GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Assessment of Intrastate Contributions to Ozone Nonattainment Monitors in Atlanta, GA

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BACKGROUND

On October 1, 2015, EPA promulgated the 2015 8-hour ozone NAAQS (70 ppb).

On February 25, 2016, EPA published a guidance memorandum "Area Designations for the 2015 Ozone National Ambient Air Quality Standards" which recommends evaluating five factors:

- **Factor 1**: Air quality data
- **Factor 2**: Emissions and emissions-related data
- **Factor 3**: Meteorological data
- **Factor 4**: Geography/topography
- **Factor 5**: Jurisdictional boundaries

According to the EPA guidance memo, photochemical grid modeling can be used to quantify nonattainment contributions as weight-of-evidence to support the conclusions from the qualitative 5-factor analysis.

5-FACTOR ANALYSIS (FACTOR 1)

Air Quality Data

- Georgia has five violating ozone monitors based on preliminary 2016 data.

County	AQS Site ID	Local Site Name	DV 2013-2015	DV 2014-2016*
Fulton	13-121-0055	Confederate Avenue	**0.073**	**0.075**
Rockdale	13-247-0001	Monastery	**0.072**	**0.074**
Henry	13-151-0002	McDonough-County Extension Office	**0.071**	**0.074**
Gwinnett	13-135-0002	Gwinnett Tech	0.069	**0.072**
DeKalb	13-089-0002	South DeKalb	0.067	**0.071**
Douglas	13-097-0004	W. Strickland Street	0.066	0.068
Pike	13-231-9991	Georgia Station	0.066	0.068
Cobb	13-067-0003	Kennesaw-National Guard	0.065	0.066
Dawson	13-085-0001	Dawsonville, Georgia Forestry Commission	0.064	0.065
Coweta	13-077-0002	Newnan	0.062	0.066
Paulding	13-223-0003	Yorkville, King Farm	0.062	0.062
Clarke	13-059-0002	Fire Station # 7	0.061	0.064

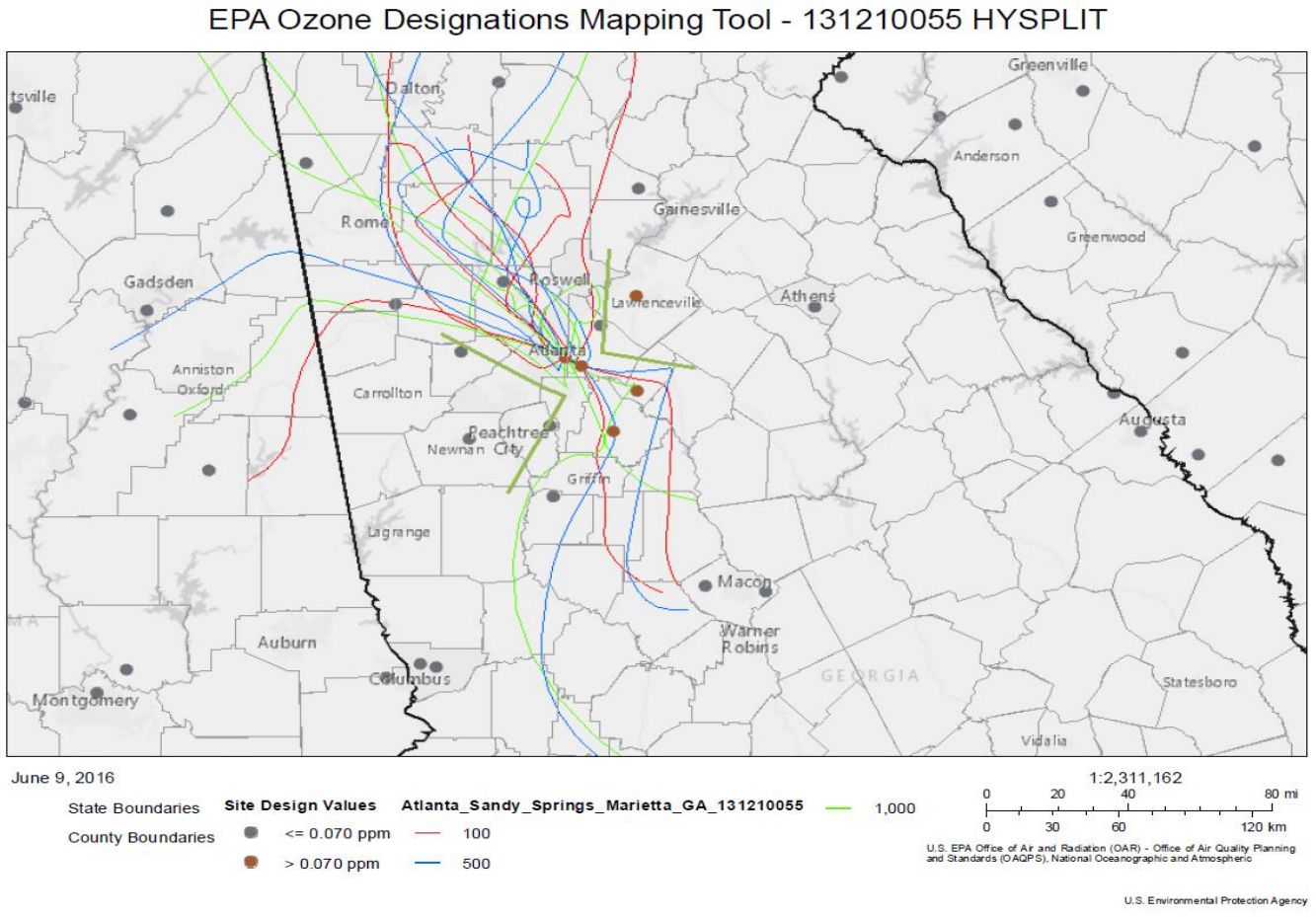
5-FACTOR ANALYSIS (FACTOR 2)

- **Emissions and Emissions-Related Data**
  - NOx emissions
  - VOC emissions
  - Population data
  - Vehicle use data
- **<u>EXAMPLE: NOx emissions</u>**
  - NOx emissions > 10,000 TPY
    - More than double the CSA average NOx emissions
  - NOx emission density > 26 tpy/mile^2
    - More than 75% higher than the Atlanta CSA average NOx emission density
  - Fulton, Gwinnett, DeKalb, Cobb, Bartow, and Clayton account for 51.5% of all NOx emissions in the Atlanta CSA

County	NOx (tpy)	NOx % CSA Total	NOx % CSA Average	NOx Density (tpy/sq mi)	NOx Density % of CSA Average
Fulton	23,218	13.0%	408.1%	43.48	194.9%
Gwinnett	16,576	9.3%	262.8%	37.93	157.2%
DeKalb	14,617	8.2%	219.9%	53.94	265.8%
Cobb	13,716	7.7%	200.2%	39.76	169.6%
Bartow	13,059	7.3%	185.8%	27.79	88.4%
Clayton	10,675	6.0%	133.6%	74.13	402.7%
Henry	6,786	3.8%	48.5%	20.75	40.7%
Hall	5,347	3.0%	17.0%	12.46	-15.5%
Coweta	4,998	2.8%	9.4%	11.21	-24.0%
Carroll	4,464	2.5%	-2.3%	8.86	-39.9%
Cherokee	4,375	2.5%	-4.3%	10.08	-31.6%
Jackson	4,012	2.3%	-12.2%	11.70	-20.7%
Troup	3,884	2.2%	-15.0%	8.71	-40.9%
Forsyth	3,690	2.1%	-19.3%	14.94	1.3%
Gordon	3,469	1.9%	-24.1%	9.69	-34.3%
Douglas	3,046	1.7%	-33.3%	15.15	2.8%
Heard	3,031	1.7%	-33.7%	10.07	-31.7%
Clarke	3,027	1.7%	-33.8%	25.02	69.7%
Newton	3,017	1.7%	-34.0%	10.81	-26.7%
Paulding	2,688	1.5%	-41.2%	8.56	-42.0%
Madison	2,540	1.4%	-44.4%	8.88	-39.8%
Walton	2,424	1.4%	-47.0%	7.35	-50.2%
Morgan	2,364	1.3%	-48.3%	6.66	-54.8%
Fayette	2,240	1.3%	-51.0%	11.26	-23.7%
Barrow	2,229	1.3%	-51.2%	13.68	-7.2%
Rockdale	2,117	1.2%	-53.7%	16.04	8.8%
Butts	1,900	1.1%	-58.4%	10.10	-31.5%
Meriwethe	1,869	1.0%	-59.1%	3.70	-74.9%
Haralson	1,743	1.0%	-61.9%	6.16	-58.2%
Spalding	1,714	1.0%	-62.5%	8.57	-41.9%
Polk	1,562	0.9%	-65.8%	5.01	-66.1%
Upson	1,399	0.8%	-69.4%	4.27	-71.1%
Oconee	1,370	0.8%	-70.0%	7.37	-50.0%
Lamar	1,141	0.6%	-75.0%	6.13	-58.4%
Pickens	1,089	0.6%	-76.2%	4.67	-68.3%
Dawson	760	0.4%	-83.4%	3.55	-75.9%
Jasper	730	0.4%	-84.0%	1.96	-86.7%
Pike	674	0.4%	-85.2%	3.08	-79.1%
Oglethorpe	644	0.4%	-85.9%	1.46	-90.1%
Average	**4,569**			**14.75**	
Total	**178,201**	**100.0%**			

5-FACTOR ANALYSIS (FACTOR 3)

- **Meteorological Data**
  - HYSPLIT 24-hour back-trajectory analysis for all exceedance days (> 70 ppb) at each violating ozone monitor for 2013 and 2014.
  - HYSPLIT maps generated by EPA Ozone Designation Mapping Tool.



5-FACTOR ANALYSIS (FACTORS 4 AND 5)

- **Factor 4: Geography/Topography**
  - This factor did not play a significant role in this evaluation of the Atlanta CSA since it does not have any geographical or topographical barriers significantly limiting air pollution transport within its air shed.
- **Factor 5: Jurisdictional Boundaries**
  - All counties discussed in this technical analysis are within Georgia and fall within the jurisdiction of GA EPD. The Atlanta-Sandy Springs-Gainesville CBSA has previously established nonattainment boundaries associated with both the 1-hour and the 8-hour ozone NAAQS.

Atlanta nonattainment boundary for the 1-hour ozone standard	Atlanta nonattainment boundary for the 1997 8-hour ozone standard	Atlanta nonattainment boundary for the 2008 8-hour ozone standard
Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale.	Barrow, Bartow, Carroll, Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Hall, Henry, Newton, Paulding, Rockdale, Spalding, and Walton.	Bartow, Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Newton, Paulding, and Rockdale.

MODELING APPROACH

Comprehensive Air Quality Model with eXtensions (CAMx) and its Anthropogenic Precursor Culpability Assessment (APCA) tool

- Ozone formed with either anthropogenic NOx or VOCs → anthropogenic ozone
- Ozone formed with both biogenic NOx and VOCs → biogenic ozone

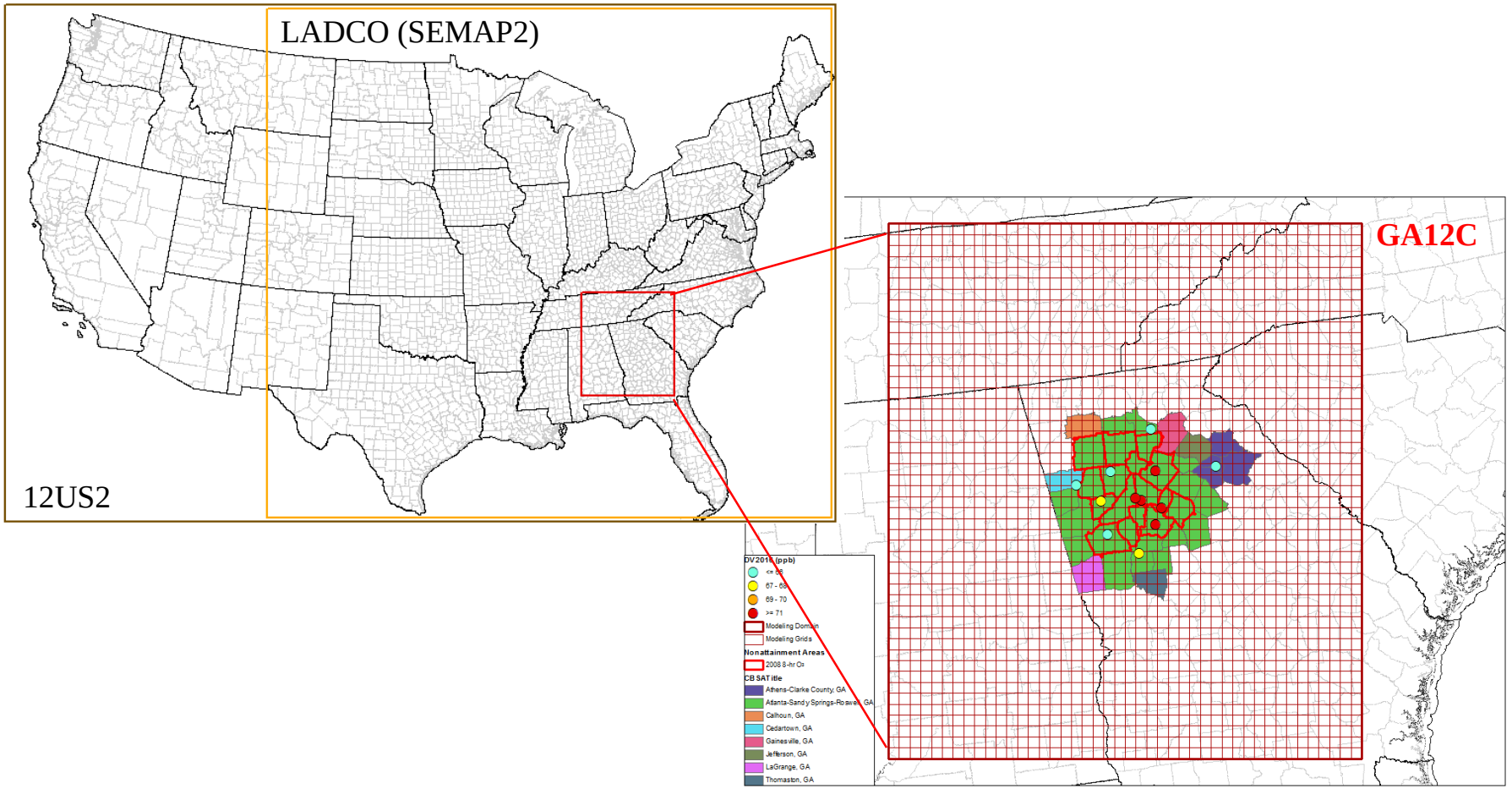
Utilizing datasets used for the Southeastern Modeling and Analysis Project – Part 2 (SEMAP2) Modeling

- Modeling platform based on EPA's proposed Transport Rule modeling platform
- 2011 as the base year and 2017 as the future year
- Updated 2017 emissions for some Electric Generating Units (EGUs)

Source Regions

- 39 counties in "Atlanta--Athens-Clarke County--Sandy Springs, GA" CSA

MODELING DOMAINS (ALL 12 KM GRIDS)



MODEL CONFIGURATION

Modeling period

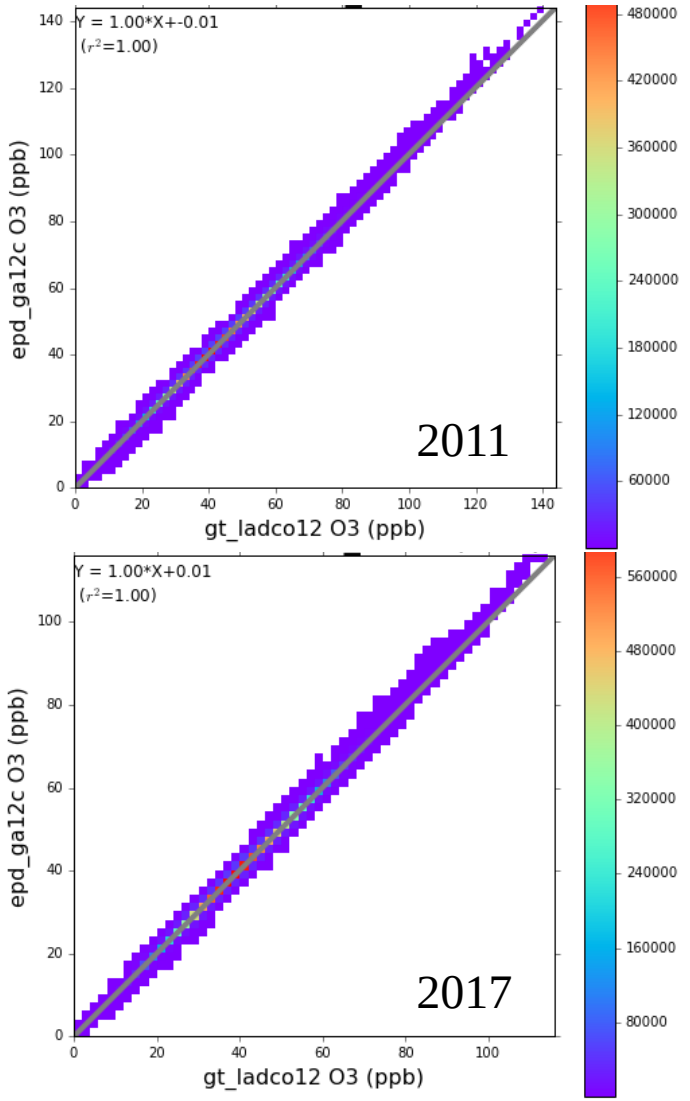
- Ozone Season (4/1-10/31) with ramp-up from 3/22

Photochemical grid model

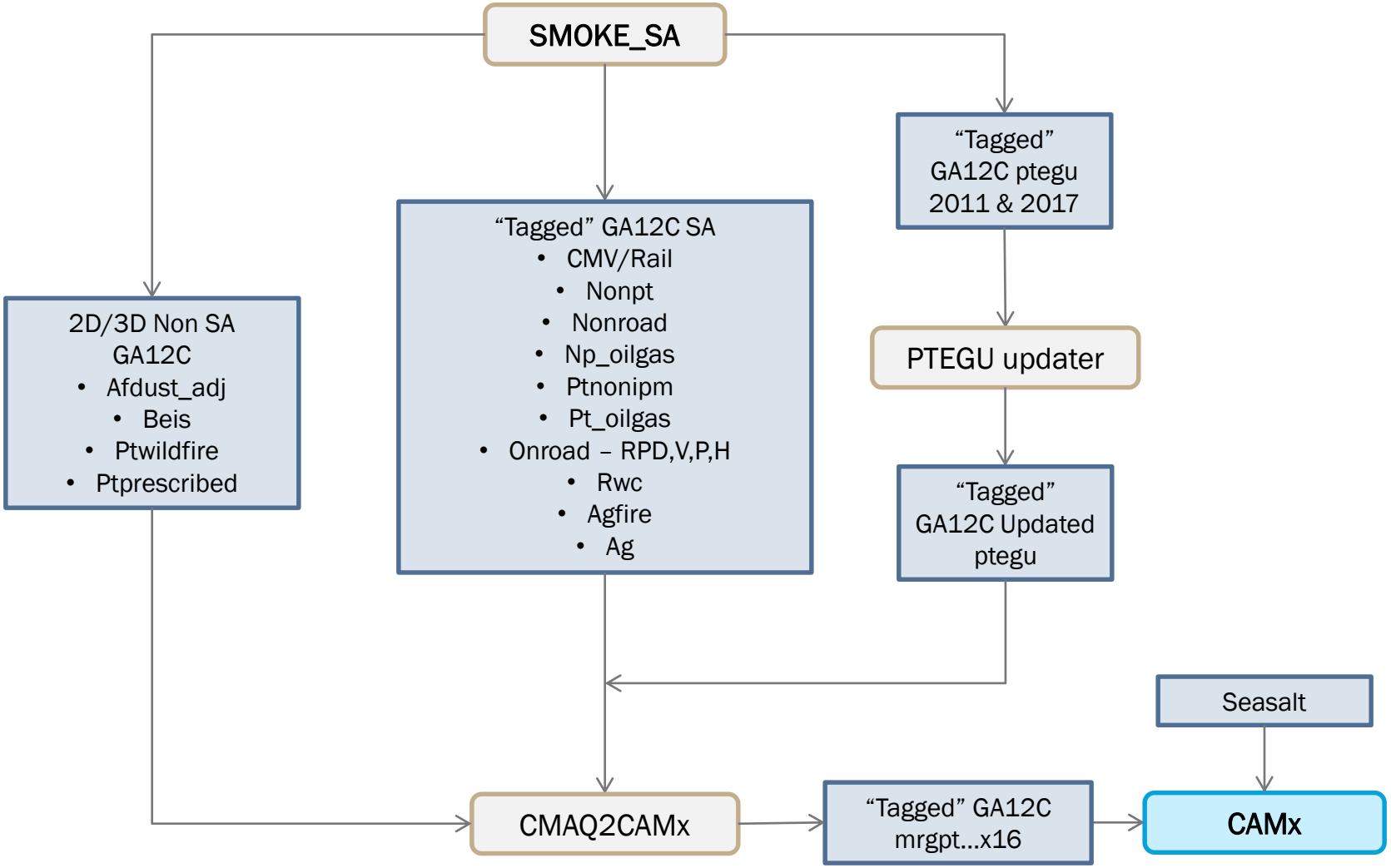
- CAMx v6.2 with CB6r2
  - No modification of CAMx source code except APCA input reader routines to treat biogenic emissions as the Region "1"
- Official WRFCAMx V4.3
- TUV4.8 (February 25, 2015 version)

Inputs

- 2011 WRF from EPA Transport Rule modeling platform
- 2011 and 2017 emissions
  - Converted all emission into point sources with specific tags for APCA 2017 run
- IC/BC from SEMAP2 modeling outputs
  - 2011 run: EPA's 2011 "eh" modeling platform
  - 2017 run: EPA's "eh" version with SEMAP2 specific updates for EGUs



CAMX 2017 CB6R2 EMISSIONS

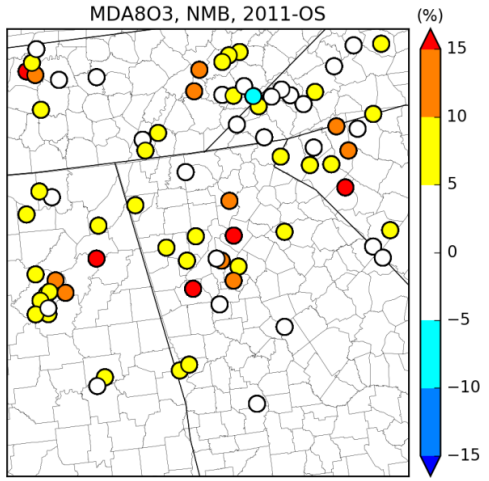


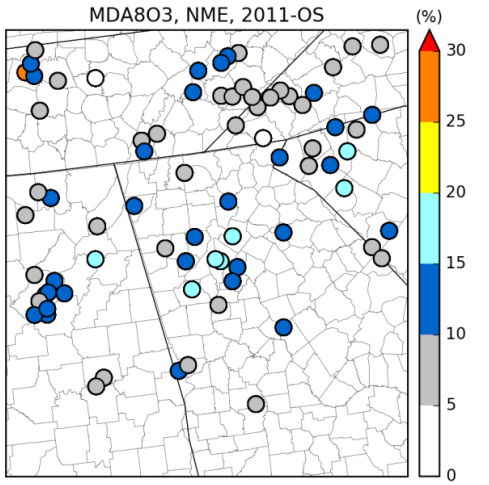
MODEL PERFORMANCE EVALUATION

Site-by-site MDA1 and MDA8 ozone time series for 9 monitors in ATL

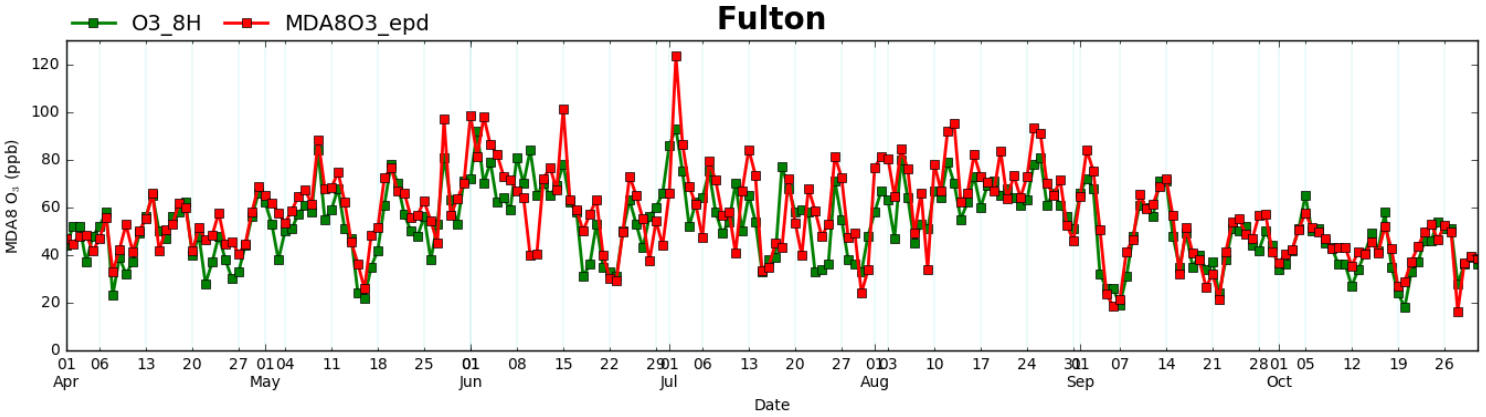
Ozone season performance statistics for MDA1 and MDA8 ozone with 60 ppb threshold

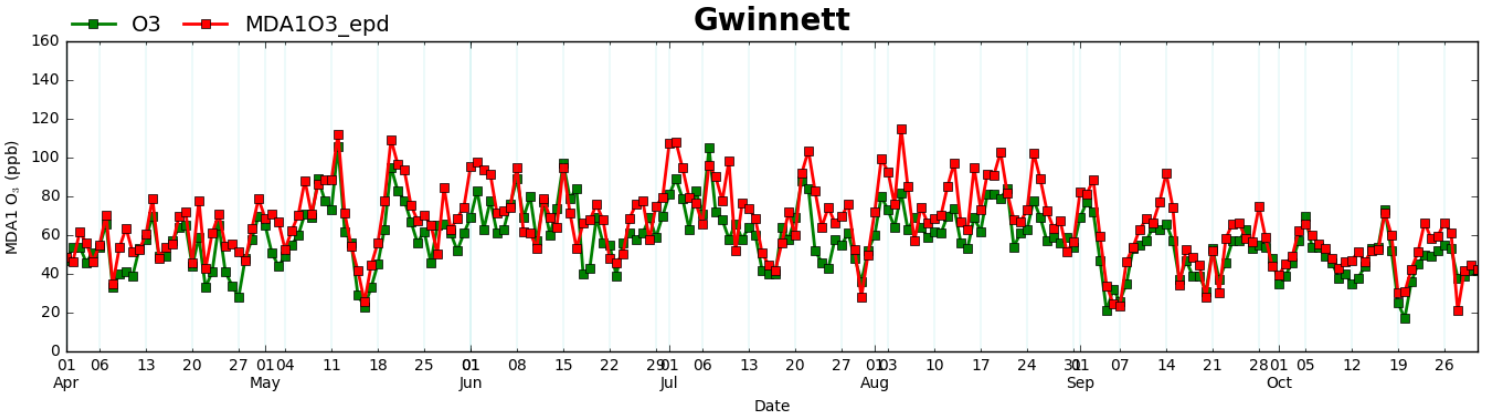
Area	AIRS _ID	N (#)	Mean Observation (ppb)	Mean Prediction (ppb)	Mean Bias (ppb)	Mean Gross Error (ppb)	Normalized Mean Bias (%)	Normalized Mean Error (%)
Atlanta CSA	13-059-0002	62	65.6	71.5	5.9	8.1	8.9	12.4
	13-067-0003	50	68.5	74.8	6.3	8.1	9.2	11.8
	13-077-0002	27	65.6	75.8	10.2	12.1	15.6	18.5
	13-085-0001	16	63.8	71.2	7.4	7.4	11.5	11.6
	13-089-0002	55	68.5	76.9	8.4	13.6	12.3	19.8
	13-097-0004	46	67.3	71.8	4.5	7.7	6.6	11.4
	13-121-0055	73	69.3	72.7	3.3	10.6	4.8	15.3
	13-135-0002	52	68.1	78.4	10.3	11.7	15.2	17.2
	13-151-0002	60	68.5	76.1	7.6	9.0	11.2	13.1
	13-223-0003	42	67.1	70.5	3.4	6.6	5.1	9.9
	13-231-9991	48	66.0	68.5	2.6	5.1	3.9	7.8
	13-247-0001	76	69.6	74.8	5.2	7.9	7.4	11.3
Outside Atlanta CSA in GA	13-021-0012	59	67.3	70.0	2.7	6.8	4.1	10.1
	13-055-0001	18	64.6	70.2	5.6	6.7	8.7	10.3
	13-073-0001	45	65.8	67.5	1.7	4.7	2.7	7.1
	13-213-0003	51	64.8	67.5	2.7	4.9	4.2	7.5
	13-215-0008	33	63.5	69.0	5.5	6.3	8.6	9.9
	13-245-0091	56	65.4	67.2	1.8	5.5	2.8	8.4
	13-261-1001	29	63.3	62.9	-0.4	4.3	-0.6	6.8





MAXIMUM DAILY 8-HOUR O_3 TIME SERIES

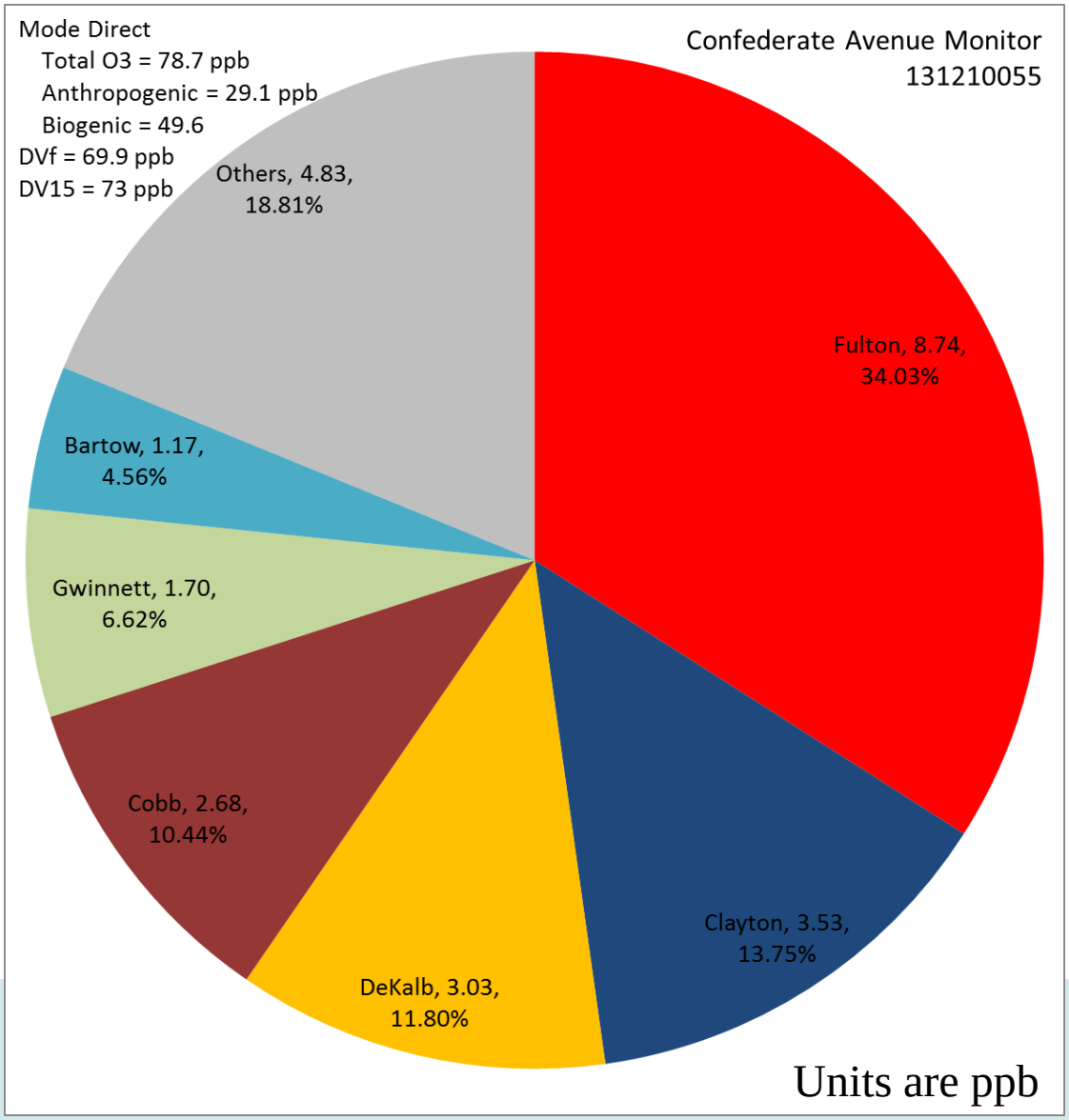




CONTRIBUTION CALCULATION

1. **Modeled 2011 hourly ozone concentrations at the monitor grid cells are used to calculate the 2011 daily maximum 8-hour (MDA8) ozone concentrations.**
2. **Modeled 2017 hourly ozone concentrations at the monitor grid cells are used to calculate the 2017 MDA8 ozone concentrations.**
3. **The 2017 DVFs were calculated at the monitor grid cells using the MATS by following the draft modeling guidance using the 2011 and 2017 MDA8 ozone concentrations.**
4. **For the same 8-hour period used in the Step 2, the 8-hour ozone contribution by each county was calculated at each monitor grid cell using direct APCA outputs.**
5. **The data from Step 4 for days corresponding to 2017 MDA8 ozone concentrations (i.e. MDA8 from Step 1) ≥ 71 ppb are averaged.**
    1. If there were fewer than five 2017 MDA8 ozone concentration days over 71 ppb at a particular monitoring site then the data from the top five 2017 MDA8 ozone concentration days are extracted and used in the calculations.
    2. If there were fewer than 5 days with a modeled 2017 MDA8 concentration ≥ 60 ppb for the location of a particular monitoring site, then contributions were not calculated at that monitor.
6. **Final contribution values were estimated by scaling results from Step 5 with the ratio of DVFs to the 2017 MDA8 ozone from Step 2 for each site.**
    1. Final numbers are truncated to the two digits to the right of the decimal.

SUMMARY OF CONTRIBUTIONS AT 13-121-0055



SIGNIFICANT CONTRIBUTION APPROACH

- A contribution threshold of 1.0 ppb was used to determine which counties significantly contribute to the violating monitors.
  - Examined contribution from 39 counties to the 5 violating ozone monitors
- The 1.0 ppb threshold was chosen based on EPA's recently proposed significant impact level for single source PSD modeling
  - *Draft Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program*, 2016

COUNTY LEVEL CONTRIBUTIONS

Monitor	Confederate Ave. (13-121-0055)	Conyers (13-247-0001)	McDonough (13-151-0002)	Gwinnett Tech (13-135-0002)	South DeKalb (13-089-0002)
Barrow	0.12	0.06	0.10	0.23	0.10
Bartow	**1.17**	0.77	0.97	**1.45**	0.96
Butts	0.04	0.07	0.14	0.02	0.04
Carroll	0.24	0.33	0.15	0.09	0.26
Cherokee	0.40	0.30	0.36	0.64	0.33
Clarke	0.08	0.03	0.10	0.09	0.08
Clayton	**3.54**	**4.22**	**3.85**	0.68	**3.26**
Cobb	**2.69**	**1.50**	**1.72**	**2.49**	**2.05**
Coweta	0.24	0.38	0.29	0.14	0.23
Dawson	0.03	0.03	0.03	0.04	0.03
DeKalb	**3.04**	**3.07**	**3.17**	**2.33**	**5.56**
Douglas	0.68	0.41	0.33	0.16	0.55
Fayette	0.21	0.31	0.40	0.07	0.18
Forsyth	0.29	0.26	0.24	0.78	0.24
Fulton	**8.74**	**4.12**	**4.07**	**3.92**	**5.98**
Gordon	0.15	0.11	0.14	0.07	0.13
Gwinnett	**1.71**	**1.93**	**1.60**	**8.25**	**1.58**
Hall	0.26	0.18	0.16	0.61	0.19
Haralson	0.07	0.10	0.03	0.04	0.09
Heard	0.14	0.26	0.16	0.09	0.15
Henry	0.55	**2.65**	**4.08**	0.26	0.88
Jackson	0.16	0.07	0.12	0.29	0.13
Jasper	0.01	0.01	0.03	0.01	0.01
Lamar	0.01	0.02	0.03	0.01	0.01
Madison	0.07	0.03	0.07	0.11	0.07
Meriwether	0.02	0.03	0.03	0.02	0.03
Morgan	0.06	0.02	0.08	0.03	0.06
Newton	0.17	0.29	0.34	0.06	0.21
Oconee	0.04	0.01	0.05	0.04	0.04
Oglethorpe	0.01	0.00	0.01	0.01	0.01
Paulding	0.35	0.20	0.22	0.20	0.29
Pickens	0.05	0.05	0.05	0.03	0.05
Pike	0.01	0.01	0.02	0.01	0.01
Polk	0.09	0.06	0.05	0.07	0.08
Rockdale	0.23	0.95	0.41	0.09	0.31
Spalding	0.04	0.10	0.15	0.03	0.05
Troup	0.03	0.04	0.04	0.03	0.04
Upson	0.01	0.01	0.01	0.01	0.01
Walton	0.16	0.09	0.20	0.14	0.17

RESULTS: 5-FACTOR ANALYSIS AND CAMX-APCA

County	Air Quality Data (Factor 1)	NOx Emissions (Factor 2)	VOCs Emissions (Factor 2)	Population (Factor 2)	VMT (Factor 2)	HYSPLIT (Factor 3)	CAMx-APCA Source Contribution
Barrow							
Bartow		X				X	X
Butts							
Carroll							
Cherokee							
Clarke							
Clayton		X	X	X	X	X	X
Cobb		X	X	X	X	X	X
Coweta							
Dawson							
DeKalb	X	X	X	X	X	X	X
Douglas							
Fayette							
Forsyth							
Fulton	X	X	X	X	X	X	X
Gordon							
Gwinnett	X	X	X	X	X	X	X
Hall							
Haralson							
Heard							
Henry	X				X	X	X
Jackson							
Jasper							
Lamar							
Madison							
Meriweth							
Morgan							
Newton							
Oconee							
Oglethorp							
Paulding							
Pickens							
Pike							
Polk							
Rockdale	X					X	
Spalding							
Troup							
Upson							
Walton							

PROPOSED RECOMMENDATION

- Fulton
- Gwinnett
- DeKalb
- Cobb
- Bartow
- Clayton
- Henry
- Rockdale

FUTURE WORK

- HYSPLIT analysis for 2015 and 2016 exceedances.
- Application of the new version of CAMx with updated APCA based on OSAT3 algorithm to account for NOx titration effects.
- Comparison between CAMx-APCA and zero-out contributions.

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