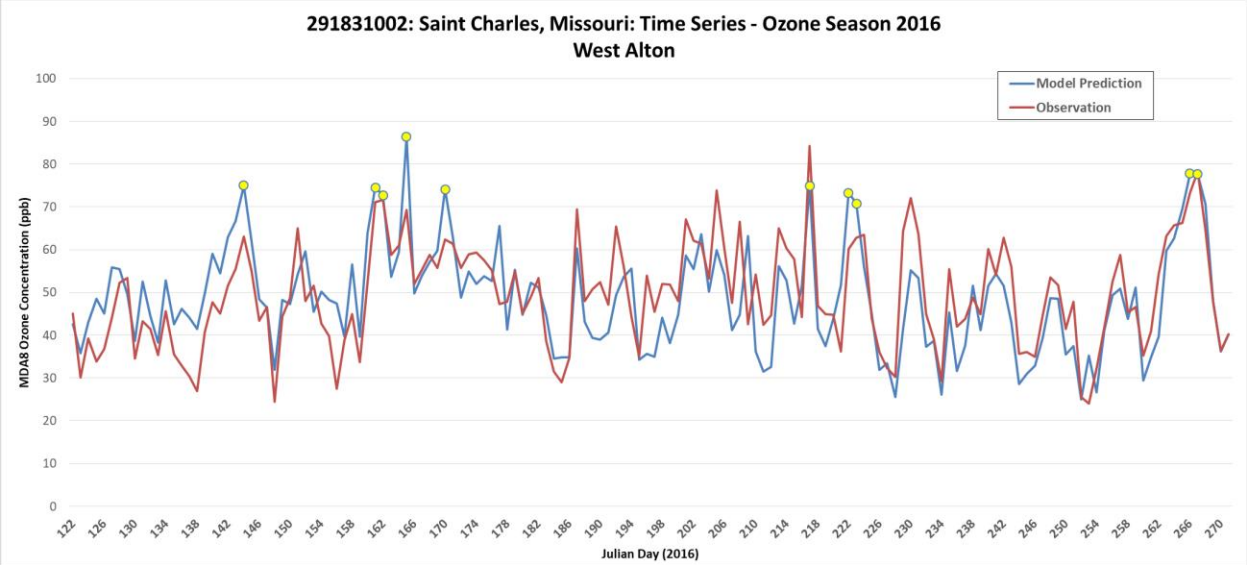

Figure 74. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 291831002. Yellow dots indicate top modeled values.

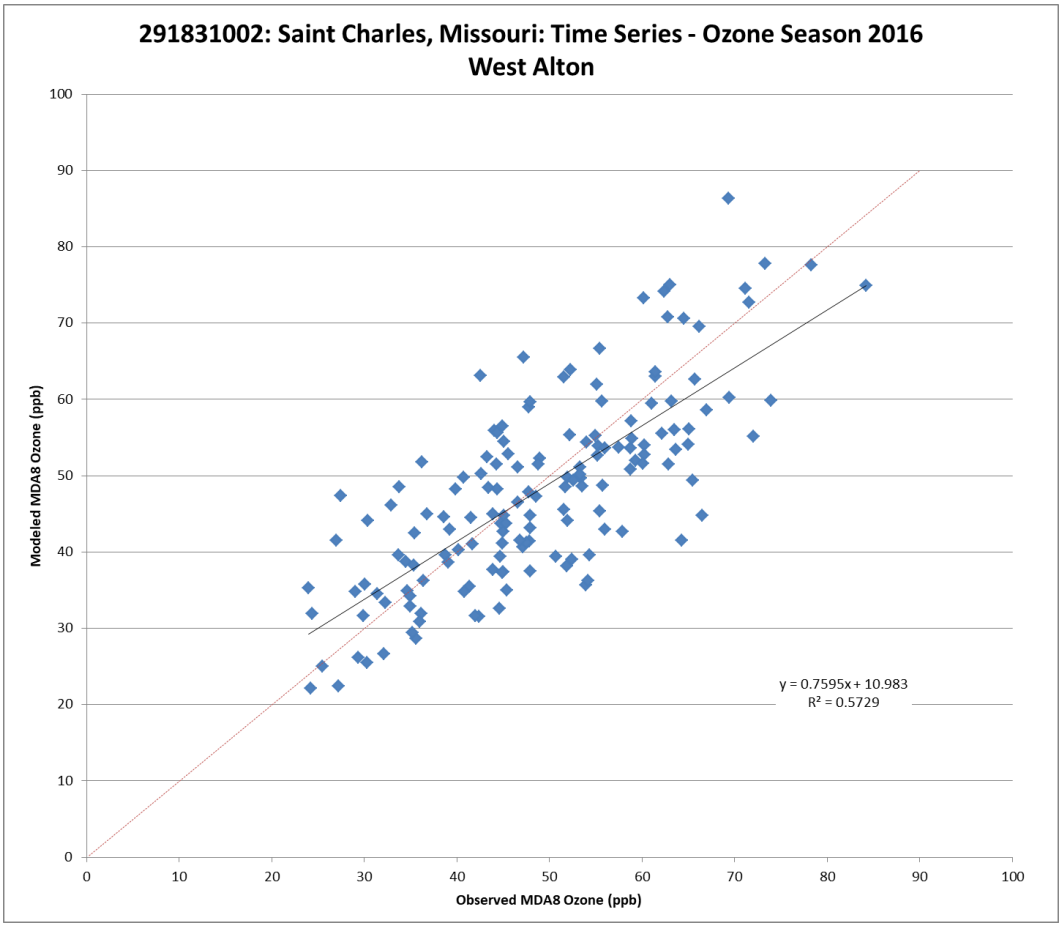

Figure 75. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 291831002.

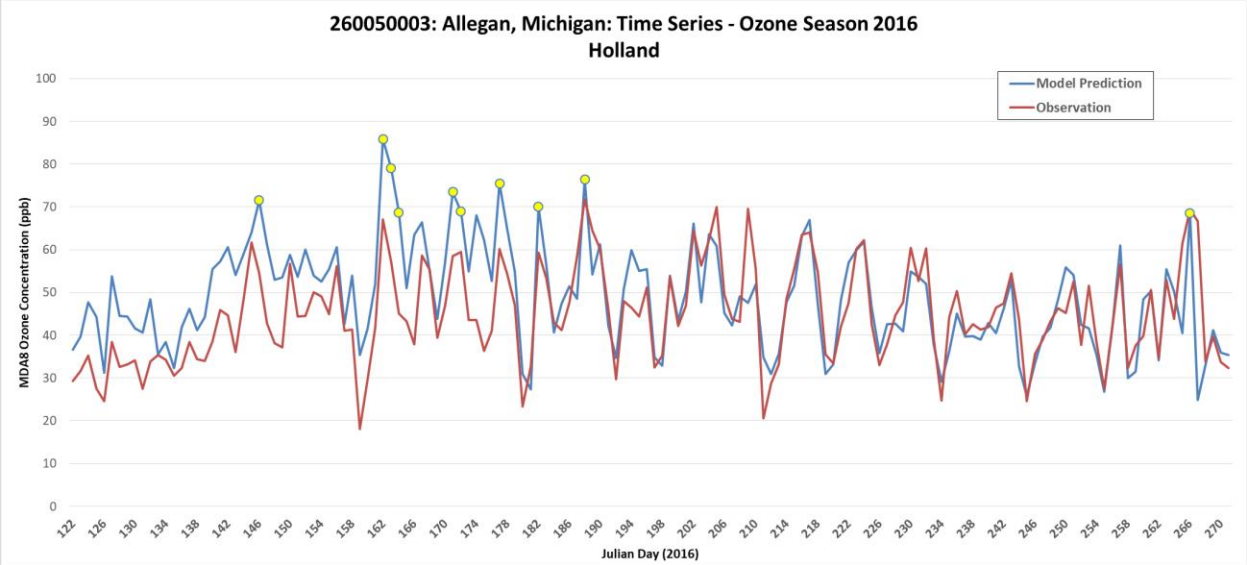

Figure 76. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 260050003. Yellow dots indicate top modeled values.

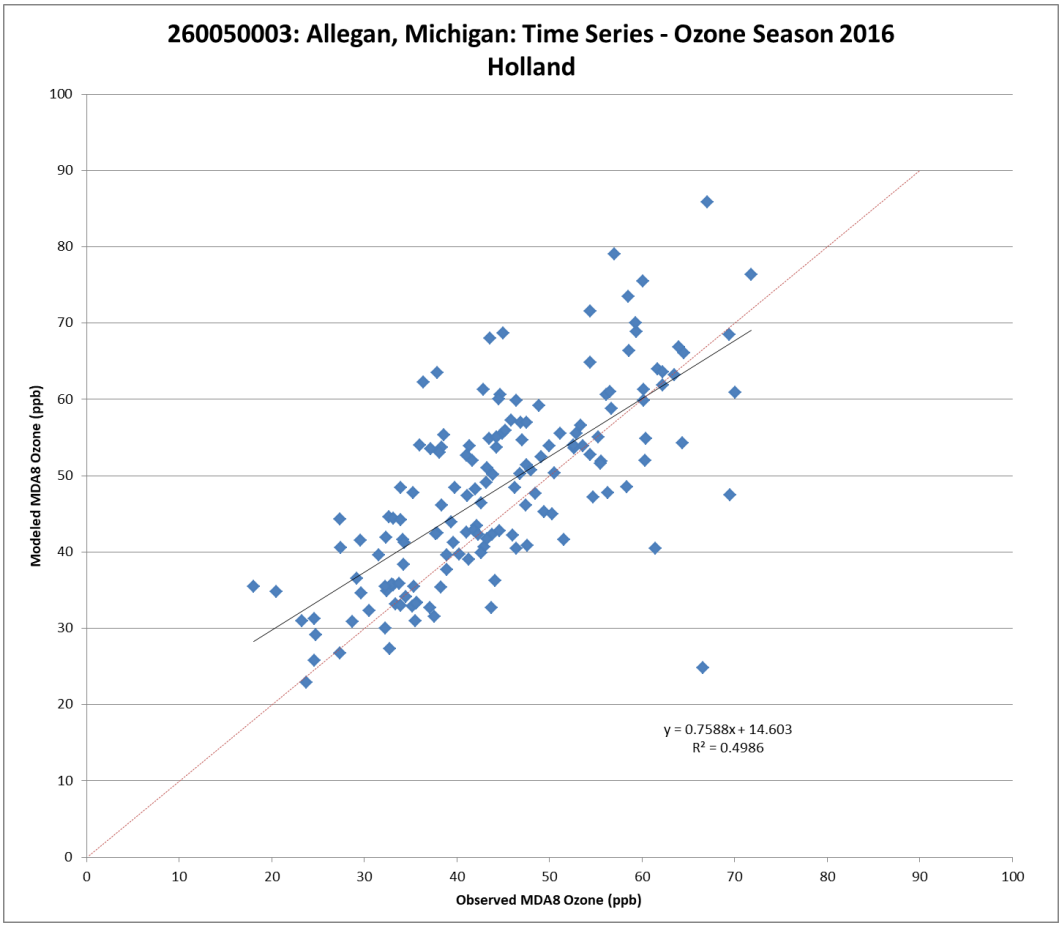

Figure 77. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 260050003.

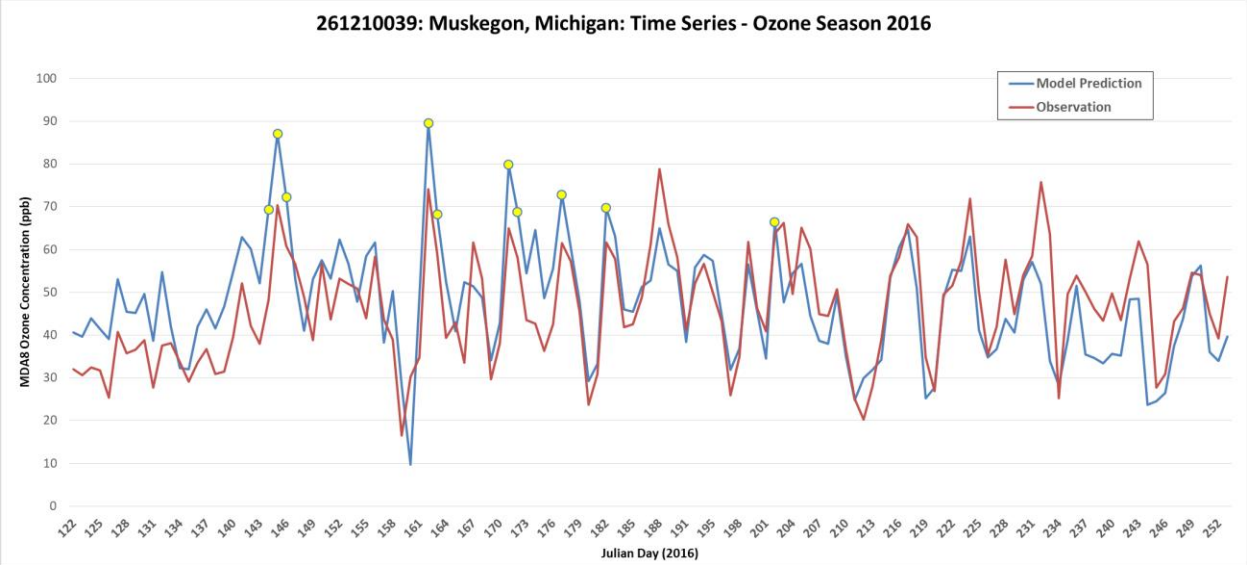

Figure 78. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 261210039. Yellow dots indicate top modeled values.

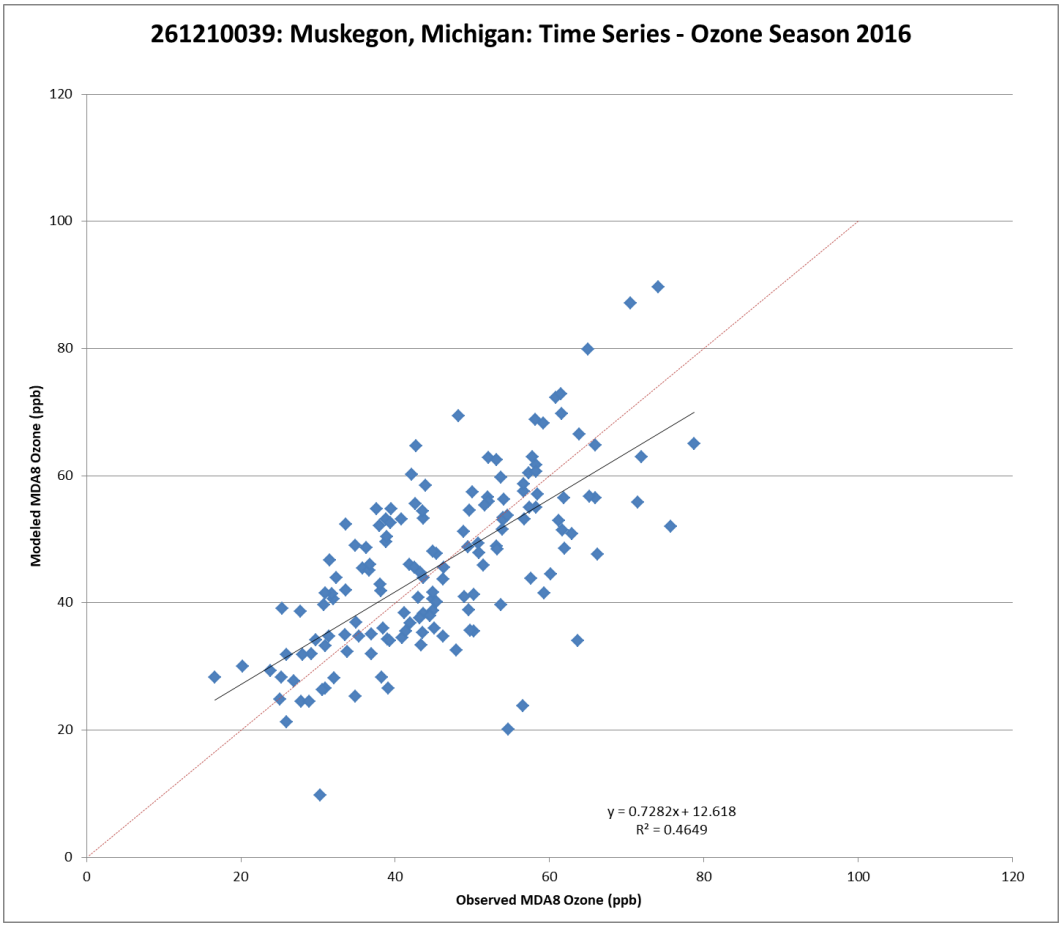

Figure 79. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 261210039.

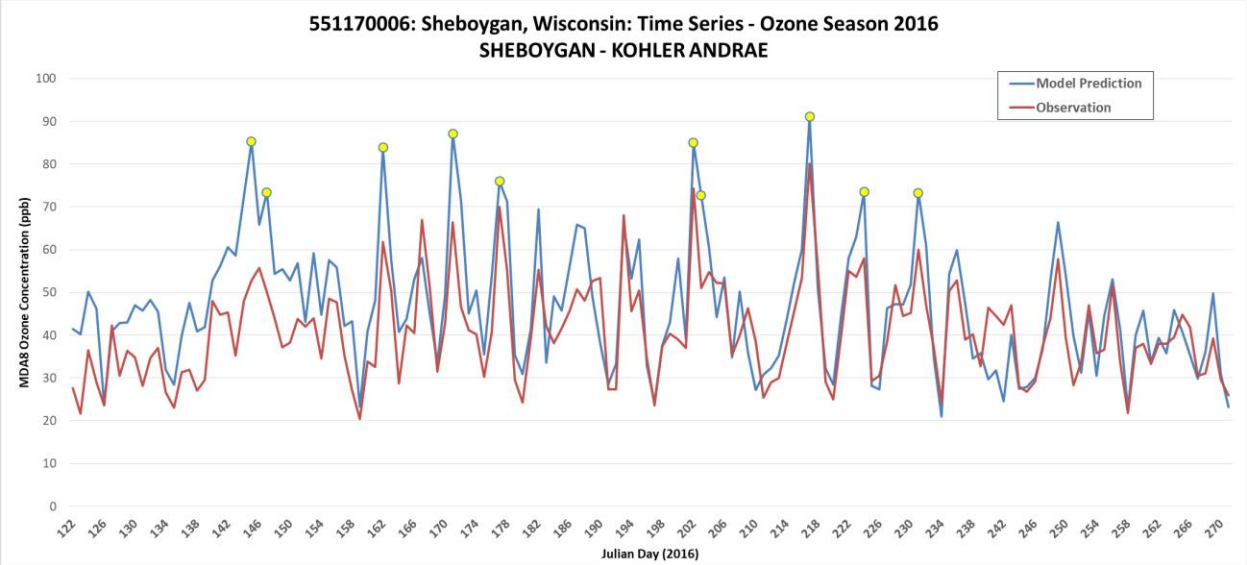

Figure 80. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 551170006. Yellow dots indicate top modeled values.

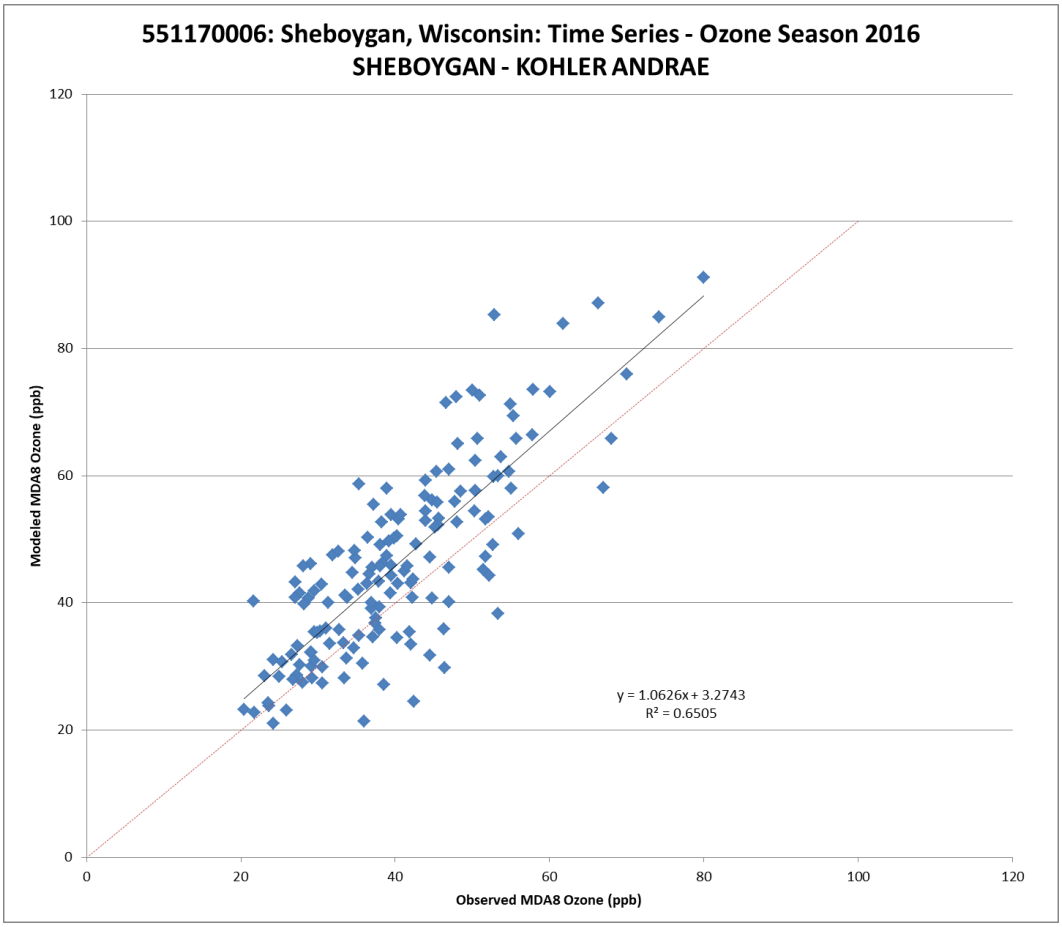

Figure 81. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 551170006.

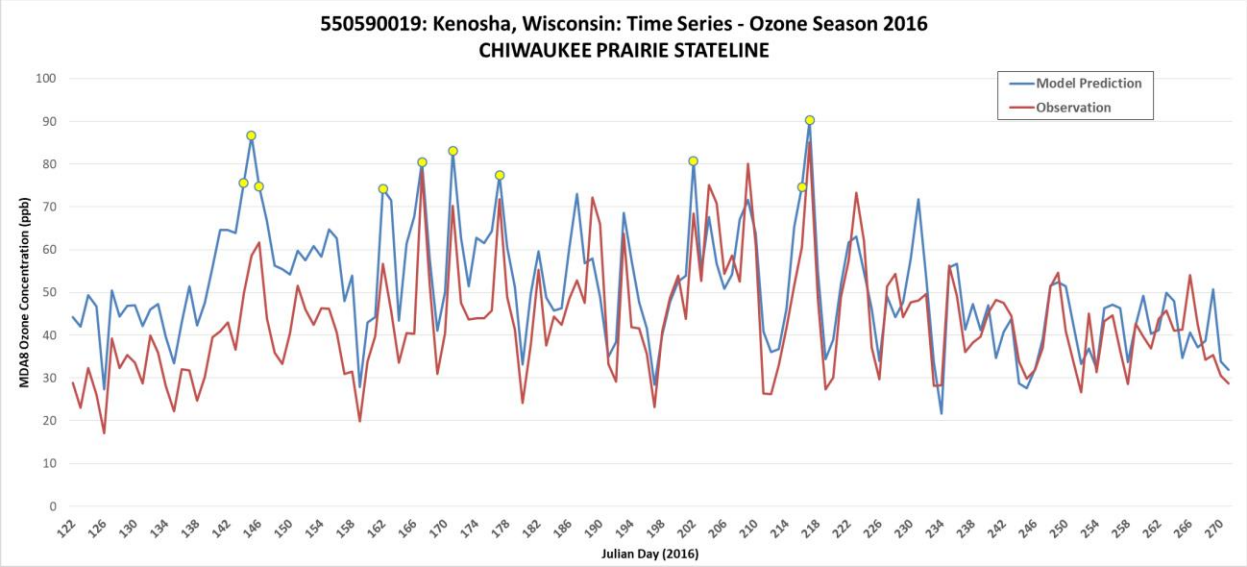

Figure 82. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 550590019. Yellow dots indicate top modeled values.

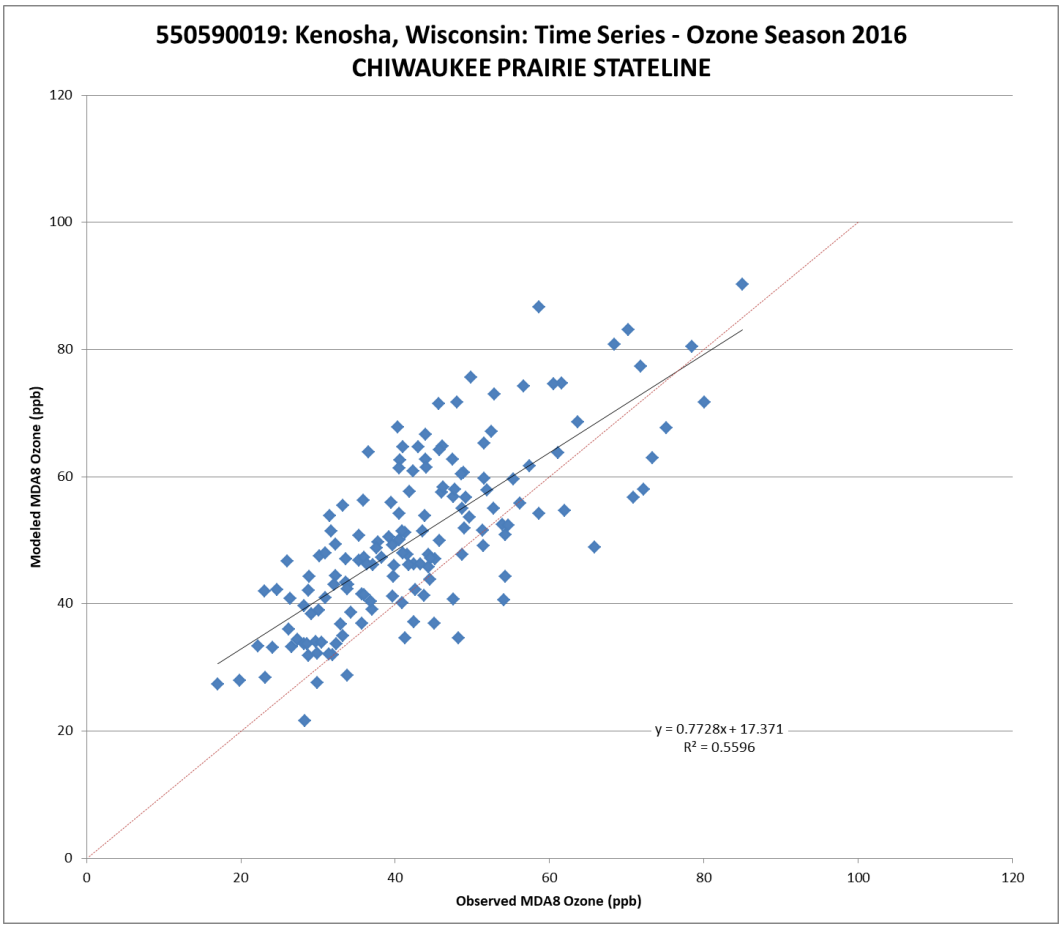

Figure 83. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 550590019.

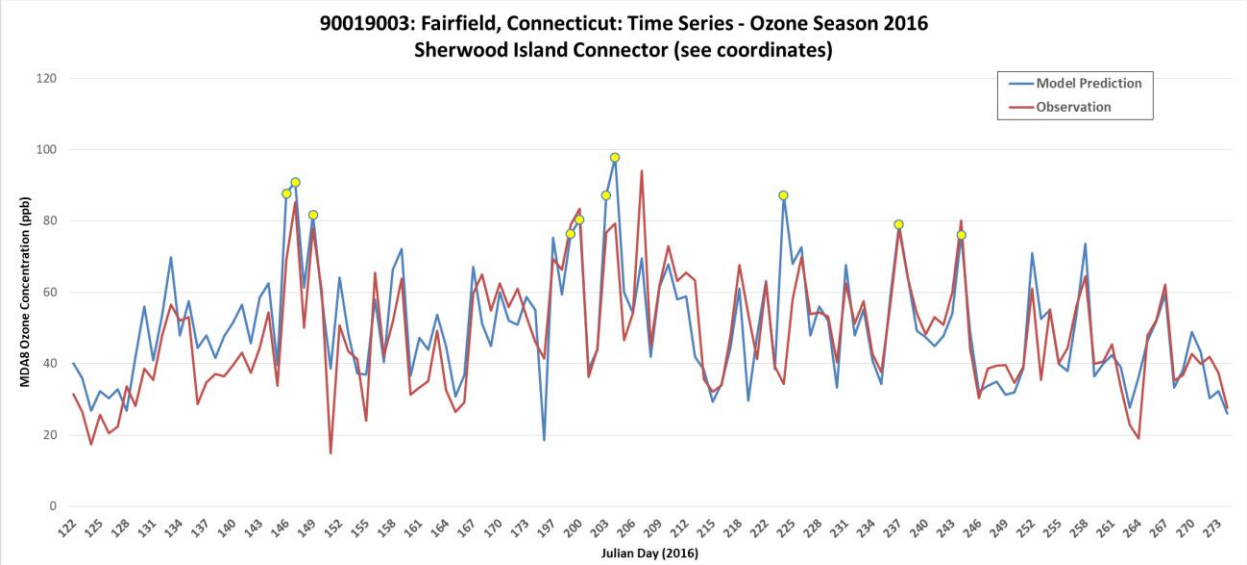

Figure 84. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 90019003. Yellow dots indicate top modeled values.

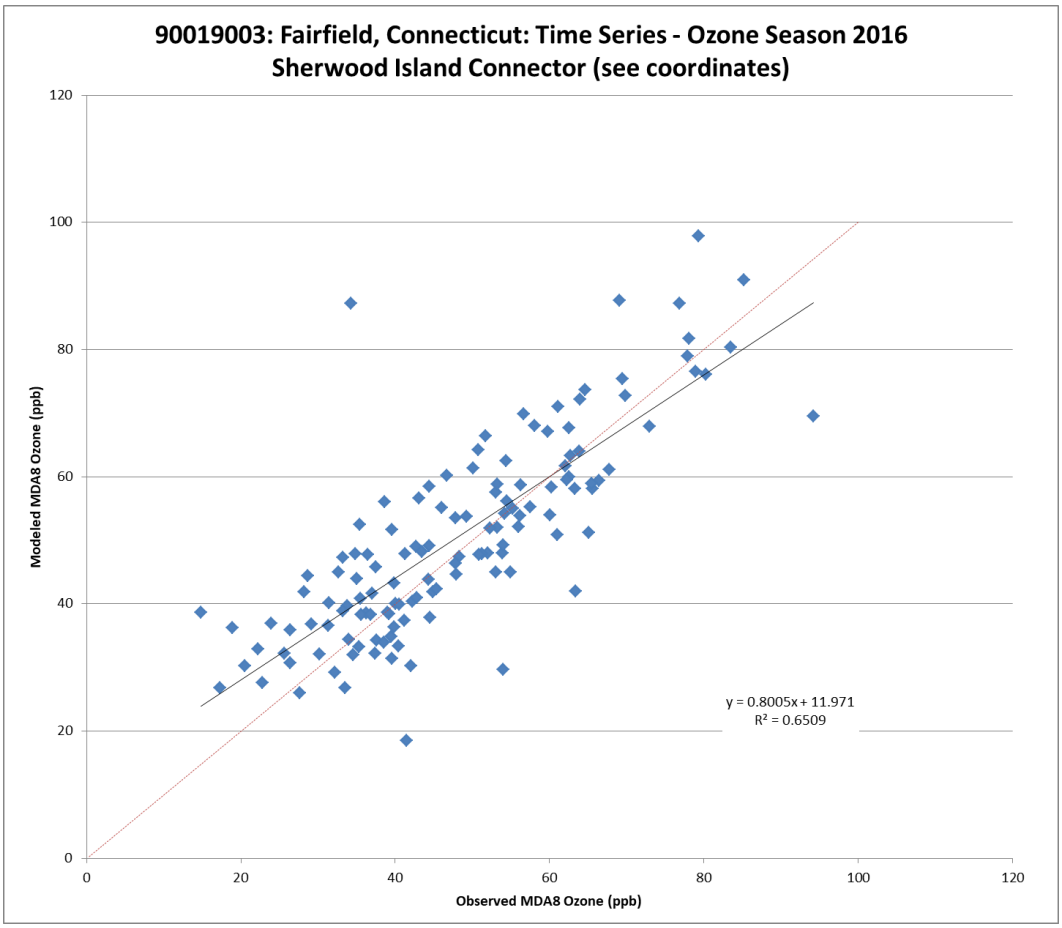

Figure 85. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 90019003.

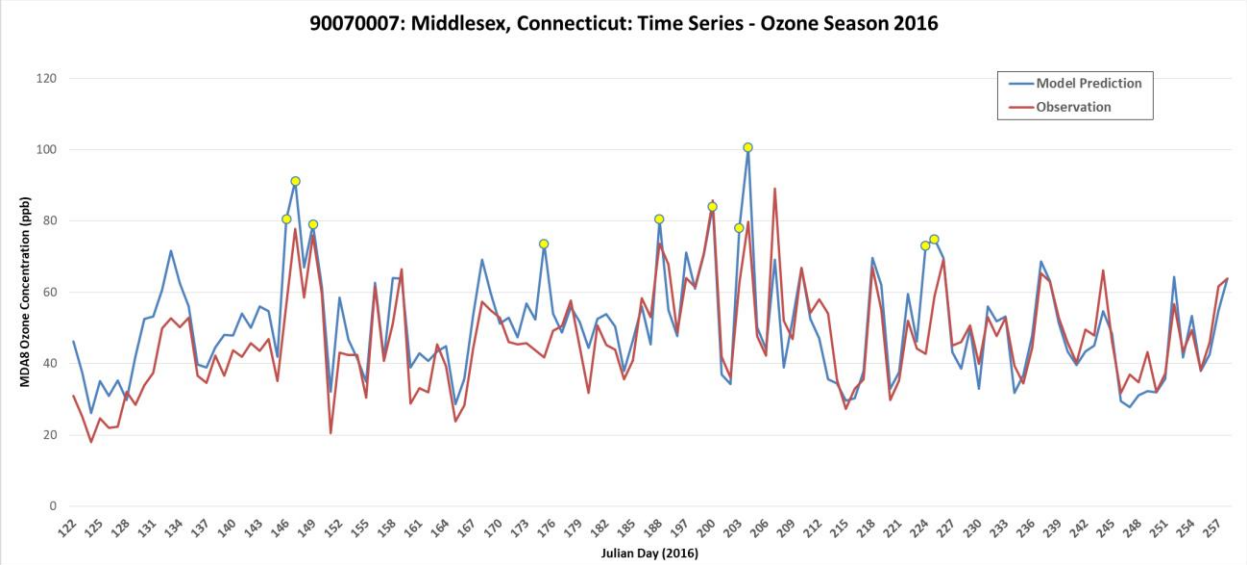

Figure 86. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 90070007. Yellow dots indicate top modeled values.

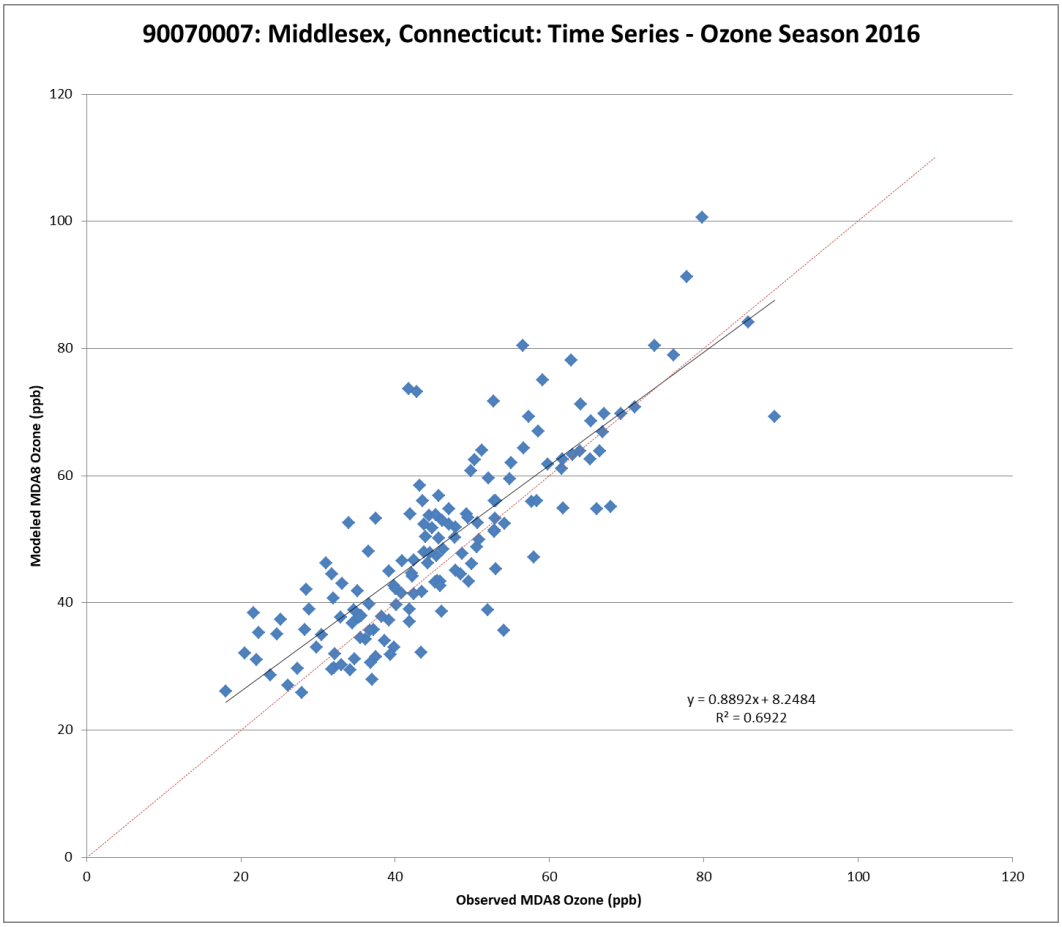

Figure 87. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 90070007.

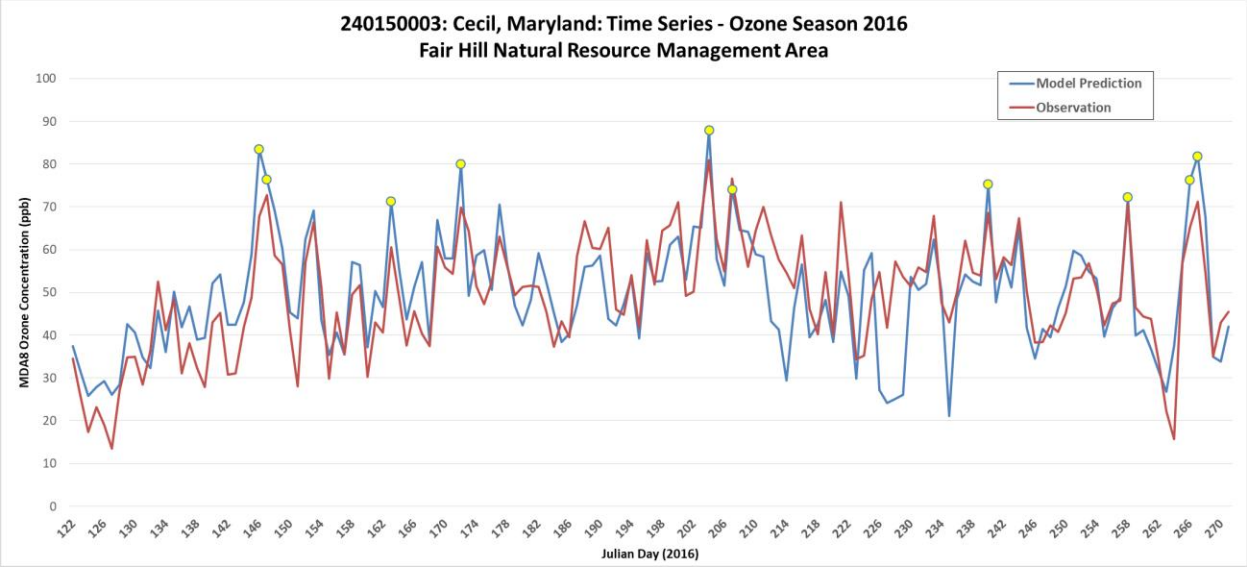

Figure 88. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 240150003. Yellow dots indicate top modeled values.

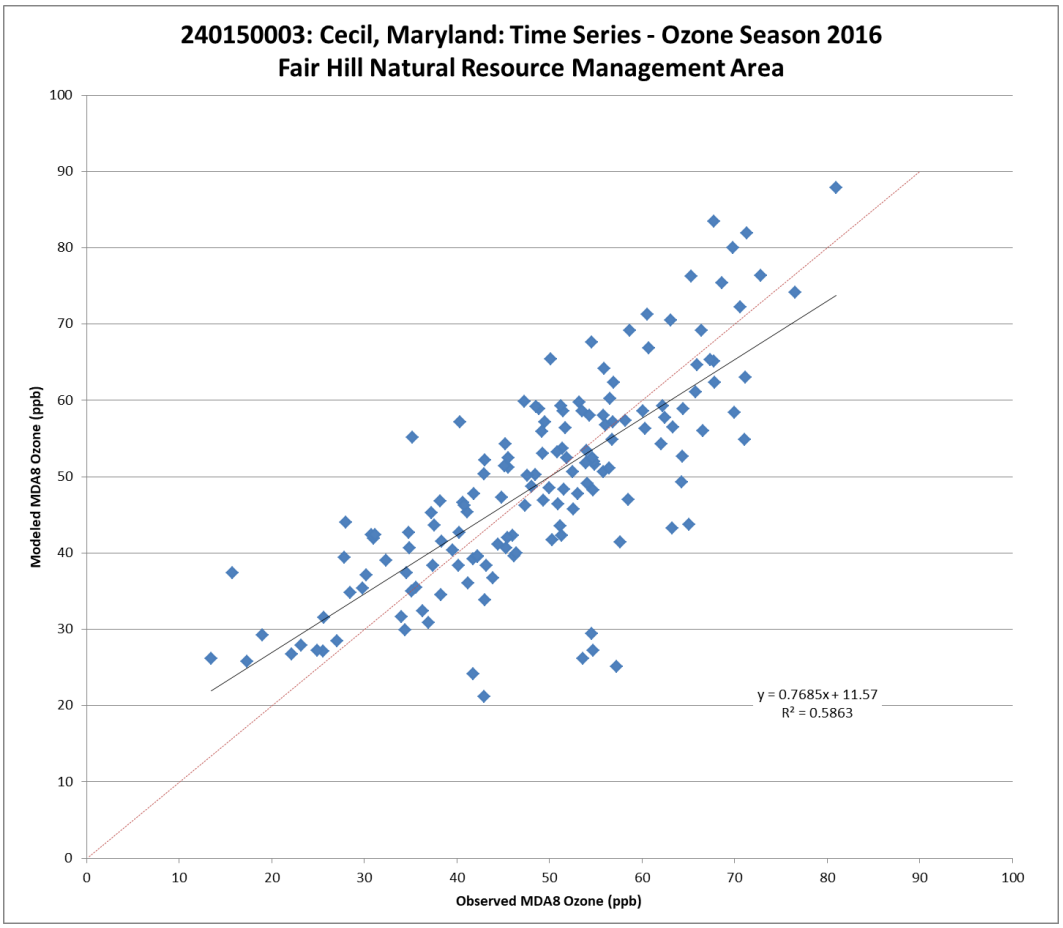

Figure 89. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 240150003.

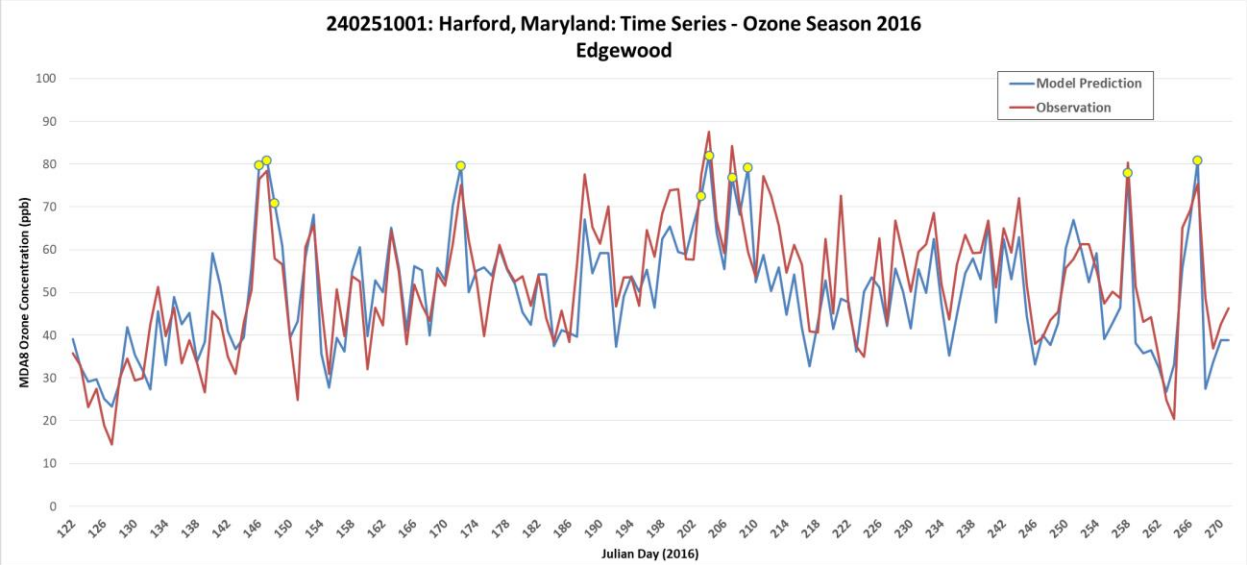

Figure 90. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 240251001. Yellow dots indicate top modeled values.

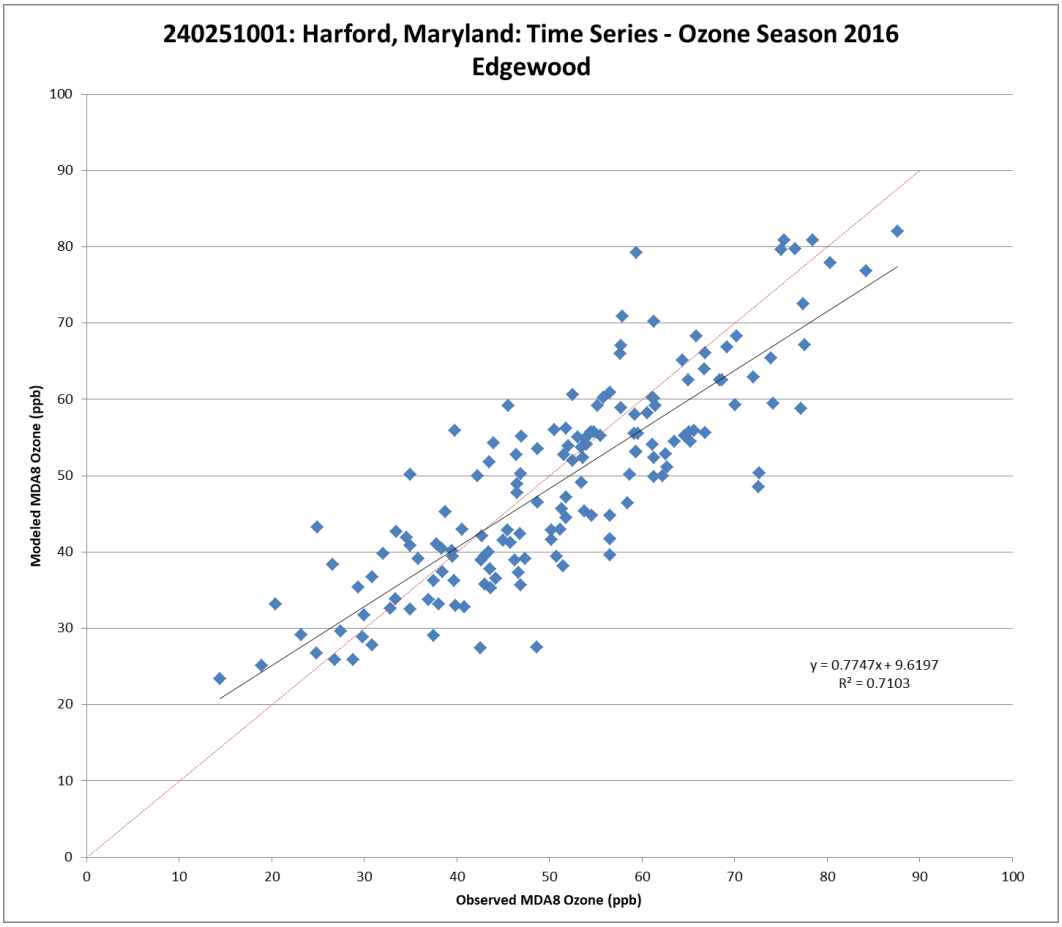

Figure 91. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 240251001.

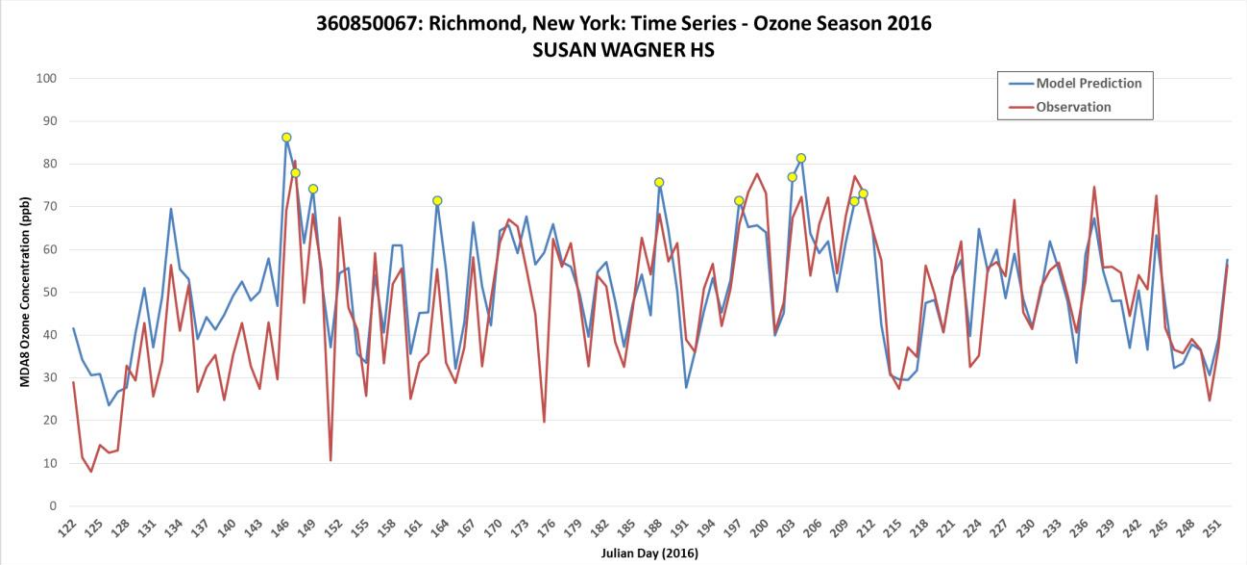

Figure 92. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 360850067. Yellow dots indicate top modeled values.

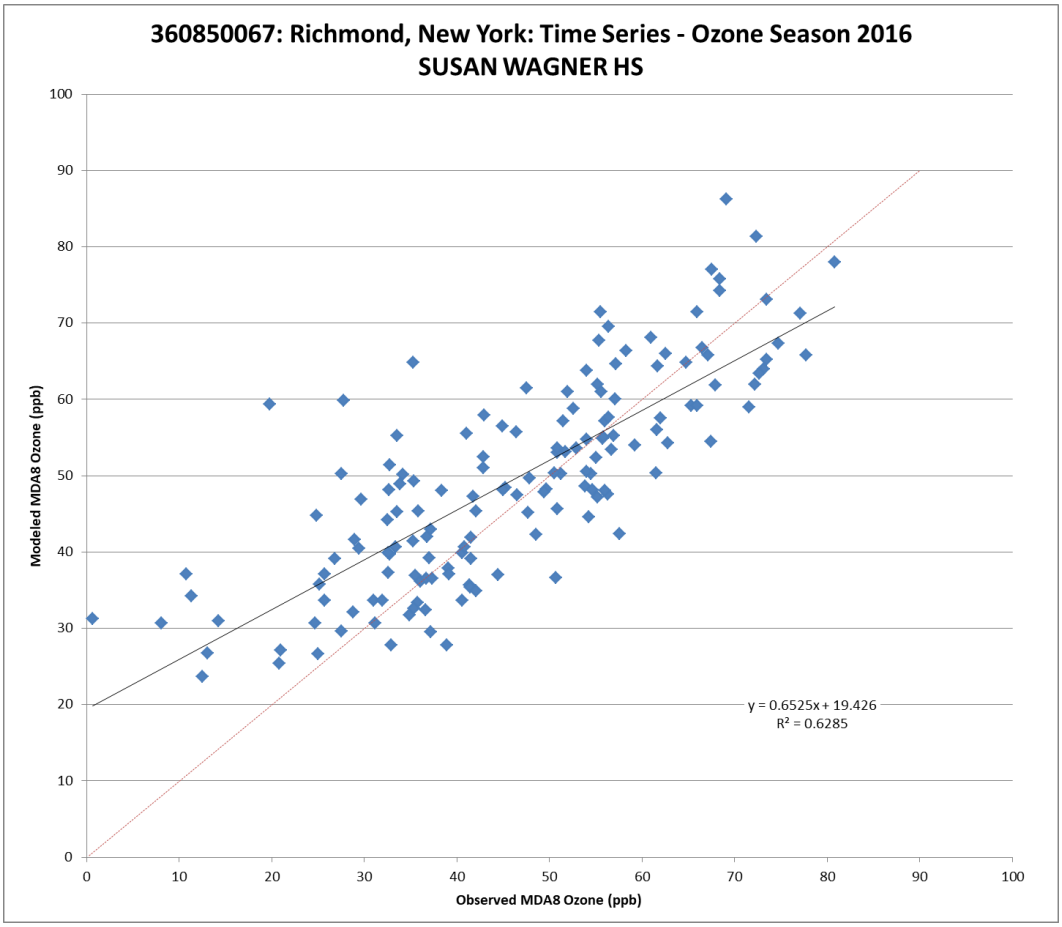

Figure 93. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 360850067.

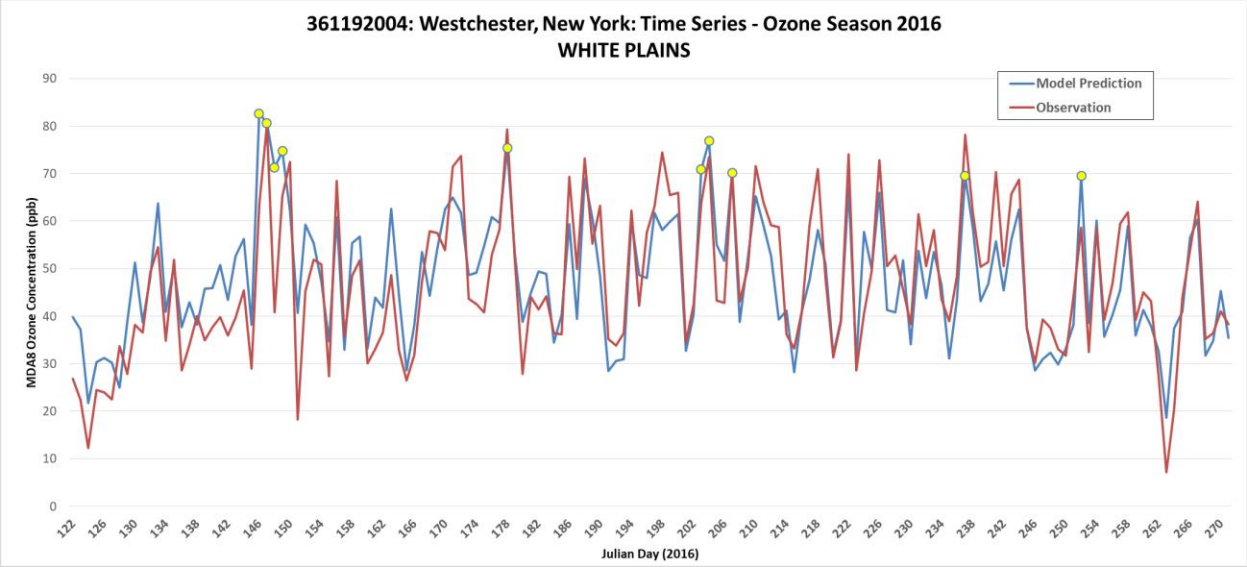

Figure 94. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 361192004. Yellow dots indicate top modeled values.

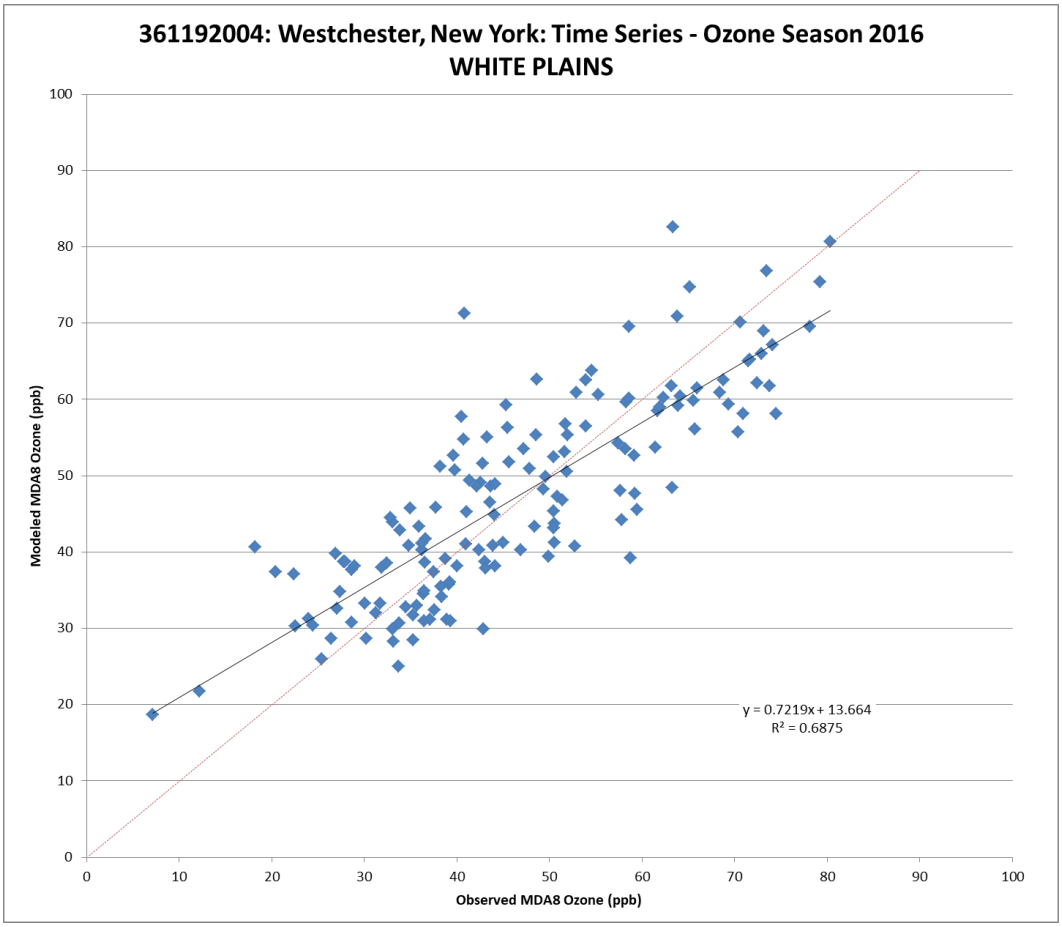

Figure 95. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 361192004.

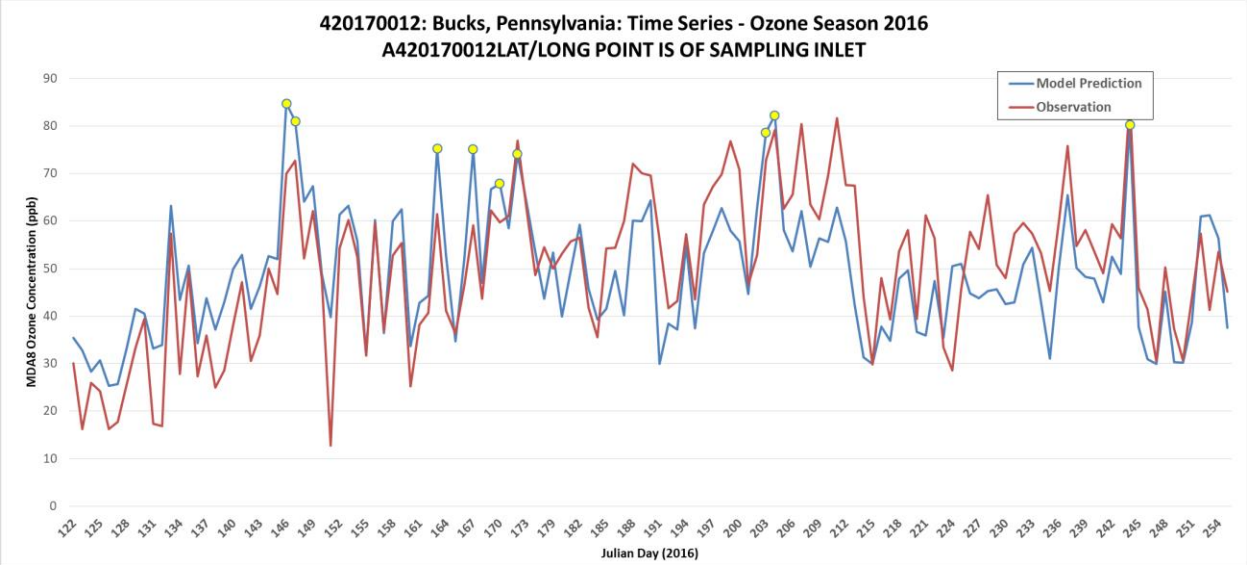

Figure 96. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 420170012. Yellow dots indicate top modeled values.

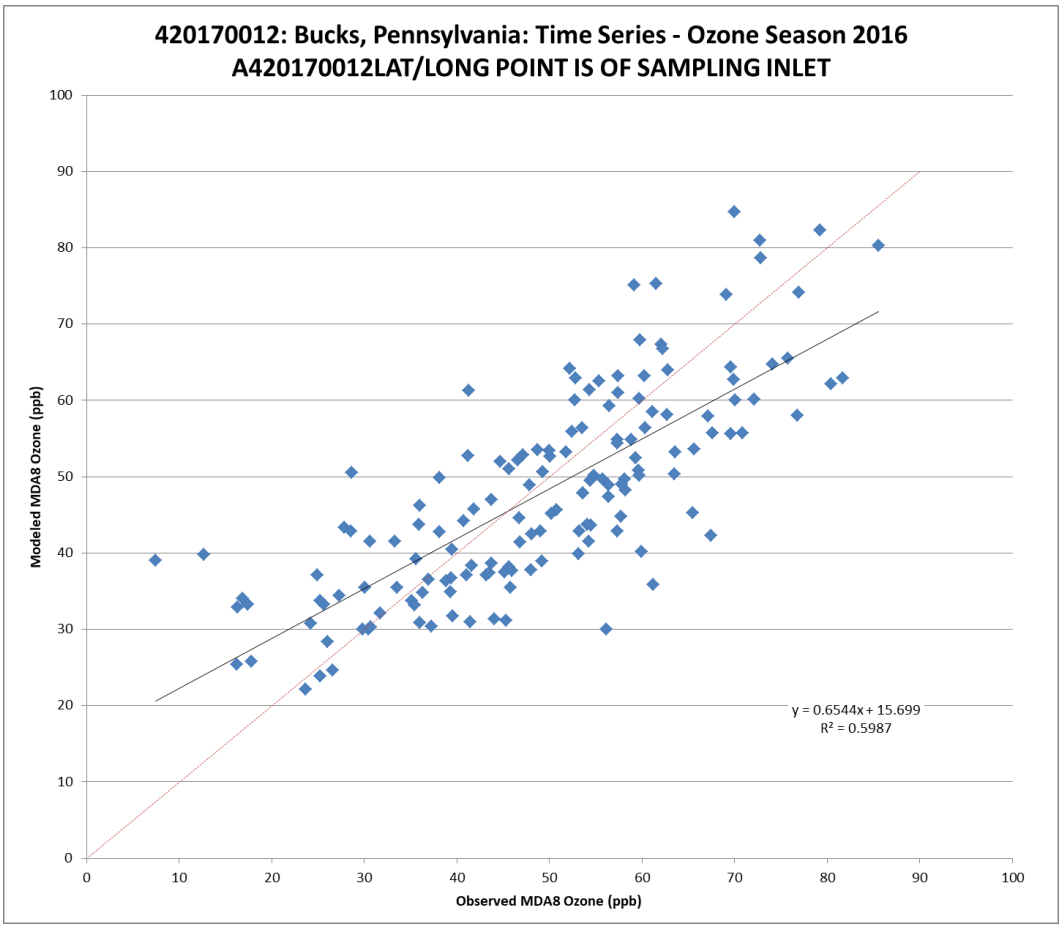

Figure 97. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 420170012.

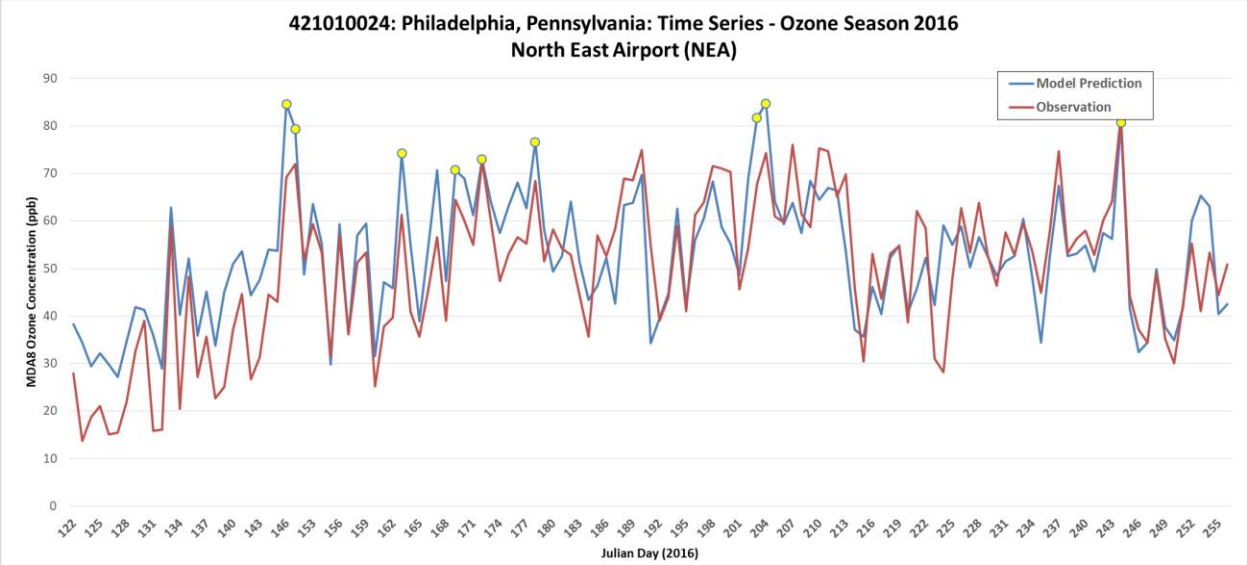

Figure 98. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 421010024. Yellow dots indicate top modeled values.

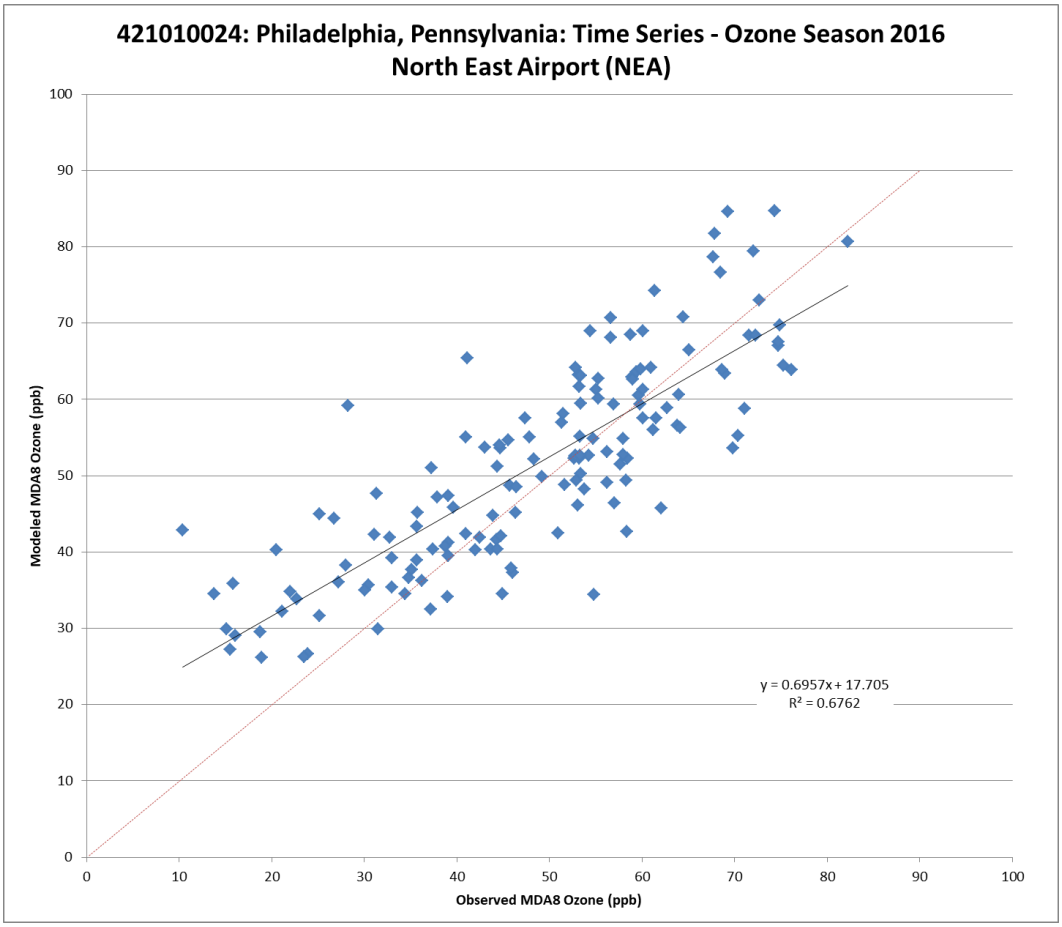

Figure 99. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 421010024.

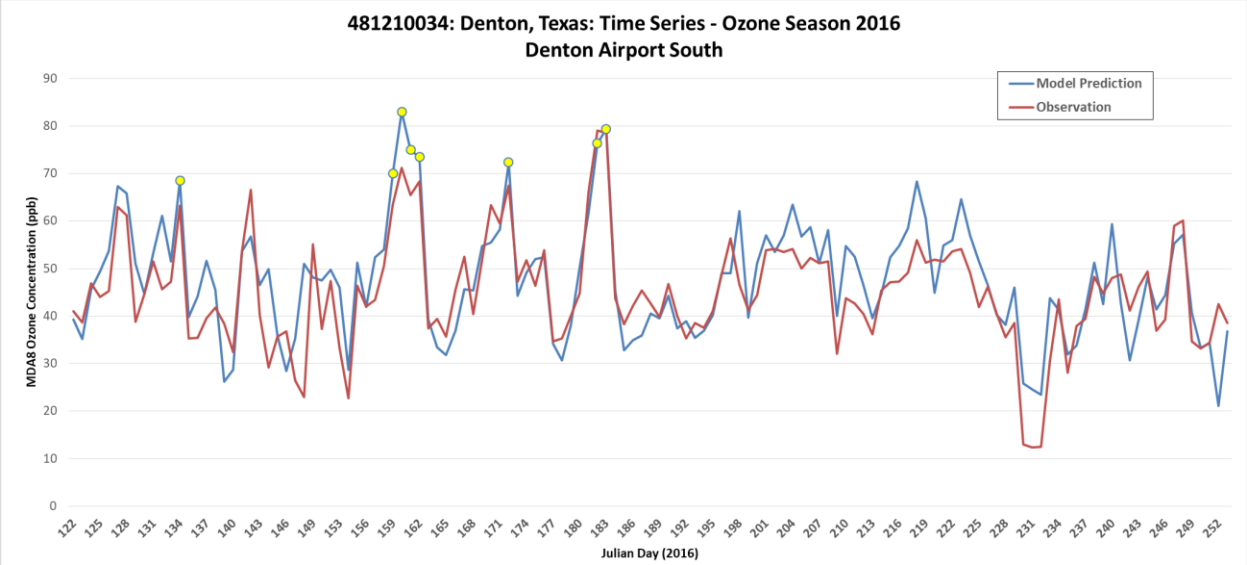

Figure 100. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 481210034. Yellow dots indicate top modeled values.

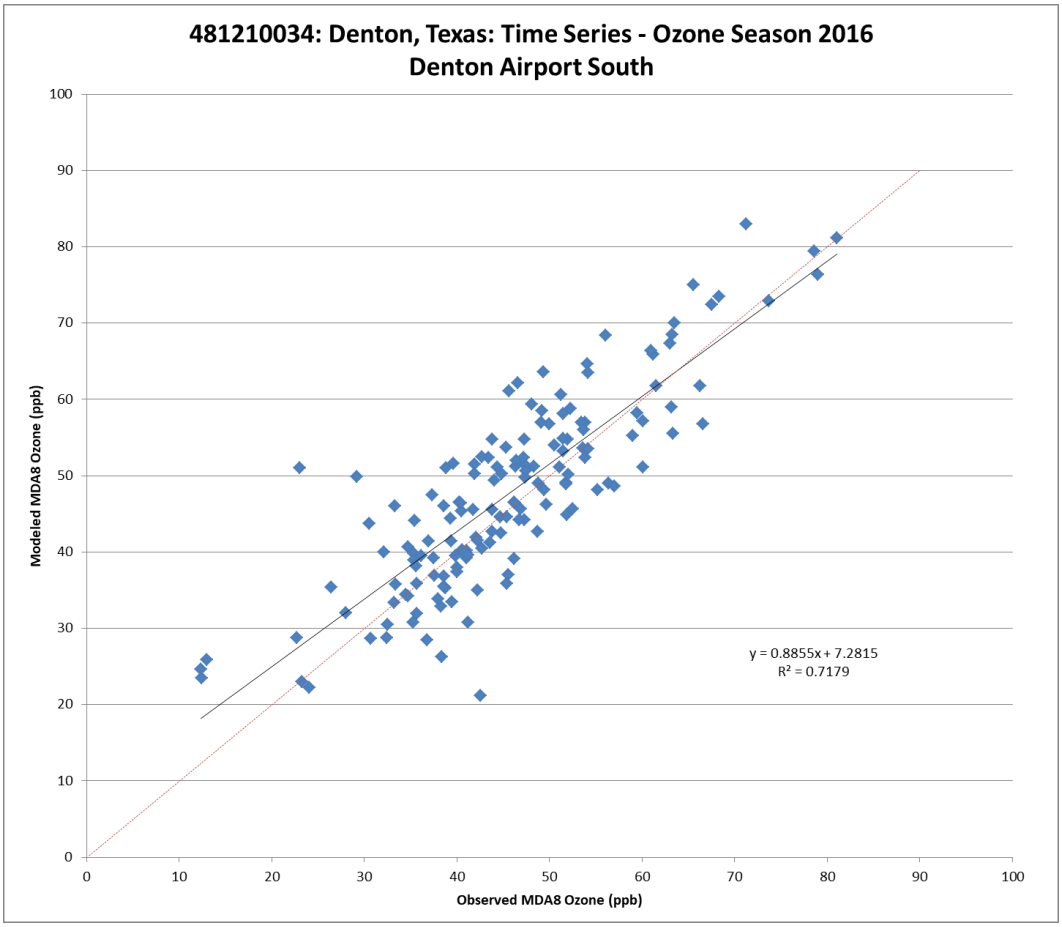

Figure 101. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 481210034.

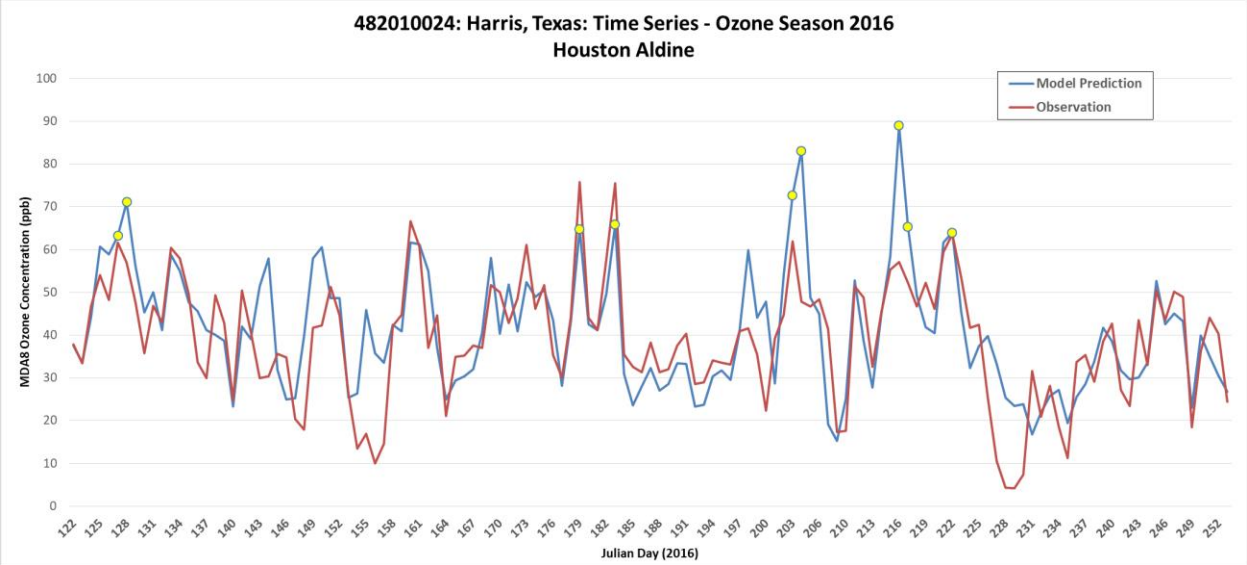

Figure 102. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 482010024. Yellow dots indicate top modeled values.

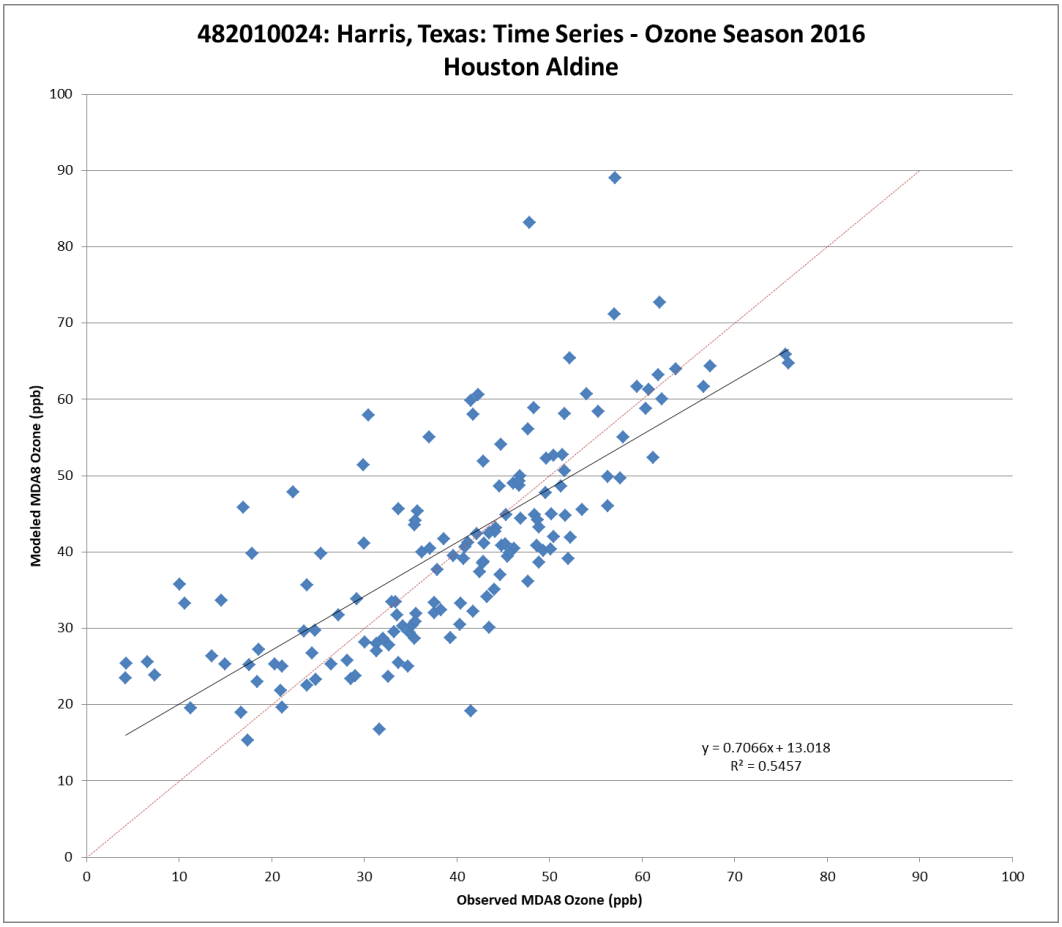

Figure 103. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 482010024.

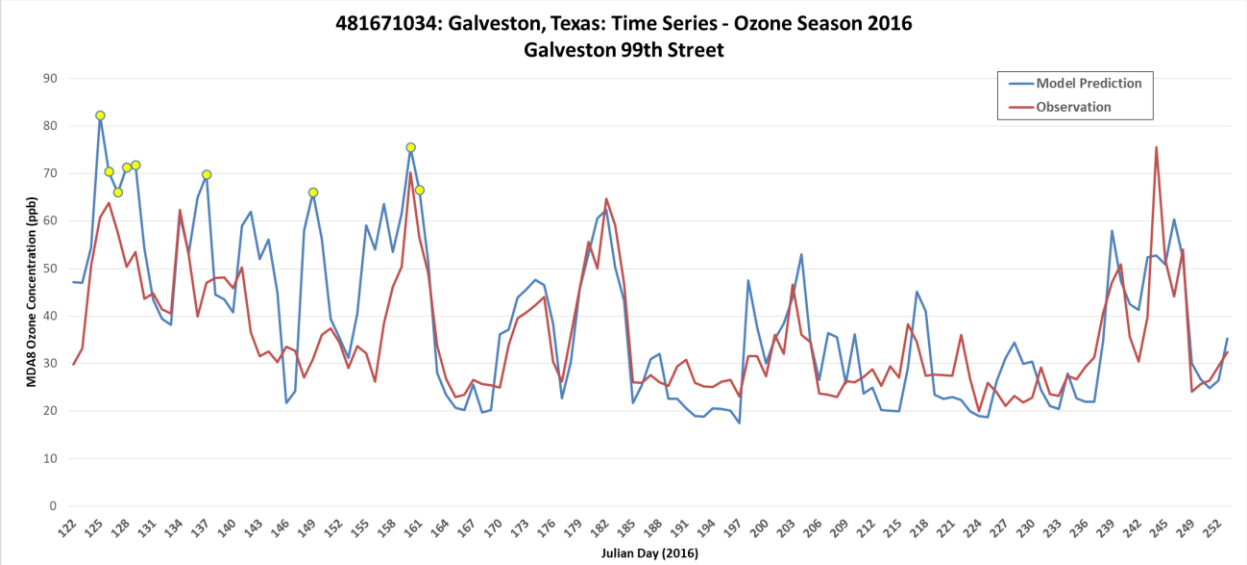

Figure 104. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 481671034. Yellow dots indicate top modeled values.

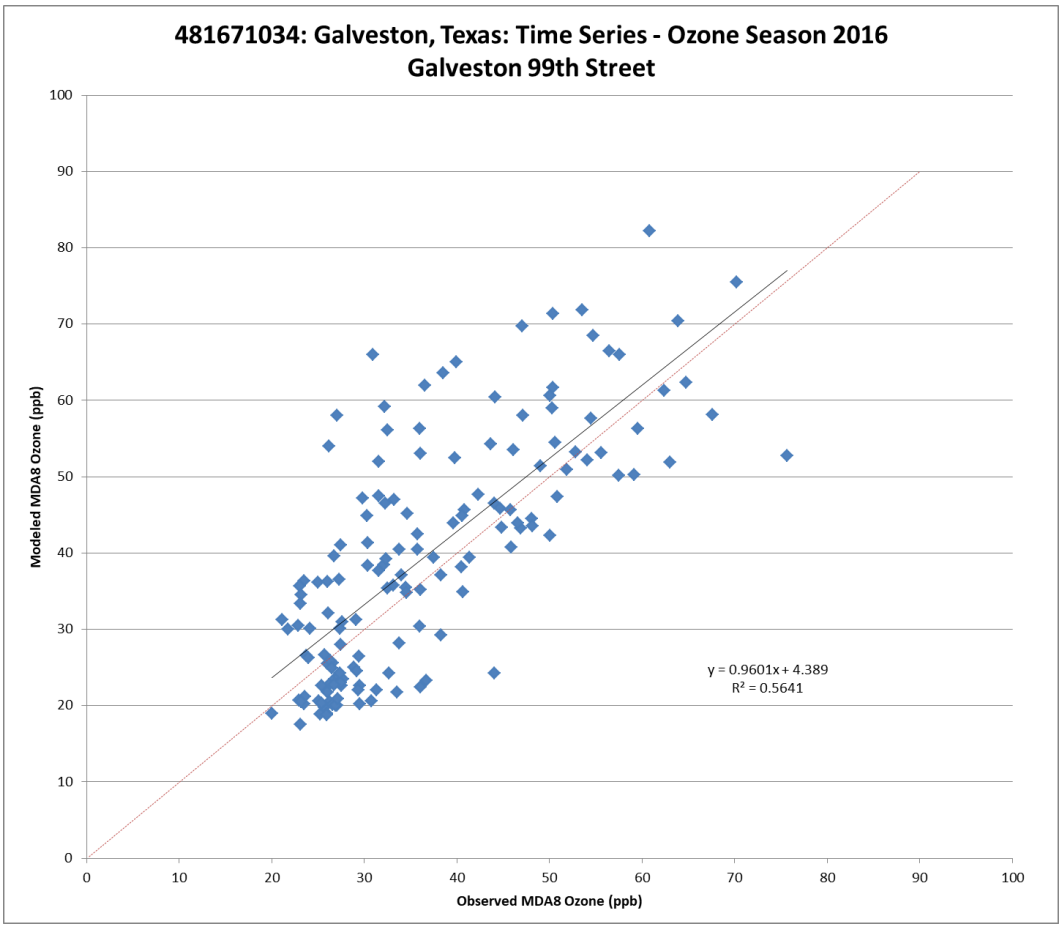

Figure 105. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 481671034.

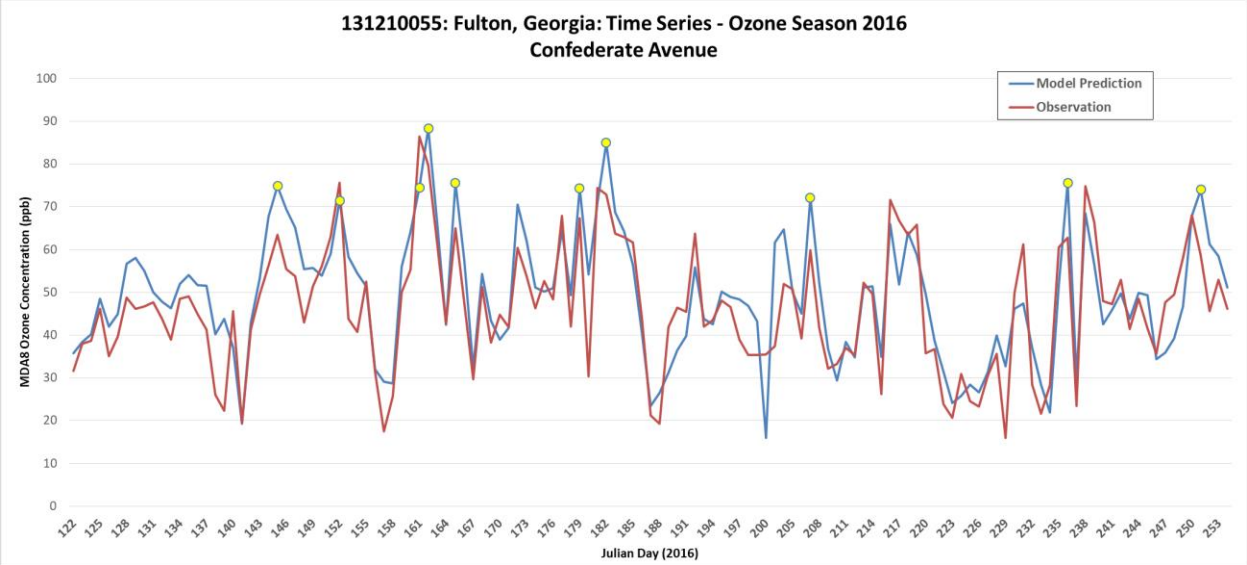

Figure 106. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 131210055. Yellow dots indicate top modeled values.

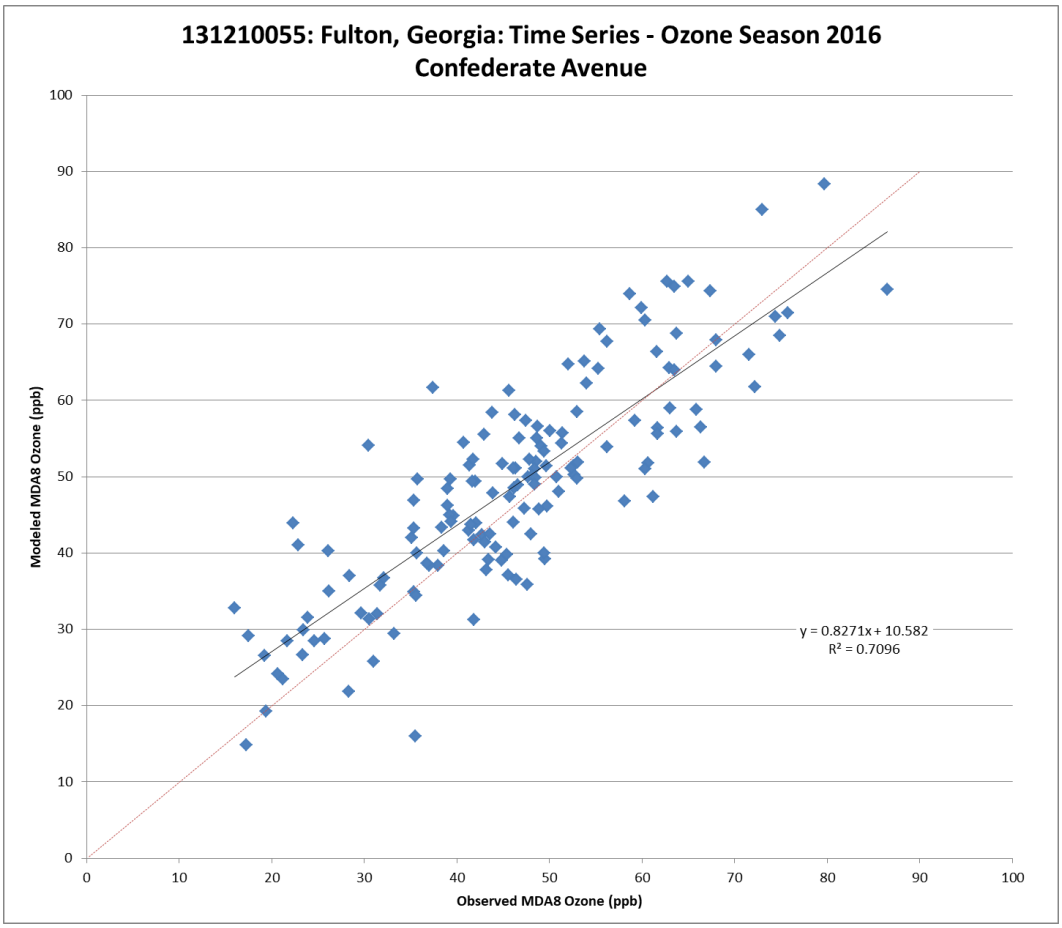

Figure 107. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 131210055.

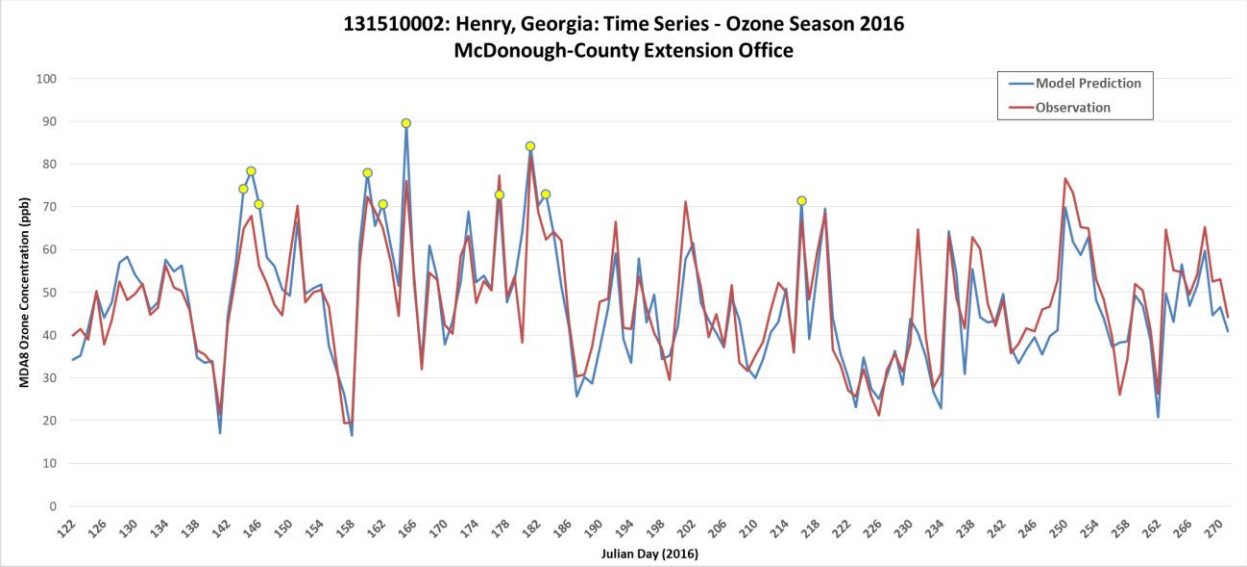

Figure 108. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 131510002. Yellow dots indicate top modeled values.

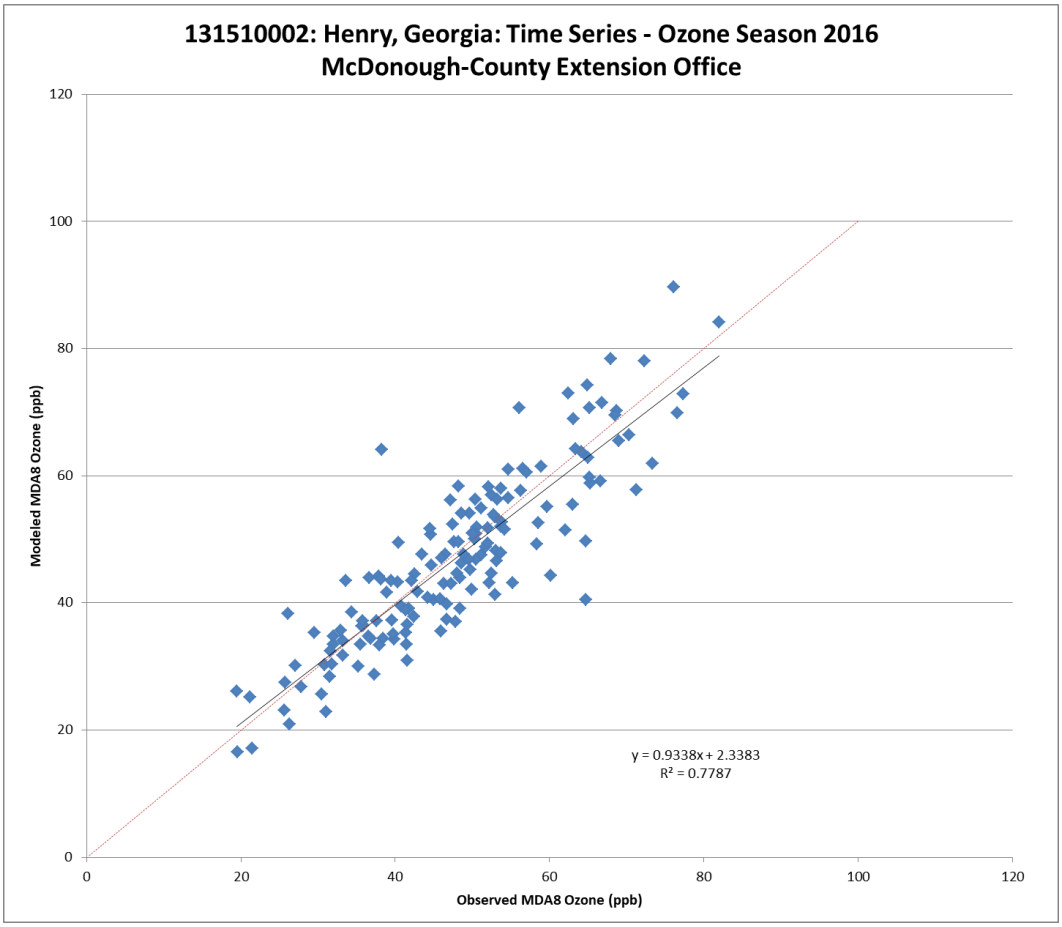

Figure 109. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 131510002.

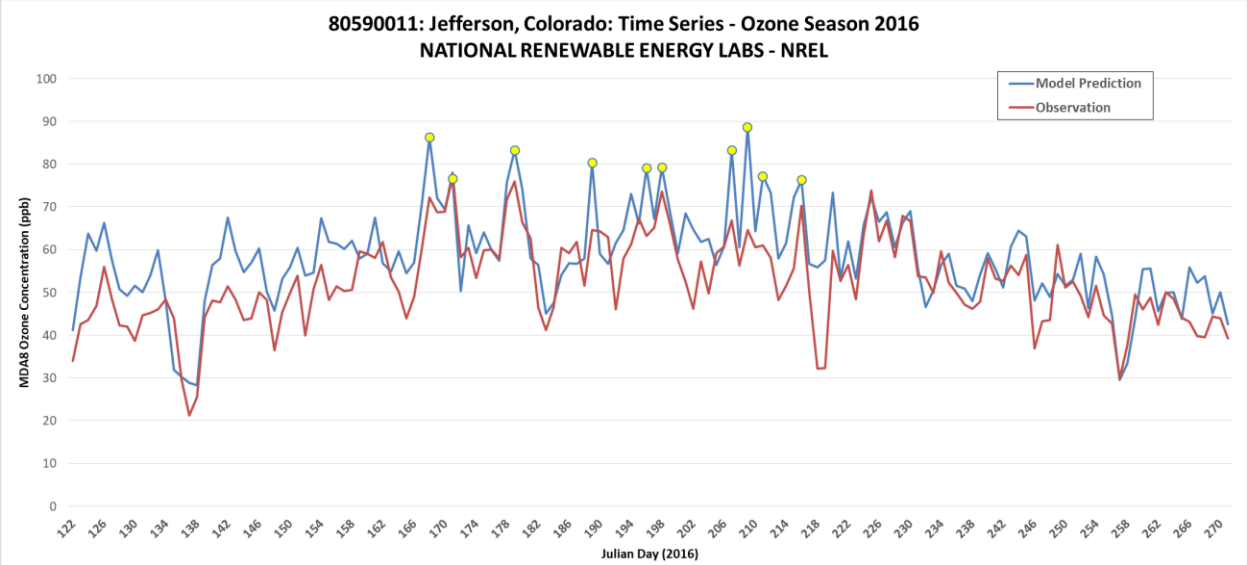

Figure 110. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 80590011. Yellow dots indicate top modeled values.

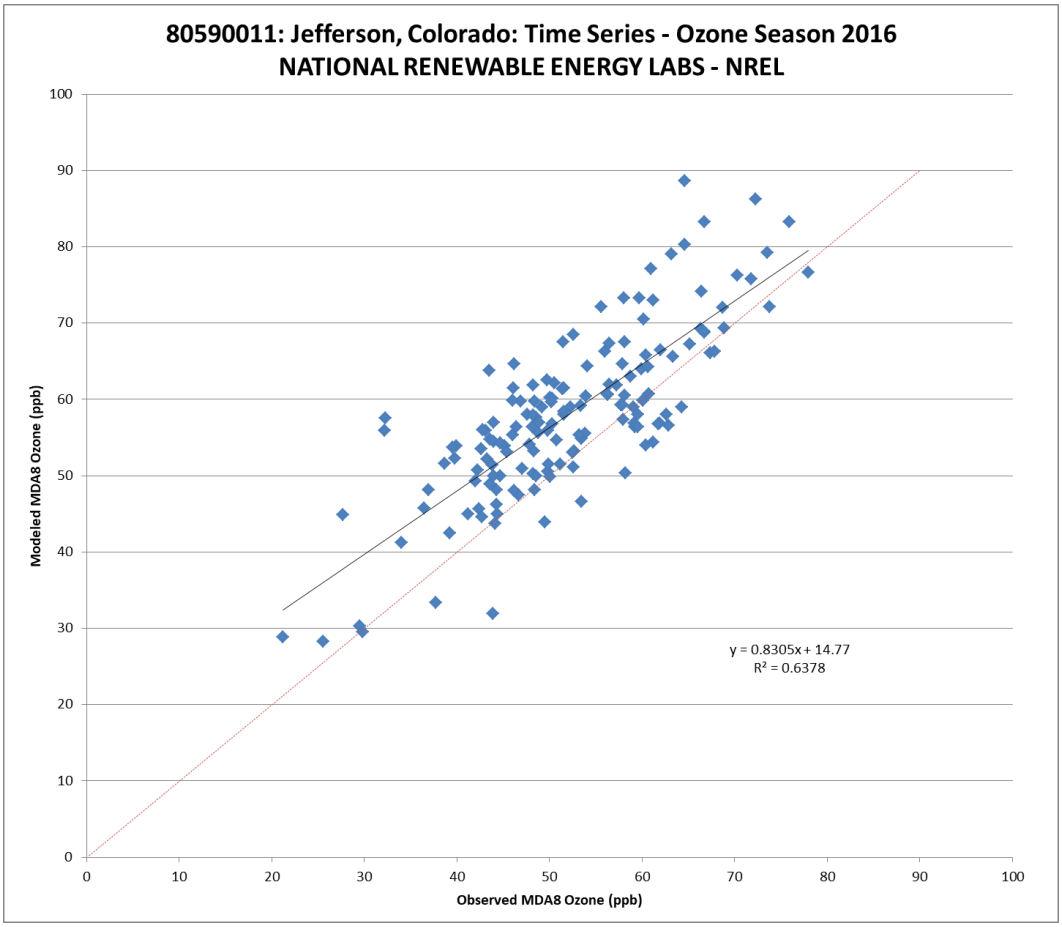

Figure 111. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 80590011.

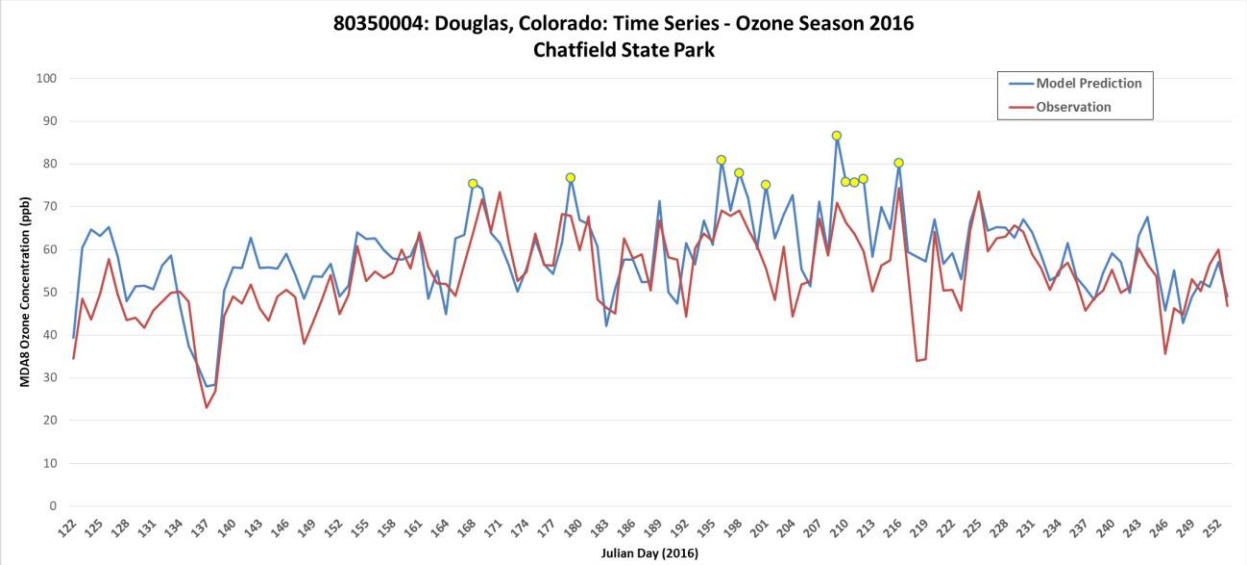

Figure 112. Time series of observed (red) and predicted 12km (blue) MDA8 ozone for May through September 2016 at site 80350004. Yellow dots indicate top modeled values.

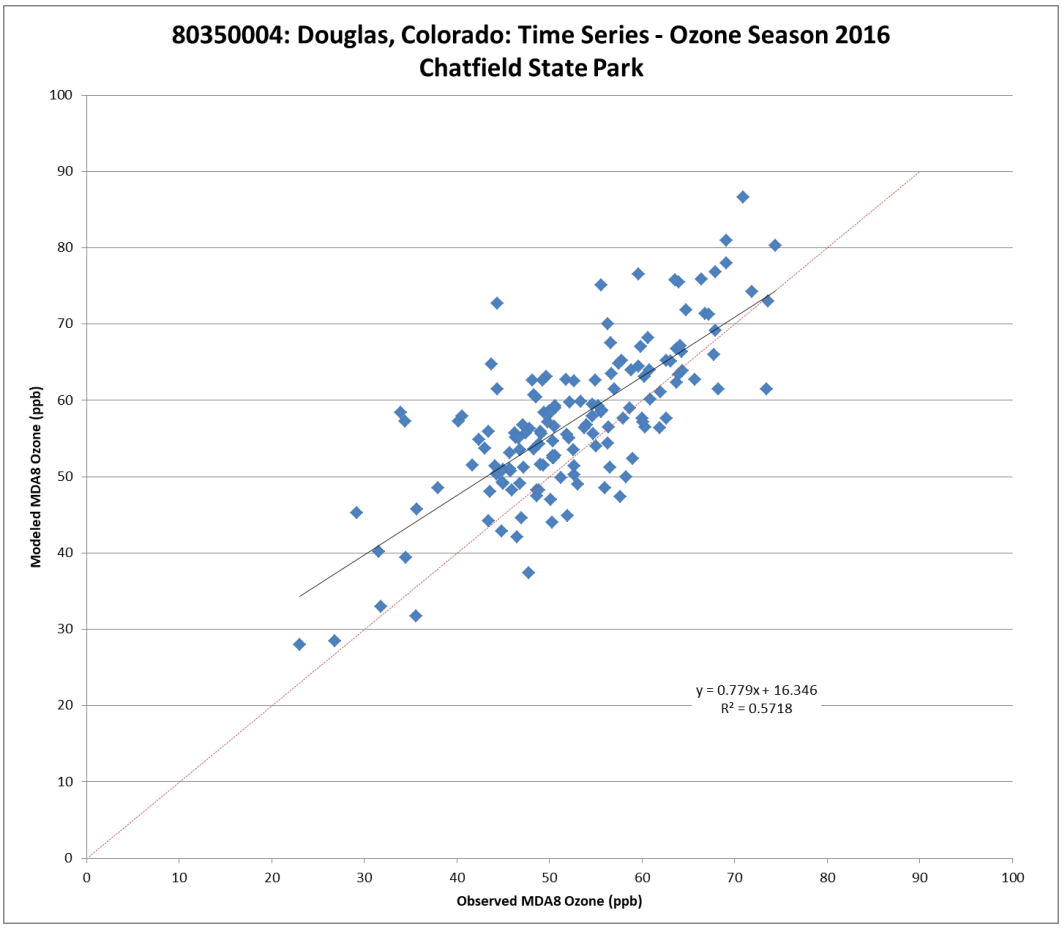

Figure 113. Correlation of observed and predicted MDA8 ozone for May through September 2016 at site 80350004.

3.0 SUMMARY

As has been seen with recent 12km evaluations conducted by EPA on the 2016fe platform (EPA, 2019), this 12km CAMx modeling configuration has better skill at predicting ozone concentrations in the mid-range of 40 to 60 ppb than it does at the tail ends of the concentration curves. Additionally, as noted above and demonstrated with the statistics and figures of this analysis, low-end observed concentrations (less than 40 ppb) tend to be over predicted and high-end (greater than 60 ppb) concentrations tend to be under predicted by this platform configuration across every domain.

Over the entire concentration range, the model tends to under predict MDA8 ozone across most months in the SouthWest, West, and West-North-Central regions and over predict MDA8 ozone concentrations everywhere else. We see this list of regions expand to all regions where the model under predicts across concentrations ≥ 60 ppb. However, looking across all represented monitors in 12km domain, we note that the model is able to capture site-to-site differences in the short-term (i.e., day-to-day) variability and the general magnitude of the observed ozone concentrations for the May through September 2016 episode.

We see a small over prediction of concentrations in the Gulf Coast for all (> 0 ppb) observations and under prediction at concentrations > 60 ppb. In the I-95 Corridor region, we note ozone under prediction during the Similar to the larger regions, we note that the model is able to capture site-to-site differences in the short-term (i.e., day-to-day) variability and the general magnitude of the observed ozone concentrations for the May through September 2016 episode.

As a result, and compared to similar results from comparable studies, we find that the predictions from the 12km domain using this configuration of the 2016fh modeling platform corresponds closely to observed concentrations in terms of the magnitude, temporal fluctuations, and geographic differences for 8-hour daily maximum ozone.

Thus, the model performance results demonstrate the scientific credibility of the 2016 modeling platform for this 12km domains. These results provide confidence in the ability of the modeling platform to be used for future year ozone concentration projections and contribution analyses.

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Appendix A

Model performance statistics for MDA8 ozone at individual monitoring sites based on days with observed values ≥ 60 ppb.

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
010030010	7	63.20	58.54	-4.66	5.60	-7.37	8.86	0.15
010331002	4	65.34	62.12	-3.23	3.23	-4.94	4.94	0.98
010499991	13	62.98	59.55	-3.43	4.46	-5.45	7.08	0.64
010510001	2	62.70	57.68	-5.02	5.02	-8.01	8.01	1.00
010550011	13	63.11	58.83	-4.28	5.03	-6.79	7.97	0.71
010690004	3	63.21	54.87	-8.34	8.34	-13.19	13.19	0.99
010730023	25	65.31	60.90	-4.41	6.11	-6.76	9.35	0.65
010731003	22	64.31	63.37	-0.94	5.36	-1.47	8.33	0.64
010731005	15	65.52	64.23	-1.29	4.47	-1.96	6.82	0.81
010731010	16	63.34	60.05	-3.29	6.38	-5.19	10.07	0.08
010732006	19	66.34	64.69	-1.64	4.21	-2.48	6.35	0.79
010735003	17	64.19	61.99	-2.21	3.15	-3.44	4.91	0.72
010736002	23	65.87	63.66	-2.21	6.44	-3.36	9.77	0.48
010890014	17	63.81	59.90	-3.91	4.51	-6.13	7.07	0.34
010890022	10	63.82	58.58	-5.24	5.24	-8.20	8.20	0.84
010970003	6	64.07	57.09	-6.98	6.98	-10.90	10.90	0.64
010972005	5	63.03	61.04	-1.99	6.10	-3.15	9.68	0.72
011011002	8	64.01	64.04	0.03	8.18	0.05	12.78	0.25
011030011	18	63.70	58.76	-4.93	5.23	-7.75	8.21	0.47
011130002	10	64.95	56.71	-8.25	9.85	-12.70	15.16	0.41
011170004	16	67.34	67.30	-0.04	3.13	-0.05	4.65	0.78
011190003	1	60.00	56.02	-3.98	3.98	-6.63	6.63	0.00
011250010	4	64.88	68.51	3.63	3.63	5.59	5.59	0.99
040038001	22	62.42	50.11	-12.32	12.34	-19.73	19.77	0.27
040051008	13	63.07	53.54	-9.53	9.53	-15.10	15.11	0.27
040058001	18	62.93	51.77	-11.16	11.16	-17.73	17.73	0.08
040070010	43	64.60	55.66	-8.93	9.11	-13.83	14.10	0.20
040128000	38	63.14	47.93	-15.21	15.21	-24.09	24.09	0.33
040130019	48	64.88	55.94	-8.94	10.16	-13.78	15.67	0.40
040131003	68	66.56	56.47	-10.09	10.83	-15.16	16.27	0.46
040131004	61	66.90	57.33	-9.57	10.44	-14.31	15.61	0.45
040131010	61	65.71	58.45	-7.26	9.96	-11.04	15.16	0.21
040132001	36	63.14	58.76	-4.38	7.64	-6.94	12.11	0.20
040132005	74	66.21	59.47	-6.73	7.64	-10.17	11.53	0.32
040133002	38	65.46	56.68	-8.78	9.50	-13.41	14.52	0.51
040133003	44	65.25	60.97	-4.28	7.14	-6.56	10.94	0.34
040134003	41	63.94	56.45	-7.48	9.22	-11.70	14.43	0.24
040134004	41	64.63	55.37	-9.26	10.63	-14.33	16.44	0.31
040134005	35	63.43	59.47	-3.97	7.78	-6.25	12.26	0.17
040134008	44	65.35	59.18	-6.17	8.01	-9.45	12.26	0.23
040134010	12	63.21	61.28	-1.93	6.15	-3.05	9.73	0.15
040134011	3	61.96	44.64	-17.32	17.32	-27.95	27.95	0.87
040135100	45	64.47	61.65	-2.82	6.93	-4.37	10.75	0.16
040137003	24	62.49	50.77	-11.72	12.32	-18.76	19.71	0.18
040137020	51	65.40	60.07	-5.33	7.81	-8.14	11.94	0.42
040137021	68	65.77	60.26	-5.51	8.14	-8.38	12.38	0.40

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
040137022	64	65.36	60.90	-4.46	7.37	-6.82	11.27	0.36
040137024	54	65.14	60.79	-4.35	7.00	-6.67	10.74	0.30
040139508	68	64.99	55.87	-9.12	9.56	-14.04	14.71	0.39
040139702	59	64.95	60.21	-4.73	7.59	-7.29	11.68	0.35
040139704	43	63.89	63.23	-0.66	6.40	-1.03	10.01	0.06
040139706	33	64.78	57.08	-7.70	9.08	-11.89	14.02	0.24
040139997	60	66.31	54.14	-12.17	12.54	-18.35	18.91	0.53
040170119	13	61.76	48.79	-12.97	12.97	-21.00	21.00	0.46
040190021	41	64.24	53.06	-11.18	11.37	-17.40	17.69	0.17
040191011	13	61.39	56.77	-4.62	6.38	-7.52	10.39	0.45
040191018	18	62.39	48.43	-13.96	14.02	-22.37	22.47	0.18
040191020	19	63.07	52.64	-10.43	11.26	-16.54	17.86	0.17
040191028	10	62.55	53.99	-8.56	9.74	-13.68	15.56	0.09
040191030	23	63.56	51.91	-11.66	12.11	-18.34	19.05	0.20
040191032	21	62.99	54.70	-8.29	8.71	-13.17	13.82	0.02
040191034	3	62.04	50.38	-11.66	11.66	-18.80	18.80	0.70
040213001	53	65.53	59.01	-6.52	8.44	-9.95	12.88	0.23
040213003	22	62.86	51.70	-11.16	11.36	-17.76	18.07	0.49
040213007	29	63.55	49.68	-13.87	13.87	-21.83	21.83	0.18
040217001	19	63.91	49.95	-13.95	14.43	-21.83	22.58	0.15
040218001	69	64.81	53.35	-11.46	11.73	-17.68	18.09	0.30
040258033	13	62.73	52.51	-10.23	10.83	-16.30	17.26	0.08
040278011	24	64.69	53.23	-11.46	12.23	-17.72	18.90	0.37
050350005	14	68.33	59.70	-8.63	8.63	-12.63	12.63	0.90
051010002	4	63.69	52.41	-11.28	11.28	-17.71	17.71	0.43
051130003	5	62.28	53.15	-9.13	9.13	-14.66	14.66	0.50
051190007	8	64.60	61.94	-2.66	6.15	-4.12	9.51	0.19
051191002	7	64.66	64.82	0.16	5.20	0.24	8.05	0.27
051430005	1	60.13	53.90	-6.23	6.23	-10.36	10.36	0.00
051430006	1	63.63	58.27	-5.36	5.36	-8.42	8.42	0.00
060010007	19	68.28	56.41	-11.87	12.68	-17.39	18.58	0.43
060012001	8	62.83	57.18	-5.65	8.10	-8.99	12.89	0.03
060012005	49	68.23	56.75	-11.48	11.49	-16.82	16.84	0.65
060050002	37	65.66	60.36	-5.30	6.69	-8.07	10.18	0.23
060070007	65	67.63	56.98	-10.65	10.82	-15.75	16.00	0.50
060070008	15	64.32	64.15	-0.17	5.67	-0.26	8.82	0.24
060090001	65	69.15	56.66	-12.49	12.62	-18.06	18.25	0.47
060111002	20	63.20	56.05	-7.15	7.82	-11.31	12.38	0.18
060130002	11	64.72	62.52	-2.20	6.75	-3.41	10.43	0.81
060131002	13	67.13	62.75	-4.37	5.22	-6.51	7.78	0.62
060131004	1	61.50	80.43	18.93	18.93	30.78	30.78	0.00
060132007	9	65.57	58.64	-6.93	11.75	-10.58	17.92	0.09
060170010	107	72.74	56.77	-15.98	16.37	-21.96	22.50	0.52
060170012	46	64.94	56.41	-8.53	9.56	-13.13	14.72	0.08
060170020	64	69.70	63.20	-6.50	8.38	-9.32	12.02	0.48
060190007	108	72.36	56.92	-15.44	15.44	-21.34	21.34	0.76

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
060190011	110	72.76	56.40	-16.36	16.45	-22.49	22.60	0.77
060190242	91	71.72	55.80	-15.91	15.91	-22.19	22.19	0.65
060190500	101	71.14	56.81	-14.33	14.33	-20.15	20.15	0.77
060192009	71	67.46	53.13	-14.33	14.33	-21.24	21.24	0.62
060194001	123	74.69	58.28	-16.41	16.41	-21.97	21.97	0.84
060195001	110	74.10	58.59	-15.51	15.51	-20.93	20.93	0.80
060210003	7	61.43	54.98	-6.45	6.45	-10.50	10.50	0.37
060250005	48	66.41	61.11	-5.30	7.17	-7.98	10.80	0.36
060251003	46	67.09	60.35	-6.74	8.06	-10.05	12.01	0.41
060254003	10	63.15	60.22	-2.93	4.55	-4.64	7.21	0.46
060254004	11	62.38	59.89	-2.48	4.04	-3.98	6.47	0.19
060270002	3	66.17	56.14	-10.03	10.03	-15.15	15.15	1.00
060270101	58	65.33	54.54	-10.79	11.39	-16.52	17.43	0.23
060290007	127	71.59	56.82	-14.76	14.76	-20.62	20.62	0.79
060290008	121	69.50	52.82	-16.68	16.68	-24.00	24.00	0.70
060290011	130	71.07	54.27	-16.79	16.88	-23.63	23.76	0.60
060290014	120	70.69	52.79	-17.90	17.90	-25.32	25.32	0.71
060290232	70	65.03	57.41	-7.62	8.87	-11.72	13.64	0.22
060292012	120	72.27	54.99	-17.28	17.28	-23.91	23.91	0.68
060295002	135	72.99	56.82	-16.17	16.28	-22.15	22.30	0.75
060296001	115	69.82	52.09	-17.74	17.74	-25.40	25.40	0.69
060310500	78	67.30	54.08	-13.22	13.23	-19.64	19.65	0.64
060311004	105	70.43	53.52	-16.90	16.93	-24.00	24.04	0.73
060333001	2	61.63	52.53	-9.10	9.10	-14.76	14.76	1.00
060370002	97	70.83	61.60	-9.23	10.16	-13.03	14.34	0.63
060370016	109	73.00	60.56	-12.44	12.67	-17.04	17.35	0.66
060370113	16	64.85	54.98	-9.87	11.63	-15.22	17.94	0.07
060371103	25	65.52	57.57	-7.95	11.37	-12.13	17.36	0.04
060371201	87	68.11	53.71	-14.39	14.80	-21.14	21.74	0.48
060371302	12	63.55	53.83	-9.71	9.71	-15.28	15.28	0.31
060371602	27	66.05	56.99	-9.06	10.81	-13.72	16.37	0.48
060371701	77	69.65	63.61	-6.04	8.60	-8.67	12.35	0.63
060372005	62	69.11	56.48	-12.63	12.84	-18.27	18.58	0.63
060375005	13	66.39	43.57	-22.82	22.82	-34.37	34.37	0.33
060376012	114	73.13	58.69	-14.44	15.01	-19.74	20.52	0.47
060379033	132	71.16	56.76	-14.40	14.57	-20.24	20.48	0.53
060390004	79	69.07	56.81	-12.26	12.26	-17.75	17.75	0.60
060392010	99	70.32	55.56	-14.76	14.76	-20.99	20.99	0.64
060410001	1	67.00	81.26	14.26	14.26	21.28	21.28	0.00
060430003	72	66.28	54.16	-12.12	12.13	-18.29	18.31	0.43
060430006	88	68.08	53.77	-14.31	14.31	-21.02	21.02	0.36
060470003	80	69.66	56.59	-13.07	13.18	-18.77	18.92	0.47
060530002	2	61.00	56.72	-4.28	4.28	-7.02	7.02	1.00
060530008	2	63.82	56.48	-7.34	7.34	-11.50	11.50	1.00
060550003	3	64.46	68.80	4.34	4.34	6.73	6.73	1.00
060570005	103	71.22	57.08	-14.14	14.17	-19.85	19.90	0.57

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
060590007	15	65.85	60.01	-5.85	7.10	-8.88	10.77	0.08
060591003	18	63.53	51.92	-11.61	12.52	-18.27	19.71	0.07
060592022	51	68.29	61.21	-7.08	8.35	-10.36	12.23	0.58
060595001	40	65.62	59.83	-5.79	7.69	-8.83	11.72	0.39
060610003	76	69.52	61.88	-7.64	9.15	-10.99	13.16	0.47
060610004	58	68.63	61.18	-7.45	7.83	-10.86	11.41	0.57
060610006	51	69.62	60.81	-8.81	10.28	-12.65	14.77	0.55
060611004	31	62.98	56.72	-6.25	7.63	-9.93	12.11	0.00
060612002	58	67.04	58.98	-8.06	9.44	-12.02	14.08	0.47
060650008	71	66.30	55.37	-10.93	11.03	-16.49	16.63	0.57
060650009	22	64.79	64.04	-0.75	6.27	-1.15	9.68	0.58
060650012	117	73.50	64.02	-9.48	10.04	-12.90	13.66	0.71
060650016	92	66.21	58.58	-7.63	8.32	-11.53	12.56	0.65
060651004	58	65.05	52.41	-12.64	12.64	-19.44	19.44	0.49
060651010	22	65.41	54.63	-10.78	11.06	-16.48	16.91	0.27
060651016	119	75.59	61.02	-14.58	15.08	-19.28	19.95	0.61
060652002	98	68.74	55.75	-12.99	13.05	-18.90	18.98	0.58
060655001	127	70.36	58.83	-11.53	11.79	-16.39	16.75	0.60
060656001	116	72.04	61.45	-10.59	10.96	-14.69	15.22	0.69
060658001	129	73.81	62.18	-11.63	12.23	-15.75	16.57	0.68
060658005	128	73.73	62.13	-11.61	12.25	-15.74	16.62	0.68
060659001	106	70.55	60.63	-9.92	10.45	-14.07	14.81	0.60
060659003	1	61.38	47.43	-13.95	13.95	-22.73	22.73	0.00
060670002	47	69.32	58.13	-11.20	11.47	-16.15	16.55	0.62
060670006	34	67.80	61.18	-6.62	7.20	-9.76	10.62	0.62
060670010	12	66.28	61.51	-4.78	6.76	-7.21	10.19	0.38
060670011	21	64.55	57.04	-7.52	7.59	-11.64	11.76	0.72
060670012	61	70.16	60.94	-9.22	10.53	-13.15	15.01	0.57
060670014	40	66.66	55.64	-11.02	11.02	-16.53	16.53	0.68
060675003	49	69.13	59.20	-9.93	9.96	-14.36	14.40	0.74
060690002	1	60.50	60.40	-0.10	0.10	-0.17	0.17	0.00
060690003	26	65.39	52.62	-12.77	12.77	-19.52	19.52	0.10
060710001	101	68.22	57.67	-10.55	10.91	-15.47	16.00	0.56
060710005	145	82.58	63.30	-19.28	19.35	-23.35	23.43	0.69
060710012	124	72.49	58.59	-13.90	14.19	-19.17	19.57	0.42
060710306	101	70.16	61.97	-8.18	9.18	-11.67	13.08	0.43
060711001	94	67.32	53.00	-14.33	14.33	-21.28	21.28	0.47
060711004	148	76.45	59.52	-16.93	17.04	-22.15	22.28	0.71
060711234	80	66.43	55.48	-10.95	11.68	-16.48	17.58	0.17
060712002	114	73.08	62.60	-10.48	10.88	-14.34	14.89	0.71
060714001	138	74.80	61.99	-12.81	13.51	-17.13	18.06	0.50
060714003	139	78.51	63.96	-14.55	14.56	-18.53	18.55	0.74
060719002	134	70.19	58.19	-12.00	12.27	-17.10	17.48	0.59
060719004	149	79.35	63.02	-16.34	16.34	-20.59	20.59	0.79
060730001	7	62.77	54.48	-8.29	8.57	-13.20	13.65	0.06
060731001	12	64.09	53.13	-10.96	10.96	-17.10	17.10	0.05

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
060731006	111	67.94	60.62	-7.32	8.31	-10.77	12.24	0.62
060731008	19	66.43	55.23	-11.19	11.29	-16.85	17.00	0.15
060731010	2	61.00	55.85	-5.15	5.15	-8.44	8.44	1.00
060731011	107	66.30	58.38	-7.92	8.22	-11.94	12.39	0.53
060731014	25	65.53	47.36	-18.17	18.17	-27.72	27.72	0.56
060731016	18	65.62	51.95	-13.67	13.67	-20.83	20.83	0.36
060731018	20	66.72	55.16	-11.56	11.64	-17.32	17.44	0.41
060731022	11	64.24	55.20	-9.04	9.58	-14.07	14.91	0.58
060731201	30	63.82	62.73	-1.09	5.74	-1.71	9.00	0.67
060771002	14	64.93	61.95	-2.98	5.11	-4.60	7.86	0.54
060773005	67	67.87	55.93	-11.94	12.21	-17.59	17.98	0.62
060790005	15	62.68	51.89	-10.79	10.88	-17.21	17.36	0.03
060792006	1	62.13	52.36	-9.77	9.77	-15.73	15.73	0.00
060794002	5	62.53	52.69	-9.84	9.84	-15.74	15.74	0.93
060798002	7	63.13	51.64	-11.50	11.50	-18.21	18.21	0.07
060798005	52	66.27	49.99	-16.28	16.28	-24.56	24.56	0.36
060798006	46	65.10	50.95	-14.15	14.15	-21.73	21.73	0.01
060830008	5	65.85	56.29	-9.56	9.56	-14.52	14.52	0.87
060830011	5	64.58	58.50	-6.07	7.98	-9.40	12.36	0.13
060831013	4	61.19	52.46	-8.74	8.74	-14.28	14.28	0.86
060831014	12	64.29	55.47	-8.82	9.02	-13.72	14.03	0.69
060831018	5	63.60	60.31	-3.29	6.92	-5.17	10.88	0.04
060831021	2	64.04	59.84	-4.21	4.21	-6.57	6.57	1.00
060831025	9	64.81	55.96	-8.84	10.25	-13.65	15.81	0.40
060832004	2	61.13	56.36	-4.77	4.77	-7.80	7.80	0.00
060832011	4	64.94	59.34	-5.61	9.55	-8.63	14.70	0.06
060833001	4	63.85	54.62	-9.23	9.23	-14.45	14.45	0.96
060834003	3	64.67	51.29	-13.38	13.38	-20.69	20.69	0.91
060850002	4	64.97	53.87	-11.11	11.11	-17.10	17.10	0.01
060850005	5	63.40	57.77	-5.63	5.64	-8.89	8.89	0.32
060851001	5	63.45	58.98	-4.47	8.82	-7.05	13.89	0.73
060852006	8	66.86	64.91	-1.96	4.60	-2.92	6.88	0.76
060890004	27	65.91	59.19	-6.72	6.88	-10.20	10.44	0.50
060890007	15	65.49	59.15	-6.33	6.98	-9.67	10.66	0.06
060890009	39	68.23	56.43	-11.80	11.80	-17.30	17.30	0.72
060893003	11	63.40	56.93	-6.47	6.47	-10.20	10.20	0.40
060932001	1	68.86	34.55	-34.31	34.31	-49.83	49.83	0.00
060950004	4	64.94	65.88	0.94	3.45	1.44	5.31	0.95
060950005	8	64.31	56.84	-7.47	9.51	-11.61	14.78	0.58
060953003	13	64.70	58.62	-6.09	7.15	-9.41	11.05	0.55
060970004	1	64.88	62.09	-2.79	2.79	-4.30	4.30	0.00
060971003	2	63.65	60.83	-2.82	3.95	-4.43	6.21	1.00
060990005	62	68.87	58.29	-10.57	10.63	-15.35	15.44	0.68
060990006	74	69.48	58.71	-10.77	10.81	-15.50	15.55	0.65
061010003	5	63.90	59.66	-4.24	4.27	-6.63	6.69	0.53
061010004	91	69.80	49.44	-20.36	20.36	-29.17	29.17	0.57

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
061030004	113	71.17	49.59	-21.58	21.58	-30.32	30.32	0.77
061030007	25	64.77	57.97	-6.80	6.80	-10.50	10.50	0.54
061070006	114	73.46	55.19	-18.27	18.27	-24.87	24.87	0.63
061070009	130	75.54	56.75	-18.79	18.86	-24.88	24.97	0.68
061072002	82	67.25	62.07	-5.19	6.01	-7.71	8.94	0.63
061072010	133	73.36	56.57	-16.79	16.80	-22.89	22.90	0.79
061090005	102	70.82	54.20	-16.62	16.62	-23.47	23.47	0.68
061110007	17	64.25	59.16	-5.09	7.38	-7.93	11.49	0.34
061110009	32	65.65	58.29	-7.37	7.72	-11.22	11.76	0.54
061111004	31	65.47	54.08	-11.39	11.39	-17.40	17.40	0.38
061112002	54	66.42	58.15	-8.28	8.39	-12.46	12.63	0.67
061113001	5	65.85	55.05	-10.80	10.80	-16.41	16.41	0.57
061130004	12	63.91	59.71	-4.20	5.16	-6.56	8.08	0.66
061131003	23	65.46	58.03	-7.43	7.64	-11.34	11.67	0.68
080013001	19	63.52	62.97	-0.55	5.97	-0.87	9.41	0.36
080050002	46	64.82	59.60	-5.22	6.64	-8.05	10.24	0.46
080050006	30	63.18	53.75	-9.43	9.43	-14.93	14.93	0.06
080130014	2	63.13	56.84	-6.29	6.29	-9.96	9.96	1.00
080150001	30	65.37	50.78	-14.60	14.60	-22.33	22.33	0.19
080190004	45	66.59	56.28	-10.31	10.38	-15.48	15.59	0.67
080190006	13	65.24	50.97	-14.27	14.49	-21.88	22.21	0.10
080310002	23	64.82	63.09	-1.72	4.86	-2.66	7.50	0.44
080310026	26	64.95	61.38	-3.56	6.29	-5.49	9.69	0.38
080350004	59	67.47	59.69	-7.78	8.73	-11.54	12.95	0.47
080410013	40	64.26	53.15	-11.11	11.13	-17.29	17.33	0.08
080410016	22	63.56	53.24	-10.31	10.58	-16.23	16.65	0.15
080450012	4	61.57	51.18	-10.39	10.39	-16.87	16.87	0.98
080450014	2	62.01	51.60	-10.41	10.41	-16.79	16.79	1.00
080450016	33	62.90	49.05	-13.85	13.85	-22.02	22.02	0.11
080450019	8	62.64	50.60	-12.04	12.04	-19.22	19.22	0.71
080450021	4	62.35	53.55	-8.80	8.80	-14.12	14.12	0.27
080450022	18	62.58	49.72	-12.86	12.86	-20.55	20.55	0.01
080490003	6	62.84	51.08	-11.76	11.76	-18.72	18.72	0.04
080510008	13	62.67	51.65	-11.02	11.02	-17.58	17.58	0.12
080519991	14	62.28	49.64	-12.63	13.07	-20.29	20.98	0.36
080590005	40	67.30	63.75	-3.55	6.29	-5.28	9.35	0.46
080590006	63	67.19	59.19	-8.00	8.47	-11.90	12.61	0.59
080590011	60	68.26	59.39	-8.88	9.07	-13.01	13.29	0.68
080590013	46	64.98	58.12	-6.86	8.16	-10.56	12.56	0.56
080671004	25	63.31	51.93	-11.38	12.48	-17.97	19.71	0.06
080677001	44	64.43	53.90	-10.53	10.67	-16.35	16.56	0.27
080677003	59	65.18	53.47	-11.71	11.71	-17.96	17.96	0.25
080690006	45	66.19	52.64	-13.55	13.55	-20.47	20.47	0.39
080690007	44	64.35	55.08	-9.27	9.57	-14.40	14.87	0.50
080690011	46	66.04	55.55	-10.49	10.49	-15.88	15.88	0.70
080691004	12	66.56	63.40	-3.16	4.47	-4.75	6.71	0.65

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
080770020	16	62.27	51.32	-10.94	10.94	-17.57	17.57	0.28
080770021	13	61.94	49.82	-12.13	12.13	-19.58	19.58	0.55
080770022	15	63.38	51.98	-11.40	11.40	-17.99	17.99	0.58
080810003	2	60.26	52.72	-7.55	7.55	-12.52	12.52	1.00
080830006	17	62.64	53.33	-9.31	10.25	-14.86	16.37	0.24
080830101	36	63.36	51.62	-11.74	12.12	-18.53	19.13	0.36
080850005	9	61.87	50.81	-11.06	11.06	-17.88	17.88	0.17
080930001	42	65.01	50.43	-14.58	14.58	-22.43	22.43	0.03
080930002	24	63.64	50.83	-12.81	12.91	-20.13	20.29	0.02
081030005	1	60.38	51.81	-8.57	8.57	-14.19	14.19	0.00
081030006	9	62.32	43.10	-19.22	19.22	-30.85	30.85	0.59
081130008	18	64.70	52.67	-12.03	12.23	-18.60	18.91	0.03
081230009	25	63.87	56.49	-7.38	7.88	-11.55	12.33	0.47
081230011	14	64.01	52.39	-11.61	11.61	-18.15	18.15	0.67
081230012	3	63.71	57.62	-6.09	6.70	-9.56	10.52	0.81
090010017	27	70.16	63.04	-7.12	9.71	-10.15	13.85	0.56
090011123	36	70.16	63.44	-6.72	10.68	-9.58	15.22	0.33
090013007	38	70.24	64.58	-5.66	9.62	-8.06	13.70	0.38
090019003	32	72.15	65.67	-6.49	9.55	-8.99	13.23	0.46
090031003	27	68.62	61.93	-6.68	9.24	-9.74	13.47	0.35
090050005	34	67.34	57.94	-9.40	10.76	-13.96	15.98	0.37
090070007	36	70.26	61.57	-8.68	10.22	-12.36	14.55	0.51
090090027	25	70.07	66.26	-3.81	8.58	-5.44	12.24	0.32
090099002	31	69.49	65.12	-4.37	7.41	-6.28	10.66	0.64
090110124	26	68.33	61.61	-6.72	10.04	-9.83	14.69	0.58
090131001	20	67.27	62.23	-5.04	7.96	-7.49	11.83	0.24
090159991	17	67.70	59.25	-8.44	10.04	-12.47	14.84	0.65
100010002	21	65.65	58.96	-6.70	8.04	-10.20	12.24	0.12
100031007	18	66.06	66.77	0.72	4.50	1.08	6.81	0.65
100031010	35	67.16	60.03	-7.13	8.36	-10.61	12.45	0.55
100031013	28	66.46	63.61	-2.85	6.44	-4.29	9.69	0.50
100032004	26	66.58	66.32	-0.25	5.19	-0.38	7.80	0.49
100051002	14	64.79	57.60	-7.20	7.81	-11.11	12.05	0.35
100051003	20	65.60	60.57	-5.03	6.08	-7.67	9.27	0.53
110010041	7	65.78	68.11	2.33	9.49	3.54	14.43	0.15
110010043	28	65.24	63.80	-1.45	8.63	-2.22	13.22	0.08
110010050	23	65.33	65.83	0.50	7.91	0.76	12.11	0.25
120013011	4	63.32	54.05	-9.26	9.26	-14.63	14.63	0.91
120030002	6	62.30	53.26	-9.04	9.04	-14.51	14.51	0.68
120050006	3	64.13	53.78	-10.35	10.35	-16.13	16.13	0.53
120090007	3	60.63	52.66	-7.97	7.97	-13.14	13.14	0.77
120094001	7	62.16	53.06	-9.10	9.10	-14.64	14.64	0.24
120110033	4	63.41	51.86	-11.55	11.55	-18.21	18.21	0.92
120110034	3	64.96	52.20	-12.76	12.76	-19.64	19.64	0.96
120112003	3	64.75	54.96	-9.79	9.79	-15.12	15.12	0.04
120118002	4	64.16	49.64	-14.52	14.52	-22.64	22.64	0.59

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
120210004	2	64.82	55.09	-9.73	9.73	-15.01	15.01	1.00
120230002	5	63.20	52.25	-10.95	10.95	-17.33	17.33	0.99
120310077	2	63.94	58.36	-5.58	5.58	-8.73	8.73	1.00
120310100	7	64.23	58.12	-6.11	7.01	-9.52	10.91	0.65
120310106	7	63.70	57.19	-6.51	7.53	-10.22	11.83	0.16
120330004	12	63.49	56.70	-6.79	6.79	-10.70	10.70	0.27
120330018	11	61.57	55.95	-5.62	7.43	-9.13	12.07	0.27
120350004	3	61.54	54.26	-7.29	7.29	-11.84	11.84	0.17
120550003	6	63.57	51.94	-11.63	11.63	-18.30	18.30	0.36
120570081	18	64.01	55.75	-8.25	9.35	-12.90	14.60	0.48
120571035	20	65.93	55.18	-10.75	11.12	-16.30	16.86	0.57
120571065	21	64.12	48.04	-16.08	16.08	-25.08	25.08	0.61
120573002	14	64.73	54.14	-10.59	10.60	-16.36	16.37	0.53
120590004	4	62.00	51.16	-10.84	10.84	-17.49	17.49	0.75
120619991	9	62.16	50.26	-11.90	11.90	-19.15	19.15	0.75
120690002	17	63.21	55.01	-8.20	8.20	-12.97	12.97	0.71
120712002	5	63.34	51.89	-11.45	11.45	-18.08	18.08	0.84
120713002	2	67.00	57.83	-9.17	9.17	-13.69	13.69	1.00
120730012	4	62.69	54.87	-7.82	7.82	-12.47	12.47	0.53
120779991	1	60.00	51.85	-8.15	8.15	-13.58	13.58	0.00
120813002	2	66.07	67.12	1.05	1.05	1.59	1.59	1.00
120814012	4	63.00	58.19	-4.81	4.81	-7.63	7.63	0.87
120814013	3	62.00	60.14	-1.86	4.06	-3.01	6.55	0.95
120830003	6	63.50	55.12	-8.39	8.39	-13.20	13.20	0.85
120830004	4	63.44	56.84	-6.61	6.61	-10.41	10.41	0.67
120850007	4	63.16	54.67	-8.50	8.50	-13.45	13.45	0.55
120860027	7	66.56	53.03	-13.52	13.52	-20.32	20.32	0.29
120860029	4	65.13	49.75	-15.38	15.38	-23.62	23.62	0.82
120910002	5	60.90	52.28	-8.62	8.62	-14.15	14.15	0.03
120950008	10	62.83	51.19	-11.64	11.64	-18.53	18.53	0.53
120952002	15	63.42	51.17	-12.25	12.25	-19.31	19.31	0.31
120972002	8	63.58	50.67	-12.91	13.00	-20.30	20.44	0.20
120990021	4	63.30	52.84	-10.46	10.46	-16.53	16.53	0.22
121010005	10	63.42	50.78	-12.64	12.64	-19.93	19.93	0.24
121012001	9	63.24	57.61	-5.63	6.93	-8.90	10.97	0.35
121030004	13	63.04	54.89	-8.15	9.31	-12.94	14.77	0.60
121030018	5	62.98	60.20	-2.77	6.99	-4.40	11.10	0.19
121035002	7	63.03	59.79	-3.24	5.95	-5.14	9.45	0.33
121056005	8	63.75	54.59	-9.16	9.75	-14.36	15.29	0.49
121056006	9	61.98	56.63	-5.35	5.35	-8.63	8.63	0.17
121110013	7	63.20	53.14	-10.06	10.06	-15.92	15.92	0.79
121130015	6	61.88	55.61	-6.27	6.27	-10.13	10.13	0.04
121151005	6	63.75	56.83	-6.92	6.92	-10.86	10.86	0.60
121151006	6	62.30	56.86	-5.43	5.85	-8.72	9.39	0.92
121152002	4	63.69	57.41	-6.28	6.28	-9.86	9.86	0.03
121171002	10	62.74	50.16	-12.58	12.58	-20.05	20.05	0.29

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
121272001	4	62.06	52.41	-9.65	9.65	-15.55	15.55	0.86
121275002	2	61.69	53.05	-8.64	8.64	-14.01	14.01	1.00
121290001	3	60.92	52.61	-8.31	8.31	-13.64	13.64	0.88
130210012	17	66.33	61.29	-5.04	6.53	-7.60	9.85	0.60
130510021	3	61.65	53.54	-8.11	8.11	-13.15	13.15	0.39
130550001	9	63.45	65.84	2.39	5.85	3.77	9.21	0.59
130590002	19	64.59	61.29	-3.31	4.28	-5.12	6.63	0.59
130670003	30	66.51	67.27	0.76	6.62	1.14	9.95	0.67
130730001	6	64.18	58.91	-5.27	5.32	-8.21	8.28	0.40
130770002	15	65.45	62.37	-3.09	5.42	-4.72	8.28	0.66
130850001	10	66.75	63.67	-3.08	4.31	-4.62	6.45	0.86
130890002	32	67.04	69.25	2.21	7.11	3.30	10.60	0.29
130970004	25	66.49	66.71	0.22	5.54	0.33	8.33	0.69
131210055	34	69.20	62.72	-6.49	9.17	-9.37	13.24	0.56
131270006	2	62.32	56.53	-5.79	5.79	-9.29	9.29	1.00
131350002	21	68.31	69.39	1.08	5.24	1.57	7.67	0.65
131510002	30	68.40	65.02	-3.38	5.97	-4.94	8.73	0.58
132130003	17	64.82	60.25	-4.57	7.39	-7.05	11.40	0.18
132150008	10	65.29	60.03	-5.26	7.21	-8.06	11.05	0.23
132230003	22	63.99	64.45	0.46	6.03	0.71	9.43	0.65
132319991	18	67.06	59.16	-7.90	7.90	-11.78	11.78	0.63
132450091	10	64.35	57.52	-6.83	6.85	-10.62	10.64	0.24
132470001	35	67.84	66.65	-1.19	6.01	-1.76	8.86	0.46
132611001	8	64.36	55.58	-8.78	8.78	-13.64	13.64	0.83
160010010	13	62.08	49.69	-12.38	12.38	-19.95	19.95	0.43
160010017	21	66.42	50.79	-15.63	15.63	-23.53	23.53	0.05
160230101	2	60.50	62.83	2.33	3.78	3.85	6.25	1.00
170010007	4	63.06	56.37	-6.69	6.69	-10.61	10.61	0.76
170190007	18	63.60	53.63	-9.97	11.02	-15.68	17.33	0.09
170191001	18	64.60	52.23	-12.37	12.37	-19.15	19.15	0.21
170230001	12	64.38	55.31	-9.06	9.62	-14.08	14.94	0.53
170310001	26	69.15	61.36	-7.79	10.94	-11.27	15.82	0.17
170310032	40	69.60	56.53	-13.07	13.81	-18.78	19.83	0.51
170310076	25	67.46	57.93	-9.53	11.80	-14.13	17.48	0.34
170311003	30	67.26	58.99	-8.27	11.06	-12.30	16.44	0.50
170311601	27	66.62	58.19	-8.42	11.48	-12.64	17.24	0.05
170313103	12	66.63	55.85	-10.77	11.88	-16.17	17.84	0.75
170314002	23	67.28	57.70	-9.58	11.44	-14.24	17.00	0.50
170314007	24	69.23	61.93	-7.30	10.45	-10.54	15.10	0.43
170314201	31	67.97	57.55	-10.42	11.88	-15.33	17.48	0.63
170317002	32	67.78	59.62	-8.17	10.00	-12.05	14.76	0.65
170436001	24	69.46	61.84	-7.62	10.51	-10.97	15.12	0.43
170491001	13	64.01	55.35	-8.66	8.66	-13.53	13.53	0.73
170650002	19	63.93	55.44	-8.50	9.06	-13.29	14.17	0.59
170831001	21	67.77	60.76	-7.02	8.98	-10.35	13.24	0.59
170859991	9	65.86	52.57	-13.29	13.29	-20.18	20.18	0.92

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
170890005	20	69.65	60.05	-9.60	11.09	-13.79	15.92	0.28
170971007	27	67.86	60.82	-7.04	11.16	-10.38	16.45	0.66
171110001	15	67.78	59.97	-7.81	9.96	-11.52	14.70	0.15
171132003	20	64.21	52.00	-12.20	12.20	-19.01	19.01	0.47
171150013	22	63.38	53.42	-9.96	10.08	-15.72	15.91	0.20
171170002	12	64.93	56.80	-8.13	8.13	-12.53	12.53	0.67
171190008	17	68.35	61.21	-7.14	7.83	-10.44	11.46	0.68
171191009	23	64.86	60.08	-4.78	6.41	-7.37	9.89	0.53
171193007	24	67.49	60.83	-6.66	8.62	-9.87	12.77	0.42
171199991	20	65.03	56.94	-8.09	8.17	-12.44	12.56	0.59
171430024	17	65.08	54.18	-10.90	10.90	-16.75	16.75	0.62
171431001	19	63.59	55.07	-8.52	9.22	-13.40	14.50	0.22
171570001	14	64.75	57.91	-6.84	9.86	-10.57	15.22	0.64
171613002	11	64.43	54.34	-10.09	10.09	-15.66	15.66	0.52
171630010	20	67.23	60.73	-6.49	8.26	-9.66	12.29	0.41
171670014	18	64.27	54.88	-9.39	9.39	-14.61	14.61	0.76
171971011	16	63.79	52.15	-11.64	11.64	-18.25	18.25	0.53
172012001	16	66.20	52.93	-13.27	13.27	-20.05	20.05	0.53
180030002	19	64.21	57.53	-6.67	6.71	-10.39	10.46	0.37
180030004	23	65.55	55.96	-9.59	10.01	-14.62	15.27	0.27
180050007	30	65.73	55.97	-9.76	10.70	-14.85	16.28	0.29
180110001	21	66.41	56.49	-9.93	10.19	-14.95	15.35	0.51
180130001	7	64.91	53.97	-10.93	11.23	-16.84	17.30	0.09
180150002	14	64.79	56.14	-8.64	8.70	-13.34	13.42	0.49
180190008	23	67.43	64.72	-2.71	8.11	-4.01	12.02	0.27
180350010	13	64.81	55.01	-9.80	9.80	-15.12	15.12	0.52
180390007	26	65.74	55.57	-10.18	10.87	-15.48	16.54	0.55
180431004	25	67.22	64.76	-2.46	5.97	-3.67	8.88	0.42
180550001	20	66.28	56.85	-9.44	9.58	-14.24	14.46	0.42
180570006	18	66.05	57.67	-8.37	9.12	-12.68	13.81	0.43
180630004	22	64.20	57.56	-6.63	7.87	-10.33	12.26	0.20
180690002	13	64.66	55.43	-9.22	9.93	-14.27	15.36	0.27
180710001	20	65.79	58.29	-7.50	9.23	-11.40	14.02	0.26
180810002	11	62.98	58.23	-4.75	5.61	-7.53	8.90	0.18
180839991	26	64.45	57.96	-6.49	7.63	-10.07	11.84	0.50
180890022	21	65.89	58.73	-7.16	11.07	-10.87	16.80	0.25
180892008	10	68.18	63.87	-4.31	5.97	-6.32	8.75	0.69
180910010	13	65.87	62.27	-3.60	7.53	-5.46	11.43	0.16
180950010	14	63.31	58.59	-4.72	6.43	-7.46	10.15	0.07
180970050	33	65.87	56.64	-9.24	9.85	-14.02	14.95	0.36
180970057	21	64.75	54.49	-10.26	11.01	-15.84	17.01	0.38
180970073	19	64.94	59.03	-5.91	7.54	-9.10	11.61	0.32
180970078	28	64.96	55.73	-9.22	10.37	-14.20	15.96	0.39
180970087	11	65.51	57.28	-8.23	9.84	-12.56	15.02	0.38
181090005	14	64.25	57.66	-6.59	7.59	-10.26	11.81	0.11
181230009	26	66.41	61.39	-5.02	6.71	-7.55	10.10	0.53

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
181270024	18	66.36	61.57	-4.79	7.71	-7.22	11.62	0.42
181270026	28	65.36	59.34	-6.02	8.47	-9.21	12.96	0.22
181290003	18	64.20	61.70	-2.51	5.38	-3.90	8.38	0.39
181410010	16	65.29	57.08	-8.21	8.96	-12.58	13.72	0.61
181410015	26	66.67	57.56	-9.11	10.98	-13.66	16.46	0.41
181410016	28	65.51	57.43	-8.08	8.91	-12.34	13.60	0.61
181450001	15	63.87	57.07	-6.80	7.71	-10.65	12.07	0.73
181630013	20	66.19	61.43	-4.76	6.35	-7.19	9.60	0.63
181630021	28	65.43	61.99	-3.43	6.24	-5.25	9.53	0.45
181670018	21	64.57	57.02	-7.56	8.53	-11.70	13.21	0.33
181670024	17	64.88	55.75	-9.13	9.29	-14.07	14.32	0.43
181699991	21	66.48	53.77	-12.71	12.71	-19.12	19.12	0.44
181730008	26	65.83	62.33	-3.51	5.35	-5.33	8.12	0.74
181730009	15	66.80	62.18	-4.61	6.64	-6.90	9.94	0.73
181730011	19	65.82	65.08	-0.74	5.90	-1.13	8.96	0.59
190170011	7	62.90	52.76	-10.14	10.14	-16.12	16.12	0.26
190450021	12	63.32	52.83	-10.49	10.49	-16.56	16.56	0.85
190850007	9	62.53	50.92	-11.61	11.61	-18.57	18.57	0.24
190851101	7	62.92	50.98	-11.94	11.94	-18.98	18.98	0.28
191130028	10	62.55	51.89	-10.66	10.66	-17.05	17.05	0.61
191130033	10	62.84	51.42	-11.42	11.42	-18.18	18.18	0.64
191130040	9	63.70	53.70	-10.00	10.00	-15.70	15.70	0.85
191370002	5	62.78	52.45	-10.33	10.33	-16.46	16.46	0.13
191471002	4	63.61	51.00	-12.61	12.61	-19.83	19.83	0.53
191530030	5	62.20	55.96	-6.24	6.24	-10.04	10.04	0.44
191630014	13	64.53	51.96	-12.57	12.57	-19.48	19.48	0.68
191630015	11	63.83	55.19	-8.64	8.64	-13.53	13.53	0.51
191690011	8	61.61	52.64	-8.97	8.97	-14.55	14.55	0.46
191770006	6	63.40	52.09	-11.31	11.31	-17.84	17.84	0.77
191810022	1	60.00	51.63	-8.37	8.37	-13.95	13.95	0.00
200910010	3	62.94	55.46	-7.48	8.98	-11.88	14.27	0.95
201030003	9	63.28	60.12	-3.16	8.29	-5.00	13.11	0.74
201330003	4	63.22	56.26	-6.96	6.96	-11.01	11.01	0.36
201730010	5	62.78	55.91	-6.87	6.87	-10.94	10.94	0.85
201730018	6	62.97	52.97	-10.00	10.00	-15.88	15.88	0.58
201770013	6	62.73	57.21	-5.52	6.70	-8.80	10.69	0.47
201910002	4	63.81	51.60	-12.21	12.21	-19.13	19.13	0.71
201950001	3	60.17	47.14	-13.03	13.03	-21.66	21.66	0.30
202090021	10	66.08	64.39	-1.68	6.17	-2.54	9.34	0.74
210130002	4	63.96	64.93	0.97	3.52	1.52	5.50	0.50
210150003	13	63.45	65.69	2.24	5.69	3.53	8.96	0.08
210190017	14	65.69	65.41	-0.28	6.98	-0.43	10.63	0.44
210290006	17	65.14	67.02	1.88	6.61	2.88	10.14	0.44
210373002	24	64.90	60.27	-4.63	7.74	-7.14	11.92	0.21
210430500	7	65.36	60.84	-4.52	4.96	-6.91	7.58	0.52
210470006	8	62.08	59.44	-2.64	4.89	-4.25	7.87	0.58

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
210590005	16	66.25	66.62	0.37	6.19	0.56	9.34	0.49
210610501	10	64.42	58.30	-6.12	7.61	-9.50	11.82	0.01
210670012	15	63.70	61.45	-2.25	5.18	-3.53	8.13	0.17
210890007	7	63.58	69.33	5.76	7.28	9.06	11.45	0.02
210910012	20	65.29	63.18	-2.11	5.17	-3.23	7.92	0.63
210930006	19	64.40	60.67	-3.74	7.87	-5.80	12.22	0.05
211010014	19	64.95	64.00	-0.94	5.75	-1.45	8.85	0.47
211110027	33	65.25	62.55	-2.70	5.30	-4.13	8.13	0.52
211110051	24	66.19	65.51	-0.68	6.00	-1.03	9.06	0.40
211110067	45	66.99	61.16	-5.82	7.88	-8.69	11.77	0.61
211130001	18	64.44	60.78	-3.66	5.89	-5.68	9.14	0.36
211390003	18	64.44	59.40	-5.04	6.22	-7.82	9.65	0.44
211451024	11	63.29	64.61	1.32	7.54	2.08	11.91	0.14
211759991	15	64.59	58.95	-5.63	7.10	-8.72	10.99	0.27
211850004	21	65.28	63.41	-1.87	4.29	-2.86	6.57	0.34
211930003	2	63.65	62.10	-1.55	1.61	-2.43	2.52	1.00
211950002	6	62.88	56.66	-6.22	6.22	-9.88	9.88	0.50
211990003	6	63.71	61.97	-1.74	5.54	-2.73	8.70	0.05
212130004	8	63.76	57.92	-5.84	6.73	-9.16	10.56	0.38
212219991	13	61.99	56.19	-5.80	7.42	-9.35	11.97	0.22
212270009	7	62.77	58.98	-3.79	5.49	-6.04	8.74	0.56
212299991	17	62.97	59.06	-3.91	5.19	-6.20	8.24	0.47
220050004	8	66.99	63.83	-3.16	4.24	-4.72	6.33	0.73
220150008	11	63.04	57.76	-5.28	6.93	-8.37	11.00	0.55
220170001	2	62.25	61.71	-0.54	2.39	-0.87	3.84	1.00
220190002	7	63.59	54.52	-9.07	9.72	-14.27	15.29	0.51
220190009	5	61.73	56.07	-5.66	5.73	-9.17	9.29	0.09
220330003	22	64.90	60.69	-4.21	8.88	-6.49	13.68	0.42
220330009	5	64.83	68.54	3.72	7.03	5.74	10.84	0.39
220330013	4	64.22	64.67	0.45	5.49	0.69	8.55	0.35
220470009	11	63.05	61.83	-1.22	4.84	-1.93	7.67	0.28
220470012	11	65.33	62.61	-2.72	8.05	-4.17	12.33	0.05
220511001	11	64.84	56.32	-8.53	9.66	-13.15	14.90	0.49
220550007	8	62.65	54.17	-8.49	9.33	-13.54	14.88	0.49
220570004	10	64.43	60.51	-3.92	7.48	-6.08	11.61	0.38
220630002	7	65.75	61.66	-4.09	6.28	-6.22	9.55	0.65
220730004	2	61.44	48.85	-12.59	12.59	-20.49	20.49	1.00
220770001	7	66.15	67.46	1.31	8.08	1.99	12.22	0.31
220870004	7	67.45	59.00	-8.44	8.44	-12.52	12.52	0.37
220930002	5	63.05	59.11	-3.94	5.76	-6.25	9.13	0.09
220950002	9	62.85	61.51	-1.34	5.20	-2.13	8.27	0.45
220990001	9	64.49	58.57	-5.92	6.54	-9.18	10.14	0.36
221030002	8	64.52	56.92	-7.60	7.60	-11.77	11.77	0.50
221210001	12	65.55	60.64	-4.91	10.54	-7.49	16.08	0.64
230010014	3	61.40	62.61	1.21	6.96	1.97	11.33	0.85
230050029	1	61.75	73.14	11.39	11.39	18.45	18.45	0.00

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
230052003	6	66.05	61.32	-4.73	7.29	-7.15	11.04	0.13
230090102	16	65.04	43.52	-21.52	21.52	-33.09	33.09	0.55
230090103	6	64.56	48.94	-15.63	15.63	-24.21	24.21	0.75
230112005	2	63.57	66.10	2.54	2.54	3.99	3.99	1.00
230130004	8	65.14	63.76	-1.39	7.21	-2.13	11.06	0.58
230173002	1	62.00	55.68	-6.32	6.32	-10.19	10.19	0.00
230194008	1	62.00	64.47	2.47	2.47	3.98	3.98	0.00
230290019	1	62.63	59.33	-3.30	3.30	-5.27	5.27	0.00
230290032	2	60.19	54.03	-6.16	6.94	-10.23	11.53	1.00
230310038	2	64.19	61.30	-2.90	2.90	-4.51	4.51	1.00
230310040	5	63.45	56.17	-7.29	7.29	-11.48	11.48	0.64
230312002	12	66.41	61.95	-4.46	5.67	-6.72	8.53	0.69
240031003	42	66.49	64.74	-1.74	6.56	-2.62	9.86	0.54
240051007	37	66.68	62.34	-4.34	6.61	-6.51	9.92	0.53
240053001	48	68.38	64.60	-3.78	7.34	-5.52	10.73	0.45
240053474	36	71.90	69.22	-2.68	9.07	-3.73	12.61	0.17
240090011	25	64.63	63.81	-0.83	6.49	-1.28	10.05	0.17
240130001	26	64.73	60.76	-3.98	5.59	-6.14	8.63	0.53
240150003	28	69.30	64.30	-5.00	7.17	-7.22	10.34	0.62
240170010	26	66.97	62.61	-4.36	7.43	-6.51	11.10	0.29
240190004	17	65.75	63.92	-1.83	6.53	-2.78	9.93	0.09
240199991	13	65.68	60.33	-5.34	7.21	-8.13	10.97	0.28
240210037	28	65.30	59.49	-5.81	7.08	-8.90	10.84	0.51
240230002	16	64.05	58.42	-5.63	5.88	-8.79	9.18	0.47
240251001	33	68.35	66.74	-1.62	6.02	-2.37	8.80	0.67
240259001	28	68.42	65.23	-3.19	6.19	-4.66	9.04	0.70
240290002	35	65.55	59.61	-5.94	7.57	-9.07	11.55	0.52
240313001	16	65.10	65.11	0.01	7.00	0.02	10.75	0.13
240330030	21	66.22	66.45	0.23	7.27	0.34	10.98	0.42
240338003	36	66.63	65.54	-1.08	7.95	-1.63	11.94	0.23
240339991	22	66.23	66.29	0.06	7.53	0.10	11.36	0.56
240430009	23	65.28	58.95	-6.33	6.38	-9.70	9.77	0.77
245100054	33	66.76	64.36	-2.39	7.62	-3.59	11.42	0.13
250010002	15	65.07	56.73	-8.35	10.64	-12.83	16.35	0.34
250051004	16	67.49	62.99	-4.51	5.63	-6.68	8.35	0.64
250051006	9	67.13	65.85	-1.28	5.46	-1.91	8.13	0.40
250070001	8	66.55	64.45	-2.10	8.77	-3.16	13.18	0.11
250092006	17	64.76	57.87	-6.89	9.59	-10.64	14.81	0.37
250094005	10	65.49	63.04	-2.46	4.36	-3.75	6.65	0.41
250095005	11	63.70	58.38	-5.32	9.67	-8.35	15.18	0.27
250112005	9	67.39	56.19	-11.20	11.20	-16.62	16.62	0.18
250130008	18	68.65	60.21	-8.44	9.84	-12.29	14.34	0.21
250154002	22	67.55	59.74	-7.81	8.53	-11.56	12.63	0.42
250170009	10	64.14	59.01	-5.14	9.69	-8.01	15.10	0.22
250213003	20	66.78	58.06	-8.72	9.74	-13.05	14.59	0.56
250230005	12	65.65	61.99	-3.66	7.47	-5.58	11.37	0.29

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
250250042	2	64.38	65.82	1.44	1.44	2.24	2.24	1.00
250270015	14	65.00	58.40	-6.60	8.03	-10.16	12.35	0.07
250270024	14	66.83	58.83	-8.00	9.56	-11.97	14.30	0.44
260050003	33	67.35	56.60	-10.75	11.40	-15.96	16.92	0.38
260190003	22	68.74	55.96	-12.78	12.88	-18.59	18.74	0.29
260210014	37	68.22	59.48	-8.74	10.23	-12.81	15.00	0.54
260270003	35	68.36	55.49	-12.87	12.97	-18.82	18.97	0.45
260330901	6	64.59	51.01	-13.58	13.58	-21.02	21.02	0.23
260370001	19	68.61	56.15	-12.46	12.46	-18.16	18.16	0.62
260490021	23	68.26	56.72	-11.54	11.54	-16.91	16.91	0.44
260492001	21	68.48	54.60	-13.89	13.89	-20.28	20.28	0.46
260630007	10	69.02	55.19	-13.83	13.83	-20.04	20.04	0.33
260650012	25	66.95	55.78	-11.17	11.38	-16.68	17.00	0.50
260770008	22	68.13	54.81	-13.31	13.31	-19.54	19.54	0.73
260810020	27	68.38	56.03	-12.36	12.49	-18.07	18.27	0.48
260810022	15	68.82	56.47	-12.35	12.49	-17.95	18.15	0.53
260910007	25	66.17	53.92	-12.26	12.51	-18.52	18.91	0.52
260990009	25	67.66	59.35	-8.31	10.24	-12.28	15.13	0.30
260991003	24	65.86	58.16	-7.70	9.31	-11.69	14.14	0.32
261010922	17	67.01	56.99	-10.02	10.02	-14.96	14.96	0.32
261050007	20	68.17	57.02	-11.15	11.15	-16.35	16.35	0.40
261130001	18	68.28	51.54	-16.74	16.74	-24.52	24.52	0.45
261210039	25	68.34	60.20	-8.14	10.06	-11.92	14.72	0.48
261250001	25	67.64	57.23	-10.42	11.63	-15.40	17.19	0.24
261390005	24	67.51	55.86	-11.64	11.86	-17.24	17.56	0.48
261470005	16	66.87	59.96	-6.91	8.25	-10.33	12.34	0.24
261530001	26	69.42	49.03	-20.38	20.38	-29.36	29.36	0.43
261579991	18	66.43	52.01	-14.42	14.42	-21.71	21.71	0.33
261610008	17	65.73	59.25	-6.48	8.48	-9.86	12.90	0.20
261619991	18	68.27	55.87	-12.40	12.40	-18.16	18.16	0.37
261630001	20	66.71	57.72	-8.99	10.74	-13.48	16.11	0.19
261630019	31	67.10	57.58	-9.51	11.05	-14.18	16.47	0.26
261630093	2	63.94	65.79	1.85	11.66	2.89	18.24	1.00
261630094	18	65.17	58.34	-6.83	8.28	-10.48	12.71	0.35
261659991	15	68.70	55.34	-13.37	13.39	-19.46	19.49	0.23
270031001	4	63.13	52.05	-11.08	11.08	-17.56	17.56	0.61
270031002	6	62.98	54.72	-8.26	10.59	-13.11	16.81	0.35
270052013	2	63.57	48.81	-14.76	14.76	-23.21	23.21	1.00
270177417	3	63.54	51.47	-12.07	12.07	-18.99	18.99	0.96
270353204	4	62.91	51.03	-11.88	11.88	-18.88	18.88	0.95
270495302	5	63.48	52.36	-11.12	11.12	-17.52	17.52	0.86
270530962	2	63.13	56.34	-6.79	6.79	-10.76	10.76	1.00
270750005	3	60.92	48.44	-12.48	12.48	-20.48	20.48	1.00
270834210	2	63.75	50.39	-13.36	13.36	-20.96	20.96	1.00
270953051	3	62.38	49.11	-13.27	13.27	-21.27	21.27	0.98
271095008	6	62.59	52.73	-9.86	9.86	-15.75	15.75	0.22

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
271370034	1	61.25	49.03	-12.22	12.22	-19.95	19.95	0.00
271390505	5	64.93	59.94	-4.98	8.90	-7.67	13.71	0.81
271453052	2	65.44	53.81	-11.63	11.63	-17.77	17.77	1.00
271636016	6	61.23	50.03	-11.20	11.20	-18.29	18.29	0.35
271713201	5	63.35	53.06	-10.29	10.29	-16.25	16.25	0.83
280110001	8	63.86	51.95	-11.91	11.91	-18.65	18.65	0.67
280330002	19	64.36	58.81	-5.56	6.89	-8.64	10.71	0.65
280450003	5	63.55	62.20	-1.36	5.08	-2.13	7.99	0.27
280470008	8	63.77	59.83	-3.93	6.68	-6.17	10.47	0.41
280490020	5	62.28	60.74	-1.54	2.33	-2.47	3.73	0.57
280490021	6	63.99	60.35	-3.64	4.05	-5.69	6.33	0.33
280590006	10	62.78	56.82	-5.95	6.08	-9.48	9.69	0.39
280750003	2	60.92	60.75	-0.17	3.28	-0.28	5.38	1.00
280810005	6	61.96	57.06	-4.90	5.76	-7.91	9.30	0.06
290030001	11	63.54	56.04	-7.51	7.51	-11.81	11.81	0.59
290190011	5	66.53	57.55	-8.98	8.98	-13.49	13.49	0.25
290270002	8	64.28	55.79	-8.50	8.50	-13.22	13.22	0.50
290370003	3	62.21	59.63	-2.58	2.58	-4.15	4.15	0.94
290390001	4	60.63	55.80	-4.83	4.83	-7.96	7.96	0.04
290470003	13	65.08	59.56	-5.53	7.66	-8.49	11.76	0.35
290470005	14	64.73	60.35	-4.38	5.71	-6.77	8.82	0.22
290470006	26	65.04	59.17	-5.87	7.46	-9.02	11.48	0.37
290490001	21	65.07	57.64	-7.43	8.27	-11.42	12.70	0.41
290770036	1	61.88	59.41	-2.47	2.47	-3.99	3.99	0.00
290770042	1	60.00	49.64	-10.36	10.36	-17.27	17.27	0.00
290990019	20	65.74	63.64	-2.10	6.70	-3.20	10.18	0.14
291130003	12	63.98	57.74	-6.24	7.99	-9.75	12.49	0.65
291370001	2	63.76	55.60	-8.16	8.16	-12.79	12.79	1.00
291570001	20	64.46	55.85	-8.61	9.31	-13.36	14.43	0.53
291831002	23	69.16	62.54	-6.62	8.56	-9.57	12.38	0.63
291831004	27	67.17	59.23	-7.93	9.79	-11.81	14.57	0.65
291860005	9	65.61	58.08	-7.52	7.52	-11.47	11.47	0.62
291890005	13	65.63	63.97	-1.66	6.26	-2.53	9.53	0.49
291890014	26	67.38	62.55	-4.83	8.91	-7.17	13.23	0.23
295100085	18	65.79	62.93	-2.86	6.42	-4.34	9.76	0.10
300750001	1	62.38	41.16	-21.22	21.22	-34.02	34.02	0.00
300830001	2	61.07	34.54	-26.53	26.53	-43.44	43.44	1.00
300870001	1	62.63	50.51	-12.12	12.12	-19.35	19.35	0.00
310550019	5	64.33	55.27	-9.06	9.06	-14.09	14.09	0.52
310550028	9	63.42	51.74	-11.68	11.68	-18.42	18.42	0.36
310550053	11	62.74	50.81	-11.93	11.93	-19.01	19.01	0.69
311079991	12	63.39	48.87	-14.52	14.52	-22.90	22.90	0.32
311090016	2	61.25	53.28	-7.97	7.97	-13.01	13.01	1.00
320010002	26	64.56	54.54	-10.02	11.25	-15.53	17.43	0.10
320030022	58	64.25	58.97	-5.29	7.20	-8.23	11.20	0.30
320030023	1	71.13	52.87	-18.26	18.26	-25.67	25.67	0.00

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
320030043	60	64.83	58.24	-6.59	8.16	-10.16	12.58	0.35
320030071	63	65.44	59.49	-5.95	7.84	-9.09	11.97	0.36
320030073	61	65.09	60.02	-5.07	7.24	-7.79	11.13	0.30
320030075	76	66.86	60.56	-6.30	8.17	-9.43	12.22	0.44
320030298	42	63.53	57.57	-5.96	7.79	-9.38	12.27	0.04
320030540	49	64.89	59.86	-5.04	7.29	-7.76	11.24	0.29
320030601	18	61.61	55.94	-5.67	6.48	-9.20	10.52	0.19
320031019	38	63.22	55.46	-7.76	7.79	-12.28	12.32	0.36
320032002	55	65.12	59.29	-5.82	8.04	-8.94	12.34	0.39
320037771	76	64.81	56.19	-8.62	9.35	-13.31	14.43	0.23
320037772	39	64.11	57.00	-7.11	8.31	-11.09	12.96	0.16
320038000	76	66.72	59.81	-6.92	8.27	-10.37	12.39	0.30
320190006	27	65.09	56.80	-8.28	9.54	-12.73	14.66	0.31
320310016	52	65.38	56.21	-9.17	9.68	-14.02	14.80	0.34
320310020	35	64.30	57.75	-6.55	7.50	-10.19	11.66	0.26
320310025	32	62.98	58.20	-4.78	6.97	-7.59	11.07	0.19
320311005	38	64.15	58.71	-5.44	6.50	-8.48	10.13	0.38
320312002	15	61.99	56.54	-5.45	7.67	-8.80	12.37	0.11
320312009	36	64.38	57.46	-6.92	7.89	-10.74	12.25	0.24
320330101	26	62.18	54.72	-7.46	8.26	-11.99	13.29	0.02
325100020	28	63.42	57.37	-6.05	8.77	-9.53	13.84	0.52
330012004	4	62.57	50.21	-12.36	12.36	-19.76	19.76	0.05
330050007	6	66.19	56.10	-10.09	10.09	-15.24	15.24	0.62
330074001	32	63.68	42.55	-21.13	21.13	-33.18	33.18	0.52
330074002	2	64.32	52.68	-11.64	11.64	-18.10	18.10	1.00
330090010	1	63.63	51.84	-11.79	11.79	-18.53	18.53	0.00
330111011	11	64.52	56.12	-8.40	10.88	-13.02	16.86	0.11
330115001	19	65.46	53.46	-12.01	12.91	-18.34	19.72	0.25
330131007	6	62.54	54.45	-8.09	8.09	-12.94	12.94	0.04
330150014	6	62.98	65.76	2.78	4.23	4.42	6.71	0.41
330150016	10	65.26	59.02	-6.24	8.58	-9.56	13.14	0.40
330150018	18	64.83	54.66	-10.17	10.71	-15.68	16.52	0.54
340010006	12	64.64	64.44	-0.20	5.74	-0.30	8.88	0.26
340030006	31	68.21	62.44	-5.77	8.18	-8.46	11.99	0.54
340070002	39	66.30	63.97	-2.33	7.40	-3.52	11.16	0.46
340071001	16	64.87	65.90	1.03	5.00	1.59	7.71	0.42
340110007	20	64.83	61.91	-2.91	6.78	-4.49	10.46	0.33
340130003	19	66.05	62.23	-3.82	6.37	-5.79	9.65	0.39
340150002	29	66.42	65.04	-1.38	6.39	-2.08	9.62	0.46
340170006	20	66.32	61.85	-4.46	8.14	-6.73	12.27	0.29
340190001	34	67.51	60.93	-6.58	7.69	-9.75	11.39	0.50
340210005	24	68.39	65.49	-2.90	6.05	-4.24	8.85	0.55
340219991	31	68.00	64.20	-3.80	6.75	-5.58	9.93	0.43
340230011	39	68.26	63.81	-4.45	7.16	-6.51	10.49	0.49
340250005	17	66.64	66.67	0.03	7.32	0.04	10.99	0.34
340273001	24	66.34	63.49	-2.85	5.59	-4.30	8.42	0.53

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
340290006	36	66.87	63.78	-3.09	8.55	-4.62	12.79	0.41
340315001	24	66.37	59.94	-6.42	8.48	-9.67	12.78	0.56
340410007	13	65.78	61.56	-4.22	5.59	-6.42	8.50	0.56
350010023	34	63.09	52.13	-10.96	11.53	-17.37	18.27	0.19
350010029	11	62.78	52.03	-10.74	11.95	-17.12	19.03	0.65
350011012	30	62.29	54.49	-7.79	8.25	-12.51	13.24	0.36
350130008	18	62.50	54.83	-7.67	7.92	-12.27	12.67	0.64
350130020	32	63.70	49.43	-14.27	14.37	-22.40	22.56	0.13
350130021	54	64.26	53.08	-11.18	11.95	-17.39	18.59	0.38
350130022	43	64.31	54.35	-9.96	10.77	-15.49	16.75	0.45
350130023	18	62.54	50.84	-11.70	11.70	-18.71	18.71	0.17
350151005	18	62.50	48.87	-13.62	13.84	-21.80	22.15	0.01
350153001	34	64.23	48.73	-15.49	15.61	-24.12	24.30	0.41
350250008	15	63.41	51.40	-12.01	12.01	-18.95	18.95	0.40
350390026	19	62.07	52.58	-9.49	9.88	-15.28	15.92	0.27
350431001	25	62.11	54.50	-7.62	8.05	-12.26	12.96	0.44
350450009	18	63.37	54.98	-8.39	10.94	-13.24	17.26	0.19
350450018	33	63.61	55.20	-8.42	9.14	-13.23	14.37	0.29
350451005	9	62.00	51.38	-10.62	10.62	-17.13	17.13	0.28
350451233	28	62.67	55.07	-7.60	9.11	-12.13	14.54	0.20
350490021	24	62.10	51.53	-10.56	10.70	-17.01	17.24	0.47
350610008	34	62.79	51.38	-11.41	11.76	-18.17	18.73	0.46
360010012	11	66.54	54.63	-11.92	11.92	-17.91	17.91	0.33
360050110	19	66.25	60.60	-5.66	9.25	-8.54	13.96	0.18
360050133	22	65.95	65.99	0.05	7.42	0.08	11.25	0.15
360130006	22	66.67	58.02	-8.65	8.73	-12.97	13.10	0.34
360270007	20	66.42	60.88	-5.54	8.05	-8.34	12.11	0.23
360290002	22	67.10	57.18	-9.92	10.27	-14.79	15.31	0.01
360310002	15	64.84	47.87	-16.97	16.97	-26.17	26.17	0.18
360310003	10	65.52	51.10	-14.41	14.41	-22.00	22.00	0.61
360319991	1	63.75	57.58	-6.17	6.17	-9.68	9.68	0.00
360410005	5	66.55	52.77	-13.78	13.78	-20.71	20.71	0.56
360430005	5	69.80	42.14	-27.66	27.66	-39.62	39.62	0.32
360450002	13	65.46	55.84	-9.62	9.74	-14.70	14.88	0.06
360551007	14	65.55	55.84	-9.71	10.31	-14.81	15.72	0.44
360610135	23	66.32	59.88	-6.43	8.48	-9.70	12.79	0.36
360631006	13	67.15	57.85	-9.29	9.34	-13.84	13.91	0.12
360671015	12	64.58	51.46	-13.12	13.12	-20.32	20.32	0.10
360715001	11	64.26	58.55	-5.71	6.54	-8.89	10.18	0.40
360750003	8	64.71	52.60	-12.11	12.60	-18.72	19.47	0.14
360790005	19	67.91	62.60	-5.32	9.02	-7.83	13.28	0.55
360810124	28	66.18	61.98	-4.20	11.03	-6.35	16.67	0.11
360850067	37	67.42	62.70	-4.73	8.65	-7.01	12.82	0.46
360870005	32	66.47	62.12	-4.35	7.92	-6.55	11.91	0.35
360910004	9	67.27	54.57	-12.70	12.70	-18.88	18.88	0.49
361010003	11	65.42	49.78	-15.65	15.65	-23.92	23.92	0.28

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
361030002	23	65.86	68.04	2.18	7.84	3.31	11.91	0.31
361030004	22	68.74	67.02	-1.72	6.31	-2.51	9.18	0.43
361030009	18	68.17	70.96	2.78	5.02	4.08	7.37	0.60
361099991	14	65.58	51.01	-14.57	14.57	-22.22	22.22	0.16
361173001	17	64.81	54.54	-10.28	10.47	-15.86	16.15	0.16
361192004	30	66.57	64.96	-1.61	7.72	-2.41	11.59	0.34
370030005	11	65.24	59.54	-5.70	5.88	-8.74	9.02	0.63
370110002	6	64.54	64.08	-0.46	6.84	-0.71	10.59	0.83
370119991	12	66.20	59.04	-7.16	7.67	-10.82	11.58	0.75
370210030	7	65.43	60.37	-5.06	5.06	-7.74	7.74	0.90
370270003	11	64.24	59.18	-5.06	5.64	-7.88	8.78	0.51
370319991	4	63.53	56.24	-7.30	7.30	-11.49	11.49	0.82
370330001	9	64.35	60.26	-4.09	4.98	-6.35	7.74	0.38
370510008	10	64.33	56.13	-8.20	8.20	-12.75	12.75	0.36
370510010	9	63.38	56.19	-7.19	7.19	-11.35	11.35	0.61
370630015	11	63.08	59.45	-3.63	6.18	-5.76	9.80	0.31
370650099	7	64.48	57.40	-7.09	7.09	-10.99	10.99	0.65
370670022	25	64.83	61.68	-3.15	5.33	-4.86	8.22	0.35
370670030	28	64.10	60.48	-3.61	5.43	-5.64	8.47	0.24
370671008	28	65.10	60.49	-4.61	5.58	-7.09	8.58	0.51
370750001	20	64.49	55.81	-8.68	8.68	-13.46	13.46	0.18
370770001	15	63.57	57.05	-6.52	6.82	-10.26	10.72	0.68
370810013	32	64.25	60.09	-4.15	5.46	-6.47	8.50	0.21
370870008	7	63.81	58.94	-4.87	4.87	-7.63	7.63	0.79
370870035	14	67.36	56.12	-11.24	11.44	-16.68	16.98	0.12
370870036	12	64.68	56.98	-7.70	7.70	-11.90	11.90	0.00
370990005	29	65.12	54.40	-10.72	10.72	-16.46	16.46	0.50
371010002	11	64.12	59.09	-5.02	6.16	-7.84	9.61	0.77
371050002	9	64.70	58.01	-6.69	6.69	-10.34	10.34	0.75
371070004	10	63.13	54.74	-8.39	8.39	-13.29	13.29	0.71
371090004	16	66.43	61.90	-4.53	4.97	-6.82	7.48	0.87
371139991	6	63.31	55.44	-7.86	7.86	-12.42	12.42	0.64
371170001	4	65.22	57.58	-7.64	7.64	-11.72	11.72	1.00
371190041	31	65.56	64.30	-1.26	4.42	-1.92	6.74	0.59
371190046	42	65.83	64.97	-0.86	5.12	-1.31	7.78	0.38
371239991	5	64.03	59.13	-4.90	5.97	-7.66	9.32	0.04
371290002	4	64.47	54.57	-9.91	9.91	-15.36	15.36	0.79
371450003	7	65.23	59.66	-5.57	5.89	-8.54	9.03	0.35
371470006	8	65.42	57.00	-8.43	8.43	-12.88	12.88	0.70
371570099	16	63.76	62.25	-1.50	4.56	-2.36	7.15	0.15
371590021	19	62.52	62.12	-0.40	5.34	-0.64	8.54	0.17
371730002	9	63.82	55.06	-8.76	8.76	-13.73	13.73	0.38
371730007	6	64.96	57.60	-7.36	7.36	-11.33	11.33	0.68
371790003	21	65.48	60.91	-4.57	5.93	-6.98	9.05	0.45
371830014	19	64.17	59.30	-4.88	6.78	-7.60	10.56	0.32
371990004	23	65.64	58.25	-7.39	8.02	-11.26	12.22	0.42

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
380070002	1	60.00	36.34	-23.66	23.66	-39.43	39.43	0.00
390030009	23	65.31	55.66	-9.65	9.65	-14.78	14.78	0.38
390071001	21	66.92	58.54	-8.39	8.83	-12.53	13.20	0.60
390170004	36	66.91	61.43	-5.48	7.84	-8.19	11.72	0.54
390170018	38	67.26	57.88	-9.38	10.84	-13.95	16.12	0.34
390179991	29	66.06	58.60	-7.46	8.10	-11.29	12.27	0.41
390230001	33	64.68	56.67	-8.02	9.30	-12.40	14.37	0.62
390230003	17	66.29	60.05	-6.24	8.92	-9.42	13.45	0.40
390250022	30	65.81	60.42	-5.40	9.26	-8.20	14.07	0.28
390271002	36	64.58	57.86	-6.71	7.85	-10.40	12.15	0.51
390350034	23	65.62	59.47	-6.14	9.73	-9.36	14.83	0.22
390350060	8	63.47	59.29	-4.18	5.90	-6.59	9.30	0.03
390350064	17	65.76	61.27	-4.49	7.00	-6.83	10.64	0.40
390355002	28	65.67	60.98	-4.69	7.09	-7.14	10.80	0.14
390410002	23	64.22	58.14	-6.07	8.13	-9.46	12.65	0.29
390479991	18	64.21	57.66	-6.55	8.07	-10.21	12.57	0.29
390490029	34	65.97	60.46	-5.51	7.89	-8.36	11.97	0.32
390490037	17	65.29	61.15	-4.15	7.58	-6.35	11.60	0.60
390490081	26	66.51	60.86	-5.65	8.85	-8.49	13.30	0.39
390550004	37	67.73	57.14	-10.59	10.88	-15.64	16.06	0.55
390570006	29	64.11	58.00	-6.11	8.47	-9.54	13.21	0.54
390610006	32	67.88	62.56	-5.32	7.95	-7.84	11.71	0.42
390610010	35	67.22	61.98	-5.24	8.31	-7.80	12.36	0.56
390610040	33	66.58	61.29	-5.29	7.74	-7.94	11.63	0.48
390810017	8	63.00	61.89	-1.11	3.76	-1.77	5.97	0.06
390830002	20	63.75	60.84	-2.91	6.72	-4.56	10.55	0.20
390850003	34	67.50	58.78	-8.71	10.50	-12.91	15.56	0.51
390850007	22	66.57	60.09	-6.47	12.04	-9.72	18.08	0.19
390870011	14	63.76	62.34	-1.41	6.41	-2.22	10.06	0.38
390870012	18	65.81	62.43	-3.38	6.86	-5.13	10.42	0.70
390890005	21	64.56	60.34	-4.22	6.24	-6.53	9.67	0.33
390930018	23	65.02	58.04	-6.97	7.83	-10.73	12.04	0.18
390950024	13	65.93	57.61	-8.31	9.13	-12.61	13.86	0.62
390950027	18	64.06	55.65	-8.41	9.15	-13.12	14.29	0.36
390950034	9	63.93	55.40	-8.53	9.10	-13.35	14.24	0.12
390950035	5	62.72	56.13	-6.58	6.58	-10.50	10.50	0.42
390970007	21	65.01	58.45	-6.56	7.63	-10.09	11.74	0.37
390990013	1	61.57	65.38	3.81	3.81	6.19	6.19	0.00
391030004	16	64.76	58.21	-6.56	6.58	-10.13	10.16	0.71
391090005	29	64.81	55.21	-9.60	9.60	-14.82	14.82	0.61
391130037	32	64.80	58.59	-6.21	8.31	-9.58	12.83	0.37
391219991	18	65.29	57.59	-7.70	8.25	-11.79	12.64	0.56
391331001	3	63.46	67.49	4.03	4.69	6.35	7.40	0.78
391351001	24	65.07	56.23	-8.84	9.02	-13.59	13.86	0.51
391510016	31	65.36	58.25	-7.11	7.55	-10.88	11.55	0.42
391510022	19	64.33	59.15	-5.18	5.94	-8.06	9.23	0.48

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
391514005	30	65.35	60.01	-5.33	6.26	-8.16	9.58	0.32
391530020	4	65.66	61.63	-4.03	5.08	-6.14	7.74	0.52
391550011	28	66.85	60.61	-6.24	8.07	-9.33	12.07	0.29
391550013	22	67.40	59.37	-8.03	9.20	-11.91	13.64	0.12
391650007	42	67.01	58.89	-8.12	9.01	-12.12	13.44	0.57
391670004	15	62.59	60.48	-2.12	4.41	-3.38	7.04	0.64
391730003	20	64.63	54.45	-10.18	10.18	-15.75	15.75	0.54
400170101	10	63.06	54.89	-8.17	10.79	-12.95	17.12	0.75
400190297	18	66.05	57.00	-9.06	9.06	-13.71	13.71	0.79
400219002	2	62.19	59.25	-2.94	2.94	-4.73	4.73	1.00
400270049	15	64.69	56.21	-8.48	8.48	-13.11	13.11	0.55
400310651	9	62.13	51.13	-11.00	11.00	-17.70	17.70	0.49
400330680	7	62.31	53.68	-8.63	8.63	-13.85	13.85	0.03
400370144	9	62.04	59.24	-2.81	4.35	-4.52	7.01	0.46
400430860	8	63.86	52.13	-11.74	11.74	-18.38	18.38	0.55
400690324	8	63.35	63.80	0.45	4.85	0.70	7.65	0.32
400719010	2	66.42	62.16	-4.26	4.26	-6.41	6.41	1.00
400819025	9	63.97	60.40	-3.57	5.36	-5.59	8.38	0.36
400871073	14	62.77	55.83	-6.94	7.40	-11.05	11.79	0.02
400979014	9	61.39	57.53	-3.86	5.80	-6.29	9.45	0.21
401090033	20	64.03	55.30	-8.72	9.40	-13.62	14.68	0.20
401090096	11	64.15	58.11	-6.04	6.07	-9.42	9.47	0.40
401091037	20	64.45	56.31	-8.14	9.03	-12.62	14.01	0.20
401130226	11	63.55	58.24	-5.31	7.26	-8.35	11.42	0.43
401159004	1	60.63	57.06	-3.57	3.57	-5.89	5.89	0.00
401210415	2	63.76	56.93	-6.84	6.84	-10.72	10.72	1.00
401359021	1	62.13	61.48	-0.65	0.65	-1.05	1.05	0.00
401430137	1	60.33	45.20	-15.13	15.13	-25.08	25.08	0.00
401430174	10	66.27	54.59	-11.68	11.68	-17.63	17.63	0.76
401430178	13	63.34	57.60	-5.75	7.98	-9.07	12.59	0.21
401431127	10	61.69	58.52	-3.17	8.67	-5.14	14.06	0.39
401470217	10	62.44	59.40	-3.04	4.69	-4.86	7.52	0.51
410050004	6	65.59	63.88	-1.71	8.99	-2.60	13.71	0.37
410390060	2	65.51	61.23	-4.28	4.61	-6.53	7.03	1.00
410391007	3	63.25	61.52	-1.73	2.99	-2.74	4.72	0.17
410470004	7	65.38	55.55	-9.83	9.83	-15.03	15.03	0.10
410510080	3	65.54	59.95	-5.60	5.60	-8.54	8.54	0.91
410591003	6	65.92	50.34	-15.58	15.58	-23.63	23.63	0.76
410650007	1	62.13	45.35	-16.78	16.78	-27.01	27.01	0.00
410671004	2	60.69	56.93	-3.76	3.76	-6.20	6.20	1.00
420010001	34	65.68	56.27	-9.41	9.41	-14.33	14.33	0.51
420019991	34	64.95	56.36	-8.60	8.62	-13.23	13.27	0.50
420030008	18	66.52	62.98	-3.53	5.62	-5.31	8.44	0.47
420030067	27	66.95	60.32	-6.63	8.30	-9.91	12.40	0.30
420031008	15	65.48	64.04	-1.44	4.92	-2.19	7.52	0.52
420050001	21	66.63	61.01	-5.62	6.88	-8.44	10.33	0.60

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
420070002	33	64.78	60.22	-4.56	8.41	-7.04	12.99	0.04
420070005	19	65.80	60.91	-4.89	8.79	-7.43	13.36	0.03
420070014	21	64.69	62.65	-2.03	6.79	-3.14	10.50	0.13
420110006	14	66.62	62.56	-4.06	5.19	-6.10	7.80	0.04
420110011	19	67.92	62.52	-5.41	7.07	-7.96	10.41	0.54
420130801	12	64.41	57.56	-6.85	6.85	-10.63	10.63	0.91
420150011	5	63.00	53.16	-9.85	9.85	-15.63	15.63	0.52
420170012	33	67.16	64.61	-2.55	8.57	-3.80	12.75	0.48
420210011	17	62.97	61.14	-1.84	4.82	-2.92	7.65	0.44
420270100	13	63.80	56.64	-7.16	7.36	-11.22	11.54	0.60
420279991	14	65.77	59.81	-5.96	6.07	-9.07	9.22	0.64
420290100	26	68.06	62.19	-5.87	7.67	-8.62	11.27	0.61
420334000	13	65.44	57.89	-7.55	7.91	-11.53	12.09	0.48
420430401	9	65.54	62.71	-2.83	4.45	-4.32	6.79	0.36
420431100	19	64.97	62.11	-2.85	5.52	-4.39	8.49	0.34
420450002	28	67.19	65.02	-2.17	5.06	-3.23	7.54	0.58
420479991	16	66.01	53.82	-12.19	12.19	-18.46	18.46	0.07
420490003	18	65.14	57.81	-7.33	8.48	-11.25	13.02	0.19
420550001	5	61.18	62.73	1.55	6.61	2.53	10.80	0.49
420590002	23	64.31	58.26	-6.05	6.97	-9.41	10.84	0.48
420630004	23	65.86	59.48	-6.38	7.16	-9.68	10.87	0.52
420690101	25	65.85	56.18	-9.67	9.91	-14.69	15.05	0.33
420692006	14	64.87	58.71	-6.16	6.17	-9.50	9.51	0.41
420710007	24	64.73	60.44	-4.28	6.71	-6.62	10.37	0.44
420710012	7	66.59	69.85	3.26	5.12	4.89	7.69	0.26
420730015	15	65.18	63.77	-1.41	6.79	-2.17	10.42	0.31
420750100	19	66.44	63.15	-3.29	6.03	-4.95	9.07	0.21
420770004	17	66.85	63.75	-3.11	5.17	-4.65	7.73	0.06
420791101	20	64.19	58.11	-6.08	7.43	-9.48	11.57	0.29
420810100	13	63.53	56.73	-6.80	7.44	-10.71	11.70	0.36
420850100	24	66.93	60.62	-6.31	7.39	-9.43	11.05	0.36
420859991	20	66.20	58.81	-7.38	8.13	-11.15	12.29	0.33
420890002	22	65.61	58.21	-7.40	8.16	-11.28	12.44	0.45
420910013	23	66.21	63.44	-2.76	6.05	-4.18	9.14	0.43
420950025	24	68.08	63.89	-4.19	5.68	-6.15	8.35	0.21
420958000	15	68.69	63.07	-5.63	6.28	-8.19	9.14	0.15
421010004	12	66.77	68.23	1.46	6.29	2.18	9.43	0.43
421010024	42	68.04	63.29	-4.75	7.86	-6.98	11.55	0.51
421010048	27	67.09	65.18	-1.91	7.43	-2.84	11.07	0.46
421119991	17	64.74	60.20	-4.54	6.92	-7.01	10.69	0.16
421174000	16	65.36	53.09	-12.28	12.28	-18.78	18.78	0.10
421250005	24	64.04	59.33	-4.72	5.99	-7.37	9.35	0.53
421250200	15	62.48	60.52	-1.95	6.66	-3.13	10.67	0.19
421255001	22	65.89	59.98	-5.91	7.67	-8.97	11.64	0.32
421290008	30	65.37	59.68	-5.70	6.86	-8.72	10.50	0.53
421330008	21	64.74	60.49	-4.25	6.51	-6.57	10.06	0.30

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
421330011	28	65.14	62.38	-2.76	5.77	-4.24	8.86	0.50
440030002	19	68.34	60.17	-8.17	9.64	-11.96	14.10	0.55
440071010	15	66.66	61.32	-5.34	8.14	-8.01	12.21	0.43
440090007	15	66.74	59.90	-6.84	9.06	-10.25	13.58	0.51
450010001	9	62.18	60.19	-2.00	3.35	-3.21	5.39	0.19
450030003	13	62.02	53.82	-8.20	8.20	-13.22	13.22	0.06
450070005	6	63.57	64.79	1.23	3.39	1.93	5.34	0.61
450150002	1	62.14	55.01	-7.13	7.13	-11.47	11.47	0.00
450190046	4	61.80	55.42	-6.37	6.37	-10.31	10.31	0.51
450210004	13	65.93	66.56	0.63	5.68	0.95	8.62	0.41
450250001	10	63.50	58.33	-5.18	5.77	-8.15	9.09	0.12
450290002	2	60.57	51.93	-8.64	8.64	-14.27	14.27	1.00
450310003	10	62.45	56.67	-5.78	5.78	-9.26	9.26	0.52
450370001	10	64.23	56.50	-7.72	7.72	-12.03	12.03	0.42
450450016	22	64.64	61.29	-3.36	4.58	-5.19	7.09	0.30
450730001	12	67.47	56.55	-10.93	12.44	-16.19	18.44	0.26
450770002	14	64.82	61.46	-3.36	4.76	-5.19	7.35	0.50
450770003	9	63.90	61.80	-2.09	6.52	-3.28	10.20	0.01
450790007	9	65.06	59.37	-5.69	5.90	-8.74	9.08	0.47
450790021	1	66.00	62.88	-3.12	3.12	-4.73	4.73	0.00
450791001	13	65.80	58.95	-6.84	6.84	-10.40	10.40	0.69
450830009	21	65.56	62.08	-3.49	5.79	-5.32	8.83	0.56
450910006	5	62.03	67.22	5.19	7.92	8.37	12.77	0.81
450918801	14	64.76	64.26	-0.50	5.74	-0.78	8.86	0.48
460110003	4	64.47	51.76	-12.71	12.71	-19.72	19.72	0.49
460330132	6	62.14	50.91	-11.23	11.23	-18.07	18.07	0.46
460710001	5	62.74	46.01	-16.73	16.73	-26.67	26.67	0.72
460930001	3	61.21	53.54	-7.67	7.67	-12.53	12.53	0.94
460990008	14	64.91	47.63	-17.28	17.28	-26.63	26.63	0.51
461270001	5	62.12	44.48	-17.64	17.64	-28.40	28.40	0.05
470010101	14	64.02	65.54	1.52	6.38	2.37	9.96	0.07
470090101	27	65.50	57.79	-7.70	8.38	-11.76	12.80	0.47
470090102	10	63.78	59.06	-4.72	5.99	-7.40	9.40	0.38
470259991	7	65.07	61.60	-3.47	4.66	-5.34	7.15	0.79
470370011	13	66.08	64.47	-1.61	5.43	-2.43	8.21	0.52
470370026	16	65.87	67.27	1.39	7.24	2.12	10.99	0.21
470419991	9	62.61	58.11	-4.51	4.51	-7.20	7.20	0.36
470651011	18	63.19	60.18	-3.01	5.62	-4.76	8.90	0.01
470654003	30	64.20	60.89	-3.31	5.44	-5.16	8.47	0.37
470890002	35	64.99	58.48	-6.51	7.07	-10.02	10.88	0.59
470930021	22	64.67	60.95	-3.72	5.15	-5.76	7.96	0.57
470931020	23	64.37	63.37	-1.00	4.72	-1.56	7.34	0.56
471050108	31	67.59	61.75	-5.83	7.48	-8.63	11.07	0.47
471550101	27	64.47	58.77	-5.70	6.62	-8.85	10.27	0.25
471550102	16	65.30	57.21	-8.08	8.35	-12.38	12.79	0.36
471570021	18	66.23	62.81	-3.42	7.17	-5.16	10.83	0.49

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
471570075	16	65.25	62.66	-2.58	5.26	-3.96	8.06	0.37
471571004	14	64.98	60.07	-4.90	6.04	-7.54	9.30	0.70
471632002	15	65.84	64.60	-1.24	7.55	-1.89	11.46	0.32
471632003	19	64.10	60.68	-3.41	5.01	-5.33	7.82	0.55
471650007	19	64.53	61.70	-2.83	4.31	-4.39	6.67	0.56
471870106	9	63.28	57.98	-5.30	6.47	-8.38	10.22	0.86
471890103	14	64.61	59.55	-5.06	7.72	-7.84	11.95	0.36
480271045	10	64.02	57.41	-6.61	6.61	-10.32	10.32	0.25
480271047	9	64.64	58.39	-6.25	6.25	-9.67	9.67	0.36
480290032	11	68.07	65.12	-2.95	4.33	-4.34	6.36	0.66
480290052	8	68.66	62.63	-6.03	6.14	-8.78	8.94	0.94
480290059	7	63.57	58.82	-4.76	4.76	-7.48	7.48	0.56
480391004	26	65.24	57.96	-7.28	7.97	-11.15	12.21	0.57
480391016	11	65.05	60.15	-4.90	8.55	-7.54	13.15	0.38
480430101	11	61.67	49.77	-11.90	11.90	-19.29	19.29	0.46
480610006	1	61.38	56.80	-4.58	4.58	-7.46	7.46	0.00
480611023	2	60.51	55.43	-5.08	5.08	-8.39	8.39	1.00
480850005	25	65.40	63.76	-1.63	5.51	-2.50	8.43	0.62
481130069	22	65.16	55.68	-9.48	10.04	-14.55	15.41	0.47
481130075	21	63.71	58.80	-4.91	6.76	-7.71	10.61	0.30
481130087	6	65.75	61.27	-4.48	6.02	-6.82	9.15	0.91
481210034	29	68.44	62.46	-5.97	6.59	-8.73	9.64	0.82
481211032	24	68.20	64.00	-4.20	5.66	-6.15	8.29	0.72
481390016	4	65.04	60.05	-4.98	9.10	-7.66	14.00	0.88
481391044	5	61.08	51.48	-9.59	9.59	-15.71	15.71	0.16
481410029	4	63.45	57.89	-5.56	6.25	-8.76	9.85	0.81
481410037	24	66.01	53.18	-12.83	13.58	-19.44	20.58	0.34
481410044	18	65.34	52.78	-12.55	13.45	-19.21	20.58	0.41
481410055	16	64.95	54.44	-10.51	11.86	-16.18	18.26	0.27
481410057	12	63.73	55.24	-8.49	11.46	-13.32	17.98	0.12
481410058	13	64.73	52.85	-11.88	11.88	-18.35	18.35	0.36
481671034	33	66.24	52.00	-14.24	14.53	-21.50	21.94	0.37
481830001	9	64.02	62.41	-1.62	6.70	-2.53	10.46	0.55
482010024	24	66.59	58.75	-7.84	10.59	-11.77	15.91	0.10
482010026	5	62.15	60.09	-2.06	2.30	-3.32	3.70	0.64
482010029	11	66.34	61.74	-4.60	10.03	-6.94	15.11	0.44
482010046	6	62.77	62.42	-0.35	4.39	-0.56	6.99	0.62
482010047	14	68.56	61.77	-6.79	9.59	-9.91	13.99	0.38
482010051	16	66.44	62.35	-4.10	7.06	-6.17	10.62	0.41
482010055	25	66.59	58.14	-8.44	10.36	-12.68	15.57	0.31
482010062	3	65.13	60.48	-4.64	7.66	-7.13	11.77	0.01
482010066	18	70.12	64.42	-5.70	9.49	-8.13	13.53	0.51
482010416	11	63.88	61.49	-2.39	4.38	-3.74	6.85	0.58
482011015	2	61.51	60.29	-1.22	1.22	-1.98	1.98	1.00
482011017	7	62.20	54.78	-7.42	7.45	-11.92	11.98	0.40
482011034	14	63.99	53.76	-10.24	11.67	-16.00	18.24	0.29

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
482011035	9	64.13	61.88	-2.25	5.53	-3.51	8.62	0.03
482011039	6	64.28	57.94	-6.33	6.37	-9.85	9.90	0.48
482011050	6	64.46	56.72	-7.74	9.90	-12.01	15.36	0.47
482150043	1	61.13	66.29	5.16	5.16	8.44	8.44	0.00
482210001	11	63.69	54.50	-9.18	9.18	-14.42	14.42	0.75
482311006	1	60.63	58.83	-1.80	1.80	-2.97	2.97	0.00
482450009	3	60.79	62.06	1.27	6.01	2.08	9.88	0.80
482450011	12	62.16	53.11	-9.05	9.05	-14.56	14.56	0.07
482450022	8	67.52	56.67	-10.85	10.85	-16.07	16.07	0.76
482450101	10	63.95	50.50	-13.46	13.46	-21.04	21.04	0.27
482450102	3	61.84	55.11	-6.73	6.73	-10.88	10.88	0.99
482451035	7	62.84	54.50	-8.34	8.53	-13.27	13.57	0.04
482510003	34	65.70	52.67	-13.03	13.03	-19.83	19.83	0.68
483091037	4	61.63	57.96	-3.67	4.07	-5.96	6.60	0.26
483390078	19	64.41	55.39	-9.02	9.17	-14.00	14.23	0.59
483491051	6	61.07	54.84	-6.22	7.33	-10.19	12.01	0.11
483550025	7	62.38	57.68	-4.70	4.70	-7.53	7.53	0.34
483550026	4	63.69	60.33	-3.36	5.41	-5.28	8.50	0.35
483611001	1	62.50	60.97	-1.53	1.53	-2.45	2.45	0.00
483670081	13	67.81	55.28	-12.53	12.53	-18.47	18.47	0.58
483739991	1	62.88	64.88	2.00	2.00	3.18	3.18	0.00
483819991	18	63.39	49.69	-13.70	13.82	-21.61	21.81	0.00
483970001	8	61.61	55.33	-6.28	6.67	-10.19	10.82	0.35
484230007	10	63.75	58.95	-4.80	6.11	-7.52	9.59	0.38
484390075	18	64.39	62.50	-1.89	4.17	-2.94	6.47	0.60
484391002	16	65.90	62.06	-3.84	5.56	-5.83	8.43	0.66
484392003	18	66.26	63.44	-2.82	4.47	-4.26	6.74	0.61
484393009	23	67.74	64.43	-3.31	5.94	-4.89	8.77	0.69
484393011	5	69.10	63.70	-5.40	5.40	-7.82	7.82	0.97
484530014	11	64.09	57.90	-6.19	6.19	-9.66	9.66	0.61
484530020	8	64.38	62.02	-2.37	2.98	-3.68	4.63	0.62
484690003	6	64.77	57.69	-7.09	7.09	-10.94	10.94	0.55
490030003	18	64.56	55.38	-9.18	9.18	-14.22	14.22	0.36
490050007	7	62.99	52.07	-10.92	10.92	-17.33	17.33	0.48
490071003	37	62.58	52.64	-9.94	10.01	-15.89	16.00	0.09
490110004	37	66.39	56.13	-10.26	10.45	-15.45	15.74	0.52
490130002	20	69.21	45.72	-23.48	23.48	-33.93	33.93	0.50
490137011	23	69.66	45.56	-24.10	24.10	-34.60	34.60	0.68
490350015	58	64.34	54.77	-9.57	9.68	-14.88	15.04	0.39
490353006	21	67.58	56.97	-10.61	11.65	-15.70	17.24	0.25
490353013	57	66.43	54.05	-12.38	12.48	-18.64	18.79	0.52
490370004	1	60.50	56.66	-3.84	3.84	-6.35	6.35	0.00
490370101	22	62.37	49.05	-13.32	13.35	-21.36	21.40	0.35
490450004	29	65.85	54.94	-10.91	10.96	-16.56	16.65	0.36
490470014	6	62.08	52.32	-9.76	9.76	-15.72	15.72	0.65
490471002	25	66.54	44.40	-22.14	22.14	-33.27	33.27	0.35

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
490471004	34	64.52	48.47	-16.05	16.05	-24.88	24.88	0.50
490472002	24	70.22	45.83	-24.39	24.52	-34.73	34.91	0.51
490472003	35	72.84	43.75	-29.09	29.20	-39.94	40.08	0.43
490477022	22	68.54	44.28	-24.26	24.26	-35.39	35.39	0.57
490490002	44	65.78	54.98	-10.80	10.92	-16.41	16.61	0.51
490495010	42	66.13	54.30	-11.83	11.83	-17.89	17.89	0.49
490530007	17	61.56	52.61	-8.95	8.95	-14.54	14.54	0.09
490530130	25	62.21	52.93	-9.28	9.59	-14.91	15.41	0.11
490570002	29	65.94	54.49	-11.45	11.46	-17.37	17.39	0.22
490571003	44	65.95	53.82	-12.13	12.13	-18.39	18.39	0.34
500030004	13	64.94	54.03	-10.90	11.98	-16.79	18.45	0.31
500070007	4	63.54	51.97	-11.57	11.57	-18.21	18.21	0.97
500210002	6	63.68	56.02	-7.66	7.66	-12.03	12.03	0.06
510030001	7	65.86	58.30	-7.56	7.56	-11.48	11.48	0.84
510130020	35	65.97	65.42	-0.55	7.90	-0.83	11.98	0.12
510330001	5	66.33	58.73	-7.60	7.60	-11.46	11.46	0.96
510360002	8	65.25	60.16	-5.09	5.09	-7.80	7.80	0.93
510410004	11	63.83	58.33	-5.51	7.63	-8.63	11.95	0.61
510590030	26	66.23	66.88	0.65	8.96	0.98	13.53	0.03
510610002	6	64.47	62.26	-2.21	6.33	-3.43	9.82	0.31
510690010	10	64.11	62.93	-1.18	3.08	-1.83	4.80	0.57
510719991	15	64.30	57.16	-7.14	7.36	-11.11	11.44	0.57
510850003	11	65.10	60.76	-4.33	6.62	-6.66	10.17	0.52
510870014	15	65.37	62.94	-2.43	6.56	-3.72	10.04	0.35
511071005	17	64.55	62.14	-2.41	5.41	-3.73	8.38	0.54
511130003	15	64.36	55.68	-8.67	8.67	-13.47	13.47	0.78
511479991	4	66.44	57.42	-9.02	9.02	-13.57	13.57	0.90
511530009	18	65.31	61.83	-3.48	5.85	-5.33	8.95	0.53
511611004	11	63.97	57.58	-6.39	6.67	-9.99	10.42	0.63
511630003	4	63.22	58.86	-4.36	4.36	-6.90	6.90	0.98
511650003	7	64.20	55.36	-8.84	8.84	-13.77	13.77	0.03
511790001	12	64.33	67.64	3.31	7.79	5.15	12.11	0.06
511970002	8	63.53	58.30	-5.23	5.23	-8.23	8.23	0.70
516500008	9	67.78	60.32	-7.46	7.46	-11.01	11.01	0.95
518000004	5	66.49	61.08	-5.41	5.89	-8.14	8.86	0.66
518000005	6	64.77	54.78	-9.99	9.99	-15.43	15.43	0.85
530050003	9	67.47	52.03	-15.45	15.45	-22.89	22.89	0.67
530110011	1	64.88	74.16	9.28	9.28	14.30	14.30	0.00
530330010	2	67.00	72.97	5.97	5.97	8.91	8.91	1.00
530330017	1	64.25	75.47	11.22	11.22	17.46	17.46	0.00
530330023	4	63.07	67.24	4.17	7.94	6.62	12.59	0.63
530530012	3	64.77	49.41	-15.35	15.35	-23.71	23.71	0.98
530670005	2	61.44	67.27	5.83	5.83	9.49	9.49	1.00
540030003	16	64.15	61.23	-2.92	4.85	-4.55	7.55	0.54
540110006	8	66.22	66.00	-0.22	7.15	-0.34	10.80	0.21
540219991	7	64.25	59.28	-4.97	5.75	-7.74	8.94	0.79

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
540250003	7	63.59	58.53	-5.06	5.73	-7.95	9.02	0.71
540290009	11	64.15	61.33	-2.82	6.95	-4.40	10.83	0.30
540390020	12	65.95	61.76	-4.20	7.27	-6.36	11.03	0.54
540610003	1	62.88	59.50	-3.38	3.38	-5.38	5.38	0.00
540690010	20	65.49	59.26	-6.23	7.67	-9.51	11.72	0.10
540939991	9	64.77	59.40	-5.37	6.72	-8.29	10.38	0.62
541071002	18	63.99	61.58	-2.41	5.20	-3.76	8.13	0.33
550030010	7	62.40	46.53	-15.87	15.87	-25.43	25.43	0.23
550090026	10	66.98	55.32	-11.66	11.93	-17.40	17.80	0.52
550210015	16	65.31	49.76	-15.55	15.55	-23.81	23.81	0.75
550250041	16	64.61	50.71	-13.90	13.90	-21.52	21.52	0.66
550270001	14	65.39	53.52	-11.87	11.88	-18.15	18.16	0.54
550290004	27	69.02	58.67	-10.35	11.16	-14.99	16.17	0.30
550350014	10	63.62	51.42	-12.20	12.20	-19.18	19.18	0.57
550390006	16	64.96	52.51	-12.45	12.53	-19.16	19.29	0.45
550410007	7	65.71	50.44	-15.27	15.27	-23.24	23.24	0.16
550550009	20	65.23	49.86	-15.37	15.37	-23.56	23.56	0.67
550590019	40	69.28	55.09	-14.19	15.50	-20.48	22.37	0.65
550590025	26	67.73	58.36	-9.37	10.70	-13.83	15.80	0.54
550610002	22	66.84	57.63	-9.21	9.36	-13.77	14.01	0.71
550630012	11	62.79	50.88	-11.90	11.90	-18.96	18.96	0.68
550710007	23	69.24	57.43	-11.81	12.15	-17.05	17.55	0.45
550730012	9	65.06	50.15	-14.91	14.91	-22.92	22.92	0.58
550790010	11	65.49	61.24	-4.25	8.86	-6.49	13.52	0.59
550790026	23	66.26	51.97	-14.29	14.56	-21.57	21.97	0.63
550790085	29	68.08	53.65	-14.43	14.92	-21.20	21.92	0.51
550870009	12	65.20	52.52	-12.69	12.69	-19.46	19.46	0.47
550890008	17	68.32	58.18	-10.13	10.26	-14.83	15.02	0.62
550890009	20	70.86	61.18	-9.68	10.14	-13.66	14.32	0.74
551010020	29	68.62	55.38	-13.24	14.35	-19.30	20.91	0.60
551050030	16	67.42	52.45	-14.97	14.97	-22.21	22.21	0.40
551110007	11	65.59	51.57	-14.02	14.02	-21.38	21.38	0.64
551170006	28	71.17	56.74	-14.44	14.59	-20.28	20.50	0.66
551170009	15	68.25	60.71	-7.54	8.81	-11.05	12.90	0.68
551199991	10	62.82	48.80	-14.02	14.02	-22.32	22.32	0.41
551250001	8	62.00	47.68	-14.33	14.33	-23.11	23.11	0.20
551270005	17	66.69	52.79	-13.90	13.90	-20.84	20.84	0.63
551330027	7	66.93	55.91	-11.02	11.02	-16.47	16.47	0.93
560019991	30	63.24	46.78	-16.46	16.46	-26.03	26.03	0.07
560030002	2	63.82	41.29	-22.53	22.53	-35.30	35.30	1.00
560050456	4	61.35	46.05	-15.30	15.30	-24.94	24.94	0.79
560070100	6	61.94	50.25	-11.69	11.69	-18.88	18.88	0.18
560090008	5	62.20	48.06	-14.14	14.14	-22.73	22.73	0.83
560090010	3	63.13	43.97	-19.16	19.16	-30.34	30.34	0.03
560130099	10	62.26	48.92	-13.34	13.34	-21.43	21.43	0.33
560130232	6	62.21	48.21	-14.01	14.01	-22.51	22.51	0.24

Monitor	# of Obs	Mean MDA8 (ppb)		Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	Pearson correlation coefficient r
		Obs	Model					
560150005	2	61.13	53.85	-7.28	7.28	-11.90	11.90	1.00
560210002	7	61.89	55.40	-6.49	6.55	-10.49	10.58	0.17
560210100	14	61.44	52.44	-9.00	9.00	-14.65	14.65	0.27
560250100	7	62.68	47.10	-15.58	15.58	-24.86	24.86	0.16
560252601	1	61.88	54.76	-7.12	7.12	-11.51	11.51	0.00
560330004	3	61.71	45.75	-15.96	15.96	-25.86	25.86	1.00
560350099	5	61.95	52.96	-8.99	11.10	-14.52	17.92	0.23
560350100	11	63.20	53.18	-10.01	10.91	-15.84	17.27	0.09
560350101	3	61.42	58.20	-3.22	6.36	-5.25	10.35	0.30
560350700	15	63.97	51.85	-12.12	12.58	-18.94	19.67	0.06
560351002	1	60.75	46.53	-14.22	14.22	-23.41	23.41	0.00
560359991	19	62.99	50.66	-12.33	12.65	-19.57	20.08	0.52
560370077	5	62.90	46.68	-16.22	16.22	-25.78	25.78	0.02
560370300	13	62.99	52.74	-10.24	10.60	-16.26	16.82	0.50
560390008	5	61.53	49.54	-11.99	14.58	-19.48	23.69	0.26
560391011	7	61.52	48.59	-12.93	13.80	-21.01	22.44	0.32
560410101	8	62.27	55.12	-7.15	7.15	-11.47	11.47	0.28
560450003	4	61.88	53.73	-8.15	8.15	-13.17	13.17	0.33
560450004	5	61.45	53.47	-7.99	7.99	-13.00	13.00	0.45

Appendix B

Model performance statistics for MDA8 ozone by summer month and MJO as calculated by Alpine Geophysics. 2016fh (version 1) and 2016fg (*beta*) modeling platforms for all observations (> 0 ppb).

EPA's 2016fh (v1) Modeling Platform – Performance Statistics by Month/Season and MJO									
			Mean MDA8 (ppb)						
Region	Season	# of Obs	Obs	Model	Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	r
CENRAP	WIN	12,587	33.24	28.55	-4.69	6.15	-14.10	18.51	0.79
CENRAP	SPR	14,056	43.87	39.69	-4.18	6.71	-9.53	15.29	0.71
CENRAP	SUM	17,940	39.45	40.64	1.20	6.38	3.03	16.18	0.75
CENRAP	FAL	13,887	37.67	38.34	0.66	4.83	1.76	12.83	0.81
CENRAP	OS	29,860	40.33	40.64	0.31	6.31	0.76	15.65	0.74
CENRAP	Annual	58,470	38.75	37.26	-1.49	6.04	-3.84	15.60	0.76
LADCO	WIN	4,039	29.65	23.35	-6.30	6.83	-21.24	23.05	0.76
LADCO	SPR	10,801	46.76	38.67	-8.09	8.92	-17.30	19.08	0.81
LADCO	SUM	17,697	46.31	46.41	0.10	6.87	0.22	14.84	0.71
LADCO	FAL	9,556	37.05	38.18	1.13	4.43	3.05	11.96	0.84
LADCO	OS	29,421	45.16	43.91	-1.25	6.89	-2.77	15.26	0.71
LADCO	Annual	42,093	42.72	40.34	-2.38	6.84	-5.57	16.01	0.78
MANE_VU	WIN	12,496	31.66	24.85	-6.81	7.48	-21.50	23.63	0.74
MANE_VU	SPR	14,138	44.88	36.45	-8.43	9.24	-18.79	20.59	0.81
MANE_VU	SUM	17,492	45.77	47.25	1.48	6.43	3.24	14.05	0.79
MANE_VU	FAL	13,147	34.61	34.81	0.20	5.35	0.58	15.46	0.79
MANE_VU	OS	29,136	44.27	44.01	-0.26	6.60	-0.58	14.91	0.78
MANE_VU	Annual	57,273	39.91	36.84	-3.07	7.11	-7.69	17.81	0.80
VISTAS	WIN	8,798	35.69	31.45	-4.25	5.91	-11.89	16.56	0.77
VISTAS	SPR	18,274	46.44	42.89	-3.56	5.70	-7.66	12.28	0.81
VISTAS	SUM	23,283	40.25	42.97	2.73	6.23	6.78	15.48	0.82
VISTAS	FAL	15,098	40.66	42.29	1.63	5.47	4.01	13.47	0.76
VISTAS	OS	38,753	41.57	43.22	1.66	6.06	3.99	14.58	0.80
VISTAS	Annual	65,453	41.46	41.24	-0.22	5.87	-0.53	14.15	0.78
WRAP	WIN	30,697	35.57	32.34	-3.23	6.21	-9.08	17.46	0.68
WRAP	SPR	29,006	47.63	40.82	-6.80	7.88	-14.28	16.55	0.77
WRAP	SUM	35,861	51.45	47.41	-4.04	7.39	-7.85	14.35	0.79
WRAP	FAL	28,633	40.97	39.83	-1.14	5.57	-2.78	13.60	0.75
WRAP	OS	59,497	49.53	45.42	-4.11	7.25	-8.29	14.65	0.78
WRAP	Annual	124,197	44.22	40.40	-3.81	6.79	-8.63	15.36	0.81

EPA's 2016fg (*beta*) Modeling Platform – Performance Statistics by Month/Season and MJO									
			Mean MDA8 (ppb)						
Region	Season	# of Obs	Obs	Model	Mean Bias (ppb)	Mean Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)	r
CENRAP	WIN	12,587	33.24	29.01	-4.23	5.80	-12.73	17.46	0.80
CENRAP	SPR	14,056	43.87	41.35	-2.52	6.44	-5.75	14.68	0.67
CENRAP	SUM	17,940	39.45	41.66	2.22	6.72	5.62	17.03	0.74
CENRAP	FAL	13,887	37.67	38.98	1.31	4.99	3.47	13.24	0.81
CENRAP	OS	29,860	40.33	41.78	1.45	6.58	3.60	16.32	0.73
CENRAP	Annual	58,470	38.75	38.23	-0.53	6.04	-1.36	15.59	0.76
LADCO	WIN	4,039	29.65	23.26	-6.38	6.88	-21.53	23.21	0.77
LADCO	SPR	10,801	46.76	39.47	-7.29	8.36	-15.59	17.88	0.81
LADCO	SUM	17,697	46.31	47.65	1.34	7.17	2.89	15.48	0.70
LADCO	FAL	9,556	37.05	38.60	1.54	4.59	4.17	12.39	0.84
LADCO	OS	29,421	45.16	44.93	-0.23	7.00	-0.51	15.50	0.70
LADCO	Annual	42,093	42.72	41.15	-1.57	6.86	-3.68	16.06	0.77
MANE_VU	WIN	12,496	31.66	24.71	-6.95	7.57	-21.96	23.90	0.75
MANE_VU	SPR	14,138	44.88	37.31	-7.57	8.64	-16.86	19.26	0.81
MANE_VU	SUM	17,492	45.77	48.60	2.83	6.76	6.19	14.77	0.78
MANE_VU	FAL	13,147	34.61	35.38	0.77	5.51	2.23	15.91	0.79
MANE_VU	OS	29,136	44.27	45.21	0.94	6.74	2.12	15.22	0.78
MANE_VU	Annual	57,273	39.91	37.57	-2.34	7.11	-5.87	17.82	0.79
VISTAS	WIN	8,798	35.69	31.81	-3.88	5.71	-10.87	15.99	0.77
VISTAS	SPR	18,274	46.44	44.38	-2.06	5.21	-4.44	11.22	0.80
VISTAS	SUM	23,283	40.25	44.57	4.32	6.93	10.74	17.21	0.81
VISTAS	FAL	15,098	40.66	43.30	2.64	5.77	6.51	14.19	0.76
VISTAS	OS	38,753	41.57	44.72	3.15	6.54	7.59	15.73	0.79
VISTAS	Annual	65,453	41.46	42.51	1.05	6.02	2.53	14.51	0.78
WRAP	WIN	30,697	35.57	32.40	-3.16	6.17	-8.90	17.36	0.68
WRAP	SPR	29,006	47.63	41.67	-5.95	7.40	-12.50	15.54	0.76
WRAP	SUM	35,861	51.45	49.56	-1.88	7.24	-3.66	14.07	0.76
WRAP	FAL	28,633	40.97	40.67	-0.30	5.60	-0.74	13.68	0.75
WRAP	OS	59,497	49.53	47.28	-2.25	7.02	-4.54	14.18	0.76
WRAP	Annual	124,197	44.22	41.43	-2.79	6.64	-6.30	15.01	0.80