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***TECHNICAL REPORT: EMISSIONS PROCESSING
FOR THE BIG BEND REGIONAL AEROSOL AND
VISIBILITY OBSERVATIONAL (BRAVO) STUDY***

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1 INTRODUCTION

The field study portion of the Big Bend Regional Aerosol and Visibility Observational (BRAVO) Study occurred during July through October 1999 in the region surrounding Big Bend National Park (BBNP) in Texas. The study involved speciated air quality monitoring at more than 30 sites in Texas as well as measurements of upper-air meteorology. Also, an artificial tracer was released from four different sites in Texas (Big Brown Power Plant, Parish Power Plant, Eagle Pass, and San Antonio) and monitored at many of the air quality sites. Air quality transport, chemical, and dispersion models are currently being applied to the region to assess the impacts of major sources on the visibility at BBNP. The field measurement data from the study will be used, in part, to validate the accuracy of the air quality models.

The BRAVO Study Emissions Inventory (BRAVO-EI) was used as input into the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system (MCNC, 2002). The BRAVO-EI, summarized in an earlier technical report (Kuhns et al., 2001), was compiled from existing emissions inventories in the United States, the Gulf of Mexico, and Mexico. The inventory was processed through the SMOKE modeling system to support two different air quality modeling systems:

- § SMOKE modeling supported Regional Modeling System for Aerosols and Deposition (REMSAD) (SAI, 2002) modeling for the entire United States and most of Mexico to simulate air quality for the period of July through October 1999.
- § SMOKE was also used to support Community Multiscale Air Quality (CMAQ) (U.S. EPA, 2002a) modeling applications over a more limited domain and for a few episodes, to investigate specific episodes of poor air quality at BBNP.

SMOKE version 1.4 beta was used for this effort. Some software bugs were found and corrected in this version during the project.

This report focuses on the tasks completed by the MCNC Environmental Modeling Center to generate the emissions input data for these air quality models. It documents the modeling domains, the input data used in the SMOKE modeling tasks, and a summary of the SMOKE processing and quality assurance tasks completed to support the BRAVO modeling effort. We also include visualizations and SMOKE reports to illustrate the final REMSAD/CMAQ-ready emissions generated by MCNC.

2 MODELING DOMAINS

The air quality modeling domains used in this effort included several different regional- and urban-scale domains. The CMAQ modeling effort used 12-km and 4-km horizontal resolution grids (Figure 1). The 4-km CMAQ grid includes southwestern Texas and portions of

northeastern Mexico. The 12-km CMAQ grid includes all of Texas and its surrounding states and most of northern Mexico.

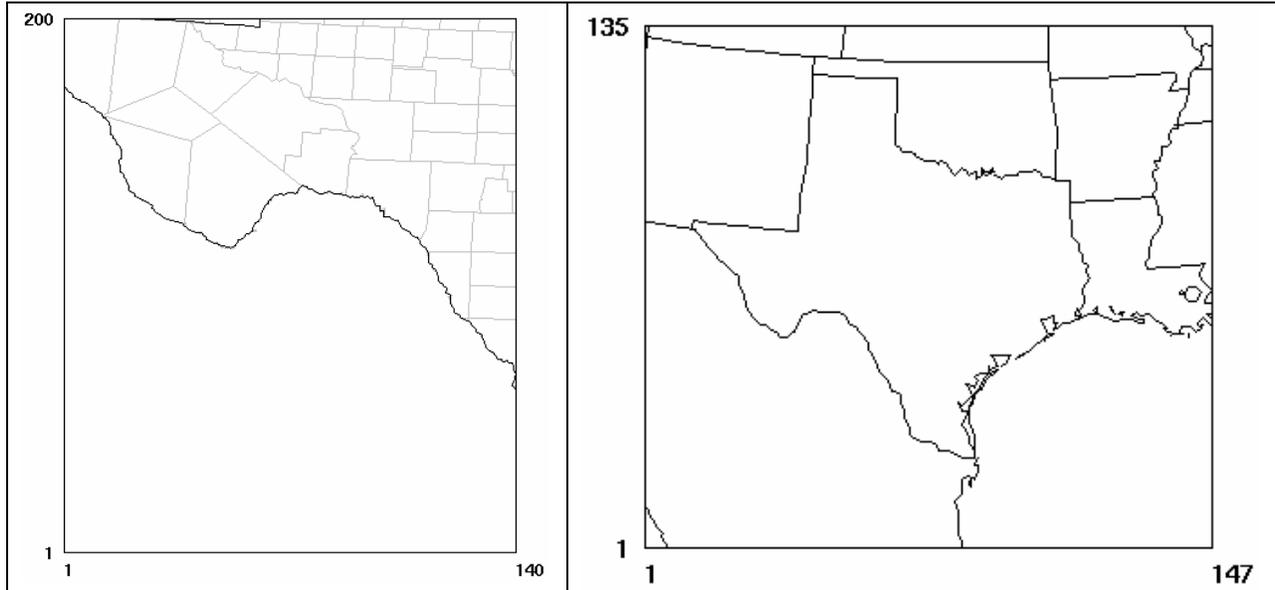


Figure 1. CMAQ 4-km (left) and 12-km (right) modeling domains.

The REMSAD modeling effort included a regional 36-km horizontal resolution grid that covered most of the continental United States and Mexico (Figure 2(a)). The REMSAD 4-km horizontal resolution grid (Figure 2(b)) covered approximately the same area as the CMAQ 4-km grid. The REMSAD 12-km grid (Figure 2(c)) covered the same area as the CMAQ 12-km grid plus a few other states and regions.

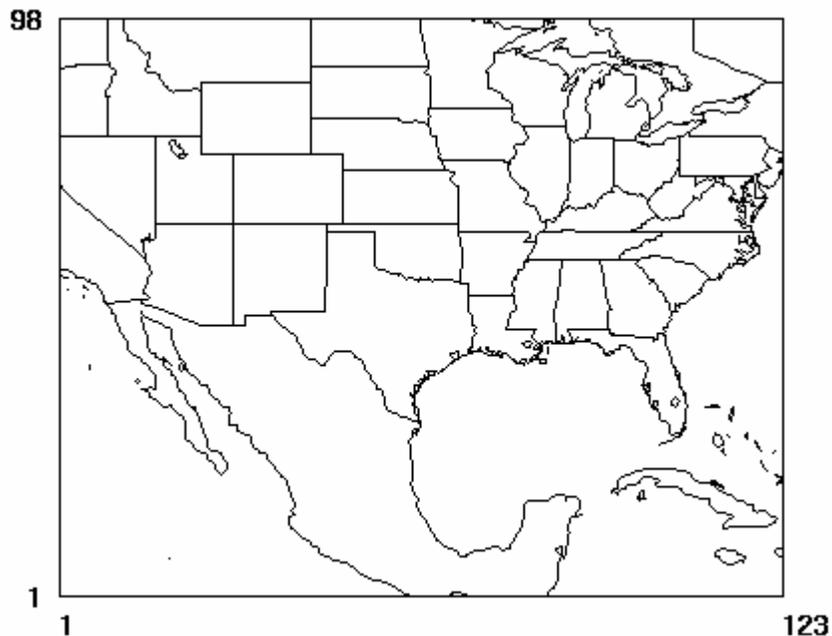
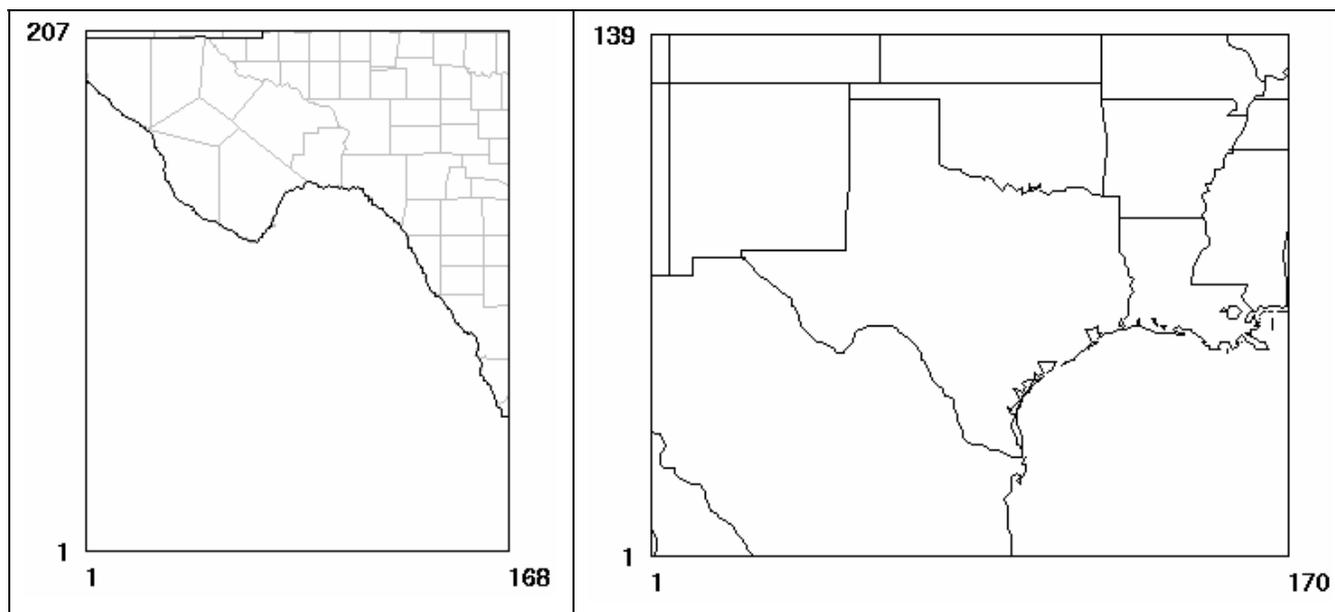


Figure 2(a). REMSAD 36-km modeling domain.



Figures 2(b) and 2(c). REMSAD 4-km (left) and 12-km (right) modeling domains.

3 SMOKE INPUT DATA

3.1 Anthropogenic Inventory Data

The Desert Research Institute (DRI) assembled and provided the point-, mobile- and area/nonroad-source inventory data to MCNC. The emissions inventory was assembled in the Inventory Data Analysis (IDA) format, which is compatible with the SMOKE modeling system. Emissions inventory data were aggregated from a wide variety of data providers in order to best estimate anthropogenic sources within the study domain. Based on their regional coverage, emissions data sources were divided into three groups: (1) United States, (2) Mexico, and (3) Offshore. DRI provided the point-, mobile- and area/nonroad-source inventories for 14 U.S. states and 10 northern Mexican states. Other detailed information about the generation of these inventory data was provided in a DRI technical report (Kuhns et al., 2001).

MCNC used the 1999 National Emissions Inventory (NEI) version 1 database (U.S. EPA, 2002c) to support the additional states included in the regional (36-km) REMSAD modeling domain. The Texas Commission on Environmental Quality (TCEQ, formerly TNRCC) provided updated offshore point- and area-source inventory data to MCNC, who converted them to IDA format. MCNC collaborated with DRI and TCEQ to ensure proper implementation of the inventory data within the SMOKE modeling framework.

3.2 Meteorological Data

The Penn State University/National Center for Atmospheric Research (PSU/NCAR) Mesoscale Modeling System (MM5) (Grell et al., 1994) was used by PSU to generate meteorological input data for the air quality and emissions modeling systems. The MM5 output data were sent to Atmospheric and Environmental Research, Inc. (AER), who processed the MM5 output using the Meteorology/Chemistry Interface Processor (MCIP) (Wheeler et al., 1998) and other meteorological preprocessors. AER then sent the postprocessed meteorological data to MCNC to support the domains shown in Section 2. The meteorological data were used for biogenic emissions processing as input into SMOKE-Biogenic Emissions Inventory System version 2 (BEIS2) (U.S. EPA, 1995b) to support both REMSAD and CMAQ applications. The meteorological data were also used for plume rise calculation and vertical allocation of point-source emissions in SMOKE to support CMAQ applications.

3.3 Other Data

MCNC provided the additional SMOKE input files to support the BRAVO modeling effort: spatial surrogate data and gridded land use data. The surrogate data were created by MCNC for all modeling domains shown in Section 2. The surrogates were generated using the MIMS Spatial Allocation Tool (Fine et al., 2002; U.S. EPA, 2002b) designed by MCNC. The tool calculates the surrogates by using shapefiles and grid information to overlay the desired grids on the geographic data layers. The shapefiles were obtained from multiple sources, including the U.S. Census Bureau, Environmental Systems Research Institute (ESRI), and the Center for International Earth Science Information Network - Socioeconomic Data and Applications Center. The following surrogate data types were available for this modeling effort:

- | | |
|-------------------|---------------------------|
| 1. Agriculture | 10. Rural Area |
| 2. Airports | 11. Urban Area |
| 3. Land Area | 12. Forest Area |
| 4. Housing | 13. Urban Primary Roads |
| 5. Major Highways | 14. Rural Primary Roads |
| 6. Population | 15. Urban Secondary Roads |
| 7. Ports | 16. Rural Secondary Roads |
| 8. Railroads | 17. Urban Population |
| 9. Water Area | 18. Rural Population |

The land use data were generated using the Biogenic Emissions Landcover Database version 3 (BELD3) (Pierce et al., 1998). The BELD3 consists of 1-km horizontal resolution for 230 different land use types. The previous version, BELD2, was used in most BEIS2 applications and consisted primarily of county-level land use based on 156 different land use types. BELD3 combines the spatial resolution available from the U.S. Geological Survey (USGS) 1-km data with the detailed tree and crop species information available in county-level forest and agricultural datasets. MCNC aggregated and interpolated the BELD3 data to the desired modeling domain and resolution and the land use data input into SMOKE-BEIS2.

4 EMISSIONS PROCESSING AND RESULTS

4.1 Point Sources

The point-source inventory was processed through the SMOKE modeling system in three separate pieces: United States sources, Mexican sources, and offshore sources. The U.S. inventory included the inventory data provided by DRI plus 1999 NEI data obtained from EPA. The Mexican inventory included 10 states (Table 1). The offshore point-source inventory included sources mainly in the western Gulf of Mexico and was supplied by TCEQ. The offshore sources are included in every modeling domain except the 4-km horizontal resolution domains. MCNC had to reformat the offshore data to conform to the SMOKE IDA format.

Table 1. List of States in BRAVO Northern Mexico Emission Inventory Database

State	MX State ID
Baja California Norte	2
Chihuahua	8
Coahuila De Zaragoza	5
Durango	10
Nuevo Leon	19
San Luis Potosi	24
Sinaloa	25
Sonora	26
Tamaulipas	28
Zacatecas	32

MCNC used the following quality assurance steps during the processing of these point-source datasets:

- Compared inventory totals (from DRI, EPA, and TCEQ) vs. emissions totals after import into SMOKE
- Compared emissions totals after import into SMOKE vs. emissions totals after application of a grid (e.g., CMAQ 4-km)
- Compared emissions totals after import into SMOKE vs. emissions totals after application of speciation profiles
- Compared emissions totals after import into SMOKE vs. emissions totals after application of temporal profiles
- Compared emissions totals after import into SMOKE vs. emissions totals for weekday, Saturday, and Sunday for each month

- Checked all SMOKE logfiles for correct use of all settings, warnings and errors listed, and other messages
- Checked to make sure cutoff stack height of 30 m was implemented correctly to support REMSAD
- Checked location of major sources to make sure that all sources were at least within the county boundaries designated by the inventory record (e.g., FIPS = 37119: Mecklenburg Co., NC)
- Used the Package for Analysis and Visualization of Environmental data (PAVE) (MCNC, 2001) to check for the reasonableness of the spatial, diurnal, and seasonal variation of emissions throughout the modeling periods and to ensure that holidays were treated as Sundays (Sunday temporal profiles were used for all holidays)

4.1.1 Supporting CMAQ tasks

To support CMAQ modeling efforts, MCNC used speciation profiles and cross-reference data to create emissions to support the Regional Acid Deposition Model version 2 (RADM2) with Particulate Matter (PM) (U.S. EPA, 2000) chemistry mechanism within the CMAQ model. The following RADM2 emitting species were generated by SMOKE for this purpose:

SMOKE- RADM2 Species	Description	SMOKE- RADM2 Species	Description
NO	Nitrogen oxide	ALD	Acetaldehyde
NO2	Nitrogen dioxide	ISO	Isoprene
CO	Carbon monoxide	TOL	Toluene
SO2	Sulfur dioxide	XYL	Xylene
SULF	Sulfuric acid	ETH	Ethane
NH3	Ammonia	HC3	Slow-reacting alkanes
PMFINE	Other fine particulates	HC5	Medium-reacting alkanes
PMCOARS	Particulates <10 µm	HC8	Fast-reacting alkanes
PSO4	Particulate sulfate	OLT	Terminal alkenes
PNO3	Particulate nitrate	OLI	Internal alkenes
POA	Other aerosols	CSL	Cresol
PEC	Elemental carbon	KET	Ketones
OL2	Ethene	ORA2	Acetic acid
HCHO	Formaldehyde		

The MCIP data acquired from AER were used in the SMOKE program called *laypoint* to calculate the plume rise of each point source and allocate them vertically for each hour of each episode. We executed *laypoint* for all U.S., Mexican, and offshore sources to support the CMAQ modeling effort. The gridded state totals for all CMAQ grids for U.S., Mexican, and offshore sources are given in Appendix A.

4.1.2 Supporting REMSAD tasks

To support REMSAD modeling efforts, MCNC used speciation profiles and cross-reference data to create emissions to support the micro-Carbon Bond IV (CB-IV) with PM chemistry mechanism within REMSAD (SAI, 2002). The following CB-IV with PM emitting species were generated by SMOKE for this purpose:

SMOKE-CB-IV with PM Species	Description	SMOKE-CB-IV with PM Species	Description
NO	Nitrogen oxide	PNO3	Particulate nitrate
NO2	Nitrogen dioxide	POA	Primary organic aerosols
CO.....	Carbon monoxide	PEC	Primary elemental carbon
SO2	Sulfur dioxide	GSO4	Gaseous pathway sulfate particles
NH3	Ammonia	VOC	Volatile organic compounds
PMFINE.....	Other fine particulates	ISOP	Isoprene
PMCOARS	Coarse particulates		

No meteorological data were used in SMOKE to compute plume rise before the REMSAD simulations. However, a stack height cutoff of 30 m was used to differentiate between elevated and low-level point sources. Two emissions files are input into REMSAD: an elevated-point-source file and a file that contains all low-level emissions sources (low-point, area, nonroad, mobile, and biogenic). REMSAD performs a plume rise calculation on the elevated sources only during model execution. All sources that have a stack height ≥ 30 m were written to the SMOKE elevated-point-source file, while all other sources were written to the SMOKE low-level point source file. The elevated-point-source file output from SMOKE required additional processing before input into REMSAD. We used the Emissions Preprocessor System version 2 (EPS2) (U.S. EPA, 1995a) program called *ptsrce* to convert the elevated-point-source file output by SMOKE into REMSAD-ready format. Appendix A contains the gridded state totals for all REMSAD grids for U.S., Mexican, and offshore sources.

4.2 Area/Nonroad and On-road Mobile Sources

As with the point-source data, we processed the area, nonroad, and on-road mobile-source inventories through the SMOKE modeling system in three separate pieces: United States sources, Mexican sources, and offshore sources. The U.S. inventory included the inventory data provided by DRI plus 1999 NEI data obtained from EPA. The Mexican inventory included the 10 states shown in Table 1. The offshore nonroad-source inventory included sources mainly in the western Gulf of Mexico and was supplied by TCEQ.

The surrogate data created by MCNC for each modeling domain were applied to each of these inventories to spatially allocate the emissions. Cross-reference files were used to allocate emissions by source category to the 18 surrogate types listed in Section 3.3. No meteorological data were used in processing these inventory data (thus neither MOBILE5 nor MOBILE6 was

used). MCNC used these quality assurance steps during the processing of these inventory datasets:

- Compared inventory totals (from DRI, EPA, and TCEQ) vs. emissions totals after import into SMOKE
- Compared emissions totals after import into SMOKE vs. emissions totals after application of a grid (e.g., CMAQ 4-km)
- Compared emissions totals after import into SMOKE vs. emissions totals after application of speciation profiles
- Compared emissions totals after import into SMOKE vs. emissions totals after application of temporal profiles
- Compared emissions totals after import into SMOKE vs. emissions totals for weekday, Saturday, and Sunday for each month
- Checked all SMOKE logfiles for correct use of all settings, warnings and errors listed, and other messages
- Used PAVE to check the spatial, diurnal, and seasonal variation of emissions throughout the modeling periods and to ensure that holidays were treated as Sundays (Sunday temporal profiles were used for all holidays)

Appendix A contains the gridded state totals for U.S., Mexican, and offshore sources for each REMSAD and CMAQ grid.

4.3 Biogenic Sources

The biogenic emissions sources that were estimated to support the BRAVO modeling effort were emissions from vegetation, soils, and large bodies of salt water (e.g., the Gulf of Mexico). SMOKE-BEIS2 was used to approximate emissions from vegetation and soils. The sea-salt emissions were estimated by converting a box model acquired from AER (Zhang, 2001) into a three-dimensional model.

4.3.1 BEIS2

The land use data generated for each modeling domain and briefly described in Section 3.3 were used as input into SMOKE-BEIS2. There are two major steps to the SMOKE-BEIS2 modeling system. The first program, *rawbio*, used the land use data and BEIS2 emissions factors (U.S. EPA, 1995b) to generate normalized emissions. The emissions factors are the flux rate that each species emits under standard environmental conditions (i.e., 30°C and 1000 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PAR for isoprene, and 30°C for monoterpenes, other VOCs, and NO). BEIS2 has both a summer and a winter table of emissions factors. Only the summer emissions factors were used for the BRAVO modeling effort.

The second program, *tmpbio*, environmentally corrected the normalized emissions based on the meteorological data supplied by AER. The basic equation used for computing biogenic emissions is as follows:

$$E = \sum (F_i \times A_i \times M) \quad (1)$$

where E is the emission rate [g/h] for each grid cell, F is a standardized emission flux [$\mu\text{g}/\text{m}^2\text{-h}$] for each land use type i , A is the area [m^2] of each land use type i in a grid cell, and M is the environmental correction factor. The meteorological variables used were temperature at 10 m (variable name in AER datafile is TEMP10) and solar radiation reaching the ground (RGRND). Biogenic VOC and NO emissions in the model respond to changes in temperature. Isoprene emissions also respond to the amount of solar radiation that reaches the vegetation and are negligible when sunlight is not present. Other documentation outlines the algorithms used to apply the environmental corrections (Williams et al., 1992; Geron et al., 1994). Speciation profiles are used to allocate other VOC and monoterpene emissions to species recognized by the chemistry mechanism in the desired air quality model. SMOKE-BEIS2 outputs only NO and ISOP emissions to support REMSAD applications; to support CMAQ applications, it outputs NO, ISO, OLI, and HC3 emissions. The output from *tmpbio* is gridded, speciated, and temporally allocated emissions in gram-moles per hour. SMOKE also has a conversion program called *smk2emis* that was used to convert the netCDF BEIS2 output files into the binary format recognized by REMSAD.

MCNC used the following quality assurance steps during the processing of these inventory datasets:

- Reviewed normalized emissions totals generated by *rawbio* and spot-checked the spatial correlation with relevant land use types for all domains
- Compared emissions totals generated by *tmpbio* vs. *rawbio* emissions totals
- Checked all SMOKE logfiles for correct use of all settings, warnings and errors listed, and other messages
- Used PAVE to check the reasonableness of the spatial, diurnal, and overall seasonal variation of emissions throughout the modeling periods

4.3.2 Sea-salt emissions

Sea-salt particles are directly produced by spume drops resulting from the mechanical disruption of wave crests by the wind, and indirectly produced by the bursting of air bubbles resulting from the entrainment of air induced by wind stress. While spume drop formation contributes significantly to large spray droplets ($>10 \mu\text{m}$ in radius), other drops produced from bubbles contribute to sea-salt particles with radii $<10 \mu\text{m}$. Sea-salt particles provide a significant source of Na^+ , Cl^- , and sea-salt sulfate (s.s. SO_4^{2-}). The production rate of sea-salt particles through both direct and indirect mechanisms has been studied by a number of researchers (Monahan et al., 1986; Smith et al., 1993; Gong et al., 1997). These studies show that the production rate of sea-salt particles is strongly dependent on meteorological conditions, especially on surface wind speed.

To support the CMAQ modeling effort, MCNC acquired a one-dimensional sea salt module from AER and converted it into a three-dimensional module. The 1-D module calculates the surface fluxes of sea-salt particle and sea-salt species (i.e. Na^+ , Cl^- , and s.s. SO_4^{2-}) as a

function of meteorological conditions (i.e. wind speeds, temperature, and relative humidity). The surface flux of sea-salt particles is calculated based on Gong et al. (1997), which was taken from Monahan et al. (1986). MCNC converted the 1-D module from FORTRAN 77 to FORTRAN 90 and implemented the Input/Output Applications Programming Interface (I/O API) (Coats, 1999) to read in the 3-D meteorological fields supplied by AER. Other software changes included reading in the necessary meteorological data and calculating other needed variables (e.g., relative humidity). An additional input file had to be created that indicates which grid cells contain salt water and how much of each of those grid cells is over salt water (e.g., 50% salt-water). It was assumed that there were no grid cells in the 4-km CMAQ grid that contained salt water. The 12-km CMAQ grid did include many grid cells that contained salt water in the southeastern part of the domain (Gulf of Mexico). There were also a few grid cells in the southwestern corner (Pacific Ocean) that contained salt water. Figure 3 illustrates the salt-water file for the CMAQ 12-km domain. The output data from the 3-D sea-salt module are emissions for six species, including fine and coarse Na^+ , Cl^- , s.s. SO_4^{2-} in grams per second.

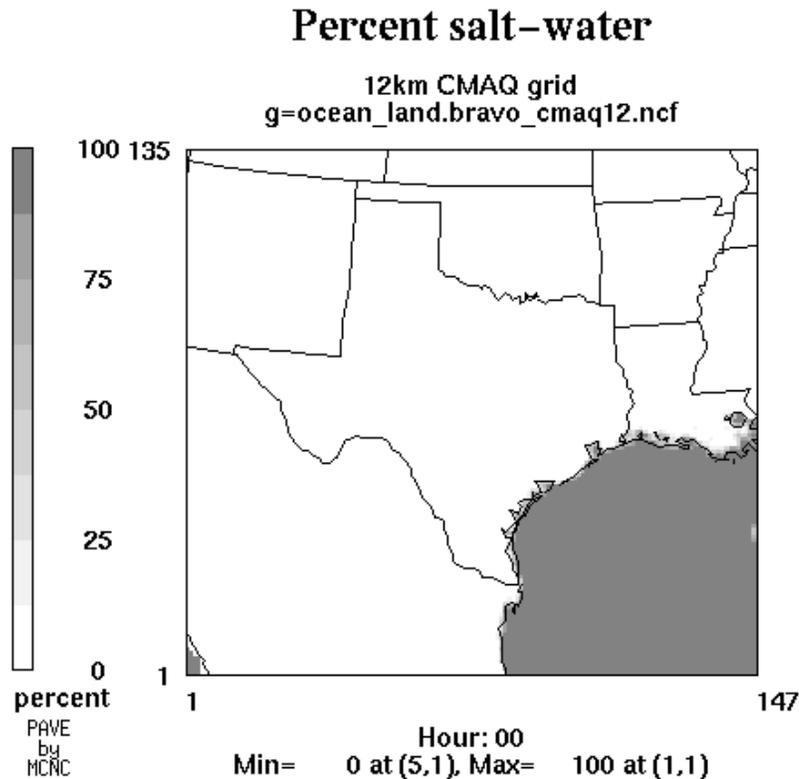


Figure 3. The percent salt water for each grid cell for the CMAQ 12-km horizontal resolution domain.

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APPENDIX A: CMAQ EMISSIONS TOTALS

Table A1. Area/non-road source state emissions totals for the CMAQ 12km grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]
Arkansas	1314.5	270.0	407.6	403.0	72.9	281.9	890.6
Colorado	126.1	31.6	39.2	56.0	3.7	36.8	133.0
Illinois	55.5	29.5	27.4	14.8	9.6	23.0	82.6
Kansas	435.6	245.4	168.6	322.8	27.0	182.8	699.7
Kentucky	39.2	22.2	15.1	13.5	5.7	9.8	28.0
Louisiana	1651.1	920.4	503.7	181.3	332.9	281.9	519.5
Mississippi	1154.3	199.4	317.9	153.2	119.1	220.6	581.0
Missouri	569.9	92.1	183.0	258.9	33.0	220.7	924.2
New Mexico	837.1	132.7	192.7	130.2	28.2	393.3	1788.8
Oklahoma	994.2	269.3	343.1	564.1	41.2	398.8	1719.4
Tennessee	490.5	350.2	186.7	27.3	38.2	68.1	162.4
Texas	6055.0	1300.3	1929.6	1354.4	187.3	1429.7	5802.4
Gulf of Mexico	70.3	276.1	34.6	0.0	0.0	0.0	0.0
Total	13793.3	4139.2	4349.2	3479.5	898.8	3547.4	13331.6

Table A2. Area/non-road and on-road mobile source Mexican state emissions totals for the CMAQ 12km grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]
Coahuila	1330.9	83.5	286.8	33.4	48.1	43.6	104.7
Chihuahua	1226.8	68.0	239.0	79.7	32.4	53.7	96.2
Durango	908.1	48.8	197.3	71.8	30.4	44.1	71.9
Nuevo Leon	3248.9	189.6	459.2	44.2	104.8	172.0	227.8
San Luis Potosi	99.5	5.3	22.2	8.3	3.6	4.9	7.8
Sinaloa	789.2	40.6	176.3	78.2	27.6	42.5	61.9
Tamaulipas	1547.1	83.9	271.3	95.2	31.3	65.4	121.4
Zacatecas	469.1	21.1	98.0	66.3	13.1	30.9	36.7
Total	9619.6	540.8	1750.1	477.1	291.3	457.1	728.4

Table A3. Area/non-road source state emissions totals for the CMAQ 4km grid (Mexican states include mobile emissions).

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
New Mexico	155.9	20.9	23.4	10.9	3.1	37.3	123.5
Texas	246.4	62.8	196.7	124.0	15.6	90.2	396.2
U.S. Total	402.3	83.7	220.1	134.9	18.7	127.5	519.7
Coahuila	1334.3	83.7	287.9	33.8	48.3	43.8	105.0
Chihuahua	103.2	5.4	19.7	8.2	2.5	4.9	8.1
Durango	345.4	19.3	78.9	23.3	12.9	15.9	27.7
Nuevo Leon	3195.8	187.8	446.7	32.0	103.1	167.1	223.6
San Luis Potosi	1.6	0.1	0.8	0.5	0.2	0.2	0.1
Tamaulipas	367.2	22.0	61.7	4.8	7.5	10.3	28.9
Zacatecas	77.9	4.5	16.7	5.4	2.7	2.9	6.1
MX Total	5425.4	490.2	1352.6	377.8	214.6	500.1	1438.9

Table A4. Mobile source state emissions totals for the CMAQ 12km grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
Arkansas	1724.5	296.2	194	7.6	11.3	7.8	2.1
Colorado	278.2	42.1	25.7	1	1.6	1.1	0.3
Illinois	157	31.2	16.9	0.7	1.1	0.8	0.2
Kansas	657.8	103.9	66.9	2.8	4	2.7	0.7
Kentucky	90.9	14.7	9.5	0.4	0.6	0.4	0.1
Louisiana	2690	430.2	297.6	10.9	16	11.5	3
Mississippi	1495.2	253.2	170.7	6.5	9.8	6.9	1.8
Missouri	793.2	181.1	93.1	5	7.6	4.6	1.3
New Mexico	1543.5	229.3	151.3	5.9	8.7	6	1.6
Oklahoma	2702.6	418.3	289.7	11.4	16.4	10.9	3
Tennessee	935.9	133.6	98.7	4	5.5	3.4	1
Texas	11627.1	2142.3	1297.5	59.3	84.2	58	16.2
Total	24695.9	4276.1	2711.6	115.5	166.8	114.1	31.3

Table A5. Mobile source state emissions totals for the CMAQ 4km grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
New Mexico	86.3	10.5	8.5	0.3	0.4	0.3	0.1
Texas	843.2	157.4	84.3	3	5.4	4.7	1.1
Total	929.5	167.9	92.8	3.3	5.8	5	1.2

Table A6. Point source state emissions totals for the CMAQ 12km grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]
Arkansas	173.2	137.9	74.3	3.2	148.3	24.4	12.8
Colorado	7.4	14.7	4.7	0.0	0.1	1.7	1.3
Illinois	5.6	55.2	9.1	0.0	159.1	3.9	4.0
Kansas	184.6	198.2	34.3	2.7	27.7	16.2	4.9
Kentucky	22.5	2.8	2.8	0.0	2.8	0.6	0.1
Louisiana	1409.0	350.8	160.4	28.4	570.0	51.5	18.3
Mississippi	70.0	159.8	56.2	74.3	23.6	7.4	4.1
Missouri	253.8	35.6	93.6	29.1	214.2	33.1	53.3
New Mexico	125.7	300.7	50.1	0.2	172.2	8.1	4.1
Oklahoma	605.6	413.6	122.7	49.0	191.3	18.0	10.8
Tennessee	9.9	57.3	44.4	0.1	5.9	0.9	0.4
Texas	1102.3	1463.7	671.4	3.5	872.1	74.3	31.9
Utah	1.6	1.5	0.1	0.0	3.8	0.0	0.0
Gulf of Mexico	46.3	199.2	540.7	0	0.4	3.4	0.3
Total	4017.5	3391.0	1864.8	190.5	2391.5	243.5	146.3

Table A7. Point source Mexican state emissions totals for the CMAQ 12km grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]
Coahuila	12.9	218.5	0.0	0.0	715.0	22.1	36.7
Chihuahua	6.3	32.9	0.4	0.0	102.1	3.9	1.3
Durango	2.7	15.3	0.2	0.0	60.2	2.3	0.8
Nuevo Leon	4.3	22.9	0.3	0.0	127.9	2.9	1.0
Sinaloa	1.1	8.5	0.1	0.0	49.5	1.8	0.7
Tamaulipas	2.7	20.1	0.3	0.0	129.1	4.2	1.6
Total	30.0	318.2	1.3	0.0	1183.8	37.2	42.1

Table A8. Point source state emissions totals for the CMAQ 4km grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]
New Mexico	1.0	1.2	0.4	0.0	0.0	0.0	0.0
Texas	57.7	167.9	76.9	0.2	77.0	1.6	0.4
US Total	58.7	169.1	77.3	0.2	77.0	1.6	0.4
Coahuila	12.9	218.5	0.0	0.0	715.0	22.1	36.7
Durango	2.7	15.3	0.2	0.0	60.2	2.3	0.8
Nuevo Leon	2.7	10.8	0.1	0.0	57.9	0.4	0.1
MX Total	18.3	244.6	0.3	0.0	833.1	24.8	37.6

APPENDIX B: REMSAD EMISSIONS TOTALS

Table B1. Area/non-road source emissions for the 36km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
Alabama	2795.9	413	567.6	222.4	154.5	394.5	899.3
Arizona	3688	450.2	507.4	82.5	46.9	364.9	537.7
Arkansas	1313	269.7	407	402.7	72.8	281.6	889.9
California	5609.6	1207.1	927.5	227.8	94.9	431.4	1014.3
Colorado	1603.2	433.1	442.2	301.6	49.2	255.6	830
Delaware	227.7	62.8	61	27.5	32.8	23.4	47.3
District of Columbia	70.3	26	33.5	2.8	17.5	6.4	12.7
Florida	7140.9	791	1531.2	197.9	231.5	543.7	885.3
Georgia	5433.2	510.9	862.8	233.4	75.5	713.8	1524.8
Idaho	1987.4	178.7	270.6	196.7	35.2	328.7	886.4
Illinois	2975	1014	1048.3	339.2	181.6	505.2	1737.2
Indiana	2082.3	550.4	759.6	251.2	72.3	350.8	1184.8
Iowa	946	366.7	418.1	815.9	82.4	313.7	1185
Kansas	1084.7	574.6	393	612.6	64.1	434.5	1652.6
Kentucky	1277.2	486.3	453.1	247	219	209.2	513.6
Louisiana	1651.1	920.4	503.7	181.3	332.9	281.9	519.5
Maryland	1497	211.7	284.2	63	52.5	112.8	249.5
Michigan	3998.6	655.4	1443	163.2	147.3	352.6	995.7
Minnesota	1777.2	372.3	680	522.2	65.4	433	1699.5
Mississippi	1841.4	318.6	494.7	187.4	221.1	313.2	768.6
Missouri	1835.3	328.1	507.7	535.7	128.4	523.4	2110.1
Montana	1207.1	219.3	207.6	233.4	21.3	243.3	722.4
Nebraska	730.6	326.8	270.1	669.6	65.3	298.4	1222.3
Nevada	706.5	165.8	163.6	41.5	30	115.9	352.9
New Jersey	1963.4	527.2	550.6	22.2	323.6	131.2	226.9
New Mexico	836.8	132.6	192.6	130.2	28.2	393.1	1788
New York	1748.6	280.7	584.7	122.3	182.3	211	548.1
North Carolina	4477.3	408.3	1145.1	505.3	141	370.7	601.2
North Dakota	403.7	240.9	199.8	208.2	171.5	201.9	763.2
Ohio	3440.3	740.8	1072.7	265.9	257.9	404.3	1079
Oklahoma	992.9	268.9	342.5	563.9	41.1	398.2	1716.7
Oregon	467.8	40.2	53.1	85.2	7.5	72.3	125.7
Pennsylvania	3346	707.6	1023.1	224.7	302.5	322.4	757.4
South Carolina	2064.4	215.5	535	77.6	65.2	244.6	549.5
South Dakota	391.2	150.1	150.9	367.2	73.4	183.8	702.7
Tennessee	2086	633.4	759.2	212	186.8	260.8	517.1
Texas	6051.1	1299.7	1928.4	1354.1	187.2	1428.5	5797.5
Utah	941.1	182.4	246.4	92.7	45.5	150.7	447
Virginia	3436.8	467.6	844	181.5	82.8	274.6	645.6
Washington	491	80.5	122	80	11.7	84.3	226.6
West Virginia	631.1	236.7	214	46.3	143.6	104.9	232.3
Wisconsin	2105.7	418.3	766.5	314.9	152	266.5	698.5
Wyoming	301.4	270	80.4	146	50	174.8	851.7
Gulf of Mexico	78.8	303.4	38.8	0	0	0	0
Total	89734.6	18457.7	24087.3	11758.7	4948.2	13510.5	40716.1

Table B2. Mexican area/non-road and mobile emissions state totals for the 36km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
Baja Calif Norte	2340.6	189	508.5	36.5	119.3	112.7	302.4
Chihuahua	1352.2	84.6	293	35.8	49.3	44.8	106.4
Coahuila	3219.2	179.9	579.7	116.7	53.2	99.2	202.4
Durango	919.1	49.2	199.5	73.4	30.7	44.8	72.8
Nuevo Leon	4094.2	227.5	589.7	46.8	113.8	191.1	277.4
San Luis Potosi	1146.3	69.4	265.7	55.5	52.1	45.5	90.5
Sinaloa	1567.2	81.5	342.7	145.5	53.1	81.4	123
Sonora	1406.7	88.3	388.4	74.4	46.4	57.3	110.3
Tamaulipas	2664.9	142.7	488.4	183.6	59.7	118.6	209
Zacatecas	996.4	49.9	203.6	100.6	28.3	53.9	78.1
MX Total	19706.8	1162	3859.2	868.8	605.9	849.3	1572.3

Table B3. Area/non-road emissions state totals for the 12km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
Alabama	187.6	37.9	54.8	6.8	24.4	24.4	61.1
Arizona	452.1	24.7	38.6	15.5	1.6	54.4	66.8
Arkansas	1314.5	270.0	407.6	403.0	72.9	281.9	890.6
Colorado	221.5	46.6	58.0	85.3	5.9	59.5	209.0
Illinois	163.3	71.6	68.9	44.9	16.8	60.0	217.6
Kansas	531.5	306.4	211.1	420.6	33.7	241.2	928.0
Kentucky	72.0	44.6	29.4	19.2	19.7	15.1	41.2
Louisiana	1651.1	920.4	503.7	181.3	332.9	281.9	519.5
Mississippi	1817.4	317.4	490.1	186.9	221.0	309.9	762.3
Missouri	1030.4	152.5	260.2	323.8	63.2	306.5	1266.5
New Mexico	837.1	132.7	192.7	130.2	28.2	393.3	1788.8
Oklahoma	994.2	269.3	343.0	564.1	41.2	398.8	1719.4
Tennessee	556.7	366.0	212.2	37.6	43.6	78.2	182.9
Texas	6055.0	1300.3	1929.6	1354.4	187.3	1429.7	5802.4
Utah	14.5	1.3	3.6	2.3	0.2	3.6	12.2
Gulf of Mexico	76.0	296.8	37.3	0.0	0.0	0.0	0.0
Total	15974.9	4558.5	4840.8	3775.9	1092.6	3938.4	14468.3

Table B4. Mexican area/non-road and mobile emissions state totals for the 12km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
Chihuahua	1352.2	84.6	293	35.8	49.3	44.8	106.4
Coahuila	3219.2	179.9	579.7	116.7	53.2	99.2	202.4
Durango	919.1	49.2	199.5	73.4	30.7	44.8	72.8
Nuevo Leon	4094.2	227.5	589.7	46.8	113.8	191.1	277.4
San Luis Potosi	157.3	7.8	35	17.8	5.4	9.1	12.3
Sinaloa	1530.1	79.9	334.8	139.4	52	78.7	120.1
Sonora	431.2	26	133.8	36.5	16.6	21.7	33.8
Tamaulipas	2151.3	113.4	382.8	159	44	98.7	168.7
Zacatecas	398.9	17.4	83.7	61.2	11.1	27.6	31.2
MX Total	14253.5	785.7	2632	686.6	376.1	615.7	1025.1

Table B5. Area/non-road source state emissions totals for the REMSAD 4km grid (Mexican states include mobile emissions).

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
New Mexico	189.9	24.6	31.7	12.9	3.6	52.6	189.9
Texas	407.0	102.4	274.1	183.0	19.9	134.2	579.1
US Total	596.9	127.0	305.8	195.9	23.5	186.8	769.0
Chihuahua	1352.2	84.6	293	35.8	49.3	44.8	106.4
Coahuila	1016.1	59.9	195.1	38.9	27.2	36.6	79.8
Durango	492.1	24.9	109.4	51.9	16.5	27.9	39.1
Nuevo Leon	4062.6	226.7	582.2	37.2	112.8	187.5	275
San Luis Potosi	2.6	0.1	0.8	0.6	0.2	0.3	0.2
Sinaloa	51.7	2.8	9	2.5	1.1	2	4.1
Tamaulipas	505.3	27	86.3	32	9.4	21.5	39.6
Zacatecas	18.8	0.7	4.8	4.1	0.7	1.7	1.5
MX Total	7501.4	426.7	1280.6	203.0	217.2	322.3	545.7

Table B6. Mobile source emissions state totals for the 36km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]
Alabama	3675.0	544.0	387.4	14.9	21.5	14.3	3.9
Arizona	2166.2	408.6	252.7	12.5	17.4	11.0	3.2
Arkansas	1721.7	295.6	193.7	7.6	11.3	7.7	2.0
California	5830.1	1210.1	622.2	51.5	67.6	39.6	12.3
Colorado	2315.7	385.0	226.1	10.6	14.9	9.6	2.7
Delaware	344.0	76.0	39.5	2.2	3.1	2.2	0.6
District of Columbia	144.6	19.4	15.1	0.8	1.0	0.6	0.2
Florida	8718.4	1236.6	987.1	37.9	51.3	31.8	9.3
Georgia	5874.1	910.4	608.5	26.1	36.7	23.7	6.6
Idaho	861.2	142.9	85.2	3.6	5.3	3.7	1.0
Illinois	5315.8	894.5	586.4	27.2	37.0	21.4	6.5
Indiana	4194.6	678.7	441.3	18.3	26.3	17.5	4.8
Iowa	1911.6	312.4	187.0	7.7	11.5	7.9	2.1
Kansas	1721.8	279.5	172.0	7.3	10.5	7.0	1.9
Kentucky	2645.9	475.5	277.0	12.5	18.2	12.2	3.3
Louisiana	2690.0	430.2	297.6	10.9	16.0	11.5	3.0
Maryland	1656.3	361.7	177.8	12.9	17.5	9.6	3.0
Michigan	5382.1	821.6	522.7	25.1	35.1	20.8	6.4
Minnesota	2963.5	506.1	299.8	13.2	18.9	12.5	3.4
Mississippi	2145.9	355.7	245.1	9.2	13.8	9.6	2.5
Missouri	2912.3	561.6	326.8	17.4	24.5	13.8	4.3
Montana	588.1	108.3	57.6	2.5	3.8	2.7	0.7
Nebraska	1150.0	187.6	113.0	4.7	7.0	4.8	1.3
Nevada	1029.5	157.4	120.3	4.7	6.5	4.1	1.2
New Jersey	2315.5	468.2	269.6	17.0	22.5	11.6	3.8
New Mexico	1542.8	229.2	151.2	5.9	8.7	6.0	1.6
New York	2463.8	432.3	247.0	13.3	19.0	11.0	3.3
North Carolina	3948.8	699.9	409.7	23.0	32.7	17.8	5.6
North Dakota	449.6	75.7	42.5	1.8	2.7	1.9	0.5
Ohio	6201.4	980.9	604.5	27.9	39.0	25.1	7.1
Oklahoma	2699.0	417.6	289.3	11.4	16.3	10.8	3.0
Oregon	206.1	44.9	19.6	0.9	1.5	1.1	0.3
Pennsylvania	4878.4	906.5	510.4	26.4	37.3	25.3	6.9
South Carolina	2730.3	447.4	299.1	11.5	17.0	11.7	3.1
South Dakota	487.7	92.1	48.6	2.1	3.3	2.3	0.6
Tennessee	3935.4	615.4	414.9	16.9	23.9	15.6	4.3
Texas	11624.1	2141.7	1297.2	59.3	84.2	58.0	16.2
Utah	1336.7	196.7	129.5	5.8	8.1	5.2	1.5
Virginia	3281.0	647.0	354.2	19.1	27.1	18.3	5.0
Washington	534.1	97.4	52.8	2.6	3.7	2.4	0.7
West Virginia	1099.5	201.7	115.1	4.9	7.4	5.2	1.4
Wisconsin	2645.2	532.0	265.4	15.2	22.1	15.4	4.1
Wyoming	524.2	94.1	48.9	2.2	3.3	2.3	0.6
Total	120862.0	20680.1	12811.4	608.5	856.5	546.6	155.8

Table B7. Mobile source emissions state totals for the 12km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
Alabama	399.6	52.9	42.3	1.5	2.1	1.4	0.4
Arizona	186.9	38.7	21.5	0.9	1.5	1	0.3
Arkansas	1724.5	296.2	194	7.6	11.3	7.8	2.1
Colorado	367.1	56.6	34.3	1.4	2.1	1.5	0.4
Illinois	436.9	80.6	46	2.1	3	2	0.5
Kansas	813.5	135.7	82.7	3.5	5.1	3.5	0.9
Kentucky	139.7	24.3	14.6	0.6	0.9	0.6	0.2
Louisiana	2690	430.2	297.6	10.9	16	11.5	3
Mississippi	2134.4	353.4	243.7	9.1	13.8	9.6	2.5
Missouri	1549.3	314.5	176	9.6	13.7	7.9	2.4
New Mexico	1543.5	229.3	151.3	5.9	8.7	6	1.6
Oklahoma	2702.6	418.3	289.7	11.4	16.4	10.9	3
Tennessee	1029.9	151.2	108.8	4.5	6.1	3.8	1.1
Texas	10622.5	1994.2	1177.4	54.3	77.5	53.7	14.9
Utah	13.9	2.5	1.4	0.1	0.1	0.1	0
Total	26354.3	4578.6	2881.3	123.4	178.3	121.3	33.3

Table B8. Mobile source emissions state totals for the 4km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
New Mexico	130.9	16.2	13	0.5	0.7	0.5	0.1
Texas	1746.2	351.4	174.1	7.8	12.4	9.8	2.5
Total	1877.1	367.6	187.1	8.3	13.1	10.3	2.6

Table B9. Point source emissions state totals for the 36km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]	[tons/day]
Alabama	568.6	783.3	265.7	11.0	1823.7	73.1	54.7
Arizona	57.4	238.9	60.4	0.0	274.8	41.4	33.4
Arkansas	173.2	137.9	74.3	3.2	148.3	24.4	12.8
California	128.8	244.7	103.1	35.8	47.2	27.3	18.4
Colorado	79.8	141.9	101.1	0.7	44.0	31.6	20.1
Delaware	43.3	58.5	23.7	2.0	192.0	2.7	1.4
District of Columbia	0.4	2.9	0.0	0.0	6.1	0.3	0.5
Florida	203.9	1022.9	74.4	22.9	2247.9	41.5	22.1
Georgia	488.7	665.6	98.8	43.3	1629.9	71.0	37.8
Idaho	12.1	16.6	1.2	0.0	64.9	21.3	13.0
Illinois	360.0	664.0	416.7	32.8	1172.3	130.6	116.4
Indiana	694.2	1127.3	123.1	22.5	3006.0	52.8	24.6
Iowa	34.8	292.2	28.6	24.3	664.9	17.9	13.9
Kansas	209.7	287.3	58.7	35.0	39.0	24.6	11.4
Kentucky	175.9	196.2	171.4	3.3	439.6	30.5	18.1
Louisiana	1409.0	350.8	160.4	28.4	570.0	51.6	18.7
Maryland	136.1	307.4	24.5	1.3	836.9	17.0	15.8
Michigan	265.1	878.4	205.2	1.5	1383.3	37.6	27.3
Minnesota	228.1	442.1	91.3	2.7	367.7	71.1	66.8
Mississippi	236.9	270.6	117.3	75.9	112.0	15.2	9.8
Missouri	281.3	147.3	169.7	63.2	453.7	50.1	82.9
Montana	127.0	156.9	16.2	1.1	135.2	22.6	20.4
Nebraska	41.1	159.7	31.4	0.1	185.6	11.0	14.9
Nevada	41.7	127.3	2.5	0.1	140.7	14.1	23.2
New Hampshire	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Jersey	115.2	330.5	267.6	1.5	369.1	39.1	9.5
New Mexico	128.5	304.0	50.3	0.2	264.0	9.4	4.6
New York	137.0	296.4	108.7	0.4	922.1	43.7	30.2
North Carolina	219.9	695.9	186.9	0.3	1377.5	47.7	25.7
North Dakota	28.7	236.6	2.8	0.1	668.3	8.6	4.8
Ohio	1956.0	1426.2	219.0	7.8	4658.0	97.6	58.9
Oklahoma	605.6	413.6	122.7	49.0	191.3	18.0	10.8
Oregon	16.2	30.5	2.5	0.0	56.5	3.6	1.5
Pennsylvania	900.9	961.6	170.0	15.5	3062.1	63.2	38.6
Rhode Island	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South Carolina	182.9	373.4	135.7	0.2	746.8	26.2	16.8
South Dakota	1.8	78.8	4.1	0.0	75.6	1.4	1.3
Tennessee	274.9	277.0	327.3	0.2	453.6	43.8	21.2
Texas	1102.3	1463.7	671.4	3.5	872.1	74.3	31.9
Utah	65.9	229.1	20.1	2.8	101.6	15.5	17.8
Vermont	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Virginia	183.1	461.4	162.0	2.2	917.6	33.0	20.6
Washington	83.4	14.4	6.5	8.1	26.7	2.0	1.6
West Virginia	26.6	780.1	4.5	0.2	2066.4	44.1	18.7
Wisconsin	214.7	437.8	148.3	2.4	815.1	39.2	21.0
Wyoming	205.7	390.1	57.9	1.2	424.4	51.5	34.3
Gulf of Mexico	60.0	255.4	762.1	0.0	0.5	4.3	0.4
Total	12506.4	18177.2	5850.1	506.7	34055.0	1547.5	1048.6

Table B10. Mexican point source emissions state totals for the 36km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
Baja Calif Norte	1.7	12.1	0.2	0.0	66.0	2.4	0.9
Coahuila	12.9	218.5	0.0	0.0	715.0	22.1	36.7
Chihuahua	6.3	32.9	0.4	0.0	102.1	3.9	1.3
Durango	2.7	15.3	0.2	0.0	60.2	2.3	0.8
Hidalgo	6.0	126.9	34.3	0.0	884.6	27.9	27.9
Mexico	7106.7	387.7	3091.3	0.0	137.0	680.5	680.5
Nuevo Leon	4.3	22.9	0.3	0.0	127.9	2.9	1.0
Puebla	0.0	0.0	0.0	0.0	4661.1	2.1	8.2
San Luis Potosi	2.1	15.6	0.3	0.0	90.8	3.3	1.2
Sinaloa	3.1	23.3	0.4	0.0	135.0	4.9	1.8
Sonora	4.0	29.2	0.5	0.0	201.6	6.0	2.2
Tamaulipas	3.9	29.8	0.5	0.0	269.4	6.3	2.3
Total	7153.7	914.2	3128.4	0.0	7450.7	764.6	764.8

Table B11. Point source emissions state totals for the 12km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
Alabama	0.0	1.9	0.6	0.0	6.7	0.0	0.0
Arizona	2.6	40.0	6.1	0.0	26.2	3.8	5.3
Arkansas	173.2	137.9	74.3	3.2	148.3	24.4	12.8
Colorado	33.4	26.0	8.7	0.0	10.9	6.1	4.7
Illinois	6.7	57.6	15.2	0.0	164.1	11.9	16.2
Kansas	198.7	224.1	45.3	3.2	34.0	18.4	5.8
Kentucky	22.8	4.8	3.9	0.0	2.9	0.9	0.4
Louisiana	1409.0	350.8	160.4	28.4	570.0	51.6	18.7
Mississippi	235.8	262.4	114.0	75.9	111.9	15.1	9.7
Missouri	263.4	48.6	105.7	39.4	326.5	38.1	60.4
New Mexico	128.5	304.0	50.3	0.2	264.0	9.4	4.6
Oklahoma	605.6	413.6	122.7	49.0	191.3	18.0	10.8
Tennessee	29.2	70.6	53.2	0.1	11.3	3.4	1.1
Texas	1102.3	1463.7	671.4	3.5	872.1	74.3	31.9
Utah	1.8	2.8	0.2	0.0	3.8	0.0	0.0
Gulf of Mexico	59.7	254.3	760.6	0.0	0.5	4.3	0.4
Total	4272.7	3663.1	2192.6	202.9	2744.5	279.7	182.8

Table B12. Mexican point source emissions totals for the 12km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
Coahuila	12.9	218.5	0.0	0.0	715.0	22.1	36.7
Chihuahua	6.3	32.9	0.4	0.0	102.1	3.9	1.3
Durango	2.7	15.3	0.2	0.0	60.2	2.3	0.8
Nuevo Leon	4.3	22.9	0.3	0.0	127.9	2.9	1.0
Sinaloa	3.1	23.3	0.4	0.0	135.0	4.9	1.8
Sonora	0.0	0.0	0.0	0.0	37.3	0.0	0.0
Tamaulipas	2.7	20.1	0.3	0.0	129.1	4.2	1.6
Total	32.0	333.0	1.6	0.0	1306.6	40.3	43.2

Table B13. U.S. and Mexican point source totals for the 4km REMSAD grid.

State	CO	NOX	VOC	NH3	SO2	PM2_5	PMC
	[tons/day]						
New Mexico	1.6	3.7	0.9	0	0	0	0
Texas	58.9	169.1	77.7	0.2	76.3	1.6	0.4
US Total	60.5	172.8	78.6	0.2	76.3	1.6	0.4
Coahuila	12.9	218.5	0	0	715	22.1	36.7
Chihuahua	1.3	10	0.2	0	58.2	2.1	0.8
Durango	2.7	15.3	0.2	0	60.2	2.3	0.8
Nuevo Leon	2.7	10.8	0.1	0	57.9	0.4	0.1
MX Total	19.6	254.6	0.5	0	891.3	26.9	38.4