Georgia's Nonattainment Area Designation Recommendations for the 2015 Ozone NAAQS – Modeling Technical Support Document –

EPA's designation guidance memo[1] states that source apportionment modeling can be used as part of the initial area designation process. The Georgia Environmental Protection Division (EPD) applied the Comprehensive Air Quality Model with eXtensions (CAMx)[2] with its Anthropogenic Precursor Culpability Assessment (APCA) tool to determine the contribution of each of the 39 counties in the Atlanta combined statistical area (CSA)[3] to the five violating ozone monitors in the Atlanta CSA. The five violating monitors were identified based on 2014-2016 preliminary ozone data and include: Confederate Avenue (Fulton county), McDonough (Henry county), Conyers (Rockdale county), South DeKalb (DeKalb county), and Gwinnett Tech (Gwinnett county). EPD used a similar approach with CAMx-APCA as EPA used for the proposed and final Cross-State Air Pollution Rule modeling[4] (hereafter, Transport Rule Modeling). The following sections describe how EPD conducted its 2011 base year modeling, 2017 future year modeling, and 2017 contribution modeling.

1. 2011 Base Year Modeling

Modeling Approach

EPD conducted 2011 CAMx modeling for the ozone season (April 1 to October 31) using 2011 meteorology and 2011 emissions. The EPD model set-up and inputs were similar to EPA's Transport Rule modeling. Also, EPD's model set-up and inputs were nearly identical to modeling performed by Georgia Tech for SESARM's Southeastern Modeling, Analysis, and Planning (SEMAP) project. A summary of configuration differences between the EPA, SESARM, and EPD modeling platforms is contained in Table 1.

Table 1. Configuration differences between the EPA, SESARM, and EPD modeling platforms.

	EPA	SESARM	EPD
WRFCAMx	WRFCAMx 4.0 beta	WRFCAMx 4.3	WRFCAMx 4.3
TUV	TUV4.8 (May 6, 2013 version)*	TUV4.8 (February 25, 2015 version)	TUV4.8 (February 25, 2015 version)
CAMx	CAMx v6.11 with modification for super-stepping routine for HMAX.	CAMx 6.11	CAMx 6.2

*Ramboll-Environ confirmed that there was an error in NO3_NO2.PHF file in the May 6, 2013 version.

[1] EPA, Guidance on the Area Designations for the 2015 Ozone National Ambient Air Quality Standards, https://www.epa.gov/ozone-designations/epa-guidance-area-designations-2015-ozone-naaqs

[2] Ramboll-Environ, CAMx Overview, http://www.camx.com/about/default.aspx

[3] EPD used the Atlanta CSA definition published by the Office of Budget and Management in February, 2013 that is available on the U.S. Census website (http://www.census.gov/population/metro/files/lists/2013/List1.xls).

[4] EPA, Proposed and Final Cross-State Air Pollution Rule, https://www.epa.gov/airmarkets/proposed-cross-state-air-pollution-update-rule and https://www.epa.gov/airmarkets/final-cross-state-air-pollution-rule-update.

All CAMx versions were modified to read point-source formatted APCA emissions and override biogenic emissions as the region “1” to be consistent across platforms. The modeling inputs for the Transport Rule Modeling covered the continental U.S. (CONUS). These inputs were extracted for the SESARM and EPD modeling domains (Figures 1 and 2). The 2011 meteorological inputs were prepared using the official WRFCAMx utility (version 4.3) with Weather Research and Forecasting (WRF) model outputs developed for the Transport Rule Modeling. Ten days (March 22 – 31) were used as ramp-up days for 2011 modeling. Ozone column files and photolysis rates were prepared prior to the CAMx run with Ramboll-Environ’s O3MAP utility released on May 6, 2013 and TUV utility (version 4.8). O3MAP requires ozone column data in text format and EPD used the Level 3 Ozone Monitoring Instrument (OMI) product. There was no missing data for the 2011 OMI dataset. 2011 initial and boundary conditions (IC/BCs) were developed using the SESARM modeling results. The SESARM modeling results were compared to EPA’s Transport Rule modeling results and all differences were explained by the configuration differences shown in Table 1[5]. The EPD modeling results were compared with the SESARM modeling results (Figure 3) to evaluate impacts of the smaller EPD modeling domain and newer version of CAMx. The slope and r^2 values were 1.00 indicating insignificant differences between the two modeling platforms.

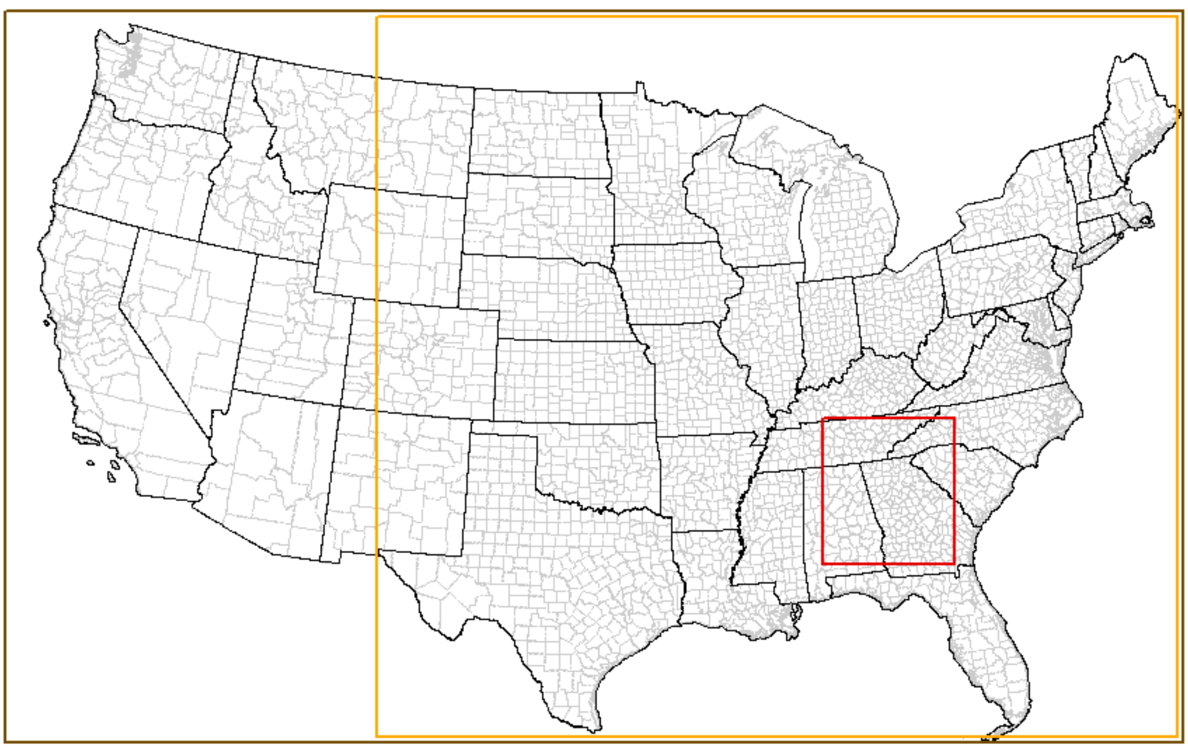

Figure 1. Domains for the Transport Rule Modeling (brown box), SESARM Modeling (orange box), and EPD Modeling (red box).

[5] Talat, O. and Hu, Y., Georgia Tech, SEMAP 2017 Ozone Projections and Sensitivity to NOx Emissions, Presented to SEMAP Air Quality Modeling Workgroup, August 15, 2016.

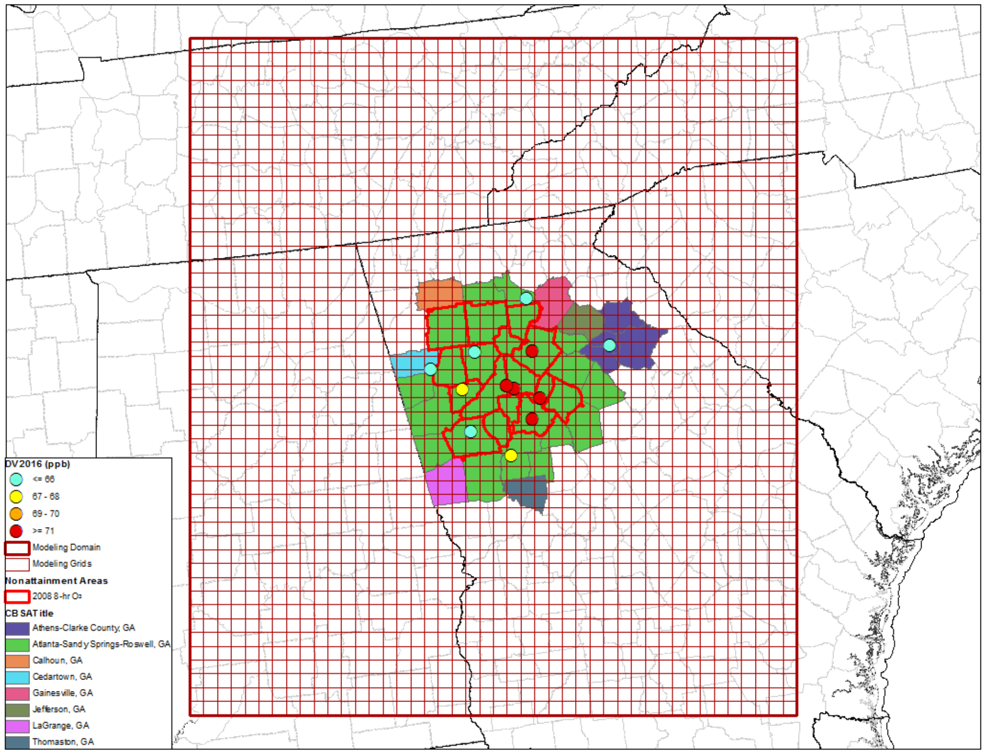

Figure 2. EPD's modeling domain and grids (red squares), preliminary 2014-2016 design values (colored circles), nonattainment areas for the 2008 ozone NAAQS (thick red outlines), and the Atlanta CSA broken down by CBSAs. All shaded counties were evaluated as part of the source contribution assessment.

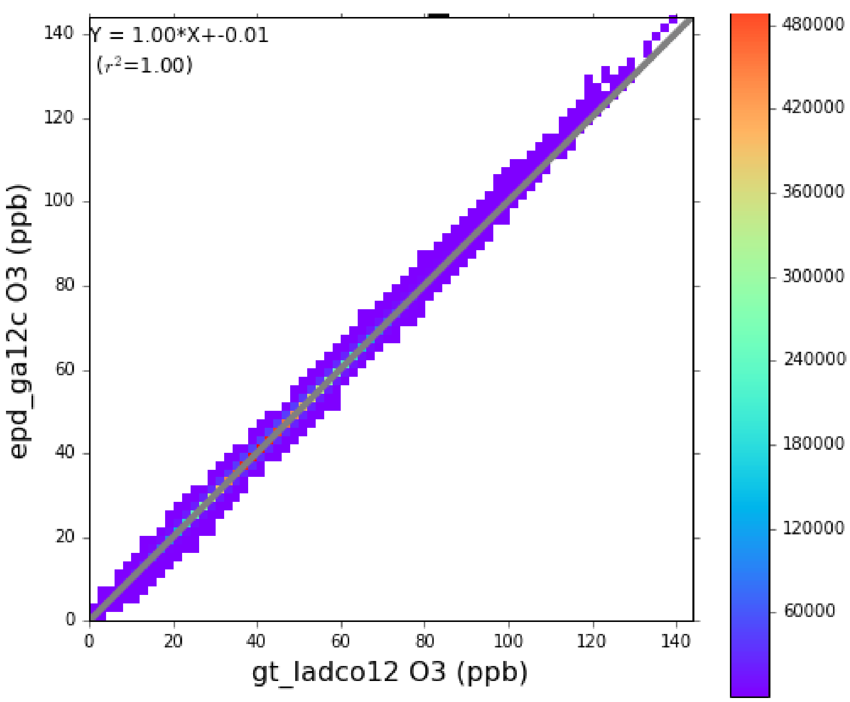

Figure 3. Comparison of 2011 CAMx modeling results between the SESARM and EPD modeling platforms. The color scale indicates the number of data points.

Model Performance Evaluation

Detailed model performance statistics listed below were calculated for the EPD CAMx modeling.

$$\text{Mean Observation} = \frac{\sum P}{N}$$

$$\text{Mean Prediction} = \frac{\sum P}{N}$$

$$\text{Mean Bias} = \frac{\sum(P - O)}{N}$$

$$\text{Mean Gross Error} = \frac{\sum |P - O|}{N}$$

$$\text{Normalized Mean Bias (NMB)} = 100\ \% \times \frac{\sum(P - O)}{\sum O}$$

$$\text{Normalized Mean Error (NME)} = 100\ \% \times \frac{\sum |P - O|}{\sum O}$$

N is the number of days when observed ozone concentrations are above the threshold, 60 ppb. *P* and *O* represent predicted ozone values and observed ozone values at each monitor for days above the performance statistics threshold.

At every monitor in the EPD modeling domain, NMB and NME were calculated for modeled daily maximum 8-hour ozone concentrations (MDA8O3, Figure 4) and daily maximum 1-hour ozone concentrations (MDA1O3, Figure 5). The EPD modeling with CAMx slightly over-predicted ozone concentrations at monitors in the Atlanta CSA. Detailed model performance statistics of MDA8O3 for Georgia monitors in the Atlanta CSA and outside Atlanta CSA are summarized in Table 2. NMB is less than ±15% for most monitors, except +15.6% for monitor 13-077-0002 in Coweta County and +15.2% for monitor 13-135-0002 in Gwinnett County. NME is less than 20% for all monitors in Georgia.

EPD also developed time series plots for MDA8O3 for the five ozone monitors violating the 2015 ozone NAAQS based on preliminary 2014-2016 design values (Figures 6 - 10). The ozone design value at the Confederate Avenue monitor is the highest in the Atlanta CSA. In general, EPD CAMx modeling over-predicted MDA8O3. EPD believes that the over-prediction on high ozone days will lead to higher modeled contributions compared to each county’s actual contributions. Hence, the modeling results will be conservative (upper-bound) estimates of the contributions.

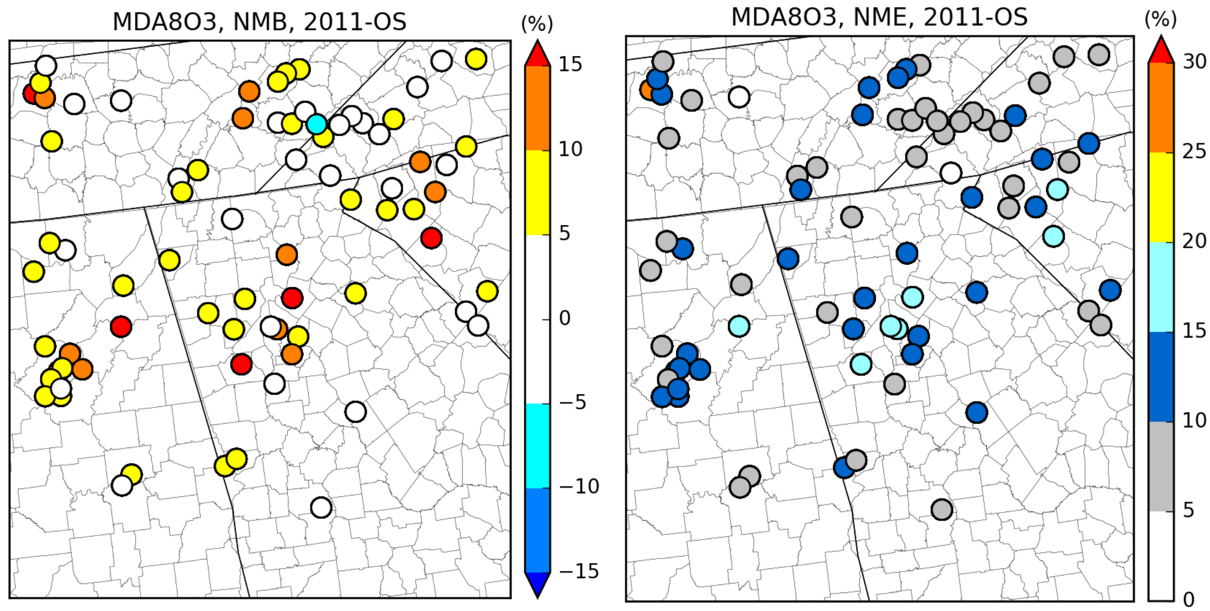

Figure 4. Normalized mean bias (left) and normalized mean error (right) of modeled daily maximum 8-hour ozone concentrations for the 2011 ozone season (April 1 to October 31). Cutoff = 60 ppb.

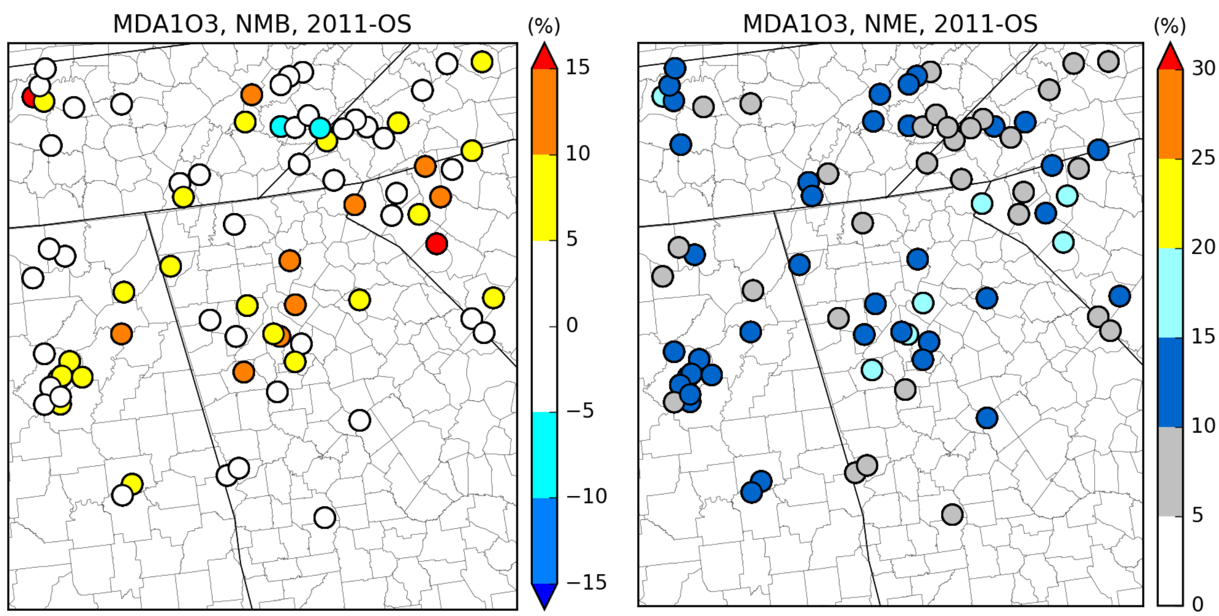

Figure 5. Normalized mean bias (left) and normalized mean error (right) of modeled daily maximum 1-hour ozone concentrations for the 2011 ozone season (April 1 to October 31). Cutoff = 60 ppb.

Table 2. Model performance statistics of daily maximum 8-hour ozone for monitors in the Atlanta CSA and outside the Atlanta CSA in GA for the 2011 ozone season (April 1 - October 31). Cutoff = 60 ppb.

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

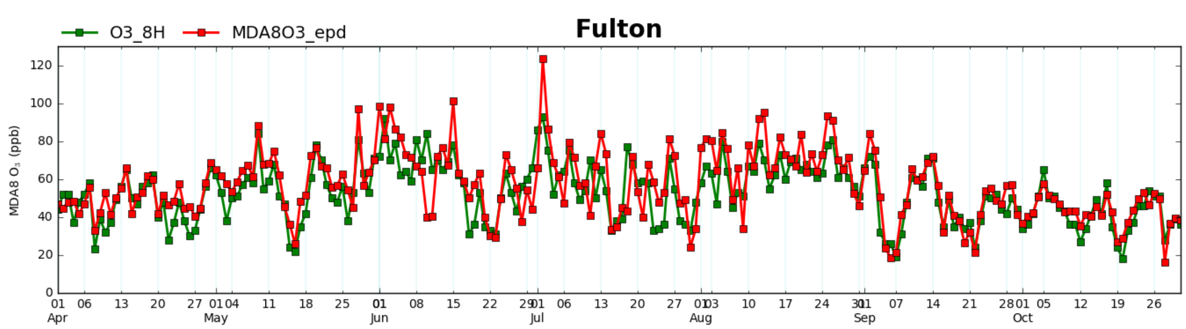

Figure 6. Time series of daily maximum 8-hour ozone concentrations at the Confederate Avenue monitor (13-121-0055) in Fulton County, GA.

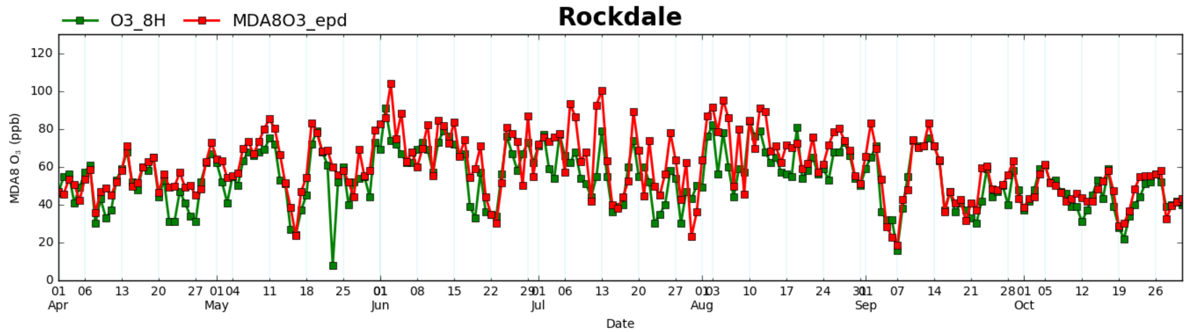

Figure 7. Time series of daily maximum 8-hour ozone concentrations at the Conyers monitor (13-247-0001) in Rockdale County, GA.

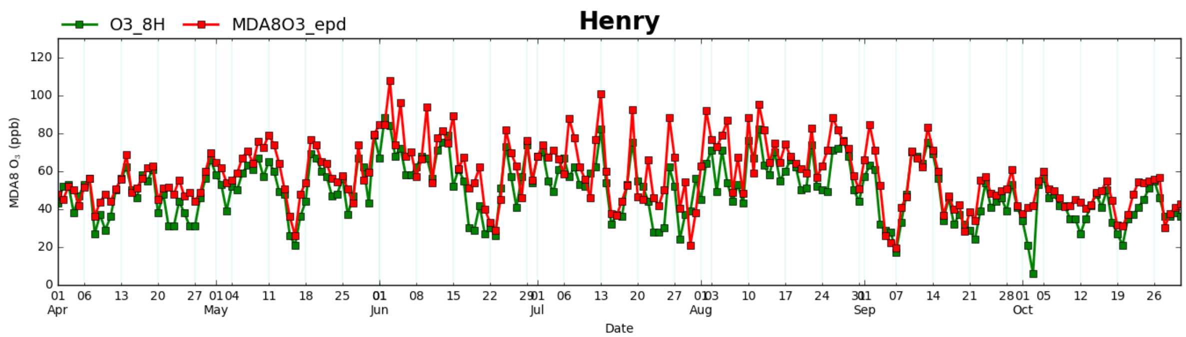

Figure 8. Time series of daily maximum 8-hour ozone concentrations at the McDonough monitor (13-151-0002) in Henry County, GA.

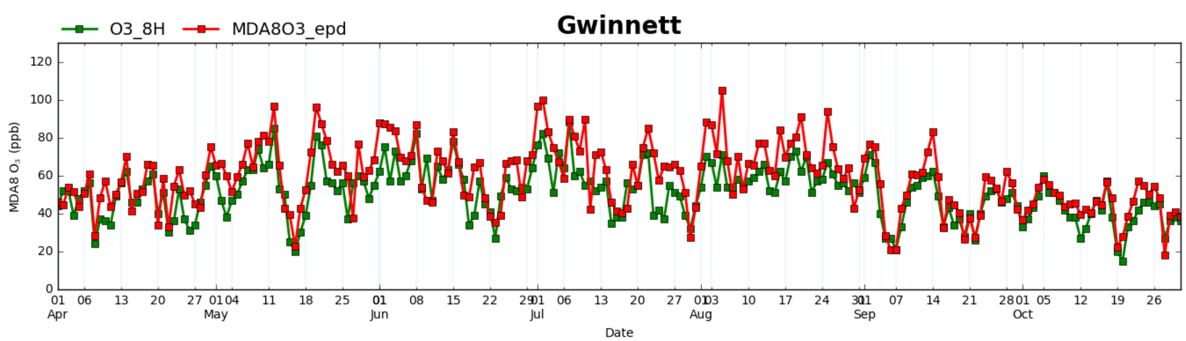

Figure 9. Time series of daily maximum 8-hour ozone concentrations at the Gwinnett Tech monitor (13-135-0002) in Gwinnett County, GA.

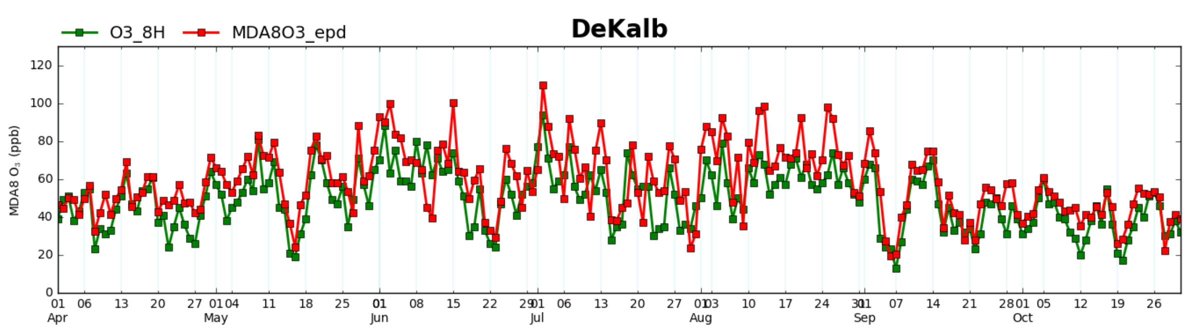

Figure 10. Time series of daily maximum 8-hour ozone concentrations at the South DeKalb monitor (13-089-0002) in DeKalb County, GA.

2. 2017 Future Year Modeling

EPD conducted the 2017 future year modeling with CAMx-APCA for the ozone season using 2017 SESARM emissions and EPA 2011 meteorology. 2017 SESARM emissions were developed using the same emissions that were used for the Transport Rule modeling except that the 2017 Electrical Generating Units (EGU) emissions were updated for the SESARM states based on feedback from those states. SESARM applied scaling factors to emission records in EPA's 2017 or 2011 hourly point source emission input files to adjust EGU emissions to reflect SESARM states emission estimates for 2017.

EPD updated the 2017 emissions from seven EGU facilities in Georgia in the EPA "2017eh" inventory. The 2014 emissions which were reported by each facility and collected by Georgia EPD were used to represent 2017 emissions for most facilities, except SO_2, PM_{10}, and $PM_{2.5}$ emissions from Plant Scherer (Unit 1) and all emissions from Plant Yates (Units Y6BR and Y7BR).

- <u>SO_2, PM_{10}, and $PM_{2.5}$ emissions from Plant Scherer (Unit 1):</u>
  SO_2, PM_{10}, and $PM_{2.5}$ emissions from Plant Scherer (Unit 1) during 2014 were adjusted to reflect the impacts of flue gas desulfurization (FGD) controls which came online in May 2014 for Unit 1. The SO_2 emissions for Unit 1 were estimated by multiplying the 2014 NOx emission from Unit 1 by the ratio of total SO_2 emissions to total NOx emissions from Units 2-4. The PM_{10} and $PM_{2.5}$ emissions for Unit 1 were reduced by 50% according to the SESARM report[6].
- <u>All Emissions from Plant Yates (Units Y6BR and Y7BR):</u>
  These two units were converted from coal to natural gas boilers in 2015. According to Georgia Power, this facility will be run as a peaking unit with a 25% capacity factor (maximum). Therefore, EPD calculated its potential NOx emissions in 2017 using its potential usage, the nominal heat rate of 12 mmBtu/MWh, and the measured NOx emission rates after the conversion to natural gas (0.116 lbs/mmBtu for Unit Y6BR and 0.141 lbs/mmBtu for Unit Y7BR). For CO and VOC emissions, the maximum measured emission rates during May and June of 2015 were used. For SO_2, PM_{10} and $PM_{2.5}$, the AP-42 emission factors were used.

Next, a scaling ratio was calculated for each unit based on annual emissions. In most cases, the scaling ratio was calculated by dividing the EPD 2017 emissions by the EPA 2017 emissions. Then, the scaling ratio was applied to the EPA hourly 2017 EGU emissions to generate EPD hourly 2017 EGU emissions. For Plant Yates and Plant McIntosh, EPA 2017 emissions were zero. Therefore, the scaling ratio was calculated by dividing the EPD 2017 emissions by the EPA 2011 emissions. Then, the scaling ratio was applied to the EPA's hourly 2011 EGU emissions to generate EPD hourly 2017 EGU emissions. Table 3 shows Georgia's EGUs that were adjusted for SESARM and EPD modeling, adjustment approach, and scaling ratios used to adjust emissions. Table 4 shows the final adjusted emissions used for the 2017 SESARM and EPD modeling. The detailed calculations are contained in Appendix B (GA_EPD_Adjusted_EGU_Emissions.xlsx). The same 2017 modeling platform was also used for the APCA modeling described in the next chapter.

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[6] AMEC, Development of the 2018 Projection Point Source Emission Inventory in the SESARM Region (Version 1.0).

Table 3. Approach and scaling ratios used to adjust EPA 2017 EGU emissions for SESARM and EPD modeling.

Plant	ORIS ID	BOILER ID	Approach	CO Ratio	NH3 Ratio	NOx Ratio	PM10 Ratio	PM2.5 Ratio	SO2 Ratio	VOC Ratio
Plant Bowen	703	1BLR	Scale 2017 emissions	1.98	1.01	2.27	2.69	2.06	3.81	2.55
Plant Bowen	703	2BLR	Scale 2017 emissions	1.90	1.00	1.93	0.79	0.70	4.37	2.44
Plant Bowen	703	3BLR	Scale 2017 emissions	1.95	0.93	3.09	1.47	1.17	5.20	2.51
Plant Bowen	703	4BLR	Scale 2017 emissions	2.53	1.27	3.55	2.00	1.60	5.30	3.25
Plant Hammond	708	1	Scale 2017 emissions	0.08	0.00	0.26	0.16	0.18	0.03	0.15
Plant Hammond	708	2	Scale 2017 emissions	0.10	0.00	0.41	0.25	0.27	0.30	0.19
Plant Hammond	708	3	Scale 2017 emissions	0.11	0.00	0.36	0.22	0.24	0.07	0.20
Plant Hammond	708	4	Scale 2017 emissions	0.08	0.00	0.27	0.15	0.17	0.03	0.15
Plant Wansley	6052	1	Scale 2017 emissions	0.25	0.41	0.59	0.22	0.18	0.41	0.38
Plant Wansley	6052	2	Scale 2017 emissions	0.19	0.32	0.44	0.26	0.21	0.29	0.28
Plant Scherer	6257	1	Scale 2017 emissions	1.05	0.05	1.29	0.13	0.11	0.11	1.35
Plant Scherer	6257	2	Scale 2017 emissions	0.91	0.05	0.93	0.13	0.10	0.08	1.17
Plant Scherer	6257	3	Scale 2017 emissions	1.63	0.05	1.44	0.14	0.09	0.10	1.16
Plant Scherer	6257	4	Scale 2017 emissions	1.24	0.05	1.06	0.11	0.07	0.10	1.08
Plant Yates	728	Y6BR	Scale 2011 emissions	0.45	0.00	0.23	0.11	0.16	0.00	0.13
Plant Yates	728	Y7BR	Scale 2011 emissions	0.63	0.00	0.42	0.20	0.26	0.00	0.18
Plant McIntosh	6124	1	Scale 2011 emissions	4.43	0.00	4.06	4.97	4.52	3.28	4.44
Mid-Georgia Co-gen	55040	1	Scale 2017 emissions	0.04	0.02	0.10	6.72	10.97	0.00	0.41
Mid-Georgia Co-gen	55040	2	Scale 2017 emissions	0.05	0.02	0.11	7.54	12.31	0.00	0.46
Mid-Georgia Co-gen	55040	ST1	Scale 2017 emissions	0.03	0.00	0.02	0.68	1.10	0.00	0.10

Table 4. Emission adjustment approach and emissions used for SESARM and EPD modeling.

Plant	ORIS ID	BOILER ID	Approach	CO Emissions	NH3 Emissions	NOx Emissions	PM10 Emissions	PM2.5 Emissions	SO2 Emissions	VOC Emissions
Plant Bowen	703	1BLR	Scale 2017 emissions	345.9	8.2	1643.0	307.6	235.6	1313.0	41.5
Plant Bowen	703	2BLR	Scale 2017 emissions	334.2	8.2	1477.0	90.9	80.1	1518.0	40.0
Plant Bowen	703	3BLR	Scale 2017 emissions	419.7	9.2	1666.0	207.1	165.2	2207.0	50.3
Plant Bowen	703	4BLR	Scale 2017 emissions	523.4	12.2	2273.0	272.5	216.7	2166.0	62.8
Plant Hammond	708	1	Scale 2017 emissions	17.0	0.0	181.0	25.2	20.4	32.0	2.0
Plant Hammond	708	2	Scale 2017 emissions	21.6	0.0	282.0	37.5	29.5	290.0	2.6
Plant Hammond	708	3	Scale 2017 emissions	22.1	0.0	238.0	32.9	26.5	59.0	2.6
Plant Hammond	708	4	Scale 2017 emissions	72.7	0.1	773.0	107.4	87.0	145.0	8.6
Plant Wansley	6052	1	Scale 2017 emissions	293.8	19.0	1200.0	135.1	111.6	1426.0	35.2
Plant Wansley	6052	2	Scale 2017 emissions	214.2	14.5	820.0	159.4	125.5	1017.0	25.6
Plant Scherer	6257	1	Scale 2017 emissions	829.2	1.9	3733.0	142.0	85.1	269.0	99.5
Plant Scherer	6257	2	Scale 2017 emissions	725.6	1.7	2872.0	142.5	82.8	198.0	87.0
Plant Scherer	6257	3	Scale 2017 emissions	1325.2	1.7	3584.0	140.8	81.9	253.0	88.7
Plant Scherer	6257	4	Scale 2017 emissions	986.5	1.7	3161.0	110.8	64.6	241.0	80.1
Plant Yates	728	Y6BR	Scale 2011 emissions	79.1	0.0	533.5	34.3	34.3	2.7	3.0
Plant Yates	728	Y7BR	Scale 2011 emissions	79.1	0.0	648.5	34.3	34.3	2.7	3.0
Plant McIntosh	6124	1	Scale 2011 emissions	36.4	0.0	1046.0	39.5	21.2	2267.0	4.3
Mid-Georgia Co-gen	55040	1	Scale 2017 emissions	9.6	0.4	18.0	5.7	5.7	0.0	2.3
Mid-Georgia Co-gen	55040	2	Scale 2017 emissions	10.7	0.4	19.0	6.4	6.4	0.0	2.6
Mid-Georgia Co-gen	55040	ST1	Scale 2017 emissions	5.6	0.0	4.0	0.6	0.6	0.0	0.6

A comparison of total anthropogenic NOx emissions (2011 NEI, 2011 modeled, 2011 NEI with 2014 EGUs, and 2017 modeled) by county are included in Table 5. The 2011 NEI and 2011 modeled NOx emissions are nearly identical. However, there are some significant differences between the 2011 NEI with 2014 EGUs vs. the 2017 modeled emissions.

Table 5. Total anthropogenic NOx emissions by county in the Atlanta CSA.

County	2011 NEI_v2	2011 model	2011 w/ 2014 point	EPA 2017 model	EPD 2017 model
Fulton	23,881	23,497	23,110	14,932	14,932
Gwinnett	16,464	16,205	16,460	9,585	9,585
Cobb	16,259	16,045	13,622	8,493	8,493
DeKalb	14,648	14,433	14,546	8,307	8,307
Bartow	14,309	14,242	12,923	6,373	10,762
Clayton	10,536	10,454	10,622	8,067	8,067
Coweta	10,384	10,336	4,861	2,282	3,464
Henry	7,327	7,263	6,681	4,182	4,182
Hall	5,172	5,101	5,217	2,916	2,916
Carroll	4,300	4,249	4,302	2,551	2,551
Cherokee	4,207	4,147	4,275	2,519	2,519
Madison	3,992	3,981	2,411	2,080	2,080
Troup	3,732	3,695	3,748	2,215	2,215
Jackson	3,705	3,664	3,876	2,212	2,212
Forsyth	3,590	3,535	3,608	2,208	2,208
Heard	3,437	3,443	2,930	4,671	2,783
Gordon	3,336	3,305	3,344	2,086	2,086
Clarke	2,985	2,939	2,964	1,699	1,699
Douglas	2,976	2,935	2,976	1,694	1,694
Newton	2,913	2,874	2,904	1,628	1,628
Paulding	2,600	2,568	2,600	1,601	1,601
Walton	2,520	2,325	2,286	1,266	1,266
Morgan	2,313	2,296	2,218	1,590	1,590
Fayette	2,165	2,132	2,163	1,274	1,274
Barrow	2,118	2,088	2,130	1,172	1,172
Rockdale	2,045	2,020	2,050	1,188	1,188
Butts	1,817	1,805	1,817	1,246	1,246
Meriwether	1,671	1,660	1,729	1,188	1,188
Haralson	1,649	1,636	1,649	1,096	1,096
Spalding	1,633	1,611	1,632	877	877
Polk	1,529	1,505	1,455	858	858
Oconee	1,287	1,262	1,287	675	675
Upson	1,161	1,147	1,301	659	659
Pickens	1,029	1,014	1,030	564	564
Lamar	810	800	1,056	491	491
Dawson	712	702	712	396	396
Jasper	599	593	614	398	398
Pike	583	576	583	341	341
Oglethorpe	508	503	508	304	304
Total	186,905	184,588	174,202	107,883	111,566

Table 6 shows that the majority of the differences are coming for on-road mobile emissions which show significant emission reductions between 2011 and 2017. Since the 2017 emissions are the closest emissions to the current emissions in 2016 and the EPA designations will be finalized in 2017, EPD feels it is most appropriate to use 2017 emission in the contribution modeling. The detailed calculations for Tables 5 and 6 are contained in Appendix C (2011_2017_Modeled_Emissions.xlsx).

Table 6. Total anthropogenic NOx emissions by source sector in the Atlanta CSA.

Sector	2011 NEI_v2	2011 model	2011 w/ 2014 point	EPA 2017 model	EPD 2017 model
Fires	785	785	785	785	785
Point	30,614	30,527	17,911	13,635	17,318
Area	14,891	14,886	14,886	13,776	13,776
On-road	111,803	109,876	109,876	59,280	59,280
Non-road	28,811	28,515	28,515	20,408	20,408

2017 initial and boundary conditions were developed using the SESARM modeling results. EPD's 2017 CAMx modeling results were compared with SESARM 2017 modeling results (Figure 11) to evaluate the impacts of using the smaller EPD modeling domain. Small differences between the SESARM and EPD modeling results (r^2=1.00, slope =1.00, intercept=0.01) indicates that the impacts of using a smaller modeling domain is insignificant.

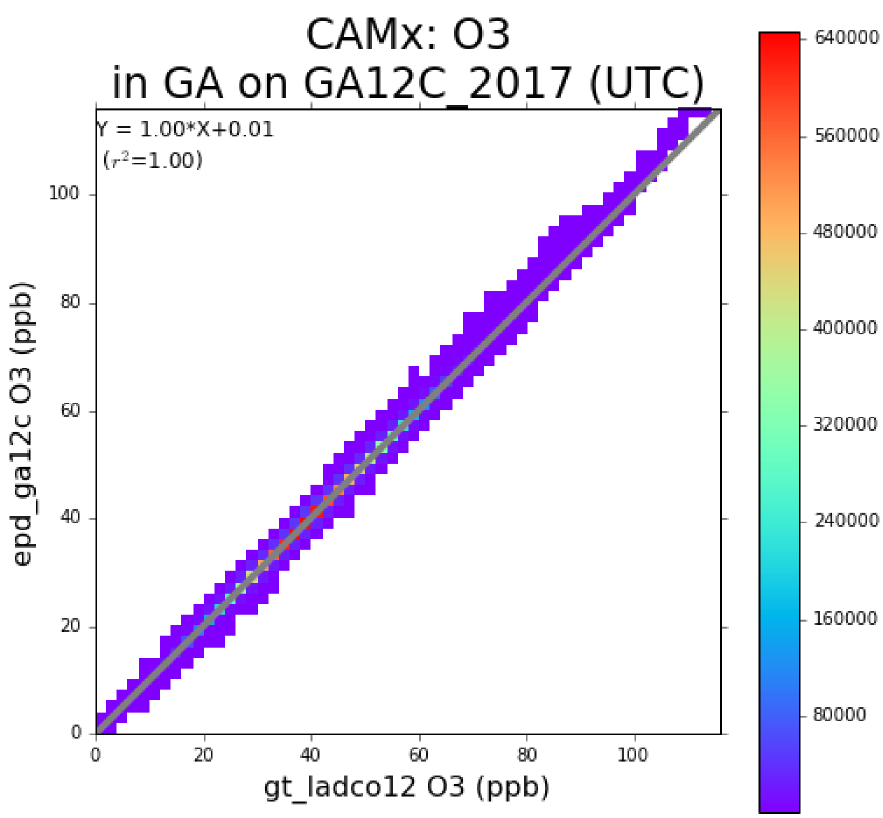


Figure 11. Comparison of 2017 CAMx modeling results between the SESARM and EPD modeling. The color scale indicates the number of data points.

2017 Future Design Values

EPD calculated the 2017 future design values by running the U.S. EPA's Modeled Attainment Test Software (MATS) version 2.6.1 following EPA's draft modeling guidance[7], except that EPD used the grid cell containing the monitor rather than the maximum in the 3x3 array. The 2017 ozone design values (DVF) were calculated by multiplying the 2011 5-year weighted ozone design value (DVC) by the relative response factor (RRF), where the RRF is the ratio of modeled 2011 MDA8O3 concentrations to modeled 2017 MDA8O3 concentrations at each modeling grid cell.

$$\mathrm{DVF} = \left(\frac{2017\ \mathrm{MDA8O3}}{2011\ \mathrm{MDA8O3}}\right) * \mathrm{DVC}$$

Appendix A contains the detailed MATS run configuration. Table 7 summarizes the projected 2017 ozone design values estimated with the EPD modeling platform.

Table 7. Projected 2017 ozone design values.

Area	AIRS_ID	DVF2017	COUNTY
Atlanta CSA	13-059-0002	58.3	Clarke
	13-067-0003	64.6	Cobb
	13-077-0002	52.9	Coweta
	13-085-0001	56.5	Dawson
	13-089-0002	65.4	DeKalb
	13-097-0004	61.9	Douglas
	13121-0055	69.9	Fulton
	13-135-0002	64.8	Gwinnett
	13-151-0002	67.0	Henry
	13-223-0003	60.8	Paulding
	13-231-9991	60.5	Pike
	13-247-0001	64.8	Rockdale
Outside Atlanta CSA	13-021-0012	59.8	Bibb
	13-055-0001	57.0	Chattooga
	13-073-0001	59.1	Columbia
	13-213-0003	60.2	Murray
	13-215-0008	56.4	Muscogee
	13-245-0091	60.6	Richmond
	13-261-1001	57.6	Sumter

[7] EPA, 2014. Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$, and Regional Haze.

3. Source Apportionment Modeling

Preparation of “Tagged” APCA Emissions Inputs

For 2017 APCA emission inputs, EPD conducted Sparse Matrix Object Kernel Emission (SMOKE, version 3.6.5) modeling to spatially and temporally allocate emissions into the EPD modeling grids, as well as speciate inventory pollutants to modeling species using the CB6r2 chemical mechanism (Figure 12). SMOKE was also run in source apportionment mode to tag anthropogenic emissions from each of the 39 counties in the Atlanta CSA as an individual source region; anthropogenic emissions from all other counties in the modeling domain were tagged as the “other” region, and emissions from biogenic sources, wildfires, and prescribed burning were tagged as the “biogenic” source group (Table 8). Biogenic and dust emissions were tagged as “1” and fire emissions were tagged as “42”.

Low level emissions (e.g. onroad, nonroad, area etc.) were processed in SMOKE from county level data and spatially allocated to grid cells that overlap the county using spatial surrogates from the NEI 2011eh v2 platform. The resulting emissions received a source apportionment tag that corresponds to the source county. In the case where one grid cell overlaps multiple counties, that particular grid cell would contain separately tagged emissions from each of the overlapped counties according to the amounts of the total county emissions allocated by the spatial surrogates. This step takes place during emissions processing and thus eliminates the need to separate each county’s emissions in a particular grid cell using area fractions within the air quality model which is less accurate.

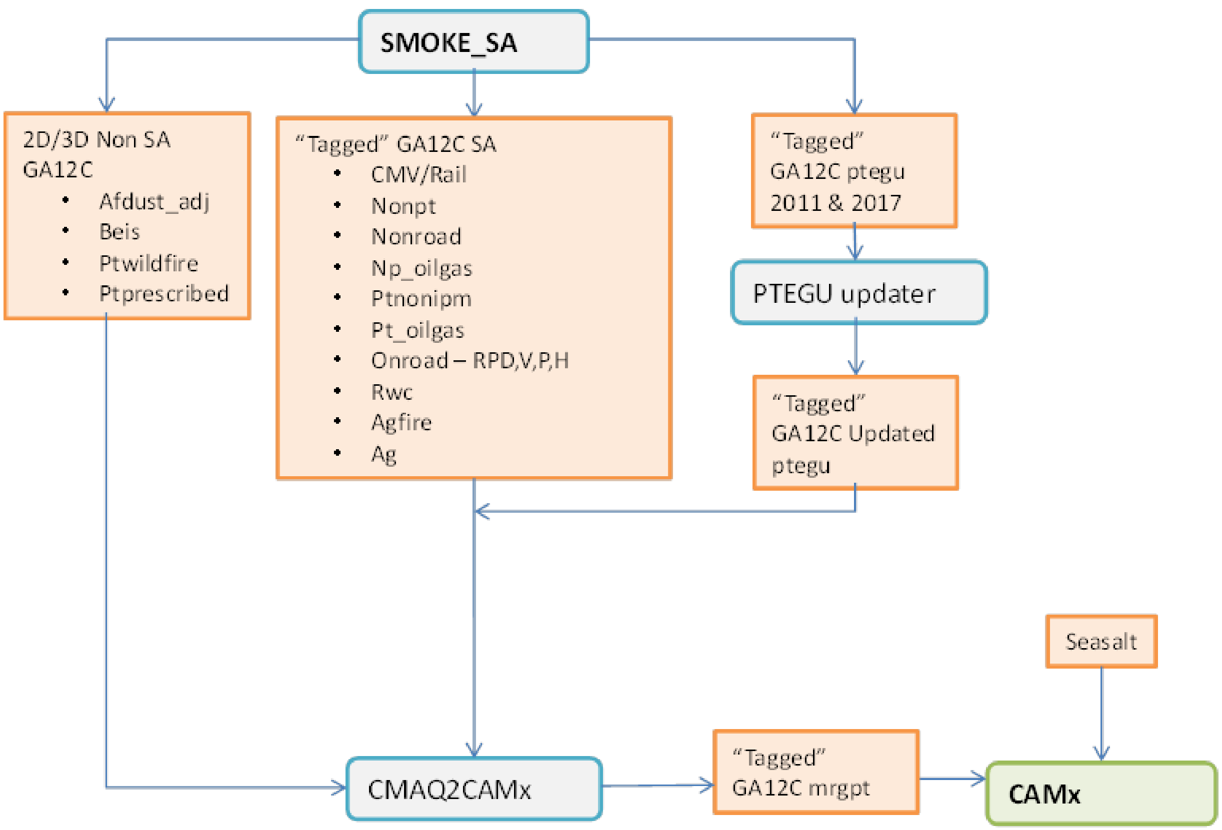


Figure 12. SMOKE processing procedures for CAMx-APCA modeling.

Table 8. County tag list for the CAMx-APCA modeling

Tag	County FIPS	County Name
2	"13059"	Clarke
3	"13195"	Madison
4	"13219"	Oconee
5	"13221"	Oglethorpe
6	"13013"	Barrow
7	"13015"	Bartow
8	"13035"	Butts
9	"13045"	Carroll
10	"13057"	Cherokee
11	"13063"	Clayton
12	"13067"	Cobb
13	"13077"	Coweta
14	"13085"	Dawson
15	"13089"	DeKalb
16	"13097"	Douglas
17	"13113"	Fayette
18	"13117"	Forsyth
19	"13121"	Fulton
20	"13135"	Gwinnett
21	"13143"	Haralson
22	"13149"	Heard
23	"13151"	Henry
24	"13159"	Jasper
25	"13171"	Lamar
26	"13199"	Meriwether
27	"13211"	Morgan
28	"13217"	Newton
29	"13223"	Paulding
30	"13227"	Pickens
31	"13231"	Pike
32	"13247"	Rockdale
33	"13255"	Spalding
34	"13297"	Walton
35	"13129"	Gordon
36	"13233"	Polk
37	"13139"	Hall
38	"13157"	Jackson
39	"13285"	Troup
40	"13293"	Upson
41	"0"	All Other Counties

Source Contribution Calculation

Source contributions of each county in the Atlanta CSA were calculated following similar procedures used in the Transport Rule Modeling.

1) Calculate the average "high" 2017 MDA8 value by averaging 2017 MDA8 ozone concentrations (MDA8H) for days showing 2017 MDA8 ozone concentrations greater or equal to 71 ppb[8] at each monitor. If the number of days with 2017 MDA8 ozone concentrations over 71 ppb is less than five at any monitor, the top five 2017 MDA8 ozone concentrations are selected by lowering the threshold to 60 ppb. If a monitor does not have five days above or equal 60 ppb, contributions were not calculated at the monitor;
2) Calculate the 2017 8-hour ozone source contribution of each county for the grid cells containing ozone monitors using CAMx-APCA outputs. Daily 2017 8-hour ozone source contribution of each county for the days and hours were extracted corresponding to the days and hours used to compute the average "high" 2017 MDA8 value;
3) Calculate the average 2017 8-hour ozone source contribution (AOC) of each county at a monitor;
4) Calculate final source contribution of a county at a monitor by multiplying its AOC and the ratio of the 2017 future design value at the monitor and MDA8H at the monitor: County Contribution = AOC x (2017 DVF/MDA8H).

4. Results and Conclusions

Contributions of 39 counties in the Atlanta CSA to the five violating ozone monitors are summarized in Table 9. A contribution threshold of 1.0 ppb (after rounding at the second decimal place) was used to determine which counties significantly contribute to the violating monitors. The 1.0 ppb threshold was chosen because it is EPA's recently proposed significant impact level for single source PSD modeling[9]. The following counties had more than a 1.0 ppb impact on at least one violating ozone monitor: Fulton, Gwinnett, DeKalb, Cobb, Bartow, Clayton, and Henry.

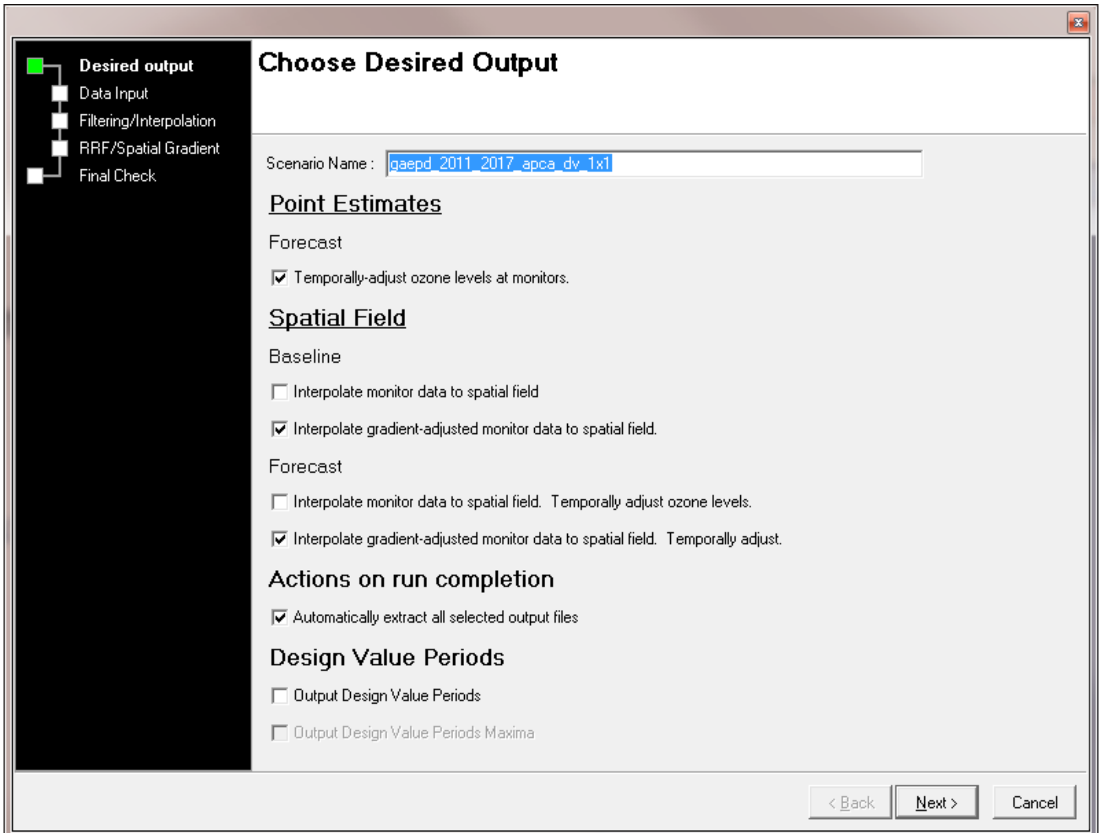
[8] GA EPD used 71 ppb as the threshold compared with 76 ppb for the EPA's Transport Rule Modeling because GA EPD's goal is to estimate contributions for the 2015 Ozone NAAQS, 70 ppb, while the EPA's modeling was for the 2008 Ozone NAAQS, 75 ppb.

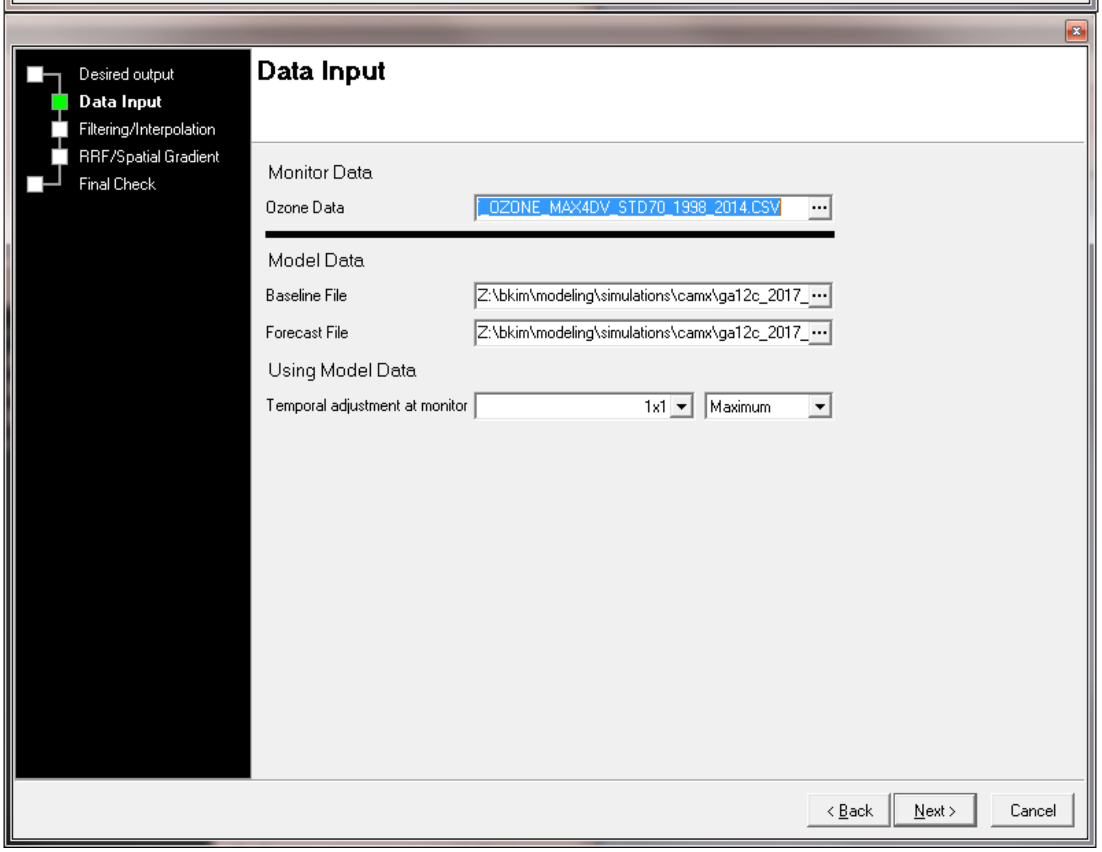
[9] EPA, 2016. Draft Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Permitting Program.

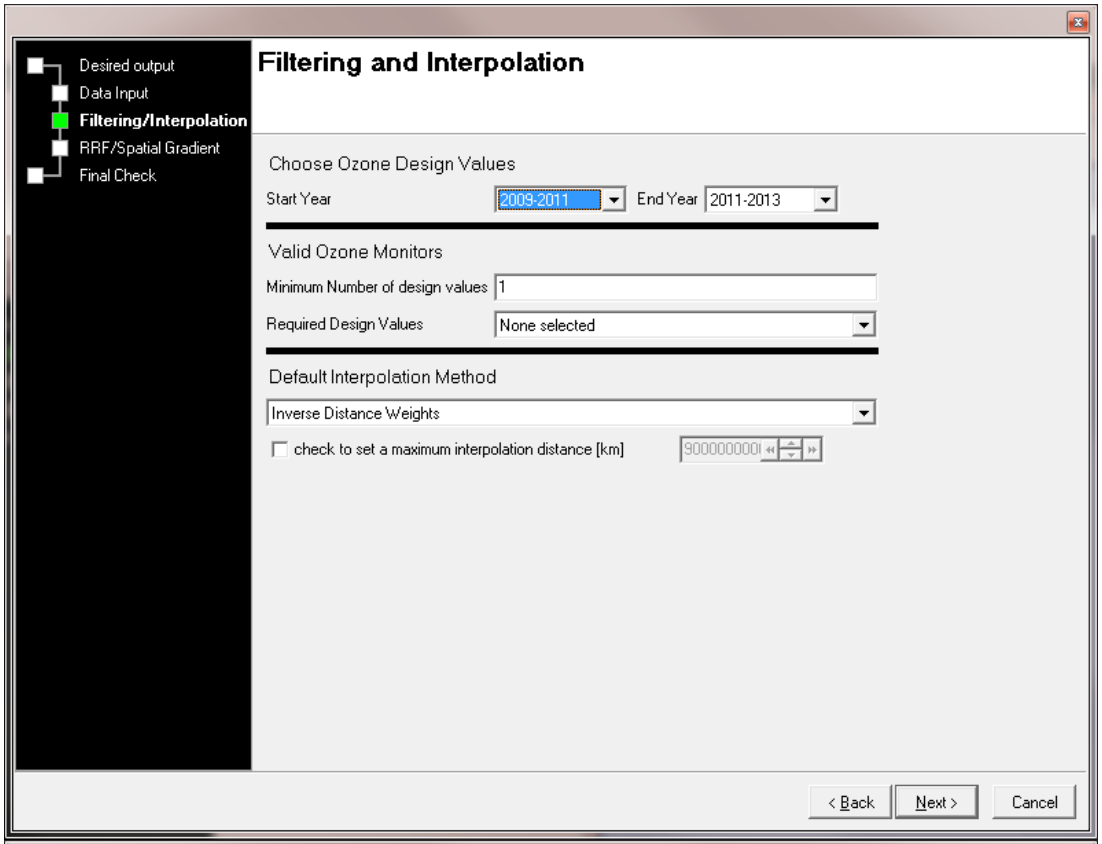
Table 9. Contributions of 39 counties in the Atlanta CSA to violating ozone monitors. Red values indicate more than 1.0 ppb contribution to a violating ozone monitor.

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

Appendix A. MATS Configuration for the 2017 design value projections.



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Filtering/Interpolation
RRF/Spatial Gradient
Final Check
Filtering and Interpolation
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Start Year
2009-2011
End Year
2011-2013
Valid Ozone Monitors
Minimum Number of design values
1
Required Design Values
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Default Interpolation Method
Inverse Distance Weights
check to set a maximum interpolation distance [km]
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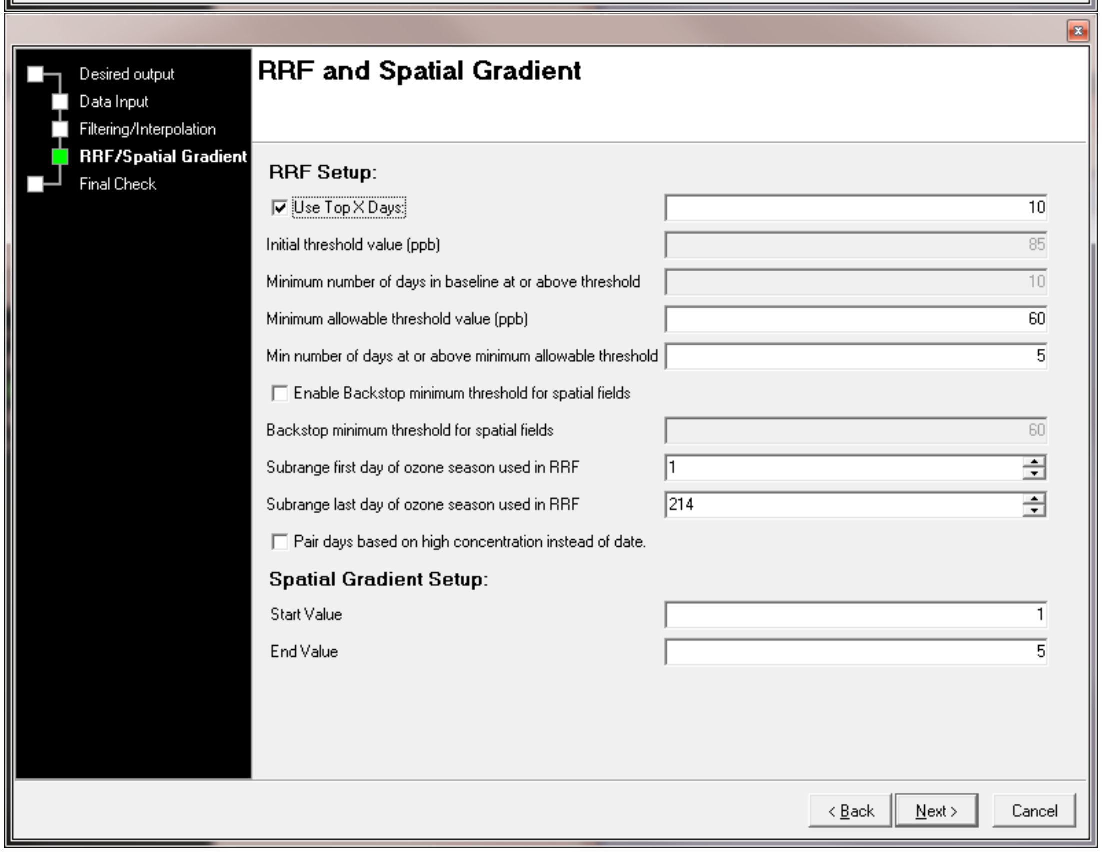
Next >
Cancel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Data Input
Filtering/Interpolation
RRF/Spatial Gradient
Final Check
RRF and Spatial Gradient
RRF Setup:
Use Top X Days:
10
Initial threshold value (ppb)
85
Minimum number of days in baseline at or above threshold
10
Minimum allowable threshold value (ppb)
60
Min number of days at or above minimum allowable threshold
5
Enable Backstop minimum threshold for spatial fields
Backstop minimum threshold for spatial fields
60
Subrange first day of ozone season used in RRF
1
Subrange last day of ozone season used in RRF
214
Pair days based on high concentration instead of date.
Spatial Gradient Setup:
Start Value
1
End Value
5
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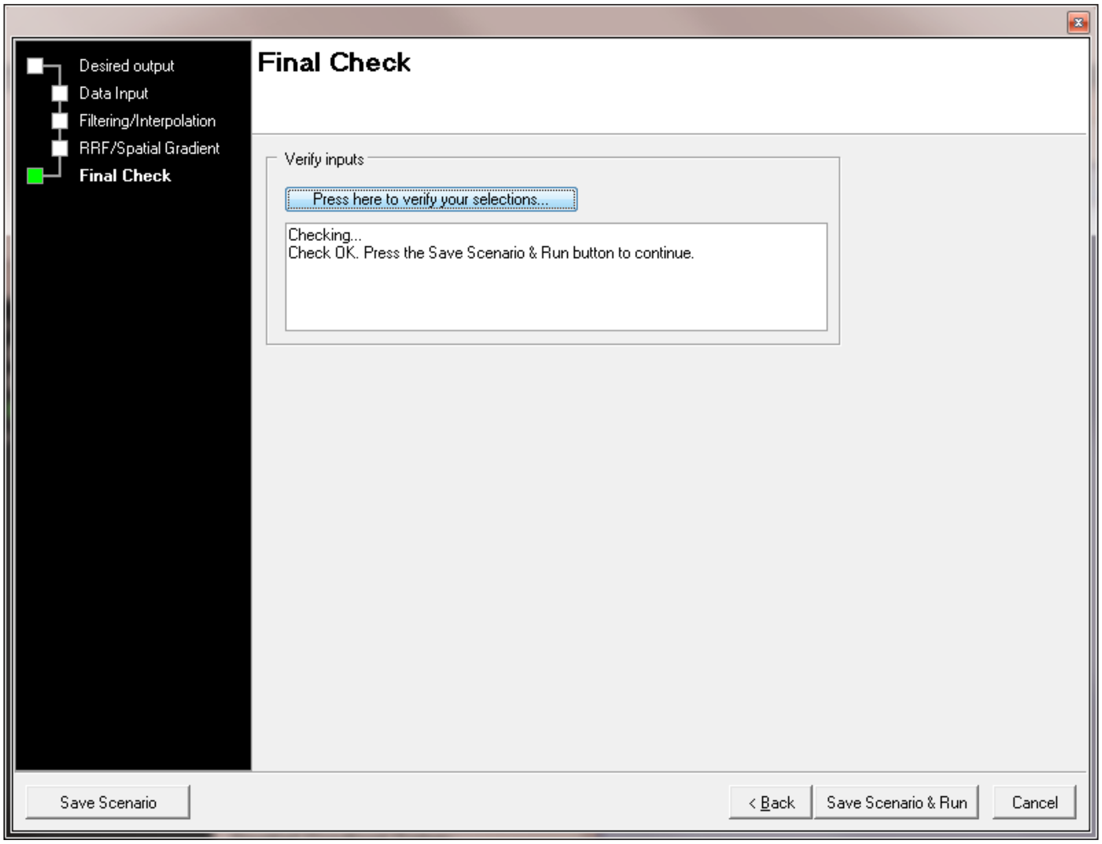
Next >
Cancel


Desired output
Data Input
Filtering/Interpolation
RRF/Spatial Gradient
Final Check
Final Check
Verify inputs
Press here to verify your selections...
Checking...
Check OK. Press the Save Scenario & Run button to continue.
Save Scenario
< Back
Save Scenario & Run
Cancel