



# **Attainment Demonstration Modeling for the 2015 Ozone National Ambient Air Quality Standard**

## **Technical Support Document – Supplementary Materials**

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## S1. 2015 O3 NAAQS NAA Model Performance Results

Additional LADCO CAMx 2016bcc simulation MPE plots are available on the LADCO website: [https://www.ladco.org/technical/modeling-results/ladco-2016-modeling/#Air\\_Quality/CAMx\\_LADCO\\_2016bcc](https://www.ladco.org/technical/modeling-results/ladco-2016-modeling/#Air_Quality/CAMx_LADCO_2016bcc)

**Table S 1. Model performance statistics for the LADCO 2016 4km CAMx simulation of high concentration (>60 ppb) MDA8 O<sub>3</sub> days at each AQS monitor in the 2015 O<sub>3</sub> NAAQS NAAs in the LADCO region**

Area	Site Name	Site ID	State	Mean Obs (ppb)	Mean Model (ppb)	NMB (%)	NME (%)	Corr
Allegan	HOLLAND	260050003	MI	70.35	61.01	-13.27	15.34	0.69
Berrien	COLOMA	260210014	MI	71.58	63.07	-11.90	14.68	0.79
Chicago	ALSIP	170310001	IL	70.65	62.17	-12.00	12.00	0.23
Chicago	CHI_SWFP	170310032	IL	69.89	61.89	-11.45	12.71	0.67
Chicago	CHI_COM	170310076	IL	67.56	58.61	-13.25	13.25	0.70
Chicago	CHI_TAFT	170311003	IL	68.03	58.11	-14.57	14.57	0.84
Chicago	LEMONT	170311601	IL	71.66	59.69	-16.70	16.70	0.82
Chicago	SCHILPRK	170313103	IL	65.73	60.24	-8.35	8.35	0.87
Chicago	CICERO	170314002	IL	66.48	57.32	-13.78	13.78	0.78
Chicago	DESPLNS	170314007	IL	69.90	60.92	-12.85	12.85	0.57
Chicago	NORTHBK	170314201	IL	69.65	59.54	-14.52	14.52	0.83
Chicago	EVANSTON	170317002	IL	69.50	68.25	-1.80	13.80	0.32
Chicago	LISLE	170436001	IL	72.03	63.32	-12.09	12.13	0.65
Chicago	ELGIN	170890005	IL	70.61	62.88	-10.95	11.70	0.62
Chicago	ZION	170971007	IL	69.46	67.85	-2.33	11.85	0.94
Chicago	CARY	171110001	IL	69.35	63.79	-8.02	8.08	0.89
Chicago	BRAIDWD	171971011	IL	62.58	52.99	-15.32	15.32	0.70
Chicago	Gary-IITRI	180890022	IN	65.63	59.36	-9.54	14.30	0.24
Chicago	Hammond	180892008	IN	65.33	61.90	-5.25	5.47	0.73
Chicago	Ogden Dunes	181270024	IN	65.35	63.62	-2.65	8.50	0.49
Chicago	Valparaiso	181270026	IN	65.25	58.36	-10.56	11.47	0.53
Chicago	CHIWAUKEE	550590019	WI	69.86	62.09	-11.13	15.49	0.86
Chicago	Kenosha	550590025	WI	68.15	59.42	-12.82	12.82	0.93
Cleveland	6th District	390350034	OH	65.69	61.09	-7.01	8.26	0.37

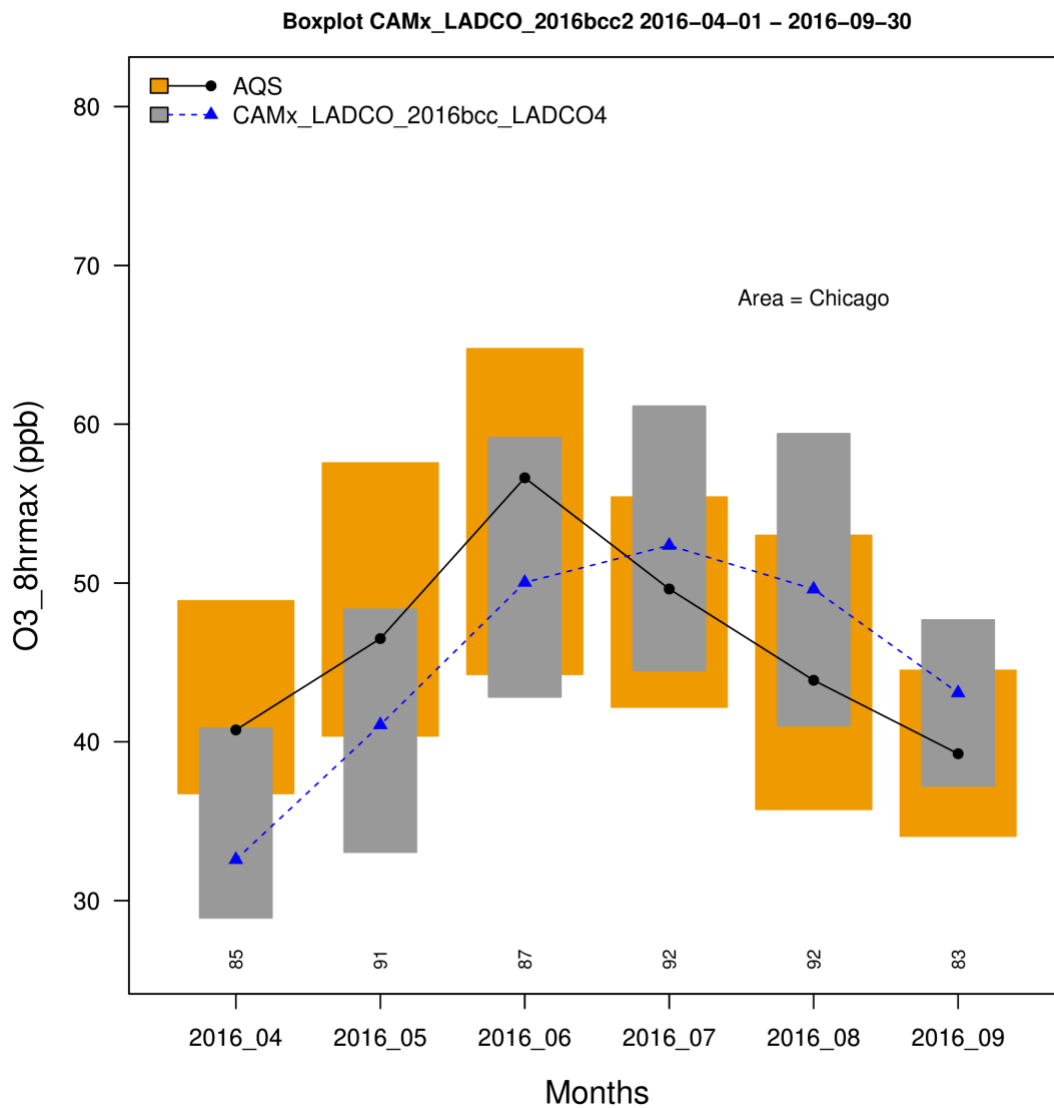
LADCO 2015 O3 NAAQS Moderate NAA SIP Attainment Demonstration TSD

Cleveland	G.T.Craig	390350060	OH	65.67	58.96	-10.21	10.21	0.58
Cleveland	Berea BOE	390350064	OH	65.04	62.74	-3.53	11.63	-0.38
Cleveland	Mayfield	390355002	OH	65.88	60.65	-7.93	9.00	0.39
Cleveland	Notre Dame	390550004	OH	67.76	60.53	-10.67	11.92	0.41
Cleveland	Eastlake	390850003	OH	68.11	61.24	-10.09	11.85	0.36
Cleveland	Painesville - JFS	390850007	OH	66.79	58.80	-11.96	12.20	0.40
Cleveland	Elyria - Sheffield	390930018	OH	66.41	61.50	-7.38	11.05	-0.32
Cleveland	Chippewa Lake	391030004	OH	62.59	56.30	-10.05	10.05	0.45
Cleveland	Lake Rockwell	391331001	OH	60.25	65.19	8.19	8.19	NA
Detroit	NEW HAVEN	260990009	MI	68.30	58.52	-14.32	14.32	0.86
Detroit	WARREN	260991003	MI	66.55	61.00	-8.33	8.51	0.79
Detroit	OAK PARK	261250001	MI	67.76	60.86	-10.19	11.20	0.09
Detroit	PORT HURON	261470005	MI	65.28	61.99	-5.03	8.72	0.75
Detroit	YPSILANTI	261610008	MI	64.54	60.43	-6.36	8.15	0.20
Detroit	ALLEN PARK	261630001	MI	67.45	58.63	-13.07	14.33	-0.31
Detroit	E 7 MILE	261630019	MI	67.10	59.32	-11.60	12.42	0.28
Detroit	TRINITY	261630099	MI	64.35	60.10	-6.59	8.69	0.36
Milwaukee	16TH ST	550790010	WI	73.08	67.17	-8.09	9.83	0.77
Milwaukee	MILWAUKEE SER	550790026	WI	66.14	59.10	-10.64	16.06	0.54
Milwaukee	BAYSIDE	550790085	WI	69.52	63.32	-8.91	17.23	0.44
Milwaukee	GRAFTON	550890008	WI	70.44	60.78	-13.72	13.72	1.00
Milwaukee	HARRINGTON	550890009	WI	78.67	71.87	-8.64	8.64	0.66
Milwaukee	Racine	551010020	WI	69.70	64.17	-7.94	14.11	0.77
Milwaukee	WAUKESHA	551330027	WI	67.38	56.78	-15.73	15.73	1.00
Muskegon	MUSKEGON	261210039	MI	72.81	63.38	-12.95	12.95	0.94
Sheboygan	SHEBOYGAN	551170006	WI	82.33	72.95	-11.40	11.40	0.78
St. Louis	Alton	171190120	IL	69.91	67.03	-4.12	7.47	0.71
St. Louis	MARYVILL	171191009	IL	65.07	62.40	-4.10	8.45	0.52
St. Louis	WOOD_WTP	171193007	IL	69.44	64.03	-7.80	9.36	0.68
St. Louis	East St. Louis	171630010	IL	69.28	64.89	-6.33	7.96	0.87

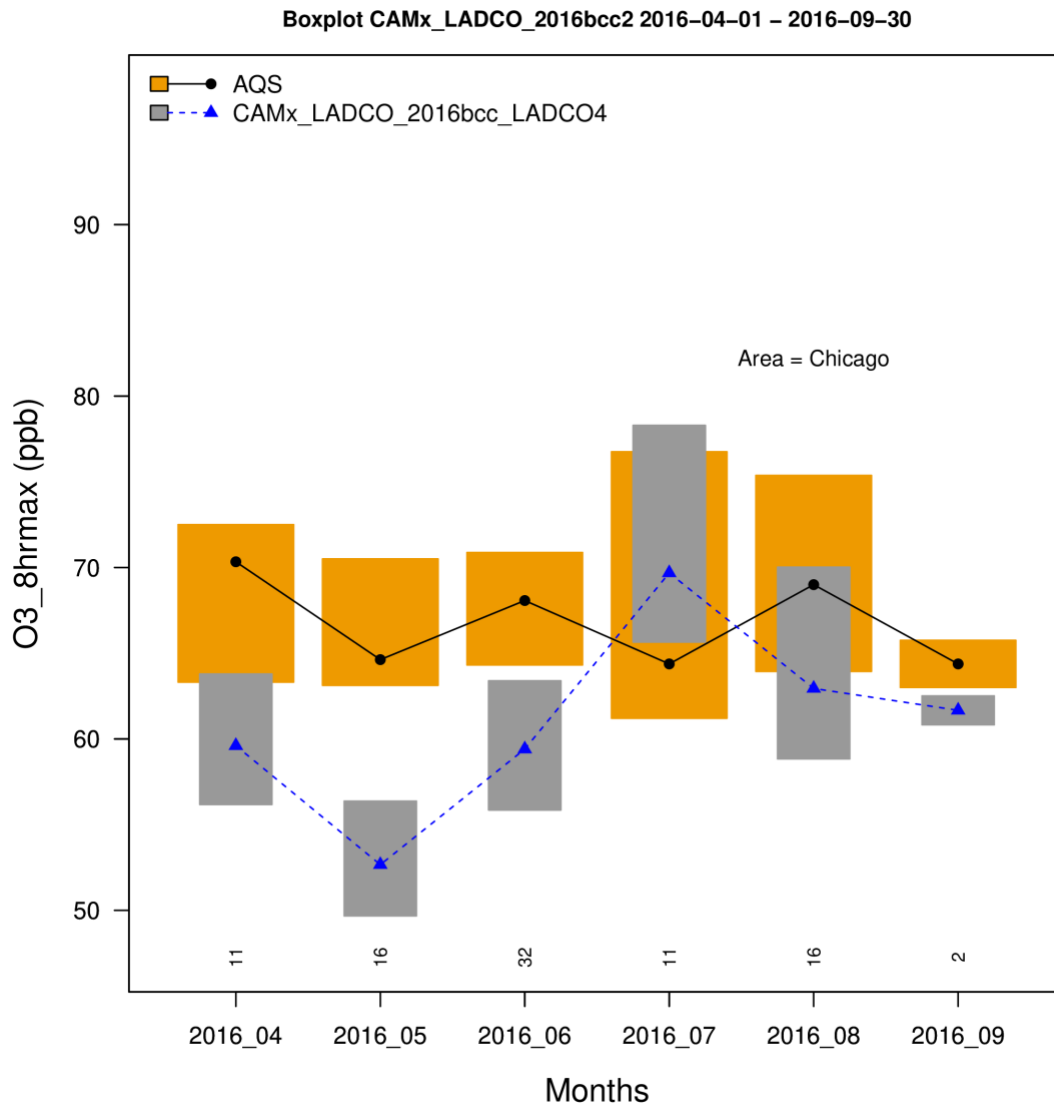
**S1.1. Chicago, IL-IN-WI**

**Table S 2. CAMx 4-km monthly MDA8 O<sub>3</sub> performance at AQS sites in the Chicago, IL/IN/WI NAA**

Region	NMB (%)		NME (%)		r	
	All	> 60ppb	All	> 60ppb	All	> 60ppb
April	-14.20	-11.80	16.20	12.10	0.89	0.67
May	-12.20	-15.90	15.80	16.30	0.84	0.59
June	-5.69	-11.10	12.30	12.70	0.81	0.65
July	12.10	11.30	15.50	16.30	0.81	0.42
August	10.50	-6.43	15.50	9.39	0.84	0.55
September	11.80	-0.70	14.90	5.17	0.70	-0.29



**Figure S 1. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in the Chicago NAA**



**Figure S 2. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in the Chicago NAA on days > 60 ppb**

**S1.2. St. Louis, IL/MO**

**Table S 3. CAMx 4-km monthly MDA8 O<sub>3</sub> performance at AQS sites in the St. Louis, IL/MO NAA**

Region	NMB (%)		NME (%)		r	
	All	> 60ppb	All	> 60ppb	All	> 60ppb
April	-7.02	-8.74	14.00	9.57	0.72	0.71
May	-0.49	-12.00	15.00	12.20	0.62	0.62
June	3.93	-3.10	11.30	8.40	0.73	0.59
July	23.00	9.67	25.00	15.60	0.68	0.19
August	23.10	6.44	25.00	13.00	0.78	0.21
September	18.00	4.20	19.10	7.66	0.90	0.55

**S1.3. Western, MI**

**Table S 4. CAMx 4-km monthly MDA8 O<sub>3</sub> performance at AQS sites in the Allegan County, MI NAA**

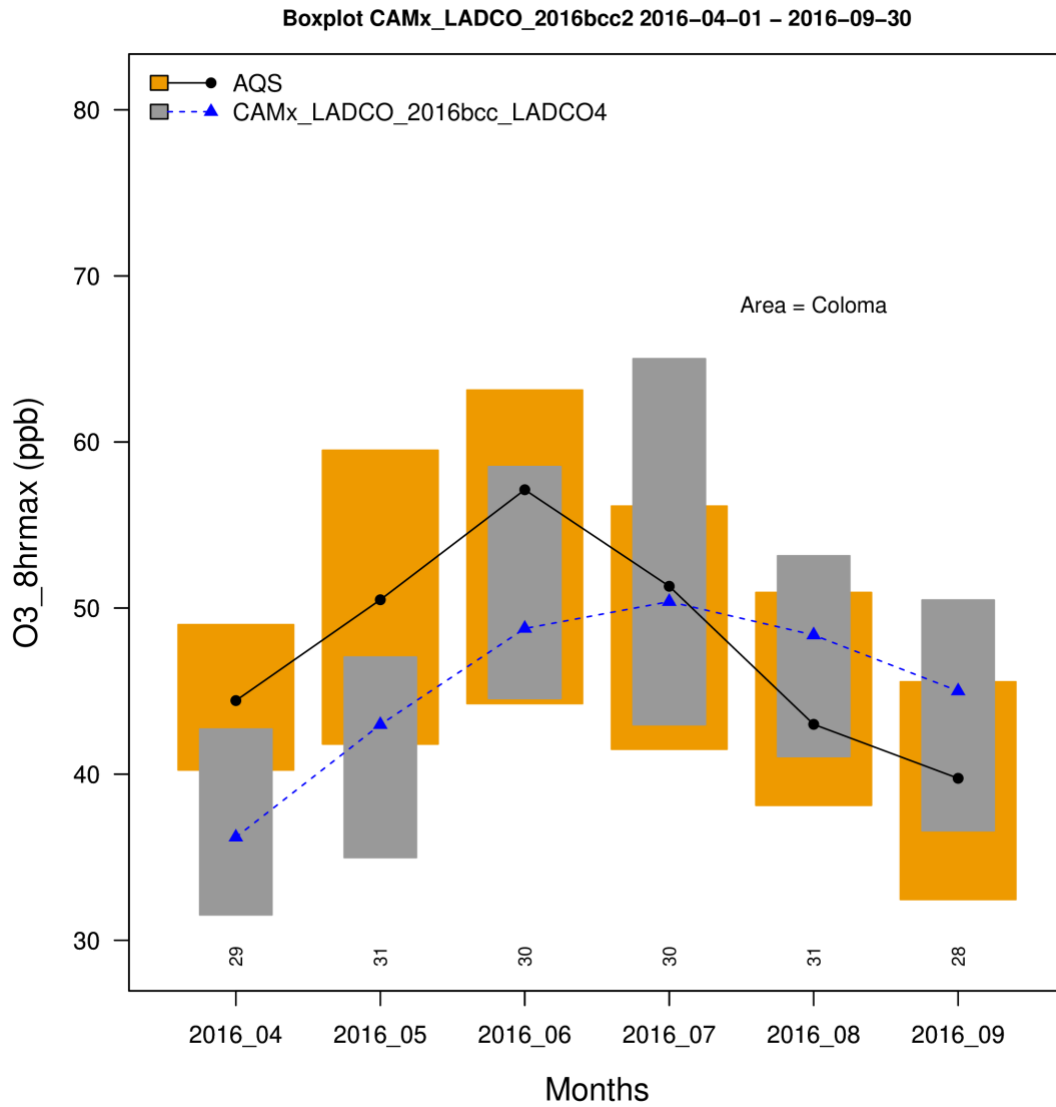
Region	NMB (%)		NME (%)		r	
	All	> 60ppb	All	> 60ppb	All	> 60ppb
April	-18.30	-16.70	19.60	16.70	0.90	0.94
May	-12.50	-16.30	15.70	16.30	0.77	0.99
June	-10.30	-13.60	15.40	15.50	0.84	0.69
July	11.20	9.48	16.50	10.70	0.75	0.86
August	8.35	5.21	12.10	5.21	0.85	0.34
September	11.20	-4.26	14.50	7.21	0.81	-1

**Table S 5. CAMx 4-km monthly MDA8 O<sub>3</sub> performance at AQS sites in the Berrien County, MI NAA**

Region	NMB (%)		NME (%)		r	
	All	> 60ppb	All	> 60ppb	All	> 60ppb
April	-18.20	-19.10	19.60	19.10	0.88	0.85
May	-17.20	-20.00	19.10	20.00	0.87	0.76
June	-10.30	-12.30	14.50	14.80	0.86	0.79
July	5.33	8.40	12.10	9.72	0.77	0.72
August	8.41	2.27	11.10	4.42	0.90	-0.19
September	10.80	-0.98	14.20	3.55	0.83	1

**Table S 6. CAMx 4-km monthly MDA8 O<sub>3</sub> performance at AQS sites in the Muskegon County, MI NAA**

Region	NMB (%)		NME (%)		r	
	All	> 60ppb	All	> 60ppb	All	> 60ppb
April	-17.70	-17.70	19.0	17.70	0.82	1.00
May	-14.20	-15.10	17.40	15.10	0.85	0.88
June	-5.06	-12.30	12.60	12.30	0.89	0.93
July	19.00	13.60	22.50	22.20	0.73	-1.00
August	13.90	6.62	15.90	6.62	0.81	0.42
September	21.70		22.60		0.83	



**Figure S 3. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Coloma, MI**

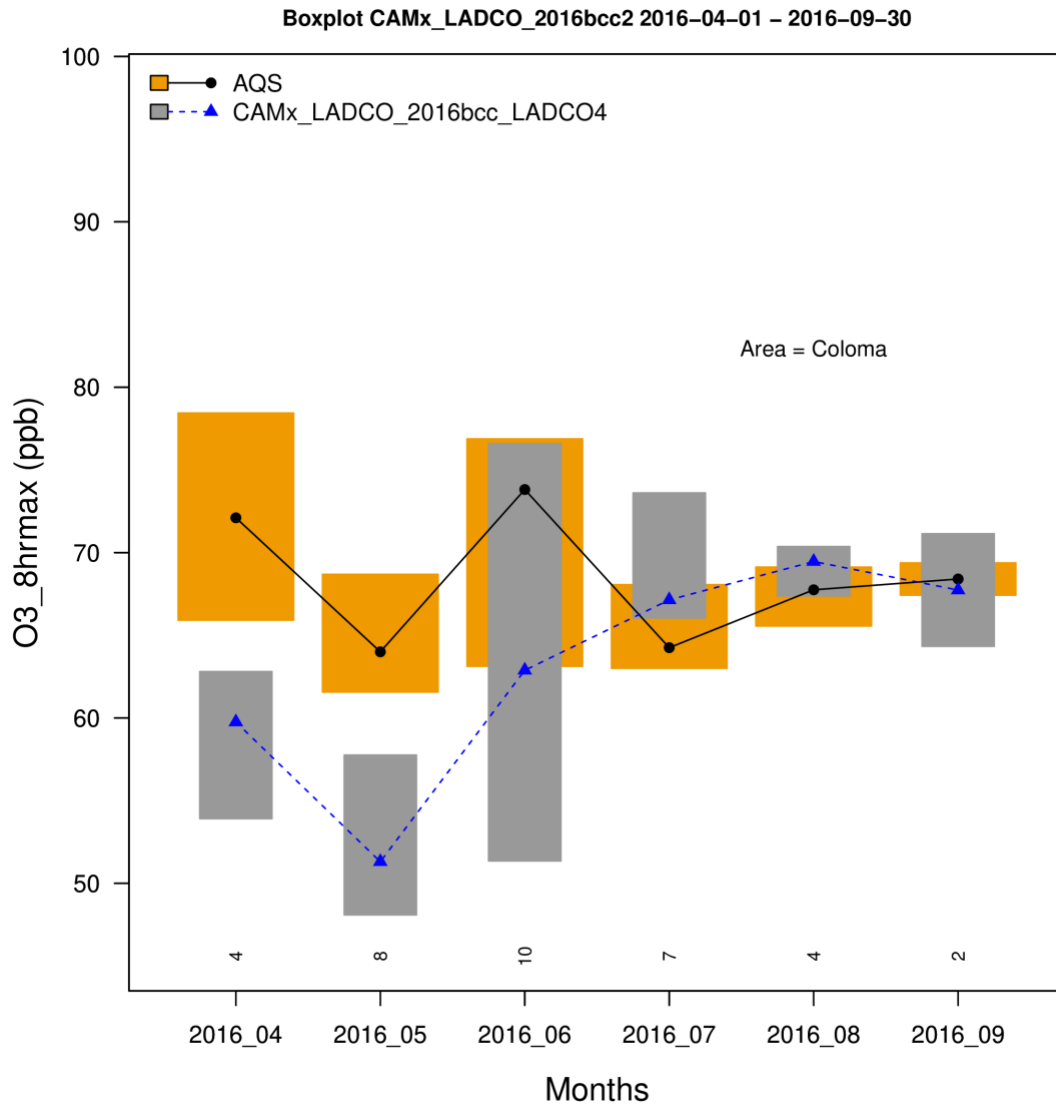
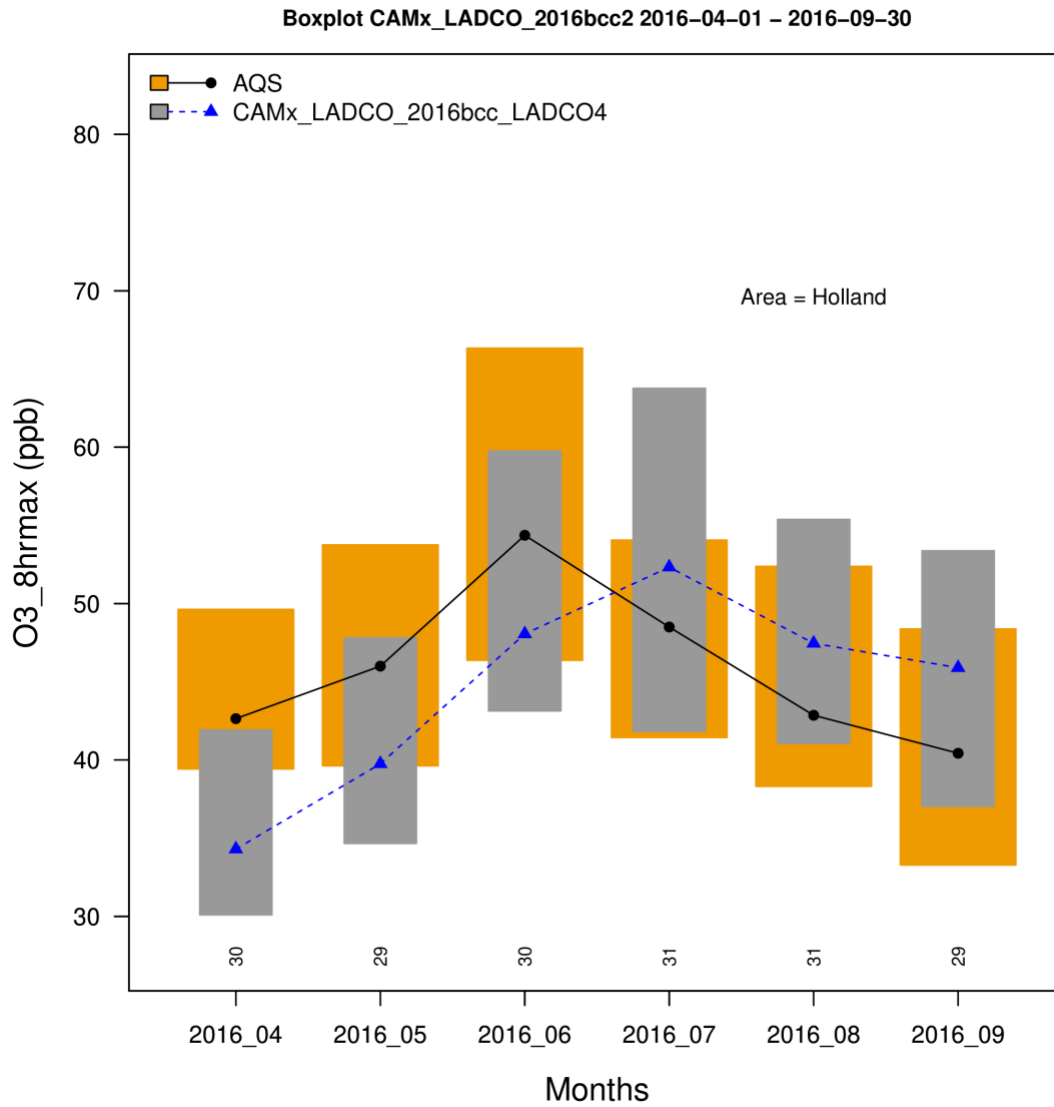
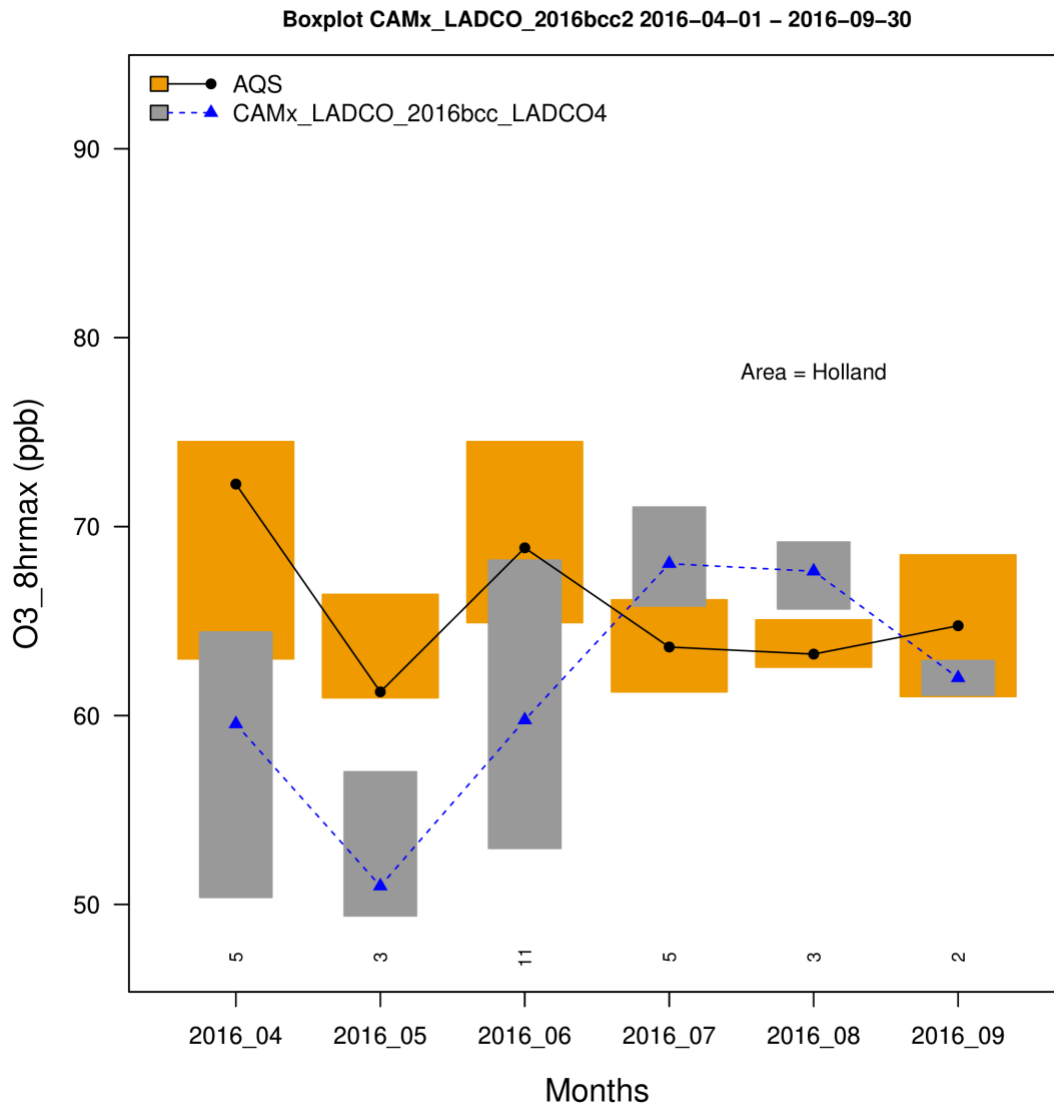


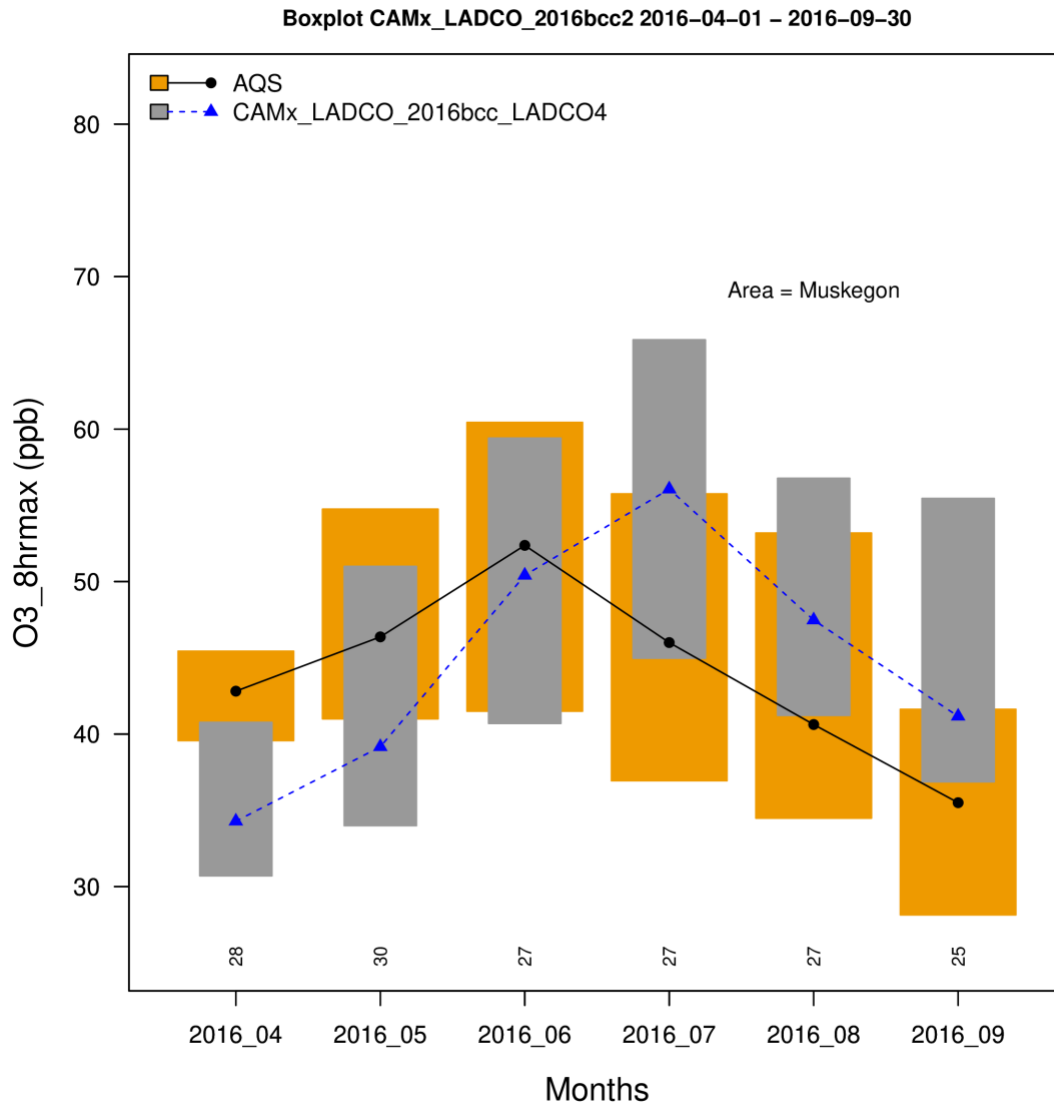
Figure S 4. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Coloma, MI on days > 60 ppb



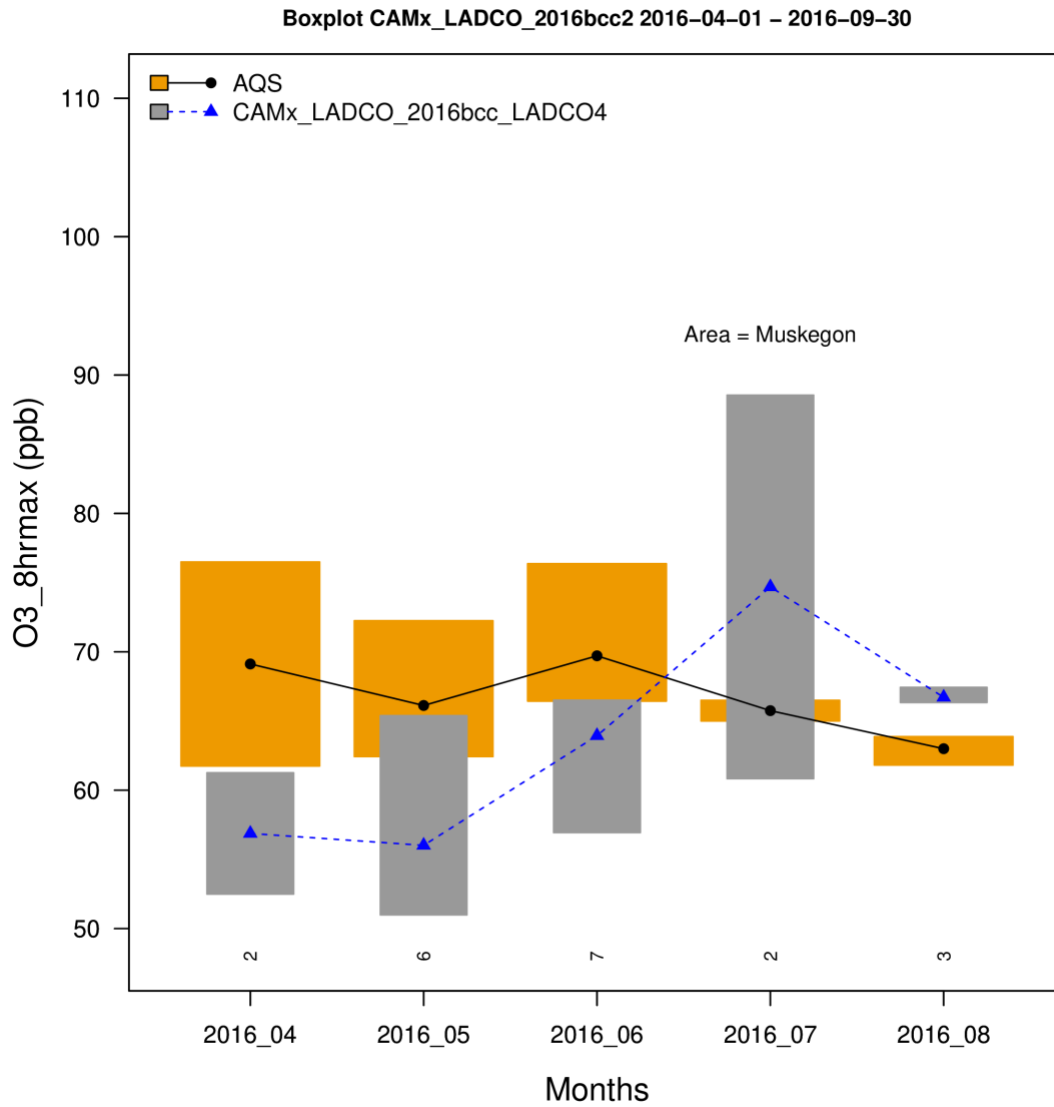
**Figure S 5. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Holland, MI**



**Figure S 6. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Holland, MI on days > 60 ppb**



**Figure S 7. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Muskegon, MI**



**Figure S 8. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Muskegon, MI on days > 60 ppb**

**S1.4. Detroit, MI**

**Table S 7. CAMx 4-km monthly MDA8 O<sub>3</sub> performance at AQS sites in the Detroit, MI NAA**

Region	NMB (%)		NME (%)		r	
	All	> 60ppb	All	> 60ppb	All	> 60ppb
April	-14.20	-13.90	16.50	13.90	0.86	0.64
May	-8.77	-11.20	14.00	13.30	0.80	0.38
June	-6.59	-10.90	13.00	11.90	0.81	0.32
July	12.70	1.04	16.40	9.46	0.67	0.16
August	21.40	6.38	22.30	9.62	0.80	0.69
September	19.70	-0.72	21.30	6.34	0.78	-0.50

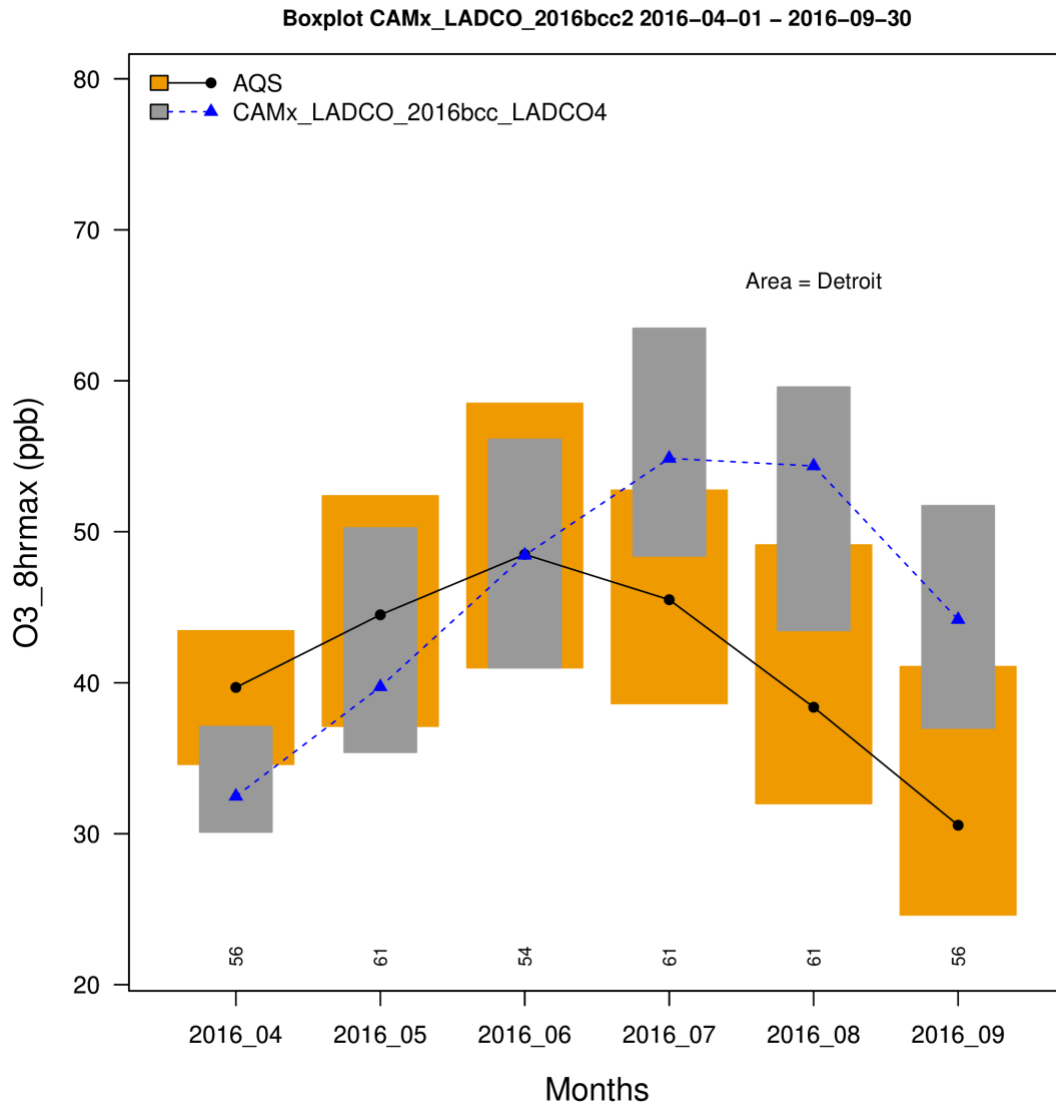
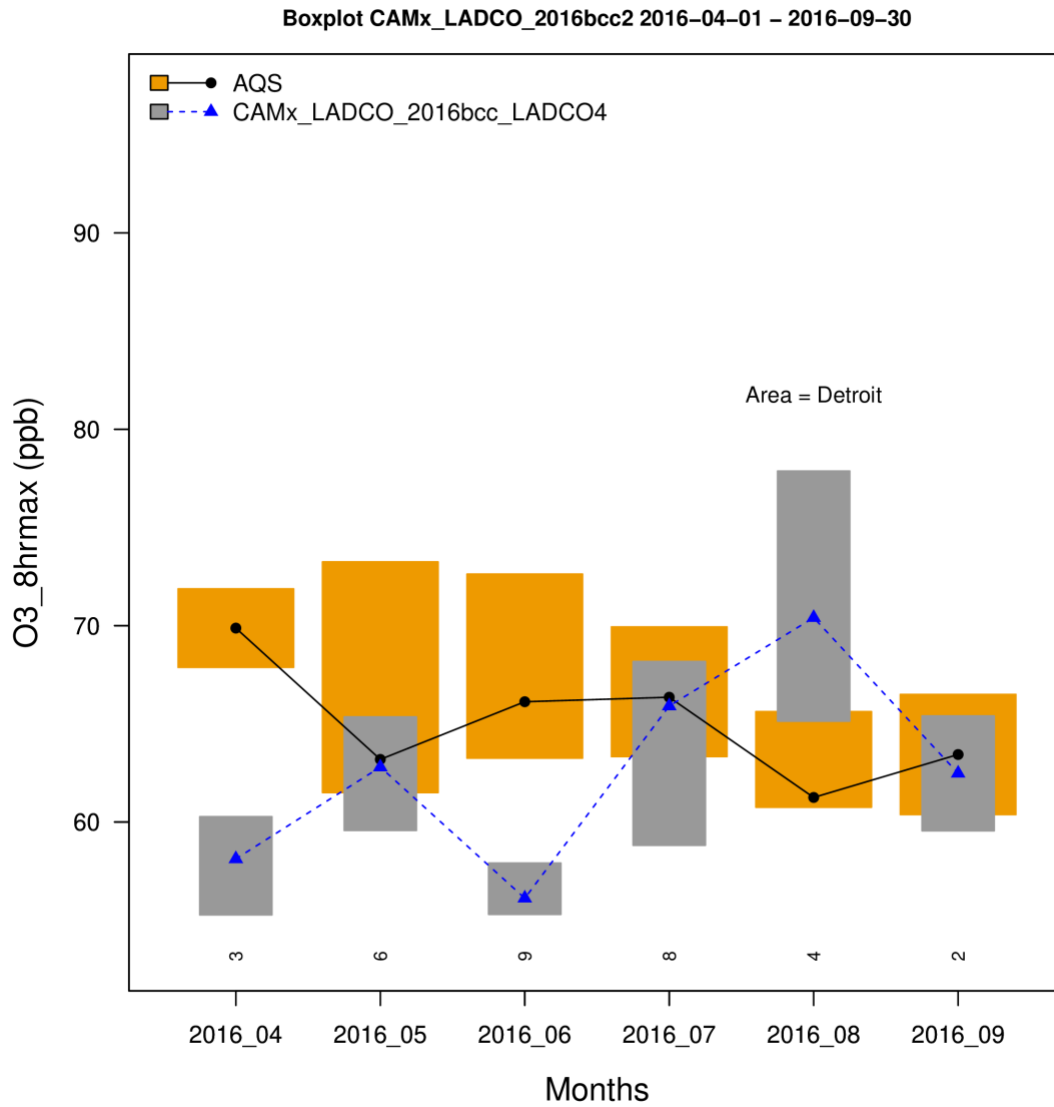


Figure S 9. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Detroit, MI

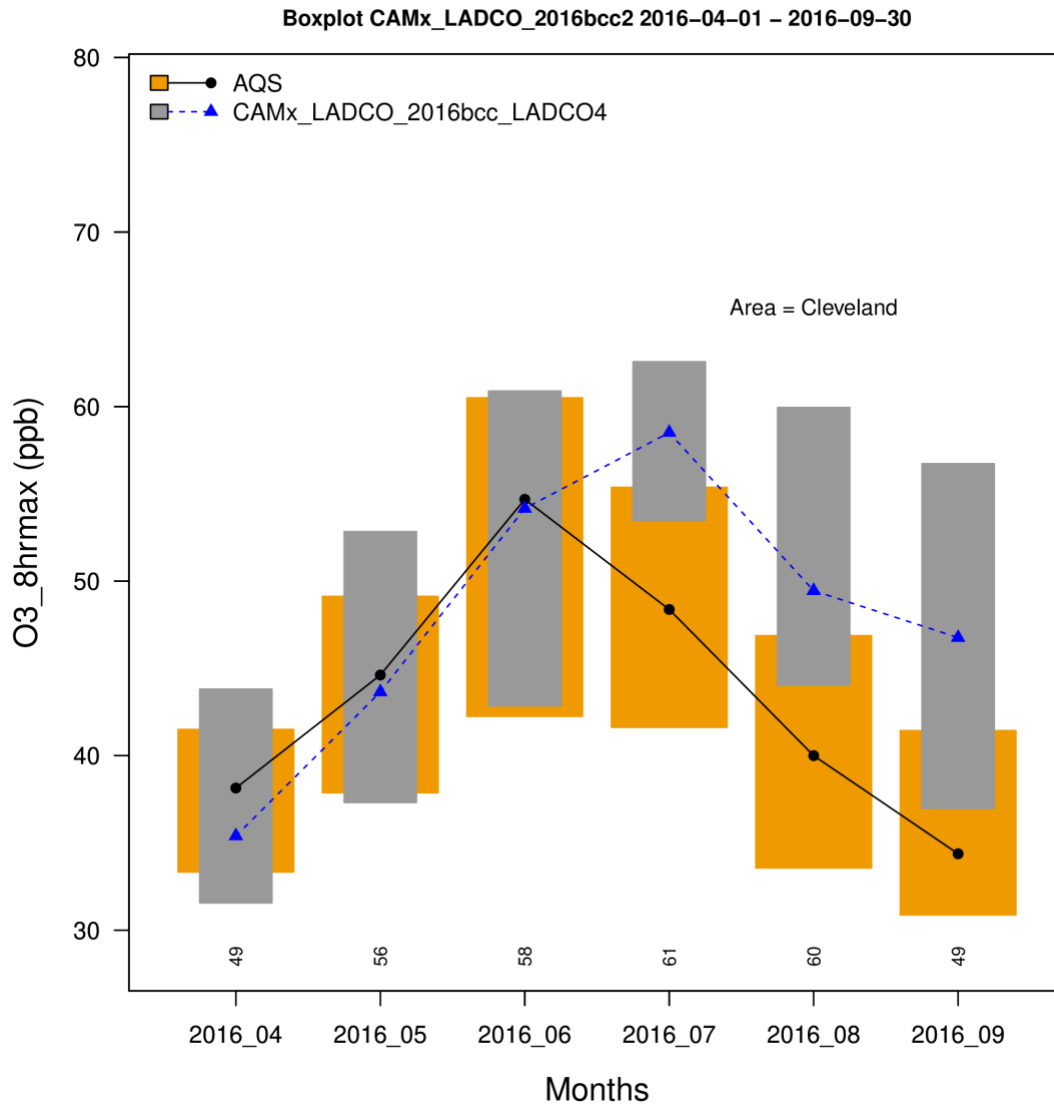


**Figure S 10. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Detroit, MI on days > 60 ppb**

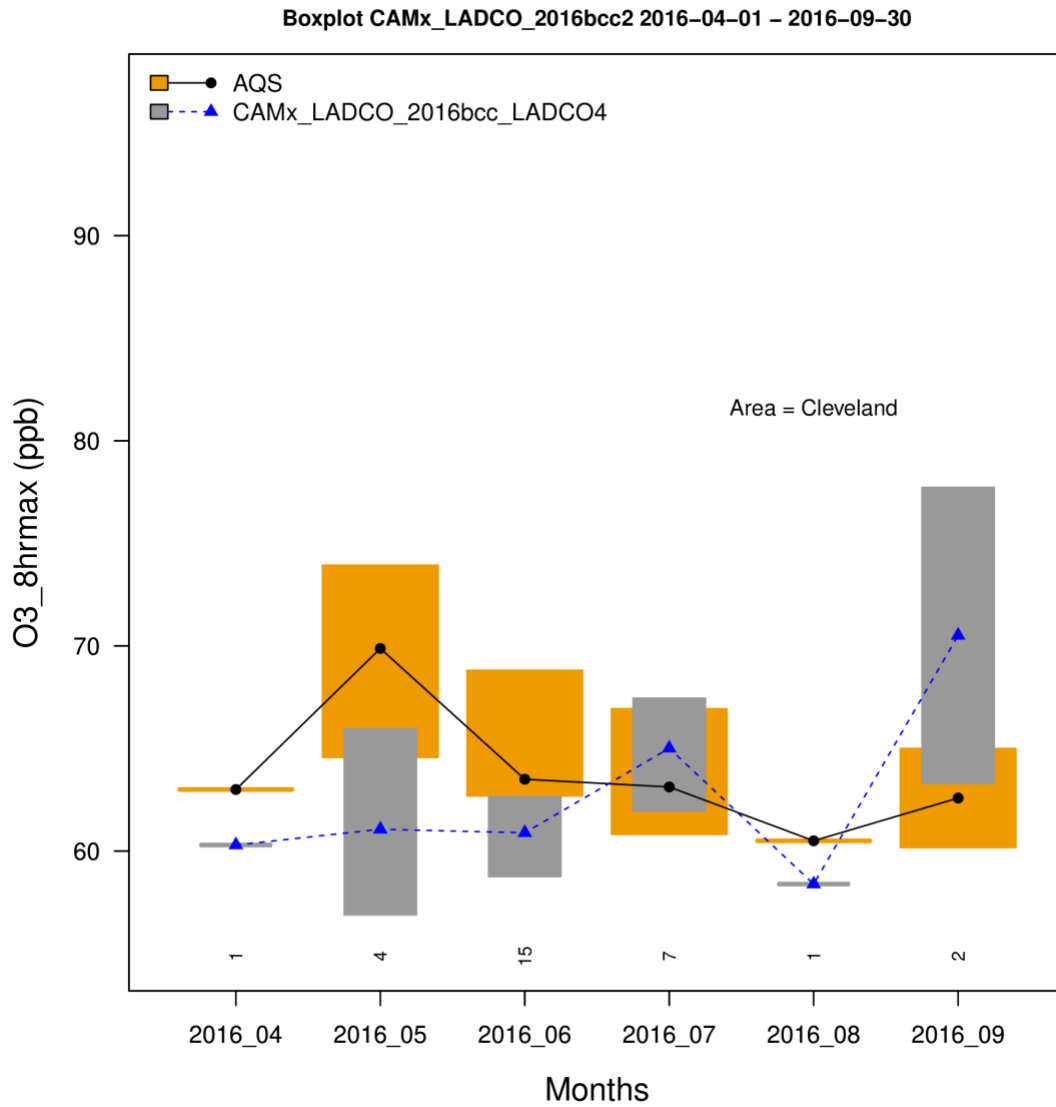
**S1.5. Cleveland, OH**

**Table S 8. CAMx 4-km monthly MDA8 O<sub>3</sub> performance at AQS sites in the Cleveland, OH NAA**

Region	NMB (%)		NME (%)		r	
	All	> 60ppb	All	> 60ppb	All	> 60ppb
April	-5.79	-8.53	13.80	8.93	0.78	0.40
May	-0.89	-12.80	15.40	14.70	0.64	0.35
June	-0.51	-8.51	12.30	10.40	0.73	0.27
July	16.00	0.39	17.60	5.96	0.67	0.43
August	21.90	-4.39	22.90	11.70	0.77	0.06
September	20.60	0.15	21.90	10.70	0.85	-0.08



**Figure S 11. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Cleveland, OH**

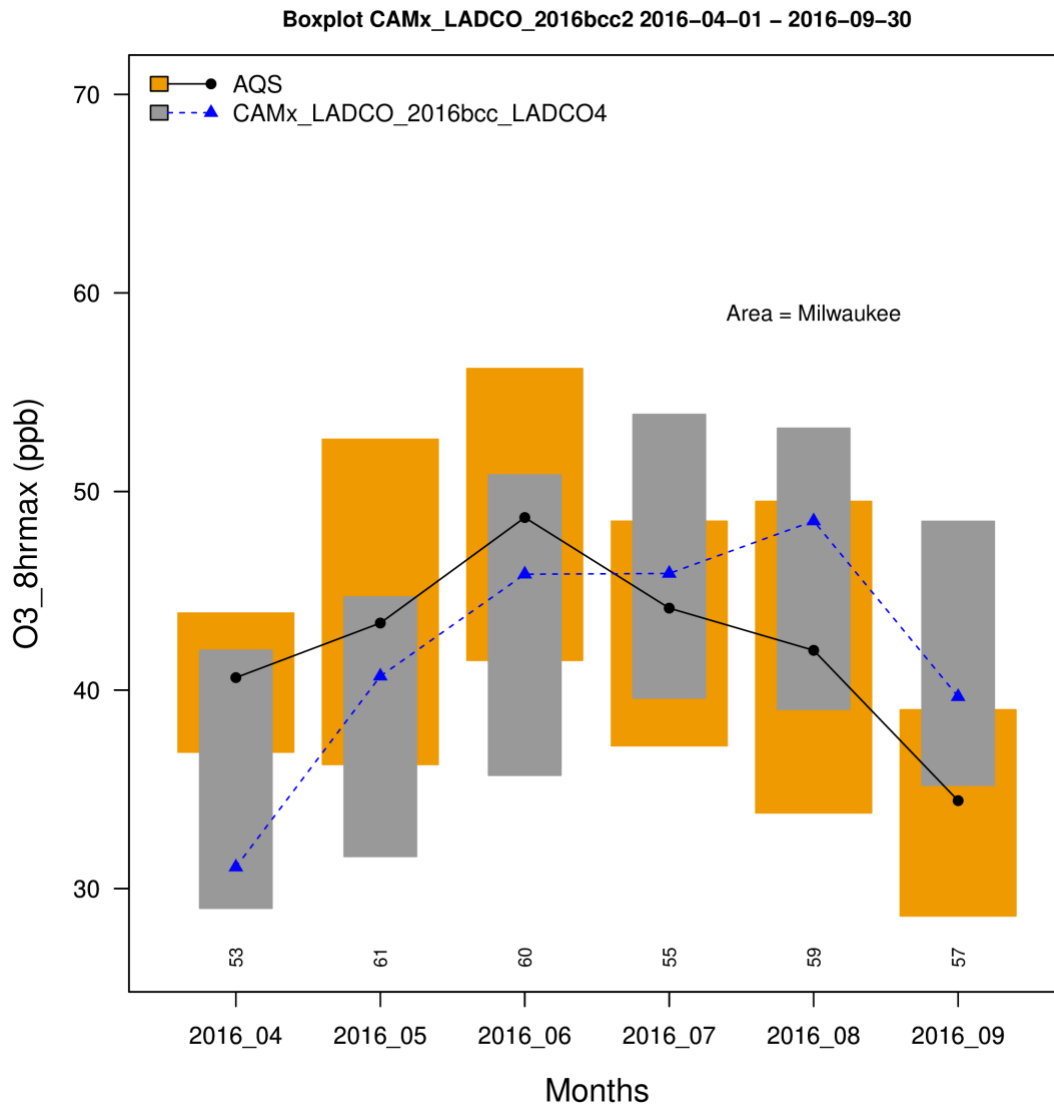


**Figure S 12. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in Cleveland, OH on days > 60 ppb**

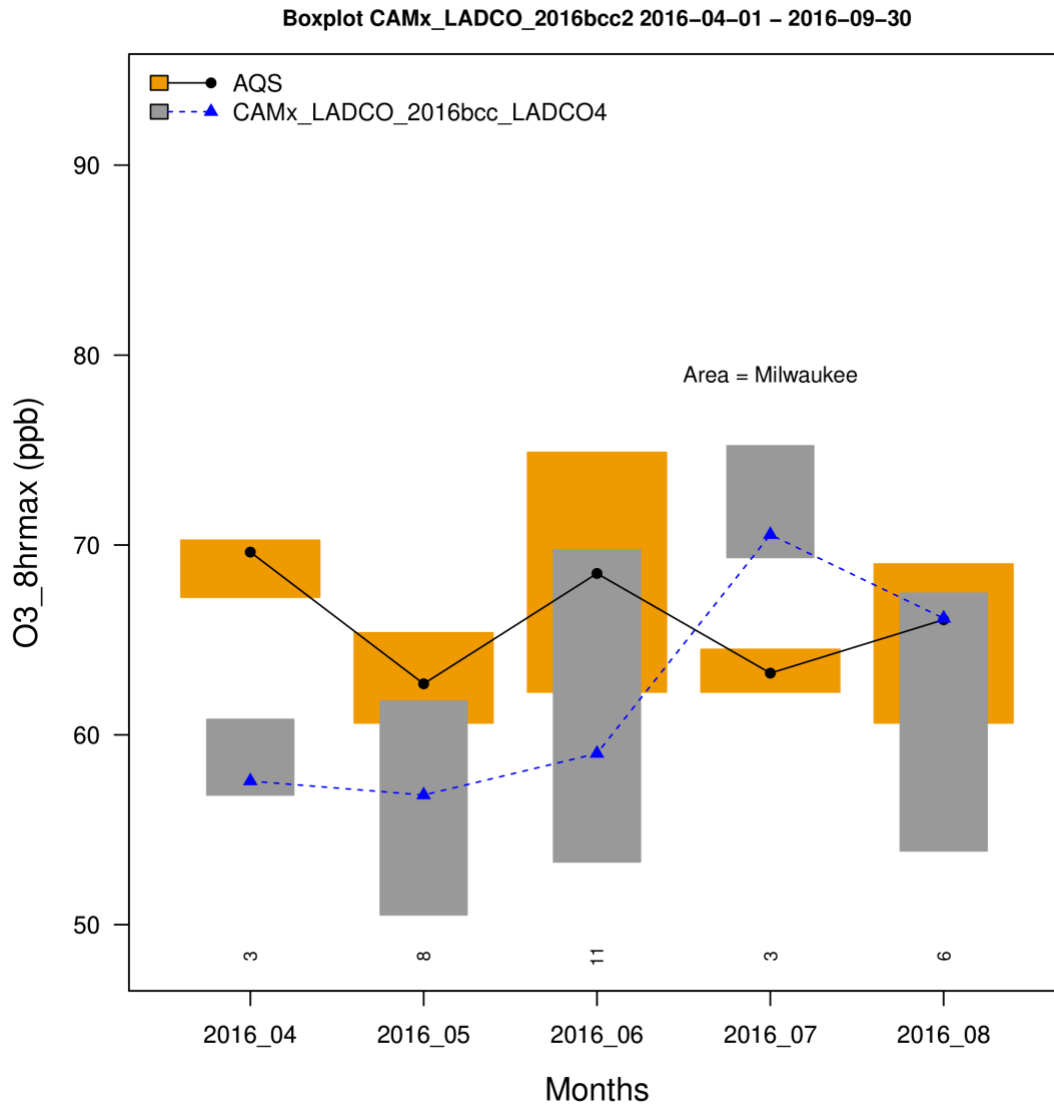
**S1.6. Milwaukee, WI**

**Table S 9. CAMx 4-km monthly MDA8 O<sub>3</sub> performance at AQS sites in the Milwaukee, WI NAA**

Region	NMB (%)		NME (%)		r	
	All	> 60ppb	All	> 60ppb	All	> 60ppb
April	-15.80	-13.00	17.80	13.00	0.87	0.70
May	-11.70	-12.30	15.20	13.70	0.84	0.50
June	-6.91	-9.67	11.80	13.70	0.86	0.66
July	11.20	9.42	15.90	11.80	0.80	0.29
August	7.97	-8.39	14.60	11.00	0.85	0.77
September	15.00		17.40		0.69	



**Figure S 13. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in the Milwaukee NAA**



**Figure S 14. 2016 monthly MDA8 O<sub>3</sub> box and whisker plot comparing CAMx with AQS monitors for sites in the Milwaukee NAA on days > 60 ppb**

**S1.7. Sheboygan County, WI**

**Table S 10. CAMx 4-km monthly MDA8 O<sub>3</sub> performance at AQS sites in the Sheboygan County, WI NAA**

Region	NMB (%)		NME (%)		r	
	All	> 60ppb	All	> 60ppb	All	> 60ppb
April	-18.30	-14.40	19.60	14.40	0.86	0.60
May	-13.00	-16.60	18.60	16.60	0.79	0.81
June	-8.74	-13.30	12.30	13.30	0.89	0.86
July	3.77	2.50	11.60	5.79	0.88	0.83
August	6.13	-8.50	13.50	10.20	0.89	0.77
September	8.40		13.30		0.77	

## S2. Description of CART Nodes

**Table S 11. Description of each high-ozone node for the different CART analyses, including its average ozone concentration and the meteorological characteristics of days within the node. Nodes are arranged from highest (left) to lowest (right) ozone concentrations.**

Chicago: Kenosha and Lake Counties, WI-IL						
Node 25	Node 28	Node 26	Node 19	Node 29	Node 22	Node 13
74 ppb O <sub>3</sub>	65 ppb O <sub>3</sub>	66 ppb O <sub>3</sub>	62 ppb O <sub>3</sub>	55 ppb O <sub>3</sub>	54 ppb O <sub>3</sub>	51 ppb O <sub>3</sub>
PM Temp >86 °F	PM Temp >86 °F	PM Temp >86 °F	PM Temp >82 & <86 °F	PM Temp >86 °F	PM Temp >82 & <86 °F	PM Temp <82 °F
RH <58%	RH >58%	RH <58%	Minimum apparent Temp <65 °F	RH >58%	Minimum apparent Temp >65 °F	Southerly winds
Little westerly transport	2-day winds <3.4 m/s	More westerly transport <sup>1</sup>		2-day winds >3.4 m/s	PM southerly winds	RH <75% PMT >76 °F
Chicago: Cook County, IN						
Node 29	Node 30	Node 22	Node 24	Node 31		
66 ppb O <sub>3</sub>	60 ppb O <sub>3</sub>	55 ppb O <sub>3</sub>	52 ppb O <sub>3</sub>	51 ppb O <sub>3</sub>		
PM Temp >85 °F	PM Temp >85 °F	PM Temp >77 & <85 °F	PM Temp >77 & <85 °F	PM Temp >85 °F		
Midday RH <53%	Midday RH <53%	Average RH <55%	Average RH >59% & <75%	Midday RH >53%		
Average RH <54%	Average RH >54%	AM southerly winds (>-1.8 m/s)	AM southerly winds (>-1.8 m/s)			
			Easterly winds (wind direction <167°)			
Chicago: Lake and Porter Counties, IN						
Node 19	Node 20	Node 17				
63 ppb O <sub>3</sub>	59 ppb O <sub>3</sub>	54 ppb O <sub>3</sub>				
PM Temp >85 °F	PM Temp >85 °F	PM Temp >77 & <85 °F				
Average RH <61%	Average RH <61%	Average RH <61%				
3-day wind speed <3.3 m/s	3-day wind speed >3.3 m/s	24-hour southerly transport (>-200 km)				
Cleveland, OH						
Node 22	Node 23	Node 24	Node 26	Node 19		
67 ppb O <sub>3</sub>	61 ppb O <sub>3</sub>	56 ppb O <sub>3</sub>	51 ppb O <sub>3</sub>	51 ppb O <sub>3</sub>		
PM Temp >77 °F	PM Temp >77 °F	PM Temp >77 °F	PM Temp >77 °F	PM Temp >77 °F		
Midday RH <53%	Midday RH <53%	Midday RH <53%	Midday RH >53% & <62%	Midday RH <53%		
Max. Temp >82 °F	Max. Temp >82 °F	Max. Temp >82 °F		Max. Temp <82 °F		
Previous day winds <3.9 m/s	Previous day winds <3.9 m/s	Previous day winds >3.9 m/s				
Average RH <57%	Average RH >57%					

<sup>1</sup>“Little westerly transport” = less than 146 km in 24 hours. “More westerly transport” = more than 146 km in 24 hours.

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Allegan County, MI					
<b>Node 21</b>	<b>Node 20</b>	<b>Node 17</b>	<b>Node 10</b>		
69 ppb O <sub>3</sub>	61 ppb O <sub>3</sub>	56 ppb O <sub>3</sub>	53 ppb O <sub>3</sub>		
Southerly winds (>0.5 m/s)	Southerly winds (>0.5 m/s)	Southerly winds (>0.5 m/s)	Northerly winds or very weak southerly winds		
PM Temp >79 °F	PM Temp >79 °F	PM Temp >72 & <79 °F	Maximum Temp >76 °F		
Westerly winds >1.0 m/s	Westerly winds <1.0 m/s	RH >74%	24-hr southerly transport >-142 km		
Berrien County, MI					
<b>Node 22</b>	<b>Node 17</b>	<b>Node 23</b>	<b>Node 20</b>	<b>Node 16</b>	<b>Node 5</b>
72 ppb O <sub>3</sub>	61 ppb O <sub>3</sub>	60 ppb O <sub>3</sub>	55 ppb O <sub>3</sub>	54 ppb O <sub>3</sub>	53 ppb O <sub>3</sub>
PM Temp >86 °F	PM Temp >79 & <86 °F	PM Temp >86 °F	PM Temp >79 & <86 °F	PM Temp >79 & <86 °F	PM Temp <79 °F
Average RH <65%	Average RH <68%	Average RH >65%	Average RH >65%	Average RH <68%	Average RH <63%
	AM southerly winds (>0.9 m/s)		Maximum Temp >84 °F	AM northerly or very weak southerly winds	24-hr southerly transport (>-241 km)
Muskegon County, MI					
<b>Node 24</b>	<b>Node 23</b>	<b>Node 25</b>	<b>Node 17</b>	<b>Node 13</b>	
74 ppb O <sub>3</sub>	65 ppb O <sub>3</sub>	58 ppb O <sub>3</sub>	54 ppb O <sub>3</sub>	52 ppb O <sub>3</sub>	
Southerly winds (>0.5 m/s)	Southerly winds (>0.5 m/s)	Southerly winds (>0.5 m/s)	Southerly winds (>0.5 m/s)	Northerly winds or very weak southerly winds	
PM Temp >79 °F	PM Temp >79 °F	PM Temp >79 °F	PM Temp <79 °F	24-hr Southerly transport (>14 km)	
RH <69%	RH <69%	RH >69%	Average RH <68%	Midday RH <64%	
PM southerly winds >4 m/s	PM southerly winds <4 m/s				
Sheboygan County, WI					
<b>Node 25</b>	<b>Node 24</b>	<b>Node 20</b>	<b>Node 22</b>	<b>Node 18</b>	
72 ppb O <sub>3</sub>	64 ppb O <sub>3</sub>	58 ppb O <sub>3</sub>	55 ppb O <sub>3</sub>	51 ppb O <sub>3</sub>	
24-hr southerly transport (>37 km)	24-hr southerly transport (>37 km)	24-hr southerly transport (>37 km)	24-hr southerly transport (>37 km)	24-hr southerly transport (>37 km)	
Southerly winds >3.2 m/s	Southerly winds >3.2 m/s	Southerly winds <3.2 m/s	Southerly winds >3.2 m/s	Southerly winds <3.2 m/s	
Maximum Temp >75 °F	Maximum Temp >75 °F	Maximum Temp >80 °F	Maximum Temp <75 °F	Maximum Temp <80 °F	
AM Temp >75 °F	AM Temp <75 °F			Wind direction from <123° (easterly)	
Milwaukee, WI					
<b>Node 28</b>	<b>Node 27</b>	<b>Node 30</b>	<b>Node 31</b>	<b>Node 23</b>	
72 ppb O <sub>3</sub>	60 ppb O <sub>3</sub>	59 ppb O <sub>3</sub>	51 ppb O <sub>3</sub>	51 ppb O <sub>3</sub>	
Maximum Temp >83 °F	Maximum Temp >78 & <83 °F	Maximum Temp >78 °F	Maximum Temp >78 °F	Maximum Temp >82 °F	
PM southerly winds >3.1 m/s	PM southerly winds >3.1 m/s	PM southerly winds >3.1 m/s	PM southerly winds >3.1 m/s	PM southerly winds <3.1 m/s	
PM westerly winds <2.0 m/s	PM westerly winds <2.0 m/s	PM westerly winds >2.0 m/s	PM westerly winds >2.0 m/s	Average wind direction <234° (southwesterly to easterly)	
		Midday RH <48%	Midday RH >48%		

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<b>Detroit, MI</b>				
<b>Node 27</b>	<b>Node 28</b>	<b>Node 21</b>	<b>Node 29</b>	<b>Node 9</b>
69 ppb O <sub>3</sub>	62 ppb O <sub>3</sub>	60 ppb O <sub>3</sub>	57 ppb O <sub>3</sub>	52 ppb O <sub>3</sub>
PM Temp >86 °F	PM Temp >86 °F	PM Temp >80 & <86 °F	PM Temp >86 °F	PM Temp >75 & <80 °F
Average wind direction <200°	Average wind direction <200°	2-day winds <2.8 m/s	Average wind direction >200°	Midday RH <48%
Midday RH <46%	Midday RH >46%	Previous day winds from the south		24-hour southerly transport (>-189 km)
<b>St. Louis, MO-IL</b>				
<b>Node 14</b>	<b>Node 13</b>	<b>Node 16</b>	<b>Node 20</b>	<b>Node 17</b>
69 ppb O <sub>3</sub>	62 ppb O <sub>3</sub>	61 ppb O <sub>3</sub>	56 ppb O <sub>3</sub>	53 ppb O <sub>3</sub>
Midday RH <59%	Midday RH <59%	Midday RH <59%	Midday RH <59%	Midday RH <59%
PM Temp >89 °F	PM Temp >79 & <89 °F	PM Temp >79 °F	PM Temp >79 °F	PM Temp >79 °F
Average RH <58%	Average RH <58%	Average RH <52%	Average RH >58%	Average RH >52% & <58%
3-day winds <2.7 m/s	3-day winds <2.7 m/s	3-day winds >2.7 m/s	24-hour transport <447 km	3-day winds >2.7 m/s
			Average wind direction from east (<174 °)	

### **S3. Description of CART Analysis**

#### **What is CART Analysis?**

- Classification and Regression Tree, aka binary recursive partitioning, decision tree
- Classifies data by yes/no questions -- is temp. < 75, is RH < 80; easy to interpret
- Nonparametric, so insensitive to distributions of variables
- Insensitive to transformations of variables
- Insensitive to outliers and missing data
- Frequently more accurate than parametric models

The beauty of CART is the ease of interpreting the results--you get back a natural-language sequence of questions that anyone can use to classify a new data set. You can also adjust the sensitivity of the model to various parameters or outcomes, if it's more important to accurately classify group 1 rather than group 2, for example.

#### **How do you use CART for ozone analysis?**

- CART is used to categorize each day by ozone concentration and associated met conditions
- Incorporates 30+ meteorological variables
- Results in a decision tree with 10-15 branches, each describing the meteorological conditions associated with a particular ozone concentration
- Trends are then developed for meteorologically similar days to minimize the effects of meteorological variability on ozone trends

#### **Which meteorology variables were used in the LADCO CART analysis?**

These variables were selected from previous model runs that had many more variables included; these are just those that had any influence in previous models:

- Daily precipitation
- Cloud cover
- 850 and 700 mb temperatures at 6 am
- Maximum daily temperature, dew point, relative humidity, pressure
- Average daily wind speed

- Average daily, morning, and afternoon wind direction as N/S and E/W vectors
- Morning, afternoon and evening dewpoint and pressure
- Day of week
- Previous day's average temperature, pressure, wind speed, wind direction
- Change in temperature and pressure from previous day
- 2- and 3-day average wind speed and temperature
- 24-hour transport direction and distance (from Hysplit trajectories)
- Deviation from 10-year averages of 850 and 700 mb temperature and height

**Where did the meteorology data come from that were used in the LADCO CART analysis?**

- Hourly surface observations from 2379 sites around the US collected from National Climatic Data Center's (NCDC) Integrated Surface Database (mostly airports)
- Upper air observations from 85 sites collected from NCDC's Integrated Global Radiosonde Archive
- Each surface site is paired with closest upper air site (upper air data can be less spatially representative than surface obs)
- Hysplit back trajectories calculated for each site at noon every day to provide transport distance and u,v,w vectors
- Data for each year/site is acquired from NCDC, processed to calculated derived values (daily max/min, mixing heights, e.g.)
- QA flags assigned based on completeness, upper air site proximity
- Lags and deviation from long term means are calculated
- Data are combined and formatted into ASCII and SAS datasets
- Years 2005 to 2018

#### S4. ERTAC 16.2 Electricity Generating Unit Shutdowns

The table below shows the electricity generating units (EGU) that operated in 2016 but were excluded from the LADCO 2023 CAMx modeling because they are scheduled to shut down before the end of 2023. The ERTAC EGU model considers shut downs that are scheduled in 2023, only discontinuing the emissions after the scheduled retirement date.

ORIS	Unit ID	Facility	State	Fuel/Unit Type Bin	BY OS NOx (tons)	Retirement Date
6085	17	R M Schahfer Generating Station	IN	coal	900	6/1/23
6085	18	R M Schahfer Generating Station	IN	coal	527	6/1/23
994	2	IPL - Petersburg Generating Station	IN	coal	935	1/1/23
6090	2	Sherburne County	MN	coal	803	1/1/23
4050	5	Edgewater (4050)	WI	coal	212	1/1/23
963	33	Dallman	IL	coal	127	1/1/23
8027	2	Blue Lake Generating Plant	MN	oil	9	1/1/23
8027	3	Blue Lake Generating Plant	MN	oil	6	1/1/23
8027	4	Blue Lake Generating Plant	MN	oil	6	1/1/23
8027	1	Blue Lake Generating Plant	MN	oil	5	1/1/23
884	4	Will County	IL	coal	550	6/30/22
883	8	Waukegan	IL	coal	368	6/30/22
883	7	Waukegan	IL	coal	300	6/30/22
6019	1	W H Zimmer Generating Station	OH	coal	3,240	5/31/22
2836	12	Avon Lake Power Plant	OH	coal	870	4/1/22
2836	CT10	Avon Lake Power Plant	OH	oil	1	4/1/22
1745	9A	Trenton Channel	MI	coal	594	1/1/22
1743	7	St. Clair	MI	coal	518	1/1/22
856	2	E D Edwards	IL	coal	508	1/1/22
1743	1	St. Clair	MI	coal	451	1/1/22
1743	3	St. Clair	MI	coal	436	1/1/22
1743	2	St. Clair	MI	coal	343	1/1/22
1743	6	St. Clair	MI	coal	275	1/1/22
856	3	E D Edwards	IL	coal	273	1/1/22
6085	15	R M Schahfer Generating Station	IN	coal	531	12/30/21
6085	14	R M Schahfer Generating Station	IN	coal	149	12/30/21
1008	4	R Gallagher	IN	coal	220	6/1/21

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1008	2	R Gallagher	IN	coal	210	6/1/21
1740	3	River Rouge	MI	coal	1,054	5/31/21
994	1	IPL - Petersburg Generating Station	IN	coal	760	1/1/21
4143	1	Genoa	WI	coal	337	1/1/21
10075	1	Taconite Harbor Energy Center	MN	coal	119	1/1/21
10075	2	Taconite Harbor Energy Center	MN	coal	99	1/1/21
1943	2	Hoot Lake	MN	coal	21	1/1/21
1943	3	Hoot Lake	MN	coal	17	1/1/21
995	10	Bailly Generating Station	IN	simple cycle gas	1	12/31/20
4057	CT6B	Rock River	WI	simple cycle gas	16	9/30/20
4057	CT6A	Rock River	WI	simple cycle gas	16	9/30/20
4057	CT3	Rock River	WI	simple cycle gas	15	9/30/20
4057	CT5A	Rock River	WI	simple cycle gas	11	9/30/20
4057	CT5B	Rock River	WI	simple cycle gas	11	9/30/20
2866	4	W H Sammis	OH	coal	233	5/31/20
2866	1	W H Sammis	OH	coal	184	5/31/20
2866	3	W H Sammis	OH	coal	159	5/31/20
2866	2	W H Sammis	OH	coal	111	5/31/20
2840	4	Conesville	OH	coal	699	5/1/20
2837	6	Eastlake	OH	oil	2	2/18/20
10849	PB2	NorthShore Mining Silver Bay Power	MN	industrial	400	1/1/20
1825	3	J B Sims	MI	coal	265	1/1/20
976	4	Marion	IL	coal	236	1/1/20
1831	4	Eckert Station	MI	coal	185	1/1/20
10849	PB1	NorthShore Mining Silver Bay Power	MN	industrial	146	1/1/20
1831	5	Eckert Station	MI	coal	133	1/1/20
963	31	Dallman	IL	coal	105	1/1/20
1831	6	Eckert Station	MI	coal	79	1/1/20
963	32	Dallman	IL	coal	72	1/1/20
1011	2	Broadway Avenue Generating Station	IN	simple cycle gas	9	12/22/19
2836	10	Avon Lake Power Plant	OH	coal	4	9/30/19
2840	6	Conesville	OH	coal	1,332	5/1/19
2840	5	Conesville	OH	coal	1,094	5/1/19
1769	9	Presque Isle	MI	coal	480	4/1/19
1769	7	Presque Isle	MI	coal	463	4/1/19
1769	8	Presque Isle	MI	coal	364	4/1/19
1769	6	Presque Isle	MI	coal	225	4/1/19
1769	5	Presque Isle	MI	coal	174	4/1/19
861	02	Coffeen	IL	coal	550	1/1/19
6016	1	Duck Creek	IL	coal	535	1/1/19
891	9	Havana	IL	coal	514	1/1/19
892	2	Hennepin Power Station	IL	coal	334	1/1/19
861	01	Coffeen	IL	coal	259	1/1/19
1893	1	Boswell Energy Center	MN	coal	229	1/1/19

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1893	2	Boswell Energy Center	MN	coal	173	1/1/19
892	1	Hennepin Power Station	IL	coal	157	1/1/19
1002	2A	Connersville Peaking Station	IN	oil	1	12/31/18
1002	2B	Connersville Peaking Station	IN	oil	1	12/31/18
1002	1A	Connersville Peaking Station	IN	oil	1	12/31/18
1002	1B	Connersville Peaking Station	IN	oil	1	12/31/18
4072	8	Pulliam	WI	coal	224	10/31/18
4072	7	Pulliam	WI	coal	74	10/31/18
4050	4	Edgewater (4050)	WI	coal	402	9/30/18
995	8	Bailly Generating Station	IN	coal	359	5/31/18
995	7	Bailly Generating Station	IN	coal	277	5/31/18
6170	1	Pleasant Prairie	WI	coal	552	4/10/18
6170	2	Pleasant Prairie	WI	coal	403	4/10/18
6031	2	Killen Station	OH	coal	1,904	1/1/18
2850	4	J M Stuart	OH	coal	625	1/1/18
2850	2	J M Stuart	OH	coal	591	1/1/18
2850	1	J M Stuart	OH	coal	522	1/1/18
2850	3	J M Stuart	OH	coal	507	1/1/18
1843	3	Shiras	MI	coal	167	1/1/18
55867	BLR-1	Benson Power Biomass Plant	MN	egu-other	120	1/1/18
1719	4	Thetford	MI	simple cycle gas	2	1/1/18
1719	3	Thetford	MI	simple cycle gas	1	1/1/18
1719	2	Thetford	MI	simple cycle gas	1	1/1/18
1891	1	Laskin Energy Center	MN	coal	5	12/31/17
1891	2	Laskin Energy Center	MN	coal	4	12/31/17
889	3	Baldwin Energy Complex	IL	coal	801	1/1/17
6017	2	Newton	IL	coal	377	1/1/17
1743	4	St. Clair	MI	coal	330	1/1/17
880086	UNITC	Pacific Ethanol Pekin Inc.	IL	industrial	285	1/1/17
898	5	Wood River Power Station	IL	coal	118	1/1/17
898	4	Wood River Power Station	IL	coal	36	1/1/17
4259	1	Endicott Generating	MI	coal	36	1/1/17
1010	1	Wabash River Gen Station	IN	combined cycle gas	12	1/1/17
1830	5	James De Young	MI	coal	0	1/1/17