MAG EIGHT-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA NONATTAINMENT AREA

APPENDICES

VOLUME TWO

FEBRUARY 2009

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FEBRUARY 2009

MARICOPA ASSOCIATION of GOVERNMENTS

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TECHNICAL SUPPORT DOCUMENT

FOR

OZONE MODELING IN SUPPORT OF THE EIGHT-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA NONATTAINMENT AREA

APPENDICES

FEBRUARY 2009

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MODELING PROTOCOL IN SUPPORT OF AN EIGHT-HOUR OZONE REDESIGNATION REQUEST AND MAINTENANCE PLAN FOR THE MARICOPA NONATTAINMENT AREA

Maricopa Association of Governments
May 2008

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1. OVERVIEW OF MODELING STUDY

1.1 Background

Under the 1990 Clean Air Act Amendments, the Maricopa County nonattainment area was initially classified as Moderate for the one-hour ozone National Ambient Air Quality Standards (NAAQS). The area did not achieve the NAAQS for one-hour ozone by the required deadline of November 19, 1996. The one-hour ozone nonattainment area was subsequently reclassified to Serious, effective February 13, 1998. The deadline for Serious areas to attain the one-hour ozone standard was November 19, 1999. There have been no exceedances of the one-hour ozone standard in the nonattainment area since 1996.

The Maricopa Association of Governments (MAG) prepared the One-hour Ozone Redesignation Request and Maintenance Plan which was submitted to EPA in 2004 (MAG, 2004). EPA subsequently redesignated the Maricopa County one-hour ozone nonattainment area to attainment, effective June 14, 2005; EPA revoked the one-hour ozone standard on June 15, 2005.

On April 30, 2004, EPA published the final rule designating eight-hour ozone nonattainment areas, effective June 15, 2004. A 5,000 square mile area located mainly in Maricopa County and the portion of Pinal County that includes the City of Apache Junction, was designated as a nonattainment area for eight-hour ozone. The Maricopa eight-hour ozone nonattainment area is classified as "Basic" under Part D, Subpart I, of the Clean Air Act, with an attainment date of June 15, 2009.

MAG submitted the Eight-Hour Ozone Plan for the Maricopa Nonattainment Area (MNA) to EPA by June 15, 2007, as required by the Clean Air Act. The plan demonstrates attainment of the eight-hour ozone standard for all modeled episodes during the ozone season of 2008. Air quality monitoring data indicate that the MNA has not exceeded the eight-hour ozone standard since 2005. Thus, the area has attained the eight-hour ozone standard. However, EPA has not yet redesignated the area as an attainment area for the eight-hour ozone standard. An eight-hour ozone maintenance plan needs to be submitted to EPA as one of several requirements for the area to be redesignated as attainment.

As the designated regional air quality planning agency, MAG conducts modeling of emissions and pollutant concentrations and prepares maintenance plans necessary for redesignation to attainment. The ozone maintenance plan must provide for maintenance of the eight-hour ozone standard for at least 10 years after the area is officially redesignated to attainment by EPA. Lead time should be allowed for EPA's review and approval action on the redesignation request. In determining the amount of lead time, EPA indicated that 18 months, as granted in section 107(d)(3)(d) of the Clean Air Act Amendments, should be assumed for EPA to approve a redesignation request (EPA Memorandum, 1992). Due to uncertainties regarding when the area will be redesignated to attainment, the year 2025 will be modeled to assure that the eight-hour ozone standard is maintained at least ten years after an official notice of redesignation to attainment by EPA.

1.2 Objectives

Key objectives to be accomplished in this protocol document are: (1) enhance technical credibility, (2) encourage the participation of all interested parties, (3) lay out responsibilities of all participants, (4) provide for consensus-building among all interested parties concerning modeling issues, and (5) provide documentation for technical decisions to be made in applying the models.

The protocol document describes the procedures MAG will use for conducting all phases of the modeling study. These include: (1) identifying the background, objectives, tentative schedule, and organizational structure, (2) developing the necessary input data bases, (3) performing quality assurance and diagnostic model analyses, (4) evaluating model performance and interpreting results, and (5) describing procedures for using the model to demonstrate whether adopted control strategies are sufficient to demonstrate maintenance of the eight-hour ozone standard.

1.3 Conceptual Description

EPA guidance (EPA, 2007) recommends that a conceptual description be formulated in developing a modeling protocol. A conceptual description is a qualitative way of characterizing the nature of an area's nonattainment problem. MAG developed an initial conceptual model for the eight-hour ozone attainment demonstration modeling by following EPA's guidance (MAG, 2007a). The conceptual model has been updated by supplementing recent air quality and emissions data for the present study. The eight-hour ozone exceedance problem in the MNA is characterized as: (1) The peak hourly ozone concentration occurs between 3 pm and 7 pm, and the minimum is usually reached at approximately 6 am. The diurnal cycle is stronger at sites located closer to central Phoenix. The diurnal variation is less prominent at sites farther away from central Phoenix. (2) More than 90 percent of high ozone events occur when the daily maximum temperatures are above 90° Fahrenheit (F). High ozone levels tend to occur when dew point temperatures are higher than the average. (3) 24-hour back trajectories on high ozone days indicate that the eight-hour ozone exceedances in the nontattainment area are likely caused primarily by local factors, rather than by regional transport. (4) In 2008 the nonattainment area exhibits a NOx-disbenefit in the urbanized portion of the eight-hour ozone modeling domain and a NOx benefit in the non-urbanized portions of the modeling domain. (5) Annual trends of eight-hour ozone design values and NOx at monitoring sites indicate that eight-hour ozone air quality in the MNA has been gradually improving. A detailed conceptual description is provided in Attachment I.

1.4 Management Structure and Committees

MAG has responsibilities for regional involvement in a number of planning issues, and has established an extensive mechanism for ensuring coordinated policy direction from elected officials, coordinated management and technical input, advice from the appropriate agency staff, as well as direct citizen input. Figure 1-1 displays the MAG Policy Structure and Figure 1-2 presents the MAG Committee Structure. All policy committees and formal technical committees follow the Arizona open meeting law which requires, among other requirements, the posting of meeting notices and agendas at least 24 hours prior to any meeting.

The MAG Regional Council is the governing body of MAG. It is comprised of elected officials from each member agency, two ex-officio members representing the Arizona State Transportation Board, and a representative from the Citizens Transportation Oversight Committee. This composition of elected officials is a reflection of citizen input at the local government level. The MAG Regional Council agenda includes a call to the audience, providing the opportunity for public comments at each monthly meeting. MAG holds at least one formal public meeting prior to the adoption of any new or update to the nonattainment area plan. Formal public meetings are advertised locally at least 30 days prior to the meeting date and documentation is available for public review during this 30-day period. Draft documents are distributed to appropriate federal, state, and local agencies for review and comment during this period. Comments received are analyzed with a staff response for consideration by the MAG Air Quality Technical Advisory Committee and MAG Regional Council before taking approval action. Documentation of the comments and responses are incorporated into the plan document.

Due to the technical complexity of many MAG programs, committees consisting of professional experts are often needed to assist in program development. The Air Quality Technical Advisory Committee is composed of representatives from eight MAG member agencies, citizens, environmental interests, health interests, automobile industry, fuel industry, utilities, public transit, trucking industry, rock products industry, construction firms, housing industry, architecture, agriculture, industry, business, parties to the Air Quality Memorandum of Agreement, and various State and Federal agencies. The role of the Technical Advisory Committee is to review and comment on technical information generated during the planning process and make recommendations to the MAG Management Committee.

1.5 Participating Organizations

Technical oversight for this project will be provided by the Air Quality Planning Team. This team includes staff representatives from the Maricopa Association of Governments (MAG), the Arizona Department of Environmental Quality (ADEQ), the Arizona Department of Transportation (ADOT), and the Maricopa County Air Quality Department (MCAQD). The activities of this working group are directed by a Memorandum of Agreement among the agencies involved (see Attachment II). Representatives of other agencies, including EPA and the U.S. Department of Transportation, will be consulted on technical matters, as needed. The Air Quality Planning Team will meet as necessary during the ozone modeling effort. Periodic reports on the status and progress of various phases of the modeling work will be presented at these meetings, and technical issues will be discussed and resolved.

1.6 Schedule

The eight-hour ozone air quality analysis for the Maricopa Nonattainment Area will include the following tasks. The schedule for these tasks is presented in Table 1-1.

1. Prepare a protocol document (this document) describing the purpose, background, and the procedures to be followed in the remainder of the analysis. This document also specifies the modeling domain and identifies three modeling episodes. (Completion Date: March 31, 2008)

2. Develop emissions preprocessing and CAMx inputs for the future year 2025. (Completion Date: April 30, 2008)

3. Prepare onroad mobile source emissions using MOBILE6.2 and M6Link for the 2025 episode periods. (Completion Date: April 30, 2008)

4. Develop emissions inventories for modeling three episodes in 2025. (Completion Date: May 30, 2008)

5. Evaluate committed control measures, and reflect emission reduction benefits of the committed control measures in emission inventories. (Completion Data: June 30, 2008)

6. Perform CAMx simulations for 2025. (Completion Date: August 29, 2008)

7. Write draft Technical Support Document (TSD) and maintenance plan. (Completion Date: October 24, 2008)

8. Provide draft TSD for Air Quality Planning Team Review. (Completion Date: October 27, 2008)

9. Release the plan and TSD for public review. (Completion Date: November 21, 2008)

10. Provide the plan and TSD for public hearing. (Completion Date: December 15, 2008)

11. Obtain Air Quality Technical Advisory Committee recommendation. (Completion Date: January 29, 2009)

12. Obtain Management Committee recommendation. (Completion Date: February 11, 2009)

13. Get Regional Council approval for the plan. (Completion Date: February 25, 2009)

14. Submit the plan and TSD to ADEQ/EPA. (Completion Date: February 27, 2009)

15. Obtain EPA adequacy determination for conformity budgets (Completion Date: May 31, 2009)

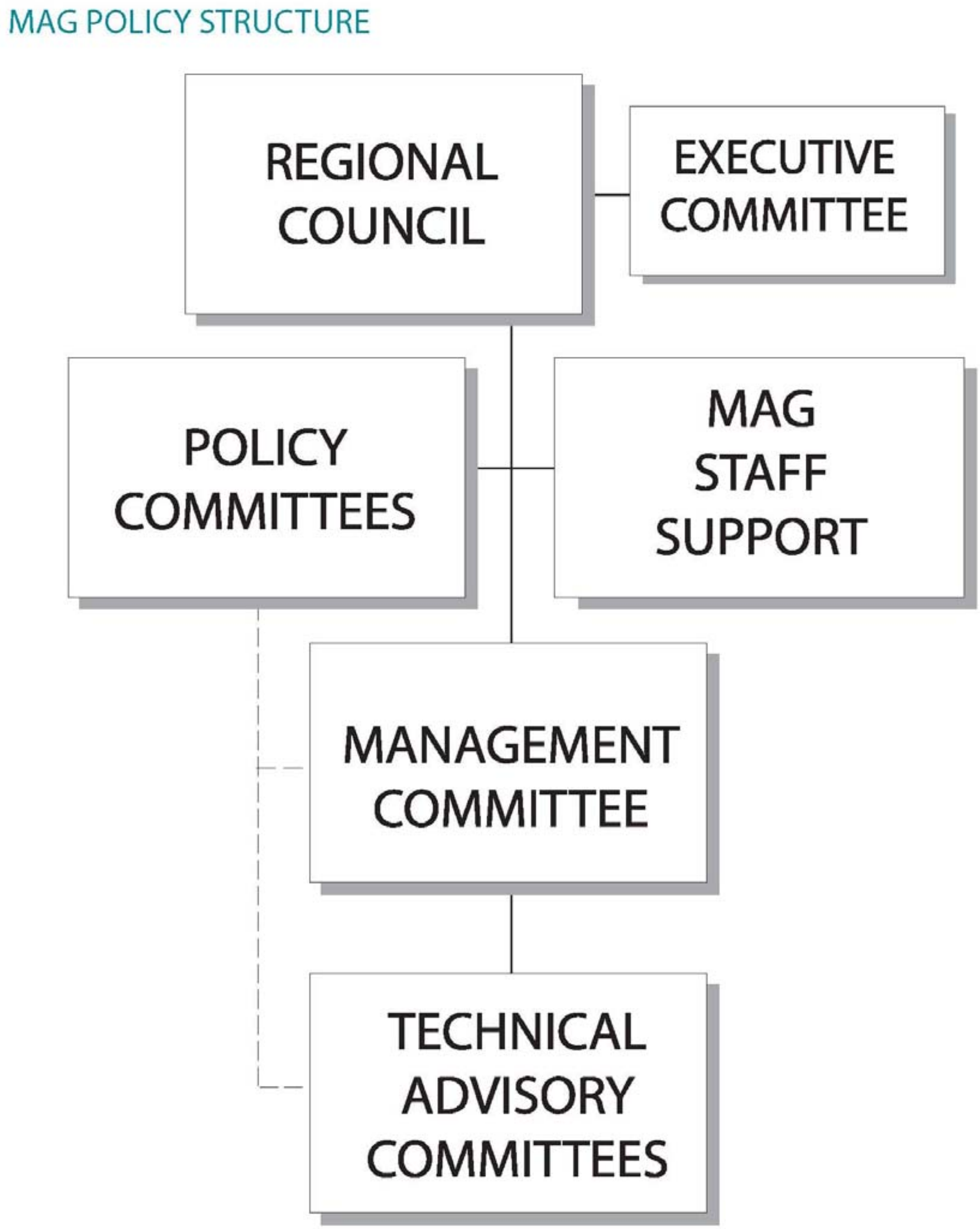

Figure 1-1 MAG Policy Structure

MAG COMMITTEE STRUCTURE

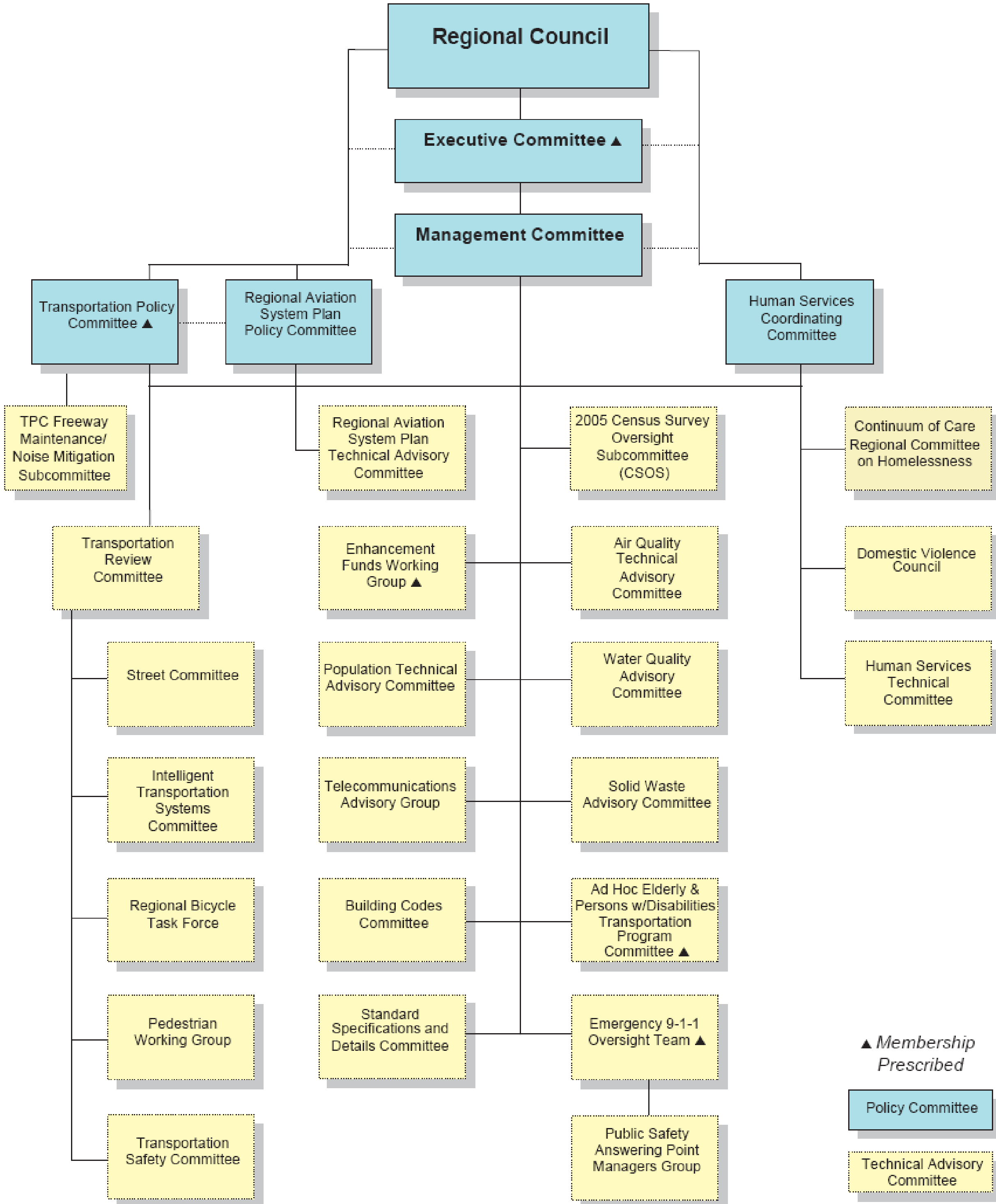

Figure 1-2 MAG Committee Structure

Table 1-1 Schedule for the Eight-Hour Ozone Modeling Demonstration for the MAG Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa Nonattainment Area

8-Hour Ozone Maintenance Modeling Task List	2008										2009				
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Prepare modeling protocol document	★														
Prepare meteorological, emissions pre-processing and CAMx modeling inputs		★													
Conduct MOBILE6 modeling for onroad mobile source emissions		★													
Develop emissions inventories for modeling three episodes in 2025			★												
Committed control measure evaluation				★											
Complete CAMx simulations						★									
Write draft TSD and maintenance plan								★							
Provide draft TSD for Air Quality Planning Team review								★							
Draft plan document available for public review									★						
Public hearing										★					
Air Quality Technical Advisory Committee recommendation											★				
Management Committee recommendation												★			
Regional Council action												★			
Submit to ADEQ/EPA												★			
EPA adequacy finding for conformity budgets															★

Note: Assumes no additional measures beyond those in the Eight-Hour Ozone Plan and the measures in SB 1552 passed by the Arizona Legislature in 2007.

2. MODEL AND MODELING INPUTS

2.1 Rationale for Model Selection

To perform modeling for the eight-hour ozone maintenance demonstration, MAG considered three photochemical air quality models: 1) Comprehensive Air-quality Model with Extensions (CAMx), 2) Community Multi-scale Air Quality (CMAQ) model, and 3) Variable-grid Urban Airshed Model (UAM-V). EPA has indicated that any of these three models would be appropriate to simulate eight-hour ozone concentrations in urban areas (EPA, 2007). These models were evaluated according to the following selection criteria (see Table 2-1):

- Documentation and Track Record, and Advanced Technical Features - Since all three models have been peer-reviewed and adequately documented (EPA, 2007) and these models are state-of-the art photochemical air quality models equipped with advanced technological features, all of the models got the highest score for the first selection criteria - "Documentation and Track Record" and the second selection criteria, "Advanced Technical Features" (see Table 2-1).

- Recent Applications - In recent years, CAMx and CMAQ have been used more frequently in regulatory applications. EPA used CAMx to model eight-hour ozone in the eastern United states for the Clean Air Interstate Rule (CAIR). CMAQ has been used by the Western Regional Air Partnership to model visibility in the western United States. EPA has also used CMAQ to model PM-2.5 and visibility for the CAIR. UAM-V has been applied less frequently than CAMx or CMAQ. For these reasons, CAMx and CMAQ got the highest scores for the third selection criterion of "Recent Applications".

- Experience of MAG Staff - MAG staff members have extensive experience with CAMx and its pre- and post-processors during MAG's modeling for the eight-hour ozone attainment demonstration. Thus, CAMx got the highest score for the "Experience of MAG staff" criterion. In addition, MAG staff compared CMAQ's modeling performance with CAMx's modeling performance for the three episodes adopted in the MAG Eight-Hour Ozone Plan. The CAMx model had a slightly better modeling performance than the CMAQ model for the three episodes. A more detailed description of the CMAQ's modeling performance evaluation is available in Attachment III of this protocol.

- Flexibility - All three models have good computational efficiency, but UAM-V is a proprietary model, unlike CAMx and CMAQ. Therefore, UAM-IV scored the lowest number for the flexibility criterion.

Overall, since CAMx got the highest scores for the selection criteria, MAG recommends that CAMx is the most appropriate photochemical air quality model for use in the present study.

Figure 2-1 depicts the MAG air quality modeling chain with CAMx as the core model. Most of CAMx input files will be prepared using preprocessor programs. The Emissions Preprocessor System, EPS3.0, will be used to process emission inventories (ENVIRON, 2005). The onroad mobile emissions will be generated by the EPA MOBILE6.2 model and M6Link. M6Link is a MAG-developed program to develop hourly gridded emissions for the photochemical air quality model. More detailed discussions on the preparation of the emissions inventory and meteorological inputs are provided later in this protocol.

Table 2-1 Attributes of Candidate Air Quality Models

Selection Criteria	CAMx	CMAQ	UAM-V
Documentation and Track Record	3	3	3
Advanced Technical Features	3	3	3
Recent Applications	3	3	2
Experience of MAG Staff	3	1	0
Computational Efficiency	3	3	3
Flexibility (Proprietary vs. Open Source)	3	3	0
Total	18	16	11
Scoring: 3 = highest and 0 = lowest			

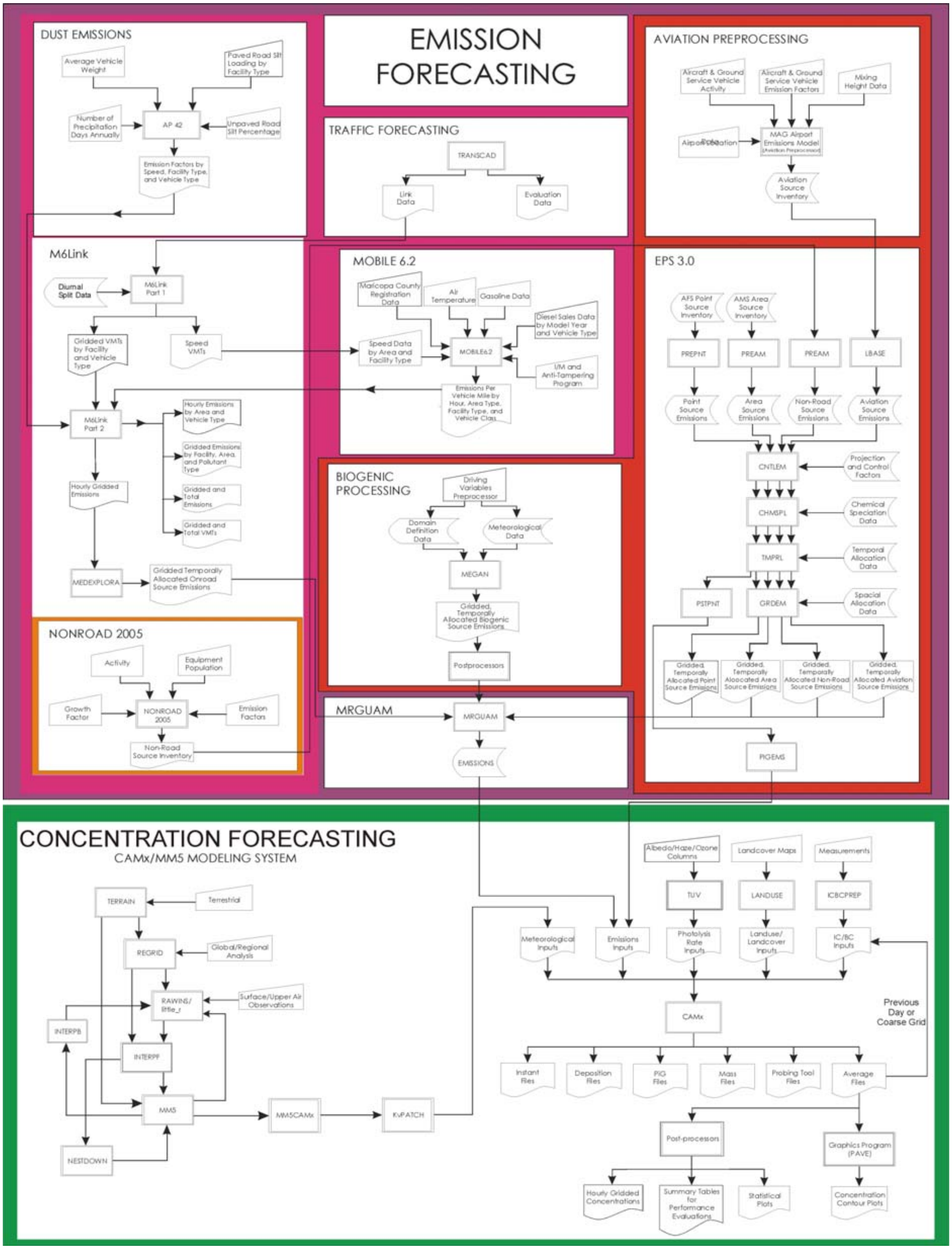

Figure 2-1 MAG Air Quality Modeling Chain

2.2 Modeling Domain and Horizontal Resolution

Selection of the 8-hour ozone modeling domains took into account the eight-hour ozone nonattainment area boundaries, the distribution of major emissions sources, the location of meteorological and air quality monitoring sites, and the prevailing winds associated with ozone episodes. Figure 2-2 illustrates the inner modeling domain comprised of 4 kilometer by 4 kilometer (km) grids along with the eight-hour ozone nonattainment area boundaries. Figure 2-3 shows the spatial relationship between the inner (4 km grid) and outer (12 km grid) CAMx and MM5 modeling domains.

MAG's previous study of 36-hour back-trajectory air flow patterns demonstrated that the outer 12 km grid CAMx domain (shown in Figure 2-3) is of sufficient size to capture the transport characteristics for the ozone episodes to be modeled (MAG, 2007). As for the meteorological modeling, MM5 will utilize three nested domains, at 4 km, 12 km, and 36 km grid resolutions, to simulate the selected episode periods. As shown in Figure 2-3, the boundaries of the 4 km and 12 km MM5 modeling domains are larger than the CAMx modeling domains.

The inner CAMx modeling domain encompasses the entire eight-hour ozone nonattainment area and consists of 50 grid cells (4 km) in the west-east direction and 29 grid cells (4 km) in the south-north direction. The origin, at the southwest corner of the inner domain, is located at 297 km Easting and 3,652 km Northing in UTM Zone 12. The inner CAMx modeling domain has an area of approximately 9,000 square miles.

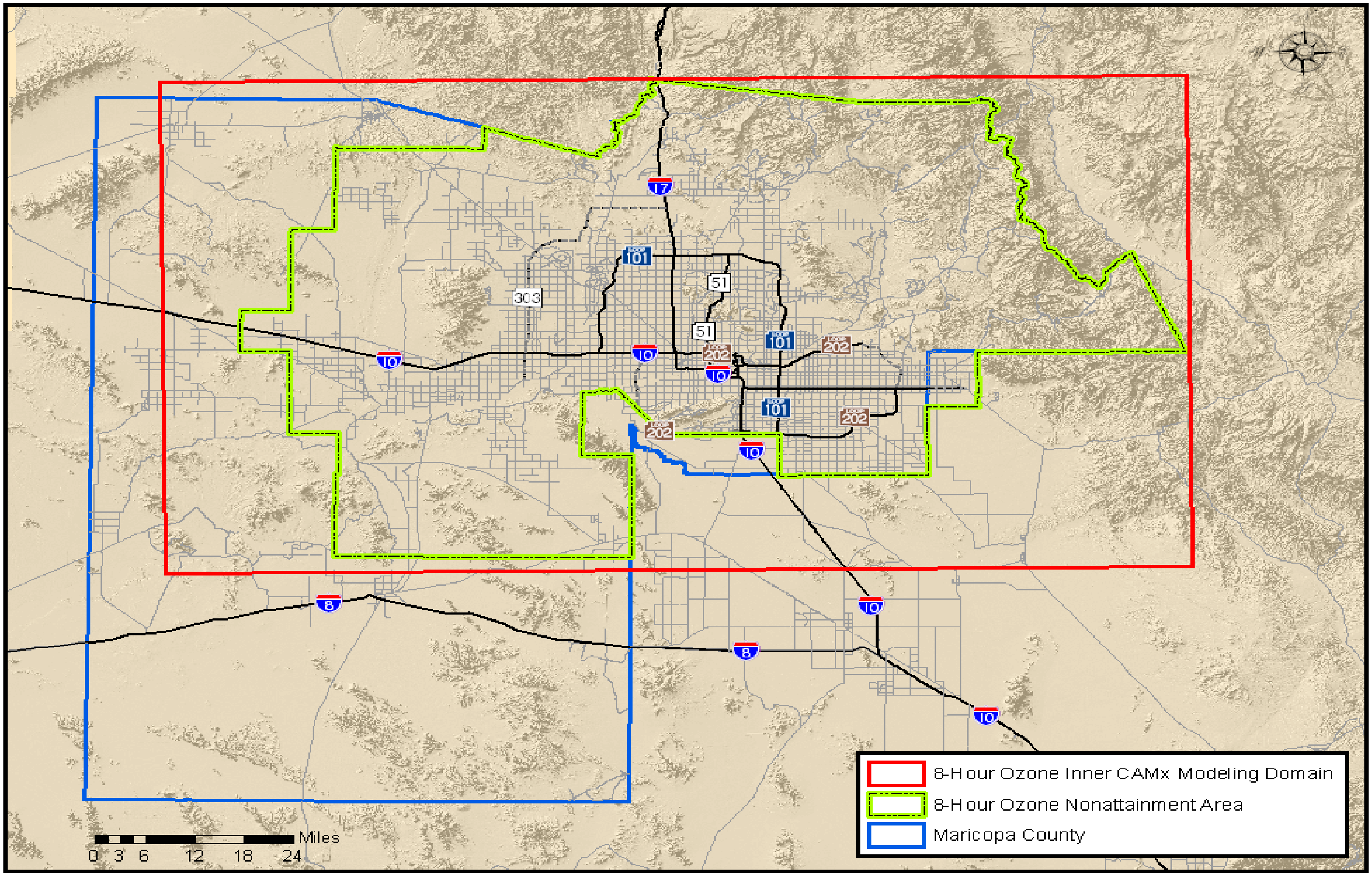

Figure 2-2 The Inner CAMx Modeling Domain

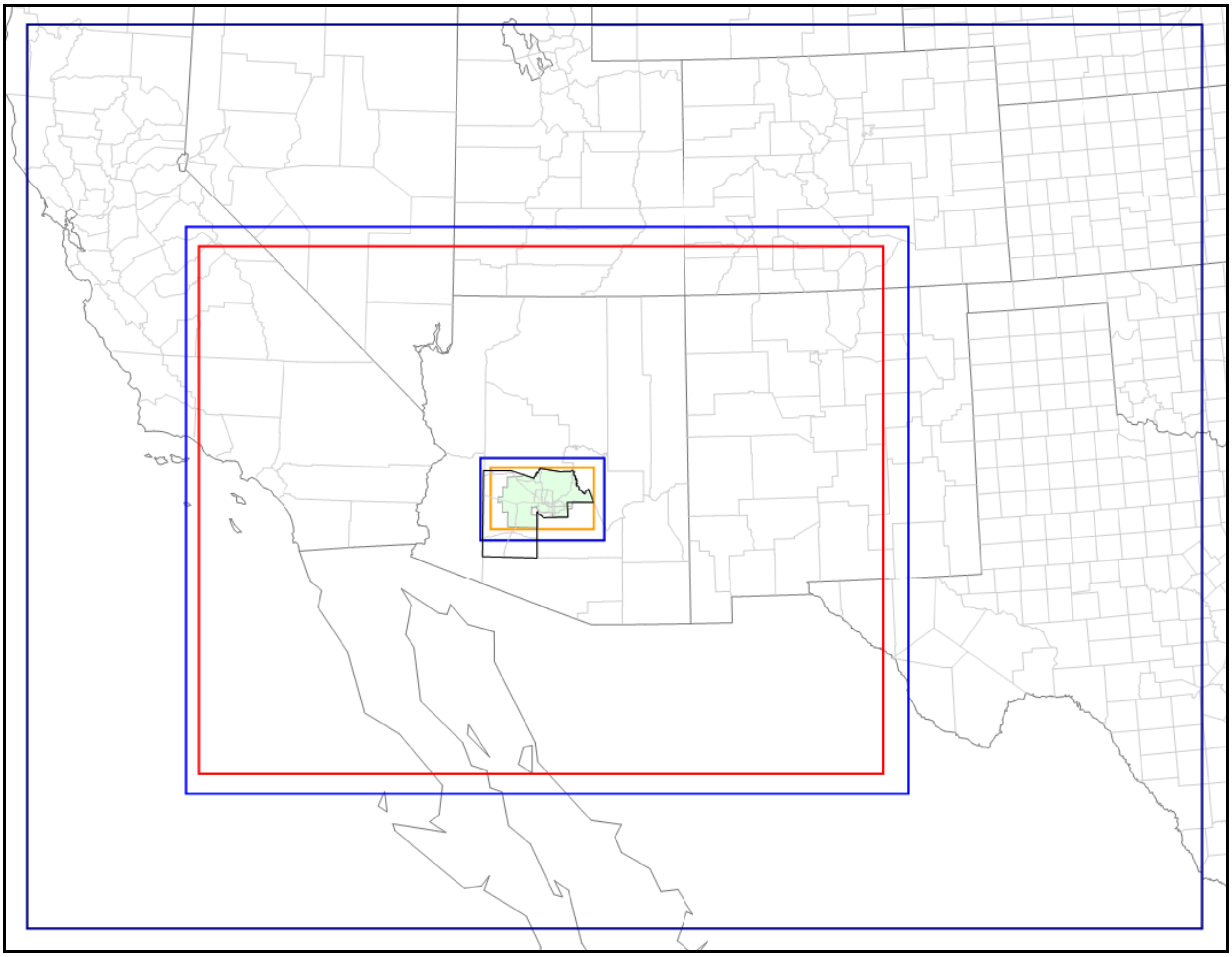

Figure 2-3 Nested CAMx and MM5 Modeling Domains

Two CAMx domains:

- 12 km grid domain (red)
- 4 km grid domain (orange)

Three MM5 domains (blue):

- 36 km grid domain
- 12 km grid domain
- 4 km grid domain

The map projection is UTM Zone 12.

2.3 Air Quality Monitoring Data and Meteorological Data

2.3.1 Air Quality Monitoring Data

The primary sources of air quality data for the Maricopa County Eight-Hour Ozone Nonattainment Area (MNA) are the monitoring networks maintained by the Maricopa County Air Quality Department (MCAQD) and the Arizona Department of Environmental Quality (ADEQ). Air quality data for the MNA is also obtained from the monitoring network managed by the Pinal County Air Quality Department (PCAQD). The PCAQD monitoring sites are not located in the MNA but are inside the CAMx inner modeling domain. Table 2-2 and Figure 2-4 present the locations of the ozone monitoring sites located in the CAMx inner modeling domain.

Air quality monitoring data from the MCAQD, ADEQ, and PCAQD monitoring networks were used in the review of ozone episodes (MAG, 2007a). However, data from monitoring sites with incomplete data and those sites lying outside the eight-hour ozone nonattainment area (MNA) were not used in the episode evaluation. The monitoring data have also been used to assess the ability of the model to replicate a historical eight-hour ozone episode, that is, to evaluate model performance for the base case (MAG, 2007a). This topic is addressed in the relevant section of the modeling protocol below.

2.3.2 Meteorological Data

The modeling demonstration of the eight-hour ozone maintenance plan will use the same MM5 meteorology data previously provided by ENVIRON for use in the Eight-Hour Ozone Plan (MAG, 2007a). The meteorological observations, the large-scale meteorological analysis fields, and other data sets required by MM5 are summarized below. The procedure for model performance evaluation and improvement of MM5 modeling is also briefly described in the following text.

Meteorological observations were obtained by MAG (MAG 2005) from three monitoring networks in the Maricopa County area and throughout Arizona: 1) Surface meteorological sites in the Arizona Meteorological Network (AZMET), 2) National Oceanic and Atmospheric Administration’s National Weather Service (NOAA/NWS), and 3) Four upper air profiler sites operated by the NOAA’s Forecast Systems Laboratory (FSL). Table 2-3 identifies the meteorological stations operated by these three networks, and Figure 2-5 illustrates the location of each meteorological station. It should be noted that the twenty-three AZMET monitoring stations, operated by the University of Arizona, are not traditional weather stations; these stations' main purpose is to provide meteorological data for agricultural and horticultural interests in southern and central Arizona. The standard National Center for Atmospheric Research's NWS (NCAR/NWS) hourly surface observation dataset (referred to as "DS472") was also obtained to augment MAG's meteorological databases and to cover the entire region encompassed by the MM5 domain. The above meteorological data were used for direct input to MM5's Four Dimensional Data Assimilation (FDDA) system; and have also been used in the qualitative and statistical model performance evaluations.

Other datasets needed for MM5 modeling include terrain elevation, landuse/landcover, and large-scale meteorological analysis fields. The large-scale analyses are used for prescribing initial and boundary conditions and for analysis nudging MM5 during integration as part of its FDDA system. The analyses were extracted from the NCEP NAM/Eta Data Assimilation System (EDAS), which provides 40 km grid North American analyses every 3 hours. All of the needed datasets listed above were procured directly from the National Center for Atmopsheric Research (NCAR).

The MM5 simulations produced the required meteorological inputs (e.g., wind, temperature, humidity, and pressure) for MAG's air quality modeling. Both analysis nudging and observational nudging have been applied, and an extensive MM5 performance evaluation was conducted using the meteorological observations mentioned above for each 8-hour ozone episode. Sensitivity runs were conducted to find the optimal configuration for the best MM5 performance in terms of replicating surface wind, temperature, and humidity for the MNA; and also for the best CAMx model performance that uses the MM5 meteorology, in terms of consistency between simulated ozone and the monitored ozone values.

Three nested domains (4/12/36 km grids) were set up in MM5. The modeling domains for MM5 are larger than the inner and outer air quality modeling domains, as shown in Figure 2-3. Therefore, the meteorological fields for the air quality model applications are a subset of the MM5 wind fields. This approach diminishes the errors propagating from the modeling domain boundaries to the area of interest. Other input variables required by CAMx include cloud cover and UV radiation, which are not directly simulated by MM5, but are diagnosed or calculated in CAMx.

MAG will evaluate using the meteorological output from NCAR's Weather Research & Forecasting (WRF) model for use in the CAMx model (i.e., as a replacement for MM5 meteorological data). WRF is a next-generation mesoscale forecast model and data assimilation system that represents state-of-the-art weather prediction techniques. WRF will be set up with the same MM5 domain and vertical structures that were used in the Eight-Hour Ozone Plan. If the CAMx model's performance is noticeably improved with the WRF data, rather than with the MM5 data, MAG will use the WRF data in its CAMx modeling for this study.

2.4 Vertical Resolution

There are 35 vertical layers in the MM5 simulation, which is based on the WRAP CMAQ/CAMx regional modeling configuration. CAMx layers are allowed to span several MM5 layers, and thus are defined as a subset of the MM5 layers. The number of vertical layers in the CAMx 12 km grid modeling domain is 20; and there are 23 layers in the CAMx 4 km grid modeling domain. The top pressure is fixed at 100 millibars (mb), which corresponds to a vertical height of approximately 16 km. The vertical resolution is much finer in the lower layers than in the upper layers, with a total of 16 layers in the planetary boundary layer (PBL). The thickness of the lowest four layers is approximately 36 meters. This vertical structure exceeds the minimum standards recommended by EPA guidance (EPA 2007).

2.5 Specification of Initial and Boundary Conditions for CAMx

ENVIRON provided the initial and boundary conditions (IC/BC) data for the CAMx 12 km grid modeling domain. The data were extracted from the 36 km grid air quality simulations made with EPA's Models-3 CMAQ (version 4.5) using CMAQ's ICON/BCON processors. These input files were subsequently converted to CAMx IC/BC inputs using the CMAQ2CAMx-v2 interface utility developed by ENVIRON. The IC/BC data for the inner 4 km grid modeling domain were obtained from the CAMx output for the outer 12 km grid modeling domain.

Table 2-2 Ozone Monitoring Sites

Abbr.	Name	AIRS Code	Operator	Location	Data Availability	O_3	CO	NO	NO_2	WS/WD
AJ*	Apache Junction	04-021-3001	PCAQD	305 E Superstition Blvd	2002-2004	√				
BP†*	Blue Point	04-013-9702	MCAQD	Usery Pass & Bush	2000-2004	√				√
BE	Buckeye	04-013-4011	MCAQD	26453 W MC85	Since 8/1/2004	√	√		√	√
CC*	Cave Creek	04-013-4008	MCAQD	37019 N Lavon Ln	Since 8/1/2001	√				√
CP†*	Central Phoenix	04-013-3002	MCAQD	1845 E Roosevelt	2000-2004	√	√		√	√
DY	Dysart	04-013-4010	MCAQD	16825 N Dysart	Since 7/21/2003	√	√			√
EM	Emergency Management	04-013-3004	MCAQD	52nd St & McDowell Rd	Till 5/31/2001	√				
FF†*	Falcon Field	04-013-1010	MCAQD	4530 E Mckellips	2000-2004	√				√
FH†*	Fountain Hills	04-013-9704	MCAQD	16426 E Palisades	2000-2004	√				√
GL†*	Glendale	04-013-2001	MCAQD	6000 W Olive	2000-2004	√	√			√
HM†*	Humboldt Mountain	04-013-9508	ADEQ	7 Springs Rd	2000-2004	√				
LP*	Lake Pleasant	04-013-9805	MCAQD	41402 N 87th Ave	Till 7/31/2001	√				√
MRCP**	Maricopa	04-021-3010	PCAQD	44625 W Garvey Rd	Since 7/1/2002	√				
MV*	Maryvale	04-013-3006	MCAQD	6180 W Encanto	2000-2003	√	√			
ME*	Mesa	04-013-1003	MCAQD	370 S Brooks	2000-2002	√	√			√
MORD*	Mount Ord	04-013-9701	ADEQ	Mountain Ord Summit	5/19/2000-2001	√				√
NP†*	North Phoenix	04-013-1004	MCAQD	610 E Butler	2000-2004	√	√			√
PALV†*	Palo Verde	04-013-9993	ADEQ	36248 W Elliot Rd	2000-2004	√		√	√	
PP†*	Pinnacle Peak	04-013-2005	MCAQD	25000 Windy Walk Way	2000-2004	√	√			√
QC**	Queen Creek	04-021-3009	PCAQD	301 E Combs Rd	Since 7/1/2002	√				
QV**	Queen Valley	04-021-8001	ADEQ	10 S Queen Ann	Since 5/23/2001	√		√	√	
RV†*	Rio Verde	04-013-9706	MCAQD	N Forest Rd & Del Ray Ave	2000-2004	√				
SAC**	Sacaton	04-021-7001	Tribal	35 Pima St	Since 7/1/2002	√				
SP†*	South Phoenix	04-013-4003	MCAQD	33 W Tamarisk Ave	2000-2004	√	√			√
SS†*	South Scottsdale	04-013-3003	MCAQD	2857 N Miller Road	2000-2004	√	√		√	√
SUPR†*	Super Site	04-013-9997	ADEQ	4530 N 17th Ave	2000-2004	√	√	√	√	√
SU	Surprise	04-013-4007	MCAQD	18600 N Reems Rd	2001-7/14/2003	√	√			
TEMP*	Tempe	04-013-4005	MCAQD	1525 S College Ave	Since 7/1/2000	√	√		√	√
TNM**	Tonto National	04-007-0010	ADEQ	South of SR88	Since 5/24/2002	√		√	√	
WC	West Chandler (old)	04-013-3009	MCAQD	163 S Price Rd	Till 5/31/2000	√	√			√
WC*	West Chandler	04-013-4004	MCAQD	Ellis St & Frye Rd	Since 8/1/2000	√	√			√
WP†*	West Phoenix	04-013-0019	MCAQD	3847 W Earll Rd	2000-2004	√	√		√	√

† Monitoring sites having a complete data record.

* Monitoring sites having 8-hour ozone exceedance at least once during the period (2000-2004) that affected selection of episodes to be modeled.

** Monitoring sites inside of the inner model domain but outside of the 8-hour ozone nonattainment area. Data from these sites were used for model performance evaluation.

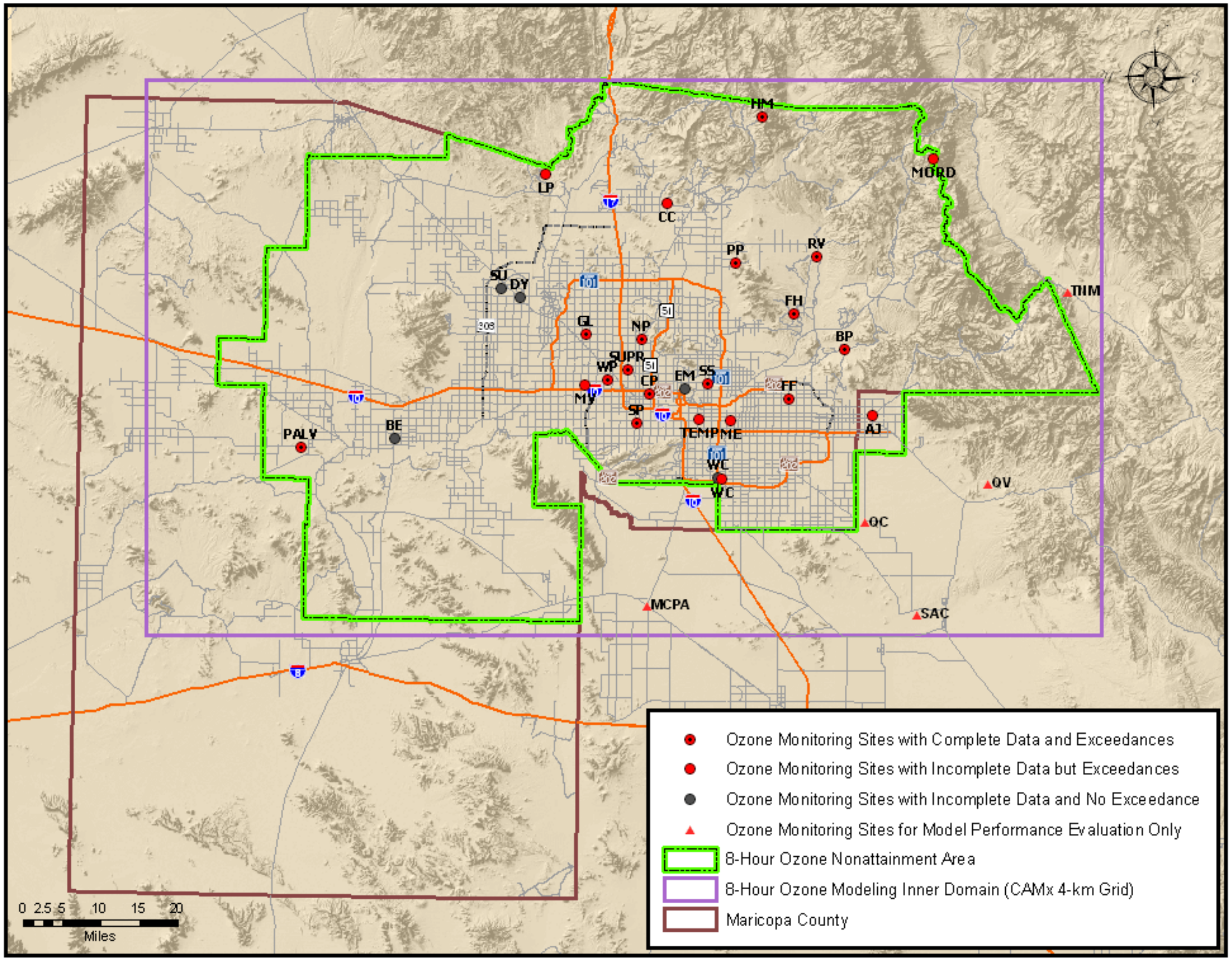

Figure 2-4 Ozone Monitoring Sites

Table 2-3 Meteorological Monitoring Stations

NWS (33 sites)								
Site	Abbr.	Lat	Lon	UTM (Zone 12)		Elev.	Address	County
				Northing (m)	Easting (m)	(m)		
Casa Grande Municipal Airport	KCGZ	32.95000	-113.76389	3646004.74	428339.63	446	510 E. FLORENCE BLVD, Casa Grande	Pinal
Chandler Municipal Airport	KCHD	33.26917	-113.93306	3681421.13	424459.38	379	2380 S. STINSON WAY, Chandler	Maricopa
Davis-Monthan Air Force Base	KDMA	32.16667	-111.44806	3558916.01	511000.13	824	DAVIS-MONTHAN AFB, Tucson	Pima
Douglas Bisbee International Airport	KDUG	31.46917	-112.42222	3482443.65	632656.74	1266	1415 MELODY LANE, BLDG C, Douglas	Cochise
Phoenix Deer Valley Municipal Airport	KDVT	33.69028	-110.72083	3728325.15	401239.94	450	702 W DEER VALLEY DR, Phoenix	Maricopa
Tucson NEXRAD	KEMX	31.88300	-110.00556	3527531.19	536222.38	1586	Tucson	Pima
Mesa/Falcon Field	KFFZ	33.46667	-109.37917	3703264.45	431857.54	424	4800 FALCON DR, Mesa	Maricopa
Flagstaff	KFGZ	36.21700	-111.67222	4008326.71	426567.23	2192	Flagstaff	Coconino
Libby AAF Fort Huachuca	KFHU	31.60000	-111.81700	3496292.91	563243.03	1438	401 GIULIO CESARE AVE, Sierra Vista	Cochise
Flagstaff Pulliam Airport	KFLG	35.14028	-112.15472	3888806.53	438763.21	2137	6200 S. PULLIAM DR, 204, Flagstaff	Coconino
Flagstaff NEXRAD	KFSX	34.56700	-114.55944	3825044.89	481654.04	2260	Flagstaff	Coconino
Gila Bend U.S. Army Airfield	KGBN	32.43333	-112.68333	3589715.73	341743.08	262	Gila Bend	Maricopa
Grand Canyon National Park Airport	KGCN	35.94611	-110.61700	3978587.39	395854.86	2014	Grand Canyon	Coconino
Glendale Municipal Airport	KGEU	33.52722	-112.38333	3710488.09	379721.07	325	6801 N. GLEN HARBOR BLVD 201, Glendale	Maricopa
Goodyear Municipal	KGYR	33.41667	-110.84583	3698335.76	371380.94	295	1658 SO LITCHFIELD RD, Goodyear	Maricopa
Laughlin/Bullhead International	KIFP	35.15750	-110.33333	3893236.68	722300.40	212	2550 LAUGHLIN VIEW DR, Bullhead City	Mohave
Kingman Airport	KIGM	35.25778	-109.60361	3905575.22	233156.32	1050	7000 FLIGHTLINE DR, Kingman	Mohave
Winslow Municipal Airport	KINW	35.02806	-110.95528	3876190.43	525466.06	1505	21 WILLIAMSON AVE, Winslow	Navajo
Mesa Williams Gateway Airport	KIWA	33.31660	-109.63556	3686574.65	439496.98	421	6001 SOSSAMAN RD, Mesa	Maricopa
Williams AFB/Chandler	KIWA	33.31667	-111.76667	3686574.65	439496.98	421	6001 SOSSAMAN RD, Mesa	Maricopa
Luke Air Force Base/Phoenix	KLUF	33.53333	-111.81111	3711271.17	371553.24	332	LUKE AFB, Glendale	Maricopa
Yuma Marine Corps Air Station	KNYL	32.62361	-109.06667	3612935.22	240675.79	64	Yuma	Yuma
Nogales International Airport	KOLS	31.42083	-111.73333	3476252.27	514652.98	1198	Nogales	Santa Cruz
Page Municipal Airport	KPGA	36.92056	-112.06556	4086153.63	460091.83	1314	697 VISTA AVENUE, Page	Coconino
Phoenix Sky Harbor International	KPHX	33.43417	-111.65000	3699914.60	402291.25	345	3400 SKY HARBOR BLVD, Phoenix	Maricopa
Prescott Love Field	KPRC	34.64917	-111.65000	3835058.29	369663.82	1537	6546 CRYSTAL LANE, Prescott	Yavapai
Wind Rock Airport	KRQE	35.65000	-112.29528	3946850.91	675023.86	2055	Window Rock	Apache
Safford Municipal Airport	KSAD	32.85722	-111.91056	3636283.38	627670.20	968	4550 E AVIATION WAY, Safford	Graham
Scottsdale Airport	KSDL	33.62278	-114.60000	3720703.49	415540.50	460	15000 N AIRPORT DR, Scottsdale	Maricopa
St. Johns Industrial Airpark	KSJN	34.51833	-111.20000	3820822.44	648772.04	1747	St. Johns	Apache
Show Low Regional Airport	KSOW	34.26528	-110.88333	3792017.67	591549.62	1955	3150 AIRPORT LOOP, Show Low	Navajo
Tucson International Airport	KTUS	32.13139	-112.05111	3555000.31	504218.01	805	Tucson	Pima
Yuma International Airport	KYUM	32.65000	-112.38333	3615031.47	725106.73	65	2191 E 32ND ST, Yuma	Yuma

Table 2-3 Meteorological Monitoring Stations (Continued)

AZMET (23 sites)

Site	Abbr.	Lat	Lon	UTM (Zone 12) Northing (m)	UTM (Zone 12) Easting (m)	Elev. (m)	Address	County
Aguila	AGUI	33.946667	-113.188889	3758401	297716	655	0.6 Miles NW of Aguila City Limits	Maricopa
Bonita	BONI	32.463611	-109.929444	3592330	600610	1346	18 Miles N on Rex Allen Dr from Willcox at I-10	Graham
Buckeye	BCK1	33.400000	-112.683333	3696899	343454	304	3.5 km S of Exit 109 from I-10	Maricopa
Coolidge	COOL	32.980000	-111.604722	3649232	443496	422	0.8 km SW of the Curry Rd & Bechtel	Pinal
Eloy	ELOY	32.773889	-111.556944	3626358	447840	461	0.8 km E of 11 Miles Corner Rd on Arica Rd	Pinal
Harquahala	HARQ	33.483333	-113.116667	3706876	303337	350	1.8 km N of the Intersection of Courthouse Rd & 491st Ave	Maricopa
Laveen	LAVE	33.376389	-112.150000	3693605	393027	315	3921 W Baseline Rd	Maricopa
Litchfield	LITC	33.467222	-112.398056	3703959	370087	309	1 Mile N of McDowell Rd on Cotton Ln	Maricopa
Marana	MARA	32.461111	-111.233333	3591572	478071	601	1 Mile W of I-10 on Trico-Marana Rd	Pima
Maricopa	MARI	33.068611	-111.971667	3659313	409299	361	NW corner of field #5 S of Irrigation Lab Building	Pinal
Mohave	MOHA	34.967222	-114.605833	3872026	718581	146	14.2 Miles S of Bullhead City on AZ Route 95	Mohave
Paloma	PALO	32.926667	-112.895556	3644751	322765	219	9 Miles W of Gila Bend on I-8 to Paloma Exit	Maricopa
Parker	PARK	33.882778	-114.447778	3752091	736045	94	8 Miles S of Poston & 0.4 Miles E on Nez Rd	La Paz
Phx. Encanto	ENCA	33.479167	-112.096389	3704947	398135	335	SE of Thomas Rd & 19th Ave (Encanto Golf Course)	Maricopa
Phx. Greenway	PGRN	33.621389	-112.108333	3720728	397193	401	SE of Greenway & 23rd Ave (Cave Creek Golf Course)	Maricopa
Queen Creek	QUEE	33.258333	-111.641667	3680110	440233	430	0.1 km E of Queen Creek Rd & Ellsworth Rd	Maricopa
Roll	ROLL	32.744444	-113.961111	3626837	222539	91	County 4th St & Ave 39 E	Yuma
Safford	SAFF	32.813333	-109.678333	3631367	623729	901	0.8 km SE of Lone Star Rd & Mountain Rd	Graham
Tucson	TUCS	32.280278	-110.945833	3571504	505101	713	1 km NW of Campbell Ave & Roger Rd	Pima
Waddell	WADD	33.618056	-112.459722	3720763	364592	407	2 Miles W of Cotton Ln & 0.4 Miles S of Greenway Rd	Maricopa
Yuma Mesa	YMES	32.611944	-114.633889	3610740	722021	58	0.32 km W of Ave A on 15th St	Yuma
Yuma North Gila	YUMA	32.735278	-114.529444	3624641	731506	44	2.1 km W on 7th Ave from Gila Center	Yuma
Yuma Valley	YVAL	32.712500	-114.705000	3621744	715106	32	5 Miles W of Yuma on 8th St	Yuma

FSL (4 sites)

Site	Abbr.	Lat	Lon	UTM (Zone 12) Northing (m)	UTM (Zone 12) Easting (m)	Elev. (m)	Address	County
Flagstaff/Bellemt	FGZ	35.23	-111.82	3898858	425383	2179	123 miles North from Central Phoenix	Coconino
Tucson	TUS	32.12	-110.93	3553739	506603	788	113 miles South from Central Phoenix	Pima
Yuma/US Army	YUM	32.87	-114.33	3640036	749823	131	138 miles West from Central Phoenix	Yuma
Yuma/US Army	1Y7	32.87	-114.40	3639872	743271	98	142 miles West from Central Phoenix	Yuma

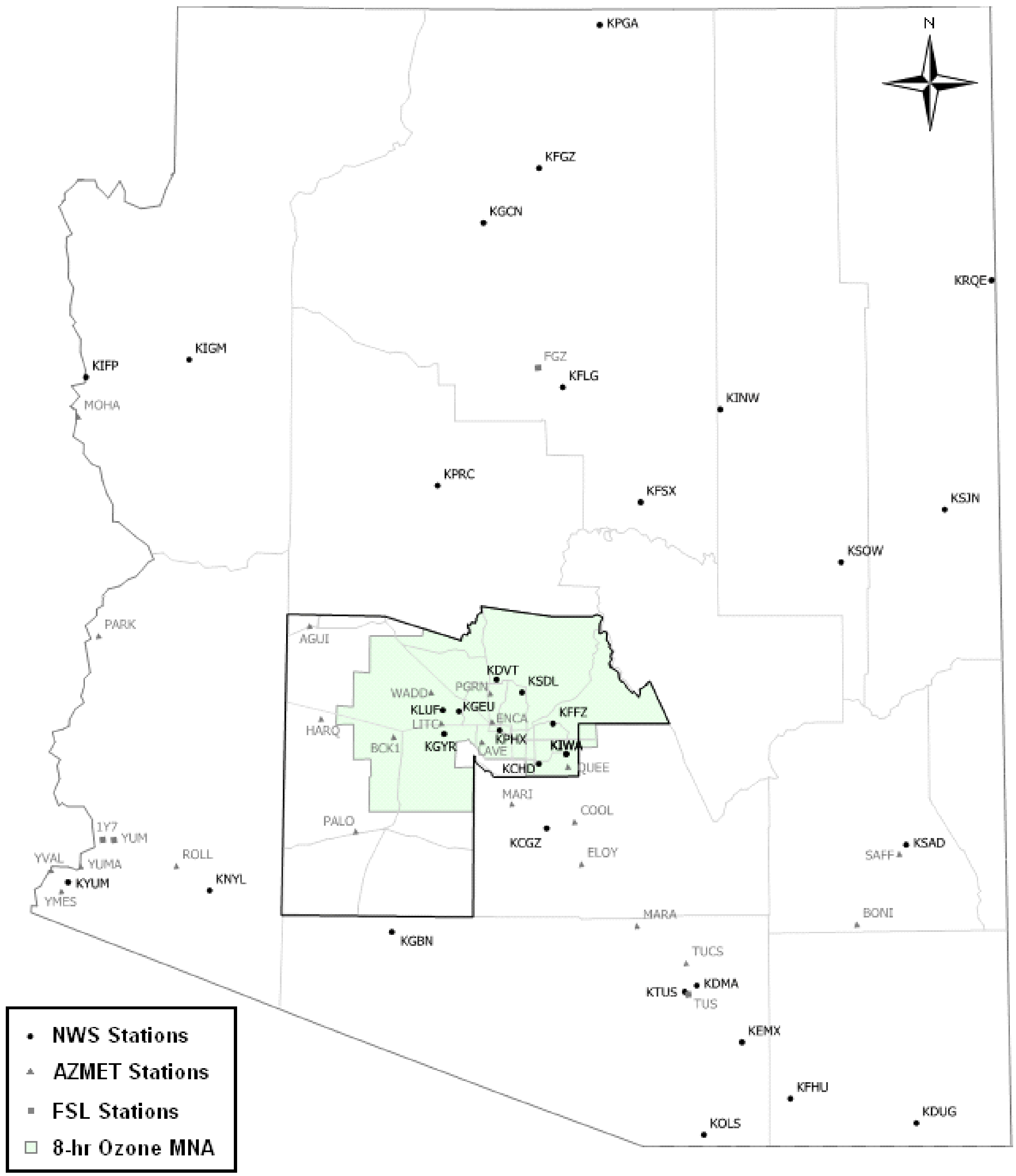

Figure 2-5 Meteorological monitoring stations

2.6 Episode Selection

Since the Eight-Hour Ozone Maintenance Modeling Demonstration employs the same base years used for the Eight-hour Ozone Plan, three elevated ozone episodes that occurred during the ozone seasons of the five years, 2000 through 2004, will be used for this modeling study. The historical patterns of ozone episodes and the fundamental meteorological regimes conducive to ozone formation in the area were taken into account in evaluating and justifying the selection of episodes. The selected episodes represent three different meteorological regimes that correspond to eight-hour ozone concentrations of at least 80 parts per billion (ppb). Wind flow patterns (e.g., well defined transport winds vs. light and variable winds) were the primary consideration for distinguishing among regimes. Region-wide temperature observations (e.g., high temperatures vs. less extreme temperatures) were also considered as a factor in selecting the modeling episodes. High ozone days were partitioned into the three major regimes recommended in EPA guidance (EPA, 2007). The detailed evaluation resulting in episode selection is provided in the MAG Eight-Hour Ozone Plan for the Maricopa Nonattainment Area (MAG, 2007a).

The primary criteria influencing the selection of the episode periods were:

- The episodes represent a variety of meteorological conditions that frequently correspond with eight-hour ozone exceedances at multiple monitoring sites;

- The episode days have eight-hour ozone concentrations that are close to the design value for each monitor;

- There are adequate emissions, air quality, and meteorological data available for the maintenance test for these periods; and

- The selected episodes have a sufficient number of days to base the modeled maintenance test on (e.g., more than one day at each violating monitor).

Three high eight-hour ozone episode periods were selected based on the detailed analysis described in the Eight-Hour Ozone Plan. The three episodes are:

1. July 8-14, 2002 (Regime 1)
2. June 3-7, 2002 (Regime 2)
3. August 5-11, 2001 (Regimes 2 and 3).

The first episode (Regime 1) is characterized by stagnation and locally-generated ozone. It contains the highest 8-hour ozone concentration measured in the MNA between 2001 and 2004 and includes weekend exceedances. During this period, there were 17 sites with peak ozone concentrations greater than 85 ppb and 8 sites measured their fourth-highest concentrations of the year. This episode ranked the highest of the six candidate episodes that were evaluated.

The second episode (Regime 2) is characterized by higher surface winds, with potential transport mainly from the south and southwest. This episode does not include weekend exceedances. During this period, there were 8 sites with ozone concentrations above 85 ppb and 9 sites measured their fourth-highest concentrations of the year. This episode ranked third highest among the six candidates evaluated.

The third episode (Regimes 2 and 3) is characterized by higher surface winds, with both locally generated and transported ozone. It includes weekend ozone exceedances and has 11 sites with concentrations above 85 ppb. This episode was fourth highest among the candidates evaluated.

These three episodes will be modeled in order to reflect the full range of meteorological, transport, and emissions-generation conditions that are characteristic of high ozone days in the MNA. Three spin-up days will be added to each episode, resulting in a total of 28 days to be modeled.

2.7 Emission Inventories

Emission inventories consist of emissions from point, area, onroad mobile, nonroad mobile and biogenic sources. For this modeling analysis, the nonroad mobile source category includes aviation and locomotive emissions, in addition to gasoline and diesel-powered equipment, ranging from lawn and garden equipment to construction equipment. The version 3.0 of Emissions Preprocessor System (EPS3.0) will be used to process emission inventories for the 8-hour ozone maintenance modeling demonstration. EPS3.0 is an updated and improved version of EPS2.0 provided to MAG by ENVIRON. EPS3.0 consists of a set of FORTRAN programs (modules) that are executed sequentially in order to prepare the gridded emission inventory for use in photochemical air quality modeling.

Point, area, and nonroad mobile source emissions will be temporally adjusted and spatially allocated in the grid cells by EPS3.0, while hourly gridded onroad and biogenic emissions will be directly developed by emission models such as MOBILE6.2 and M6Link for onroad emissions and the Model of Gases and Aerosols from Nature (MEGAN) for biogenic emissions. More details on these models are described in Sections 2.7.2 and 2.7.3 of this protocol. Prior to the CAMx model run, gridded emissions for each source will be merged by the mrguam module of EPS3.0 and be reformatted for use in the CAMx model.

Emission inventories for the maintenance year 2025 will be developed for the same three episodes developed in the MAG Eight-Hour Ozone Plan to demonstrate attainment for the MNA in 2008. For the 2025 emission inventories, the latest 2005 emission inventories for ozone precursors, which were submitted for the EPA National Emission Inventory (NEI) database, will be adjusted to reflect emissions expected to occur in 2025. Emissions will also be adjusted to reflect control programs and activity levels expected to occur in 2025. The general methodology for creating the 2025 emissions will be based on EPA guidance for the preparation of emissions projections (EPA, 1991). These adjustments will entail the use of growth factors, ongoing and new control programs, and retirement rates for obsolete sources of emissions. The growth factors used to create the 2025 emission inventories will reflect the latest socioeconomic projections adopted by the MAG Regional Council in May, 2007. The impact of the committed control measures will be reflected in the 2025 emission inventories. Table 2-4 summarizes the daily ozone precursor emissions for the five major source categories during the 2005 ozone season in Maricopa County.

Table 2-4 Average Daily Emissions in Maricopa County for 2005 Ozone Season (MCAQD, 2008)

	VOC		NOx		CO	
	lbs/day	**%**	**lbs/day**	**%**	**lbs/day**	**%**
Area	482,211	30.43	150,465	20.53	4,911,645	56.01
Nonroad Mobile	159,437	10.06	185,433	25.31	2,014,686	22.97
Onroad Mobile	189,915	11.99	352,527	48.11	1,725,438	19.68
Biogenic	726,222	45.83	18,196	2.48	107,165	1.22
Point	26,702	1.69	26,129	3.75	10,491	0.12
Total	1,584,487	100	732,750	100	8,769,425	100

2.7.1 Treatment of Point and Area Source Emissions

Except for power plant emissions, the 2025 emissions will be developed by projecting point and area source emissions from the 2005 periodic emission inventories of ozone precursor emissions developed by the Maricopa County Air Quality Department (MCAQD) and the Pinal County Air Quality Control District (PCAQCD). MAG will work with MCAQD and PCAQCD to develop the growth factors needed to project the point and area source emissions from the 2005 periodic emission inventories. Power plant emissions for the year 2025 will conservatively assume the potential to emit (PTE) emissions provided by MCAQD and PCAQCD. The locations of power plants in Maricopa County are provided in Table 2-5.

2.7.2 Treatment of Mobile Source Emissions

On January 29, 2002, EPA announced the official release of the MOBILE6 model for regulatory use outside of California. MOBILE6.2 is the latest update of the onroad mobile source model developed by EPA to estimate fleet-wide vehicle emission factors. The 2025 onroad mobile source emissions for the eight-hour ozone maintenance modeling demonstration will be developed using the MOBILE6.2 and MAG M6Link models. It should be noted that the onroad mobile source portion of the 2005 periodic emission inventories for ozone precursors was also developed using the MOBILE6.2 and M6Link models. The latest socioeconomic data and transportation system assumptions available in 2008 will be employed in developing onroad mobile source emissions for the year 2025.

MOBILE6.2 uses a variety of inputs. Each modeled scenario will require at least ten runs: a minimum of one Inspection and Maintenance (I/M) run and a non-I/M run for each of the five area types included in the transportation modeling area: central business district, urban, urban fringe, suburban, and rural. The results from these runs will be weighted appropriately to reflect the actual proportions of I/M and non I/M vehicles within the nonattainment area. In addition, the inputs for each run will include Reid Vapor Pressure (RVP), oxygen, gasoline and diesel sulfur contents, and values appropriate for the summer ozone season. The temperature range will reflect episode day conditions in the nonattainment area. Note that these values will vary depending upon the episode period being modeled. The 2025 maintenance modeling demonstration will reflect control measure assumptions for the pertinent commitments contained in the MAG Serious Area Plans for PM-10 (MAG, 2000) and CO (MAG , 2001), the One-Hour Ozone Maintenance Plan (MAG, 2004), the Eight-Hour Ozone Plan for the Maricopa Nonattainment Area (MAG, 2007a), and the Five Percent Plan for PM-10 (MAG, 2007b), where appropriate. The modeling will also include benefits for the controls passed by the Arizona Legislature in S.B. 1552.

Table 2-5 Power Plants in Maricopa County

Power Plant	Location	City	UTM (Zone 12, km)	
			Easting	Northing
APS W est Phoenix Power Plant	Hadley St.	Phoenix	392,414	3,701,190
Duke Energy Arlington Valley	Elliot Rd.	Arlington	323,858	3,691,307
New Harquahala Generating Co.	491st Ave.	Tonopah	303,688	3,705,787
Mesquite Generating Station	Elliot Rd.	Arlington	326,602	3,691,016
Ocotillo Power Plant	University Dr.	Tempe	415,224	3,698,573
Gila River Power Station	Watermelon Rd.	Gila Bend	341,737	3,696,527
Redhawk Generating Station (Pinnacle)	363rd Ave.	Arlington	328,940	3,690,200
Santan Generating Plant	Val Vista Dr.	Gilbert	430,407	3,688,183
SRP Agua Fria Generating Station	Northern Ave.	Glendale	387,108	3,713,387
SRP Kyrene Steam Plant	Kyrene Rd.	Tempe	412,877	3,691,004

MOBILE6.2 generates emission factors which incorporate local vehicle speeds, episodic temperatures and soak distribution. These emission factors will be utilized by the M6Link system to estimate onroad mobile source vehicle emissions for the inner modeling domain. The M6Link system is a FORTRAN-based set of programs (M6Link1 and M6Link2) that are applied at the regional level to examine transportation and related air quality issues. The system is designed to read in files created by the MAG transportation models, and extract the relevant data needed for an air quality analysis, including data needed to run the MOBILE6.2 model. The M6Link1 extracts data such as roadway link speeds, locations, and vehicle miles of travel (VMT) and assigns link VMT to the correct hour and grid cell accordingly. M6Link1 also factors link VMT to be consistent with Highway Performance Monitoring System VMT by functional system.

The MOBILE6.2 program is run using the output from M6Link1 as part of its input data. The output from MOBILE6.2 is then used as one of the inputs to M6Link2, the second program of the M6Link system. M6Link2 combines the output from M6Link1 and the output of MOBILE6.2 to produce hourly gridded emissions, suitable for input to the photochemical air quality model. These results incorporate locally-derived hourly VMT splits, vehicle speed distribution, VMT by vehicle class for area and roadway type, fuel characteristics, and temperatures, to ensure results appropriate to episode conditions. In addition to CAMx-ready files, M6Link2 produces tables summarizing VMT and vehicle hours traveled (VHT) by facility type and area type. Also, tables summarizing emissions totals by hour, facility type, or emissions source (i.e. exhaust vs. evaporative) are produced. EPS3.0 will be used to combine the M6Link output with the emissions of other source categories (e.g., point, area, and biogenic emissions) to create the emissions file used by the photochemical air quality model.

2.7.3 Treatment of Nonroad Mobile Emissions

MAG will use EPA's NONROAD2005 model to estimate ozone precursor emissions for all nonroad mobile sources, except aircraft and ground support equipment. The MAG Airport Emissions Model will be employed to estimate emissions from aircraft and ground support equipment. The forecasted 2025 nonroad emissions will be developed by applying 2025 emission factors and 2025 growth factors to 2005 nonroad vehicle activity and population data.

Locomotive emissions will be estimated by applying EPA 2025 emission factors to 2005 activity data provided by the Union Pacific and the Burlington Northern Santa Fe Railroads. No growth in locomotive activities will be assumed in the modeling, which is consistent with the assumption in the MAG Five Percent Plan for PM-10 (MAG, 2007b). In estimating emissions from aircraft and ground support equipment, MAG Airport Emissions Model (AEM) will be employed. Detailed descriptions of the model are available in the report by Systems Applications International (MAG, 1996). Emission factors for estimating aircraft emissions will be calculated using the FAA Aircraft Engine Emissions Database (FAEED) and supplemented with emission factors not included in the FAEED database, based on EPA guidance (EPA, 2007). Aircraft operation for the 2025 future year will be obtained from MAG Regional Aviation System Plan (RASP) Update 2006 (MAG, 2006). The same growth factor will be applied in estimating the 2025 ground service equipment activity levels at each airport in Maricopa County.

2.7.4 Treatment of Biogenic Emissions

Biogenic emissions developed for the three high ozone episodes in the MAG Eight-Hour Ozone Plan (MAG, 2007a) will be assumed to remain constant for the year 2025. Biogenic emission estimates for the modeling domain were derived using the MEGAN model. MEGAN is an acronym for Model of Emissions and Gases and Aerosols from Nature, which was developed by ENVIRON. The emission factors in MEGAN were updated and added for local vegetation based on the results of a field study to identify prevalent plant species in Maricopa County, including their locations and biomass density (Guenther, A., 2006a and 2006b). MEGAN reads in gridded meteorological data (i.e., temperature, solar radiation, humidity, soil moisture, etc.) generated by MM5 and vegetation characteristics such as monthly leaf area index (LAI), plant function type (PFT), and emission factors as inputs. MEGAN creates an EPS3.0 ready hourly gridded emission file as output.

2.7.5 Temporal Allocation of Emissions

To predict hourly concentrations of ozone, CAMx requires hourly estimates of emissions for each grid cell in the modeling domain. Hourly biogenic and onroad mobile source emissions will be directly generated by biogenic and onroad models so that these emissions do not need to go through temporal adjustment process of EPS3.0. However, since point, area, and nonroad emissions are provided as daily emissions for the ozone season, point source emissions will be resolved to hourly emissions using available operating schedule data, while area and nonroad emissions will be temporally adjusted based on profiles for seasonal, day of week, and diurnal patterns of activities.

2.7.6 Spatial Allocation of Emissions

The point source emission inventory includes UTM coordinates for each source. The emissions are allocated to the appropriate grid cells according to the UTM coordinates of the source. However, since area and nonroad emissions are provided as county-level emissions, spatial surrogates need to be used to allocate these emissions to the appropriate grid cells. The assumption using spatial surrogates is that emissions from each source behave spatially in the same manner as the spatial surrogate indicator. Fourteen spatial surrogates will be developed based on socio-economic data, MAG General Plan, and MAG GIS data. The fourteen spatial surrogate codes and categories are provided in Table 2-6. The MAG transportation model will assign travel demand data to 2025 highway networks which will be used to spatially distribute onroad mobile source emissions.

2.8 Quality Assurance

The purpose of quality assurance testing is to establish that good model performance is the result of valid model inputs and assumptions, and not the result of compensating errors in input data. Prior to conducting modeling analysis, individual air quality, meteorological, and emissions data components will be reviewed for consistency and obvious omission errors. Both spatial and temporal characteristics of the data will be evaluated. Examples of component testing include:

- **Air Quality** - Air quality data will be checked for correct order of magnitude and values will be compared with monitored data to assure reasonable speciation.

- **Meteorology** - Surface and elevated wind vectors will be plotted and compared with monitoring stations and weather maps for consistent patterns. Temperature fields will be checked.

- **Emissions** - The emission inventories will be tabulated, plotted, and examined. The quality assurance procedures will include documentation of major assumptions, careful accounting of emissions totals throughout the development process, verification of spatial distribution of emissions against known source locations and emission strengths, and identification of missing or unreasonable data values.

It is crucial to perform the quality assurance tests prior to performing model simulations. Errors uncovered by the quality assurance testing of component input fields might be extremely difficult to diagnose later in the modeling process where errors could arise from any subset of the data inputs.

Table 2-6 Spatial Surrogate Codes and Categories

Code	Categories	Data Source
1	Housing	2025 Projected Socio-economic Data
2	Industrial	MAG General Plan
3	Non-industrial	MAG General Plan
4	Undeveloped Total	MAG General Plan
5	Developed Total	MAG General Plan
6	Construction	MAG GIS Data
7	Agriculture - Stockyards	MAG GIS Data
8	Agriculture - Other Crops	MAG General Plan
9	Non-developable Forest	MAG GIS Data
10	Railroad	MAG GIS Data
11	Landfill	MAG GIS Data
12	Water	MAG General Plan
13	Golf Course	MAG GIS Data
14	Airport	MAG General Plan

3. MODEL PERFORMANCE EVALUATION

EPA recommends that model performance be evaluated in two ways - operational and diagnostic evaluations - prior to using photochemical modeling to support a maintenance demonstration (EPA, 2007). In addition to a discussion on performance evaluation, this section summarizes the performance evaluation results performed for the MAG Eight-Hour Ozone Plan (MAG, 2007a).

3.1 Operational Evaluation

An operational evaluation is a major method to assess how accurately the model predicts observed concentrations for specific cases. The results of an operational evaluation could be used as a benchmark for model performance and a reference for further model improvement. It is expected to conduct an operational evaluation of ozone model performance using the EPA-recommended statistical measures, graphical displays, and other analytical techniques. MAG will conduct the operational evaluation presented below:

Statistics - For hourly ozone and eight-hourly maxima ozone over the episode days in a maintenance demonstration, EPA recommends, at a minimum, to calculate three statistical measures including Mean Normalized Bias (MNB), Mean Normalized Gross Error (MNGE), and Average Peak Prediction Bias and Error. Along with the three metrics above, additional statistics such as mean bias, mean error, mean fractional bias, mean fractional error, root mean square error, correlation coefficients, etc. should be calculated. It is recommended to calculate these statistical measures for pairs in which the one-hour or eight-hour observed concentrations are greater than 60 ppb and for all pairs without threshold.

Plots/Graphics - EPA recommends to provide five sets of graphical displays, which are time series plots, scatter plots, quantile-quantile (Q-Q) plots, tile plots of daily maximum predicted ozone, and animations of predicted hourly ozone concentrations. It is recommended to provide these graphical displays for both one-hour and eight-hour ozone.

In the Eight-Hour Ozone Plan, MAG conducted operational evaluations for both statistical and graphical assessments of model versus observed pairs. The statistical analysis showed that the performance of CAMx for the June 2002 episode is satisfactory and acceptable by EPA standards; the graphical analysis indicated that the temporal and spatial characteristics of the observed ozone distribution patterns were reasonably replicated. It is concluded that CAMx can adequately replicate the ozone episode of June 2002, and therefore is suitable to use to predict future ozone concentration levels for the MNA. Although CAMx consistently underestimated monitored ozone concentrations for the July 2002 and August 2001 episodes, these two episodes provided a better understanding of the CAMx simulation under different meteorological situations.

3.2 Diagnostic Evaluation

A diagnostic evaluation is a potentially useful approach to understand whether the model predictions are plausible or not. The results of diagnostic evaluations could be used to explain model performance and to provide ideas about how to improve the reliability of model predictions. EPA provides a list of tools for diagnostic analyses and encourages air quality modelers to complete as many as possible. If WRF is selected as a meteorological model for CAMx, MAG will conduct as many diagnostic evaluations as possible. These evaluations are discussed below.

Photochemical Source Apportionment - As one of the embedded probing tools within CAMx, photochemical source apportionment tool provides information on the contribution of tagged primary emission sources, source categories, source regions, initial conditions and/or boundary conditions to simulated concentrations and deposition in a single model run. This tool could be used to estimate how emissions from individual source areas and regions influence predicted ozone concentrations over space and time.

Decoupled Direct Method (DDM) - In a single model run, the DDM provides information for model sensitivity to various emissions reductions of model inputs (e.g., initial conditions, boundary conditions, and emissions).

Chemical Process Analysis (CPA) - As one of the most common process analysis tools implemented in grid models, the CPA provides details on the chemical transformations in CAMx simulation.

Sensitivity Tests - Sensitivity tests are useful methods to determine the response of the photochemical model to emissions reductions by using alternative model inputs or model algorithms. The parameters for sensitivity tests could include different chemical mechanisms in CAMx, different meteorological models (MM5 and WRF), different meteorological configurations, and different initial/boundary conditions.

Previously, MAG conducted three sensitivity tests as a diagnostic evaluation for the eight-hour ozone attainment plan to examine the model's sensitivity to changes in model inputs and to ensure that the model responses were physically and chemically realistic. First, a sensitivity to the initial conditions was tested and the results suggested that three ramp-up days were enough to eliminate major uncertainties introduced in the initial conditions. Second, a sensitivity to the boundary conditions was tested and the results indicated that the simulated ozone is fairly sensitive to the boundary conditions. It demonstrated that transported ozone and ozone precursors were responsible for about half of the predicted high ozone levels in the MNA during the June 2002 episode; while the high ozone concentrations were less sensitive to the boundary conditions in the other two episodes. Last, a sensitivity to emissions was tested by zeroing out area, biogenic, nonroad, onroad, and point source emissions, individually, as well as removing anthropogenic NOx and VOC emissions, separately. The results showed that the simulated ozone is most sensitive to onroad mobile emissions and least sensitive to point source emissions. Also it revealed that ozone concentrations increased with NOx reductions in the urbanized portion of the nonattainment area. This result was supported by Chemical Process Analysis (CPA), which provides the detailed physical and chemical processes within the model.

4. MAINTENANCE DEMONSTRATION

4.1 Identification of Maintenance Year

The year 2025 will be modeled as the maintenance year for this modeling demonstration to assure that the eight-hour ozone standard is maintained at least ten years after an official notice of redesignation to attainment by EPA.

4.2 Identification of Control Measures

The Arizona Legislature passed Senate Bill 1552 on June 20, 2007. The two ozone control measures adopted in the Bill will be considered in the maintenance modeling demonstration: Open Burning Ban during Ozone Season, and Liquid Leaker Test as part of Vehicle Emission Inspection. The future year emissions inventories will include emission reduction credits from the two new control measures and committed measures from the Eight-Hour Ozone Attainment Plan and Five Percent Plan for PM-10 (MAG, 2007b), where appropriate. If the modeling outlined in this protocol does not demonstrate maintenance of the standard with the committed control measures, including the two new control measures, the TSD will be revised to document any additional measures that will be necessary to attain the standard.

4.3 Maintenance Test

To demonstrate maintenance of the eight-hour ozone standard in 2025, the future design values near each monitor should not exceed 84 ppb. The future design values in 2025 will be predicted by multiplying a relative response factor (RRF) by a site-specific baseline design value (EPA, 2007). The site-specific RRF is the ratio of the mean of the eight-hour ozone daily maximum predictions in the future to the mean of the eight-hour ozone daily maximum predictions with baseline emissions near a site, over all primary episode days.

As EPA recommended in its guidance (EPA, 2007), MAG will utilize 49 grid cells (an array of 7 x 7 grid cells with the monitor located in the center grid) near each monitoring site to demonstrate maintenance in the CAMx 4 km grid modeling domain. Any deviation from the

7 x 7 grid array will be justified in the TSD.

The eight-hour ozone daily maximum predicted by CAMx in the 49 grid cells near a monitoring site will be computed for each day in the episode period (except spin-up days). These site-specific daily maximum values will be averaged over the episode days for each episode to obtain the future and baseline concentrations used in calculating the RRFs. Predicted baseline maxima below 70 ppb will be excluded from the analysis.

The baseline design values for the maintenance test will be obtained from the Eight-Hour Ozone Plan. These current design values are defined as the three year average of the fourth highest daily maximum eight-hour ozone concentration monitored at each site. The 2002 design value for each monitoring site is the average of the current design values for the periods: 2000-2002, 2001-2003, and 2002-2004. Similarly, the 2001 design value for each monitoring site is the average of the current design values for the periods: 1999-2001, 2000-2002, and 2001-2003. The 2002 design values with the RRF will be used to derive the future design values for the June and July episodes, while the 2001 design values with the RRF will be the future design values for the August episode. The maintenance test will be performed for the selected three episode periods that represent worst case conditions.

4.4 Modeling Reliability and Uncertainties

CAMx is considered to be an appropriate tool for projecting the future air quality impacts of changes in emissions (EPA, 2007). However, future year modeling results should not be considered an absolute guarantee of future air quality. Uncertainties in the models used and their inputs, along with meteorological variability, may result in actual future air quality that differs from predicted air quality. Any of the following reasons could result in higher ozone concentrations than those predicted with CAMx:

Meteorological Variability - In selecting a modeling episode, the goal is to select periods that represent worst-case conditions. If episodes with more severe stagnation occur in the future, emission controls designed to reach maintenance for a historical episode may not be adequate.

Emissions Variability – Emissions estimates are based on average source activity, taking into account temporal factors such as seasonal, diurnal, and day-of-week factors. Nonroad and onroad mobile emissions estimates take into account day-specific meteorological parameters as well. However, emissions on a given day may be greater than average due to above normal source activity and other factors.

Uncertainty in Growth Projections - If emission growth projections, based on population, underestimate true emission growth rates, future year emissions may be greater than projected emissions.

Uncertainty in Control Measure Effectiveness - If actual emission reductions from control measures are smaller than the estimated emission reductions, future concentration may be greater than predicted concentrations.

Model Performance - If the model underpredicts at a particular site or fails to capture a particular aspect of the meteorology, a level of emission reduction that appeared to be adequate in the modeling may not be adequate in the real world situation.

By similar reasoning, future monitored concentrations may be lower than predicted concentrations because of the previously mentioned variability and uncertainties. In addition, future monitored concentrations will still be limited to monitoring site locations. As a result, although modeled future design values below 85 ppb are adequate to demonstrate maintenance, modeling results are better thought of as points on a probability distribution. If the modeled peak values are below 80 ppb, the probability of eight-hour ozone maintenance in the future year is high even under differing conditions. If the modeled peak is very close to 85 ppb, however, the probability of eight-hour ozone maintenance in the future year may be well below 100 percent given the probabilistic nature of meteorology and modeling.

The relative response factor approach introduced by EPA (EPA, 2007) uses average values (modeled and monitored) that are more likely to result in an accurate assessment of maintenance under a variety of conditions. However, if the modeled maintenance test shows that some estimated future design values are close to the standard, MAG will conduct additional analysis, as described below.

5. SUPPLEMENTAL ANALYSES

When estimated future design values are very close to the standard, EPA recommends that corroboratory tests be performed (EPA, 2007). MAG will conduct additional analyses to confirm that maintenance of the eight-hour ozone NAAQS is likely to occur. If estimated future design values in 2025 exceed 82 ppb at one or more sites, a weight of evidence demonstration will be conducted to determine whether aggregate supplemental analyses support the modeled maintenance test. These supplemental analyses are discussed below.

5.1 Corroboratory Tests

In addition to the monitor based maintenance test, EPA recommends that a supplemental unmonitored area analysis should be applied in the nonattainment area (EPA, 2007). Along with the unmonitored area analysis, MAG will conduct other corroboratory tests.

5.1.1 Unmonitored Area Analysis

A review of unmonitored area analysis is intended to identify areas where predicted future year design values might be greater than the eight-hour ozone standard. In order to conduct this analysis, EPA recommends using gradient adjusted spatial fields to get more accurate estimates for the unmonitored areas. Gradient adjusted spatial fields, which are created by the combination of interpolated spatial fields of ambient data and gridded modeled outputs, take advantage of the strengths of these two datasets.

In order to implement gradient adjusted spatial fields, base year design values, which are also used in the monitor based model maintenance test, will be interpolated to develop ambient spatial fields. Secondly, the spatial fields will be adjusted using gridded base year model output gradients. Finally, model derived gridded RRFs will be applied to the gradient adjusted spatial fields to create future year fields. The future year gradient adjusted spatial fields will be evaluated to determine if any predicted values in grid cells remain above the 8-hour ozone standard.

MAG will use the Modeled Attainment Test Software (MATS) developed by EPA to conduct this analysis. If predicted violations of the unmonitored area analysis occur, MAG will determine whether the predicted violations were caused by an error or uncertainty in the modeling system.

5.1.2 Absolute Model Forecasts

The absolute modeling results for the 2025 forecast may be useful in corroborating the results using RRFs. Comparing future year and base case modeled ozone concentrations, metrics concerning the frequency, magnitude, and relative amount of nonattainment might include:

- Percent change in total amount of ozone greater than or equal to 85 ppb in the MNA
- Percent change in number of grid cells greater than or equal to 85 ppb in the MNA
- Percent change in grid cell hours greater than or equal to 85 ppb in the MNA
- Percent change in maximum modeled eight-hour ozone concentration in the MNA

5.1.3 Indicator Species

To assess which precursor for ozone (e.g., VOC or NOx) will limit production of ozone in the MNA in 2025, MAG will use the indicator species approach - CAMx Chemical Process Analysis (CPA) application - over the entire 4 km grid modeling domain (ENVIRON Memorandum, 2007). Since CPA provides detailed reaction rate information over groups of reactions in the chemical mechanism for a selected area, it is possible to quantify chemically meaningful attributes such as ozone and oxidant production/loss rates, radical initiation rates, radical propagation efficiencies, radical termination rates, HOx chain lengths, formaldehyde production rates, and NOy reaction rates. This analysis will be used to reveal important chemical information within the Phoenix urban plume for the maintenance modeling year 2025. The chemical information will be used to determine the VOC or NOx-limited status and severity of biogenic VOC contribution to the Phoenix urban plume. MAG will conduct an analysis for the Maintenance Plan to determine whether there is a NOx disbenefit in any part of the nonattainment area in the year 2025.

5.1.4 Other Corroboratory Tests

MAG will perform other tests to confirm and explain the results of the CAMx modeling. The CMAQ model may be applied to corroborate the CAMx results. Other corroboratory tests may include applying the photochemical source apportionment tool in CAMx to determine which sources are contributing to maintenance during the worst-case episode period in 2025.

5.2 Weight of Evidence Approach

MAG will submit weight of evidence approach along with corroborative tests to EPA. Past analyses have shown that future design value uncertainties of 2 - 4 ppb can result from the use of alternate, but equally appropriate, emissions inventories, chemical mechanisms, and meteorological inputs (EPA, 2007). The weight of evidence document will include trends of emissions and monitored ozone design values and results of CPA analysis, as well as the evidence, viewed as a whole, supporting a conclusion that the area will maintain the eight-hour ozone standard.

6. PROCEDURAL REQUIREMENTS

The following items will be delivered in draft form to the EPA regional office for review and comment during the modeling study. MAG will also provide draft versions of these items to the Air Quality Planning Team for review and comments.

- The modeling protocol.

- The Technical Support Document which addresses the entire modeling analysis, including MM5 or WRF and CAMx input preparation and application, and the maintenance demonstration.

7. REFERENCES

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APPENDIX I

MAG Responses to Comments on the Draft Modeling Protocol in Support of an Eight-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa Nonattainment Area, March 2008

Comments received from the Arizona Department of Environmental Quality in a letter from Nancy Wrona dated April 24, 2008

1. **Comment:** *Page 2, Section 1.3: Conceptual Description*: Diurnal ozone variation should be described in this section. Information relating to when the peak hourly ozone concentration was observed and if there is spatial variation in the diurnal pattern of ozone concentrations should be discussed.

   Response: The modeling protocol was updated to include the following text:

   "The peak hourly ozone concentration occurs between 3 pm and 7 pm, and the minimum is usually reached at approximately 6 am. The diurnal cycle is stronger at sites located closer to central Phoenix. The diurnal variation is less prominent at sites farther away from central Phoenix, such as the Cave Creek site."

2. **Comment:** *Page 2, Section 1.3: Conceptual Description*: The second item in the description discussed the general weather patterns during the high ozone days: a low pressure system resides over southwestern Arizona and a high pressure system occurs over northeastern Arizona. This weather pattern could indicate that the high ozone episode may bear some significant synoptic influence. This conclusion is somewhat inconsistent with the conclusion in Attachment I, item 6, which stated that "synoptic scale forcings are weak in the area." Further examination of the synoptic air flow pattern may help to reveal possible contributions to those high ozone episodes.

   Response: Examination of meteorological observations in the Maricopa Nonattainment Area (MNA) indicate that surface winds follow a very consistent diurnal pattern that is most likely influenced by the topography of the basin. This pattern consists of northeast to east winds in the early morning and southwest to west winds in the later afternoon. Such a wind pattern indicates that large scale forcings are weak, and that the surface air is vertically decoupled from flow aloft.

   Further examination of surface weather maps reveals that the pattern of a high pressure system occurring over northeastern Arizona and a low pressure system occurring over the southwestern Arizona also prevails on low ozone days. Thus, a clear relationship between the synoptic flow pattern and high ozone events can not be determined from the available data.

3a. Comment: *Page 2, Section 1.3: Conceptual Description:* The third item discussed regional transport versus local ozone generation and concluded that the local factors are primary cause of high ozone in the MNA. Other than a back-trajectory, do you intend to employ any other approach to quantify ozone transport? Later the Protocol states that the June episode was highly sensitive to boundary conditions. MAG concluded that transport played an important role in that episode. What are the back-trajectory analysis results for this episode? Can ozone transport be ruled out, since aloft measurements of ozone are not available?

Response: The contribution of transported ozone and ozone precursors was quantified in the MAG 2007 Eight-Hour Ozone Plan by zeroing out the lateral boundary conditions. The back-trajectory analysis of the June episode revealed that the origin of the air mass at lower levels (up to 100 meters) was transported a long distance (further than 100 miles) from the southwest. This result is consistent with the sensitivity study which zeroed out the lateral boundary conditions. The sensitivity study indicated that ozone and ozone precursors that were transported from outside of the MNA contributed from 48 to 63% to the high ozone levels in the June 2002 episode. This analysis has been documented in the Eight-Hour Ozone Plan (Appendices, Volume I, TSD, Pages IV-85~87).

3b. Comment: *Page 2, Section 1.3: Conceptual Description*: The fourth item in the description states that "... in 2008 the nonattainment area exhibits a NOx-disbenefit." This is an important finding, because it indicates that further reduction of NOx would not bring any benefits in ozone reduction, but instead increase ozone production. That conclusion is contrary to real world experience in this planning area after Cleaner Burning Gasoline was implemented and contrary to MAG's reliance on fleet turnover, with improved NOx controls on newer vehicles, to continue to improve air quality. The Modeling Protocol and Maintenance Plan must provide more information about the basis for this finding, including how this conclusion was reached; monitoring and modeling results that support it; whether the NOx-disbenefit was observed across the entire MNA; and the temporal characteristics of the NOx-disbenefit. We would also recommend a more in-depth analysis to identify the controlling factors for ozone production and fate within MNA. That analysis will inform the next round of planning for the 0.075 ppm 8-Hour Ozone NAAQS.

Response: The weight of the evidence analysis in the Eight-Hour Ozone Plan (Appendices, Volume II, TSD, Pages V-14~27) addresses the NOx disbenefit finding for the attainment year of 2008. The analysis identifies (1) How this conclusion was reached, (2) Monitoring and modeling results that support it, (3) Whether the NOx-disbenefit was observed across the entire MNA, and (4) Temporal characteristics of the NOx-disbenefit. It is important to note that the modeling for 2008 indicated that the NOx disbenefit occurred only in the NOx-rich urbanized area of the modeling domain. In areas of the modeling domain outside the urbanized area, NOx reductions decreased ozone concentrations. MAG will conduct a similar analysis for the Maintenance Plan to determine whether the NOx disbenefit is still evident in any part of the MNA in the year 2025. In the real world, monitored ozone concentrations have declined in the Maricopa nonattainment area, because VOC emissions have declined more rapidly than NOx emissions (due to cleaner burning gasoline and fleet turnover, as well as other VOC controls). The Maintenance Plan will include an in-depth analysis to identify the controlling factors for ozone production and fate within the MNA.

4. **Comments:** *Page 15, Section 2.3.2 Meteorological Data*: It is noted in the Protocol that the AZMET stations "are not traditional weather stations: the main purpose of these stations is to provide meteorological data for agricultural and horticultural interests in southern and central Arizona." Please clarify that AZMET data were or were not used in FDDA for MM5; what parameters of the AZMET and NWS data sets were used for model nudging; what type of nudging was conducted; analysis nudging and/or observational nudging. Also clarify whether FDDA was applied to the 12km grid run. It will be helpful for EPA and ADEQ to understand the MM5 simulation if MAG could provide a summary table showing all scientific options and control parameters used in MM5 simulation.

   Response: AZMET meteorological data were used in the observational nudging of the 12-km and 4-km domains. Analysis nudging was applied to all three domains. More specifically, the 3-D analysis nudging included wind, temperature, and humidity above the boundary layer, while the 2-D surface analysis nudging was applied to wind alone. Observational nudging was applied to wind.

   Summary tables showing scientific options and nudging parameters were included in the Eight-Hour Ozone Plan (Appendices, Volume Two, App. III-i, Table 2-2 and 2-3). These tables may be included in the Eight-Hour Ozone Maintenance plan as well.

5. **Comment:** *Page 16:* Provide a brief description of how CAMx would process cloud cover and UV data. These parameters are vitally important since they control the photochemical formation and destruction of ozone and its precursors.

   Response: Cloud cover data obtained from MM5 is processed through the CAMx preprocessor called MM5CAMx and stored in the CAMx cloud/rain file. Since the CAMx cloud treatment is based on the RADM approach, which requires information on cloud optical depth for each cell, MM5 cloud cover data are used to provide gridded cloud optical depth fields. This gridded cloud optical depth is used to scale down photolysis rates for layers within or below clouds to account for UV attenuation, or to scale up the rates for layers above clouds to account for UV reflection. Thus, cloud cover significantly affects photolysis rates. TUV is used to calculate the photolysis rates for each grid cell. Finally, for each grid cell, CAMx incorporates cloud cover data to adjust photolysis rates calculated from TUV and applies these adjusted photolysis rates to photochemical reactions.

6. **Comment:** *Page 17:* MAG is proposing to evaluate the model performance using WRF output as an alternative to MM5 output. WRF is the model replacing MM5. Such a comparison will reveal important factors that would affect future air quality modeling practices. This is a great opportunity for the modeling community in Arizona to see how the improvement in meteorological modeling could affect the air quality assessment. It shows great commitment and dedicated by MAG to do scientifically sound and complete work.

   Response: Thank you.

7. **Comment***: Page 24, Section 2.7 Emission Inventories*: MAG should provide more information about how the emission inventory data will be prepared, such as the sources of the raw data and the emission sectors that are included in point and area categories. The 12 km modeling domain covers a large portion of south California, south Nevada, Utah, Colorado and the majority of New Mexico. How will the emission inventories for these states be obtained. How will the emission inventories for the border provinces of Mexico be obtained? Is there any refinement of the emission inventory in terms of source –specific activities?

   Response: As of May 8, 2008, the Maricopa County Air Quality Department (MCAQD) has not drafted a summary document for their 2005 Periodic Emissions Inventory for ozone. This summary document describes the methodologies, assumptions, sources of data, categories of emission sources used to develop MCAQD's emissions inventory. If the MCAQD document becomes available in time, MAG will include it in the Technical Support Document (TSD) for the Maintenance Plan.

   The emissions data for the 12 km modeling domain will be provided by ENVIRON. ENVIRON will extract the 2002 and 2018 emission inventories for the 12 km modeling domain from the Western Regional Air Partnership (WRAP) emissions database. This database contains emissions data for California, Utah, Colorado, New Mexico, and the border provinces of Mexico. Nevada is not a member of WRAP. ENVIRON will either contact Clark County, Nevada's Department of Air Quality and Environmental Management, and Nevada's Division of Environmental Protection for Nevada emissions data and/or investigate other data sources. The 2025 emissions data will be extrapolated using source-category rates of change from WRAP 2002 to 2018. ENVIRON will also investigate possible refinements of source-specific activities as it relates to the emissions inventory.

8. **Comment:** How will the pollutants be speciated? How sensitive will the model results be to the uncertainties in the speciation?

Response: MAG will use the Carbon Bond mechanism IV (CB-IV) for this study. The Carbon Bond mechanism classifies each carbon atom in organic molecules according to its bond type. VOC emissions will be disaggregated into carbon-bond classes according to VOC source-specific speciation profiles and NOx emissions will be distributed as NO and NO_2. CB-IV includes 117 chemical reactions and 30 chemical species. Carbon Bond mechanism - 2005 (CB05) was released in 2005. MAG evaluated both CB-IV and CB05 for the 8-hour ozone attainment modeling demonstration. MAG found that the CB-IV provided slightly better model performance with CAMx than CB05 for the Maricopa Nonattainment Area. In addition, VOC speciation was checked against ambient samples collected at two Photochemical Assessment Monitoring System (PAMS) sites in the Eight-Hour Ozone Plan (Appendices, Volume Two, Appendix V, Page 13-15). The analysis shows that the modeled VOC is accurately reproducing the compounds observed in central Phoenix.

9. **Comment:** *Page 25:* Will non-Arizona emission inventories be projected to 2025 or simply use the same number as in the baseline year? In other words, will the boundary and initial conditions for the inner modeling domain remain the same for baseline year and 2025? Ideally, the emission inventories in surrounding states should also be adjusted according to projected conditions for 2025.

   Response: As indicated in MAG's response to Comment #7, ENVIRON will develop 2025 emission inventories for the 12 km modeling domain based on the WRAP emissions data. The 2025 emissions will be extrapolated using the WRAP 2002 and 2018 emissions data. Since the boundary and initial conditions for the inner modeling domain (4 km) are extracted from the modeling results of the outer modeling domain (12 km), the conditions for the inner modeling domain reflect the projected conditions for 2025.

10. **Comment:** *Page 30, Section 2.7.6 Spatial Allocation of Emissions*: How will emissions be mapped for spatial surrogates? It would be very helpful if MAG could provide a summary table showing the mapping between emission categories and the spatial surrogates.

    Response: Year 2025 area and nonroad mobile source emissions will be spatially allocated to grid cells using spatial surrogates. Since the 2025 emissions inventories and spatial surrogates are currently being developed, a summary table showing the mapping between emission categories and spatial surrogates may not be available in time for inclusion in the modeling protocol. However, this table will be included in the Technical Support Document (TSD) for the Eight-Hour Ozone Maintenance Plan. In the meantime, the spatial surrogate mapping table for 2001, 2002, and 2008 emissions can be referenced from the Eight-Hour Ozone Plan for the Maricopa Nonattainment Area (Appendices, Volume Two, Page No. App. II-37, Table 2) to review the spatial surrogates that were previously used.

11. Comment: *Page 30, Section 2.7.6*: The Protocol mentioned that the "MAG transportation model" will assign travel demand data to 2025 highway networks which will be used to spatially distribute onroad mobile source emissions." What types of roads are included in onroad emission calculations other than the highways?

Response: The MAG transportation model provides data for approximately 20,000 highway network links for five time periods: am-peak, midday, pm-peak, night time, and 24-hour periods. The data include link length, travel time, the number of lanes, ten road types, five area types, traffic volume, and geographic location of link. On-road mobile source emissions by facility type and by area type for each grid cell are calculated using MOBILE6.2 and M6Link models. The types of roads include: (1) Freeway, (2) Expressway, (3) Collector, (4) 6-Legged Arterial, (5) Centroid/Local, (6) Arterial, (7) Freeway Ramp, (8) Freeway Metered Ramp, (9) Freeway Collector/Distributor (CD) Road, and (10) Freeway HOV Lane. All regionally-significant roads are coded into the highway networks.

12. Comment: *Page 37, Section 5.1.1 Unmonitored Area Analysis*: What methodology is proposed for interpolating monitored ozone design value? EPA does not have a specific recommendation in its guidance.

Response: EPA recommends using a software package called Modeled Attainment Test Software (MATS) to do unmonitored area analysis in their *Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze* (EPA, April 2007). MATS supports three interpolation methods, which are Equal Weighting of Monitors, Inverse Distance Weights, and Inverse Distance Squared Weights. MAG will select one of these methods to interpolate the monitored ozone design values.

13. Comment: *Page 38, Section 5.1.3 Indicator Species*: The Chemical Process Analysis would be the most suitable tool for understanding the NOx-disbenefit on ozone control observed in MNA. It might also be helpful in understanding the observed temporal and spatial ozone distribution.

Response: Chemical Process Analysis (CPA) is a good tool for understanding the NOx-disbenefit on ozone control observed in the MNA, as well as for understanding the observed temporal and spatial ozone distribution. MAG will apply CPA during the development of the maintenance plan to increase understanding of ozone production and distribution.

14. **Comment:** What were the updated MEGAN emission factors MAG used to estimate the biogenic emissions?

Response: MEGAN was developed by Dr. Alex Guenther at the National Center for Atmospheric Research (NCAR), who is also developing the next generation of biogenic emissions models for EPA. The MEGAN emission factors are based on the results of a field study to identify prevalent plant species and their emission rates in Maricopa County as part of the MAG Biogenics Study (Maricopa Association of Governments 2006 Biogenics Study, Final Report, September 11, 2006). As part of the MAG Biogenics Study, MEGAN was provided to MAG as a state-of-the-art biogenic model with updated emission factors.

The MEGAN model provides emission factors (ug/m^2-hr) for 135 chemical species for approximately 1,400 trees and vegetation, which were used in the development of the 2005 Ozone Periodic Emissions Inventory and the Eight-Hour Ozone Plan. Because of the massive size of the MEGAN emission factor file (i.e., several hundred pages), MAG prefers to provide the emission factors on request rather than include them in the protocol.

15. **Comment:** What is the distribution of emissions outside of the Maricopa non-attainment area, but within the 4km nested domain?

Response: Emission density plots in the Eight-Hour Ozone Plan indicate that less than 29% of total VOC emissions and 7% of total NOx emissions in the 4-km CAMx inner modeling domain are distributed outside of the MNA. More detailed emission distributions for 2001, 2002, and 2008 can be found in the emission density plots in the Eight-Hour Ozone Plan (Figure III-3 through 10 and V-4a through V-4l). Emission distributions for the 2005 emission inventory will be provided in the TSD of the Eight-Hour Ozone Maintenance Plan.

Comments received from the Pinal County Air Quality Department in an email from Scott Dibiase dated April 8, 2008

1. **Comment:** *Pg. 2, Section 1.3 Conceptual Description:* High ozone concentrations are generally observed…. Covered by clouds? This is counterintuitive to ozone formation. Perhaps some background information/data can be included in the document to back this statement up?

   Response: As described in Attachment II (Review of Eight-Hour Ozone Episodes) of the Eight-hour Ozone Attainment Plan (Appendices, Volume II), high ozone exceedances were likely to occur when the sky was partially covered by clouds. For example, 57.4% (81 out of 141 days) of the high ozone days and 88.9% (8 out of 9 days) of the top 3-ranked exceedance days from within each of the three meteorological regimes were days that had 25% or more of the sky covered by clouds (scattered clouds). The relatively high cloud cover on high ozone days might be related to high relative humidity levels since most of the top 3-ranked ozone exceedance days occurred when dew point temperatures were higher than the average.

2. **Comment:** *Pg. 16 – last sentence of paragraph two:* The word "the" is missing from between "from" and "National Center for Atmospheric Research NCAR" in the following sentence. "All of the needed datasets listed above were procured directly from National Center for Atmospheric Research (NCAR)."

   Response: The word "the" has been inserted in the updated protocol.

3. **Comment:** *Pg. 19. Figure 2-4 Ozone Monitoring Sites*: The Maricopa (MRCP) monitoring site is erroneously located east of Florence on the map. It should be located west of I-10 in the northwest corner of Pinal County. See Figure 2-5 for the correct location of the Maricopa monitoring site.

   Response: MAG obtained the geo-coordinates of the monitoring sites from the EPA's AQS website. At that time, the location data listed on EPA's AQS website for the MRCP monitor (04-021-3010) were incorrect. After Pinal County updated the MRCP site information in EPA's AQS, MAG used the correct site location in the updated protocol.

4. **Comment:** *Attachment I: Pg. 1. fourth paragraph:* The word "lists" does not need the last s on the word.

   Response: The letter "s" has been removed.

5. **Comment:** *Attachment I: Pg. 4. Figure 3.2:* North Phoenix value of 85 ppb should be in red text. Also, a suggestion, you may want to add the units “ppb” to each of these figures.

   Response: Red text was used to indicate maximum values rather than high ozone value greater than 85 ppb, thus the 85 ppb value for North Phoenix will not be in red text. Per your suggestion, the “ppb” text was added to the figure description in the updated protocol.

6. **Comment:** *Attachment III: Pg. 3. Section 2. Model input data*: Perhaps you can include the spelled out definition of the acronym “JPROC” in paragraph 3?

   Response: The suggested revision has been made in the updated protocol. JPROC stands for “photolysis rate preprocessor”.

Comments received from the Environmental Protection Agency (EPA) in an email from Scott Bohning dated May 6, 2008

1. **Comment:** *Weight of Evidence Analysis*: Since "Weight of Evidence" these days is more or less considered to be a part of the attainment demonstration, I'd like to see a commitment to definitely have a W.O.E. section, even if predicted ozone is below the 84 ppb threshold mentioned in the protocol. (And by the way, EPA guidance states an 82 ppb threshold.) This does not have to be a big effort. For WOE, you can rely on emissions trends, air quality monitor trends, and the Chemical Process Analysis (CPA) you are already planning to do per protocol section 5.1.3. I didn't say this over the phone, but the absolute model forecasts mentioned in protocol section 5.1.2 would also be good for the WOE section. (By the way, I am glad you will be looking at that, since not everyone is completely satisfied with the RRF approach to attainment demonstrations.)

   Response: The modeling protocol was updated to include the following text:

   "MAG will submit a weight of evidence analysis along with corroborative tests to EPA. The weight of evidence section will include a discussion of trends in emissions and monitored ozone design values, results of a CPA analysis, as well as evidence, viewed as a whole, supporting the conclusion that the area will maintain the eight-hour ozone standard. "

2. **Comment:** I do want to confirm that it is acceptable to base your maintenance demonstration on the same base case modeling as was used for the attainment demonstration. I checked on that with our Office of Regional Counsel, and OAQPS, and it was also discussed on a call between OAQPS and the modelers of the various EPA Regional offices. I have attached some relevant excerpts from past memoranda about ozone plans. The Clean Air Act itself and the various EPA modeling guidance documents do not address the issue. And in fact, many past maintenance plans have relied on a "carrying capacity" approach, i.e., a total emissions test. But there are some advantages to performing modeling as opposed to relying on an emissions "carrying capacity" approach. Ozone formation is nonlinear, and is affected by the spatial and temporal distribution of emissions, not just total emissions; therefore, modeling provides additional assurance of NAAQS maintenance. Since NOx reductions increased ozone for some modeled Maricopa episodes, modeling would help assure that this phenomenon does not undermine continued attainment. Finally, it may be useful to model future years to assess compliance with the recently promulgated new ozone standard.

   Response: We appreciate your confirmation that it is acceptable to use the same base case modeling that was used in the attainment demonstration. The Eight-Hour Ozone Maintenance Plan will include a comparison of the modeled values in 2025 with the recently promulgated eight-hour ozone standard. MAG will also develop a detailed schedule for modeling attainment with the new eight-hour ozone standard after EPA has released the official modeling guidance.

ATTACHMENT I

Conceptual Description for the Selected High Ozone Days in 2000-2007

Background

The following conceptual description for selected high ozone days in years 2000 - 2007 in the Maricopa County Nonattainment Area (MNA) follows EPA's *Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze* (U.S. EPA, 2007), section 11.1.1.

During the last three years (2005 - 2007), there was no violation of the eight-hour ozone standard in the MNA. The nonattainment period discussed in this conceptual description refers to the time period between 2000 and 2004. It is helpful to review the nonattainment records to obtain a better understanding of the eight-hour ozone problem in the MNA as part of the development of the eight-hour ozone maintenance plan.

Most of the supporting material in this conceptual description is from MAG's eight-hour ozone attainment plan (MAG, 2007). Tables, plots and text from the eight-hour ozone attainment plan have been updated and revised where necessary.

The following sections list questions and answers with supporting material regarding the eight-hour ozone in the MNA.

1. Is the nonattainment problem primarily a local one, or are regional factors important?

To answer this question, regional factors are checked first to see whether they are likely to be important. Figure 1 shows eight-hour ozone area counties in the U.S.

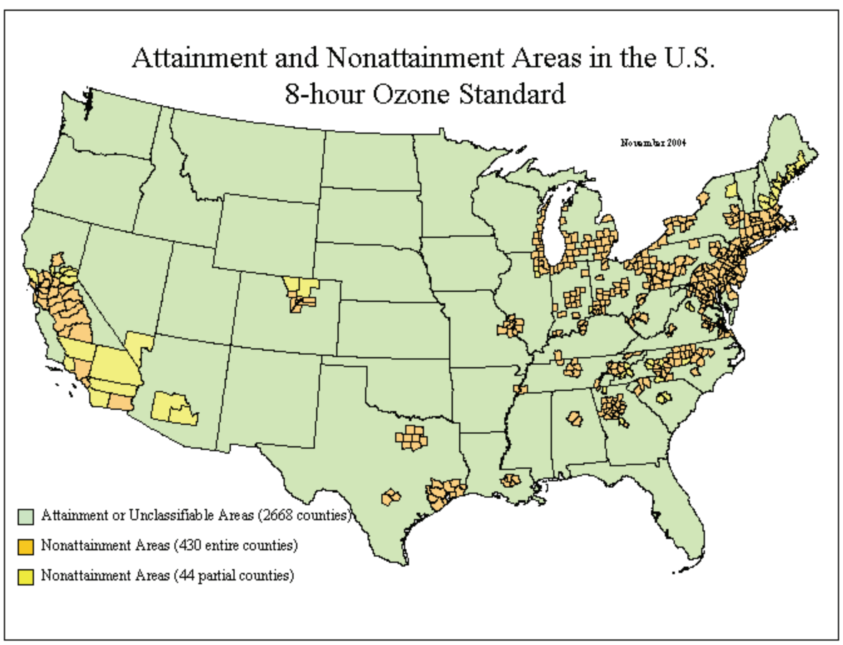


Figure 1. Eight-hour ozone area county map (source: U.S.EPA, http://www.epa.gov/air/oaqps/greenbk/naa8hrgreen.html)

The map in Figure 1 indicates that the closest eight-hour ozone nonattainment areas to the MNA reside in southern California. These nonattainment areas, however, are more than one day's transport to the MNA according to the back trajectory analyses of high ozone days in MAG's eight-hour ozone attainment plan (MAG, 2007). The majority of the 24-hour back trajectories on the high ozone days indicated that transport into the MNA originated from south-southwest of the MNA, from an area along the border of Mexico and the Pacific Ocean. This suggests that regional factors are unlikely to play a major role in eight-hour exceedances in the MNA.

Examining the relationship between the correlation coefficients of observed eight-hour daily maximum ozone and the distances of monitoring sites in the MNA provides additional evidence that regional factors do not play a major role in the MNA's eight-hour ozone exceedances. Figure 2 shows that most ozone monitors in the MNA have moderate correlation coefficients ($R^2 \geq 0.5$), and the correlation coefficients of eight-hour daily maximum ozone are strongly influenced by their distance from each other. This suggests local factors are dominant in eight-hour ozone exceedances.

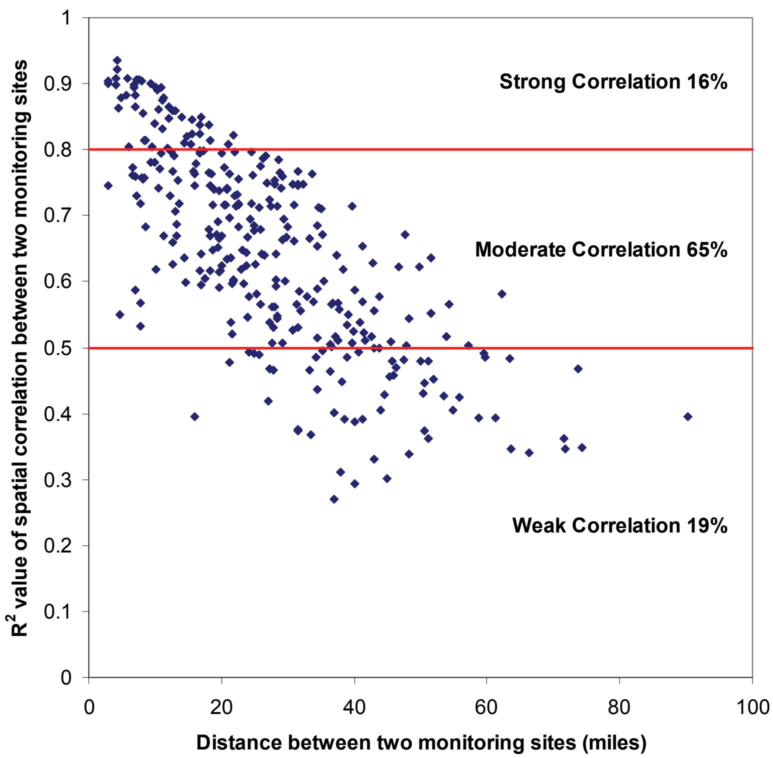


Figure 2. Relationship between distance and R^2 value of ozone monitoring sites in the MNA

Further evidence supporting the importance of the role of local factors to the MNA's eight-hour ozone exceedances is provided in Sections 3, 5, 8 and 11. Thus, it can be concluded that the eight-hour nonattainment problem was primarily caused by local, not regional, factors.

2. Are ozone and/or precursor concentrations aloft also high?

There are no such measurements available for the MNA.

3. Do violations of the NAAQS occur at several monitoring sites throughout the nonattainment area, or are they confined to one or a small number of sites in proximity to one another?

As shown in Figures 3.1~3, violations of the eight-hour ozone standard occur at a limited number of sites in proximity to one another. The number of sites having a violation decreased from three sites, during 2000-2002, to one site during 2002-2004. Humboldt Mountain is the only monitoring site that violated the eight-hour ozone standard for three consecutive periods (2000-2002, 2001-2003, and 2002-2004). There was no eight-hour ozone violation at any site during the next three periods of 2003-2005, 2004-2006, and 2005-2007.

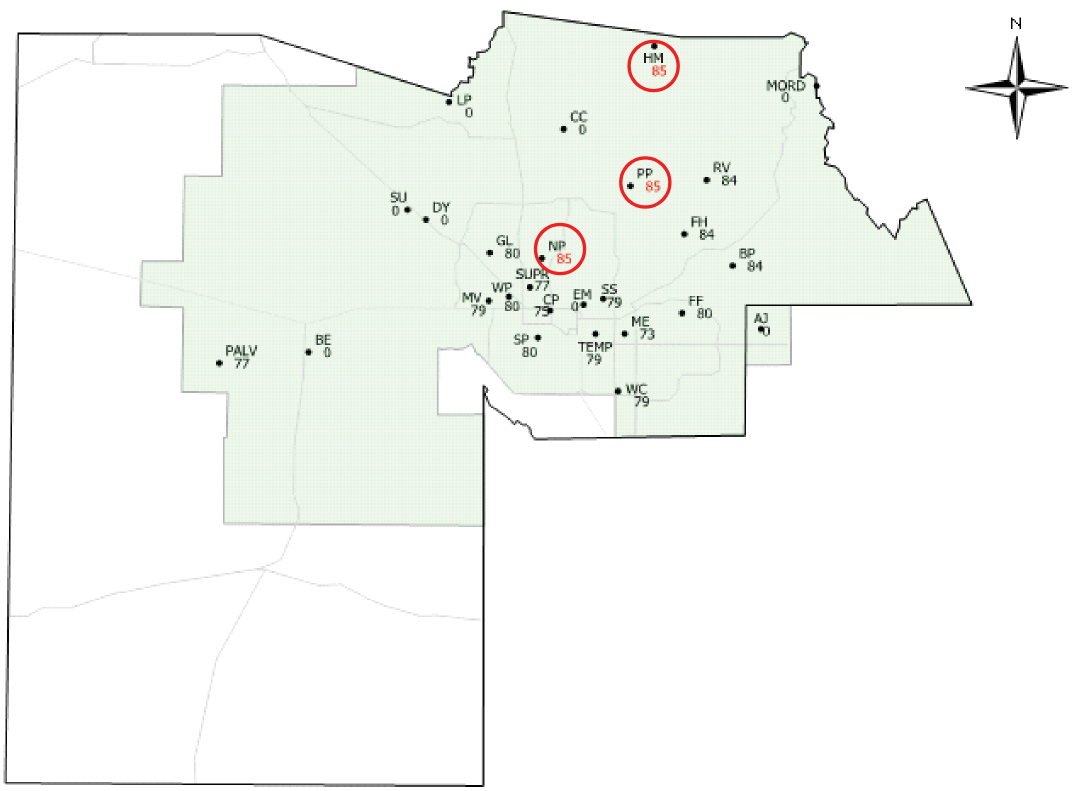


Figure 3.1. Spatial distribution of eight-hour ozone design value during 2000-2002 (Unit: ppb)

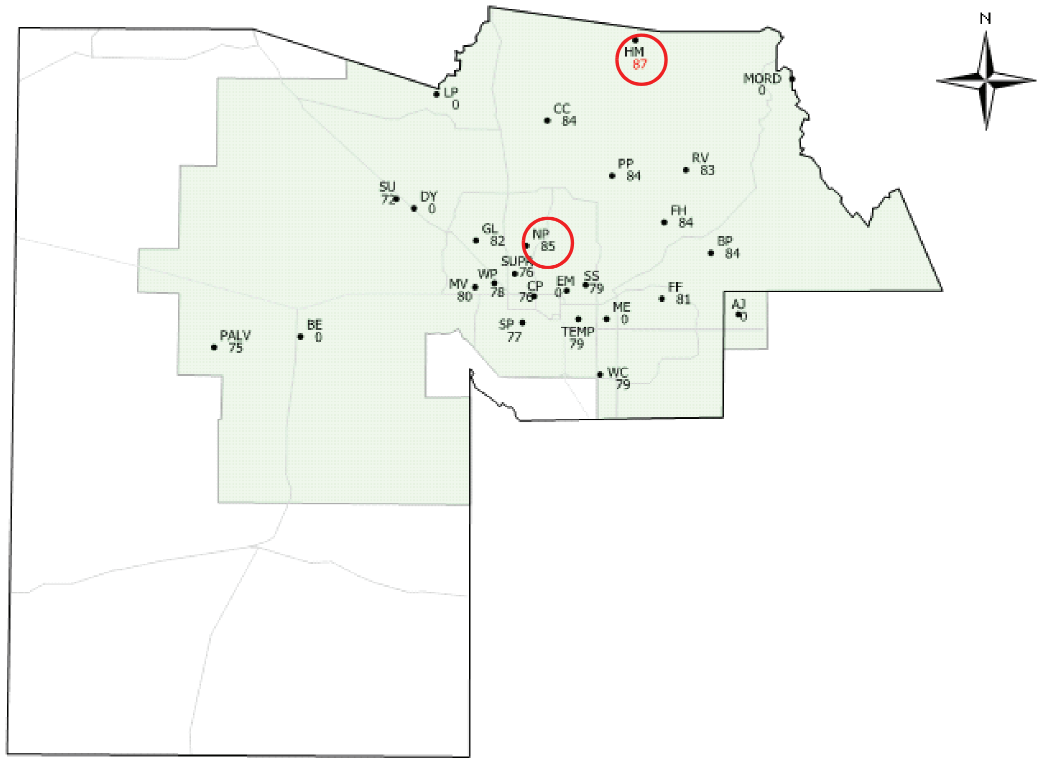


Figure 3.2. Spatial distribution of eight-hour ozone design value during 2001-2003 (Unit: ppb)

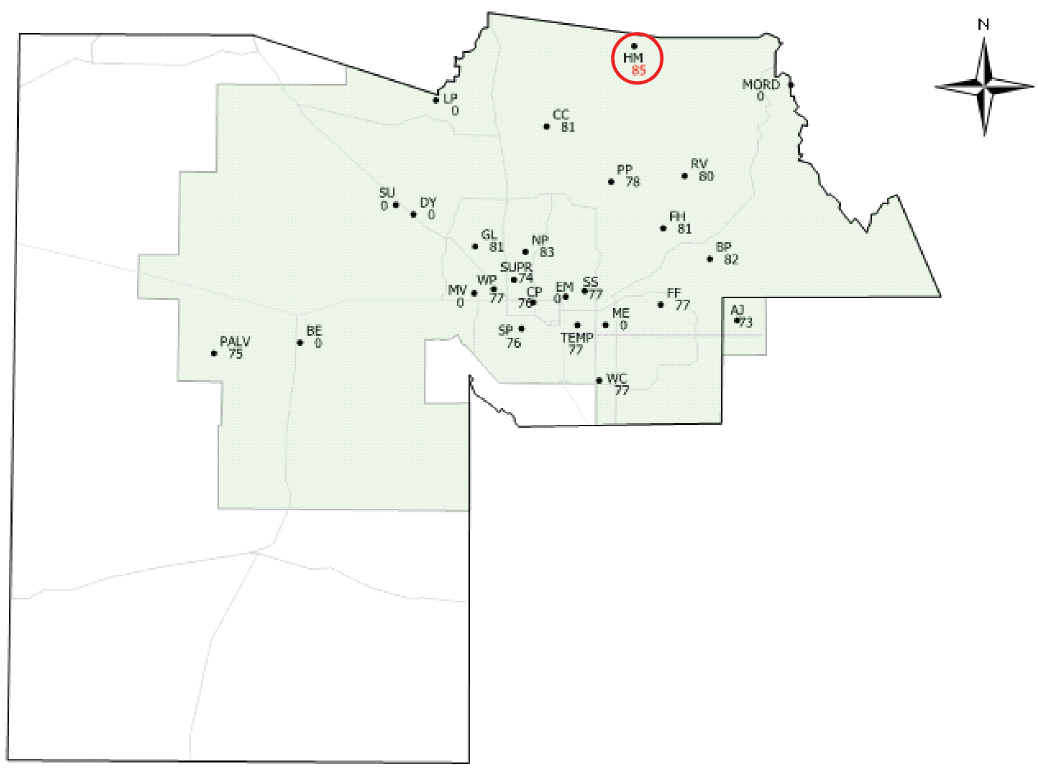


Figure 3.3. Spatial distribution of eight-hour ozone design value during 2002-2004 (Unit: ppb)

4. Do observed eight-hour daily maximum ozone concentrations exceed 84 ppb frequently or just on a few occasions?

The frequency of eight-hour daily maximum ozone exceeding 84 ppb varies among the monitors during the period between 2000 and 2007, as shown in Table 1. High ozone days with eight-hour ozone exceeding 84 ppb were observed at least once at most of the monitoring sites except for three sites, the Dysart, Surprise, and Buckeye sites. The Blue Point site had the highest annual total of eight-hour daily maximum ozone exceedances -10 days in year 2000. The eight-hour daily maximum ozone exceeded 84 ppb a number of times in year 2000, but gradually decreased to only one exceedance in year 2004. The number of daily maximum exceedances increased to 6 days at the Fountain Hills and Rio Verde sites in 2005, but decreased to 4 days at the North Phoenix site in 2006. There were no exceedances at any site in 2007. The average frequency of exceedances for all monitoring sites within the MNA for the last 8 years (2000-2007) was 1.31 days per year.

Table 1. Number of days exceeding 84 ppb of eight-hour daily maximum ozone

Site	2000	2001	2002	2003	2004	2005	2006	2007	Max
Apache Junction (AJ: 04-021-3001)	N/A	N/A	0	1	0	0	3	0	**3**
Blue Point (BP: 04-013-9702)	10	1	5	4	0	2	0	0	**10**
Buckeye (BE: 04-013-4011)	N/A	N/A	N/A	N/A	0	0	0	0	**0**
Cave Creek (CC: 04-013-4008)	N/A	2	4	2	0	0	1	0	**4**
Central Phoenix (CP: 04-013-3002)	1	0	1	0	0	0	1	0	**1**
Dysart (DY: 04-013-4010)	N/A	N/A	N/A	0	0	0	0	0	**0**
Falcon Field (FF: 04-013-1010)	0	2	3	1	0	0	1	0	**3**
Fountain Hills (FH: 04-013-9704)	4	3	5	1	0	6	3	0	**5**
Glendale (GL: 04-013-2001)	1	2	2	4	0	0	0	0	**4**
Humboldt Mountain (HM: 04-013-9508)	2	4	8	5	0	5	0	0	**8**
Maryvale (MV: 04-013-3006)	1	0	3	2	N/A	N/A	N/A	N/A	**3**
Mesa (ME: 04-013-1003)	1	0	0	N/A	N/A	N/A	N/A	N/A	**1**
North Phoenix (NP: 04-013-1004)	4	4	5	4	1	3	4	0	**5**
Palo Verde (PALV: 04-013-9993)	1	0	1	0	0	N/A	N/A	N/A	**1**
Pinnacle Peak (PP: 04-013-2005)	5	4	3	3	0	1	0	0	**5**
Rio Verde (RV: 04-013-9706)	5	0	4	2	0	6	1	0	**5**
South Phoenix (SP: 04-013-4003)	3	1	2	0	0	0	0	0	**3**
South Scottsdale (SS: 04-013-3003)	1	1	1	3	0	1	1	0	**3**
Super Site (SUPR: 04-013-9997)	1	1	2	0	0	0	1	0	**2**
Surprise (SU: 04-013-4007)	N/A	0	0	0	N/A	N/A	N/A	N/A	**0**
Tempe (TEMP: 04-013-4005)	1	1	2	1	0	1	1	0	**2**
West Chandler (WC: 04-013-4004)	1	1	2	0	0	0	2	0	**2**
West Phoenix (WP: 04-013-0019)	1	0	2	0	0	0	3	0	**3**
Max	**10**	**4**	**8**	**5**	**1**	**6**	**4**	**0**	**10**

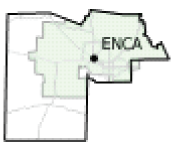
5. When eight-hour daily maxima in excess of 84 ppb occur, is there an accompanying characteristic spatial pattern, or is there a variety of spatial patterns?

According to the spatial distribution of eight-hour daily maxima on high ozone days in Appendix D of MAG's eight-hour ozone attainment plan (MAG, 2007), a variety of spatial patterns are seen when eight-hour daily maxima in excess of 84 ppb occur. These patterns, grouped by the red lines, are summarized in Figure 4. Most exceedances occur at a small number of sites in proximity to one another in localized regions of the MNA. The exception is July 31, 2000, when two separate groups of regions appeared.

Figure 4. Spatial patterns of eight-hour daily maxima in excess of 84 ppb

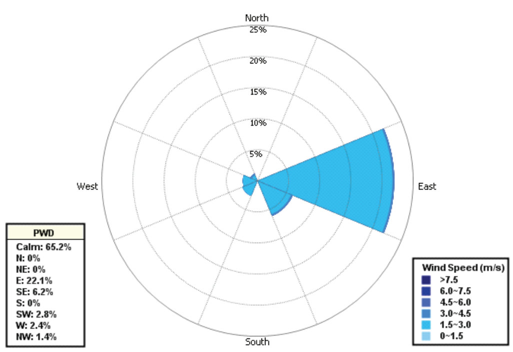
6. Do monitored violations occur at locations subject to mesoscale wind patterns which may differ from the general wind flow?

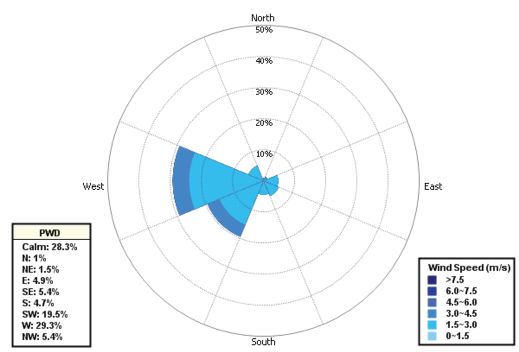
Hourly surface wind direction and speed data on high and low ozone days at the Phoenix Encanto site are summarized in Figure 5. Morning winds are predominantly calm (65.2%) and easterly (22.1%) on days with eight-hour daily maximum ozone greater than 84 ppb. This is similar to morning winds on low ozone days less than 40 ppb, except calms (72%) are more frequent and easterly component winds (12.8%) are less common. Afternoon winds are predominantly SW-W (48.8%) on high ozone days. This is also similar to low ozone days, which, however, have more frequent calm periods (44.6%) than SW-W (30.2%). The MNA has an apparent morning (easterly) and afternoon (westerly) surface wind pattern that is most likely influenced by the topography of the basin, indicating that large (or "synoptic") scale forcings are weak in the area.



Phoenix Encanto Site
(2000-2004)

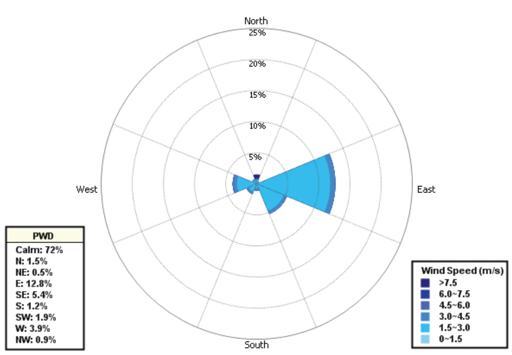
Ozone ≥ 85ppb

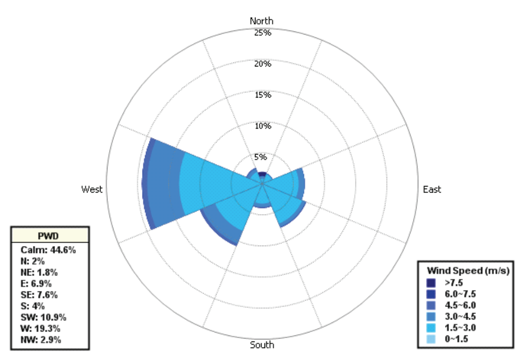




Calm	N	NE	E	SE	S	SW	W	NW	Calm	N	NE	E	SE	S	SW	W	NW
65.2%	0%	0%	22.1%	6.2%	0%	2.8%	2.4%	1.4%	28.3%	1%	1.5%	4.9%	5.4%	4.7%	19.5%	29.3%	5.4%

Ozone < 40ppb





Calm	N	NE	E	SE	S	SW	W	NW	Calm	N	NE	E	SE	S	SW	W	NW
72%	1.5%	0.5%	12.8%	5.4%	1.2%	1.9%	3.9%	0.9%	44.6%	2%	1.8%	6.9%	7.6%	4%	10.9%	19.3%	2.9%
Morning (7:00~11:00)									**Afternoon (12:00~18:00)**								

Figure 5. Wind roses for morning (7:00-11:00 MST) and afternoon (12:00-18:00 MST) hours on high and low ozone days at the Phoenix Encanto site (2000-2004)

7. Have there been any recent major changes in emissions of VOC or NOx in or near the nonattainment area? If so, what changes have occurred?

NOx and VOC emissions data for the MNA were provided by the Maricopa County Air Quality Department (MCAQD, 2004 and 2008). Table 2 summarizes total anthropogenic emissions for point, area, nonroad, and onroad mobile sources, as well as biogenic emissions, for a typical ozone season day in the MNA in 2002 and 2005. Figure 6 depicts the percentage contribution of each anthropogenic emission source category.

Table 2. Summary of ozone season-day emissions by category in the MNA (tons*/day)

Source Category		Inventory Year	
		2002	2005
Point	NOx	12.05	11.18
	VOC	14.56	13.28
Area	NOx	12.38	22.62
	VOC	113.44	126.78
Nonroad	NOx	74.76	89.59
	VOC	46.91	77.00
Onroad Mobile	NOx	199.87	174.67
	VOC	82.96	94.13
Total Anthropogenic	NOx	299.06	298.06
	VOC	257.87	311.19
Biogenic	NOx	6.94	4.99
	VOC	46.01	248.82

* Denotes short ton.

Table 2 indicates that anthropogenic NOx emissions decrease slightly (0.3 percent), while anthropogenic VOC emissions increase by 20.5 percent between 2002 and 2005. The changes in anthropogenic emissions occurred at the same time residential population in Maricopa County increased by 11.4 percent. Most of the increase in anthropogenic VOC emissions is attributable to improvements in the inputs to the 2005NONROAD model and the MOBILE6.2 and M6LINK onroad mobile source emission models.

Although three new power plants began operations in or near the MNA between 2002 and 2005 (see Table 3), Table 2 indicates that point source emissions decrease between 2002 and 2005. Thus, the addition of the new power plants did not exert a major impact on point source emissions.

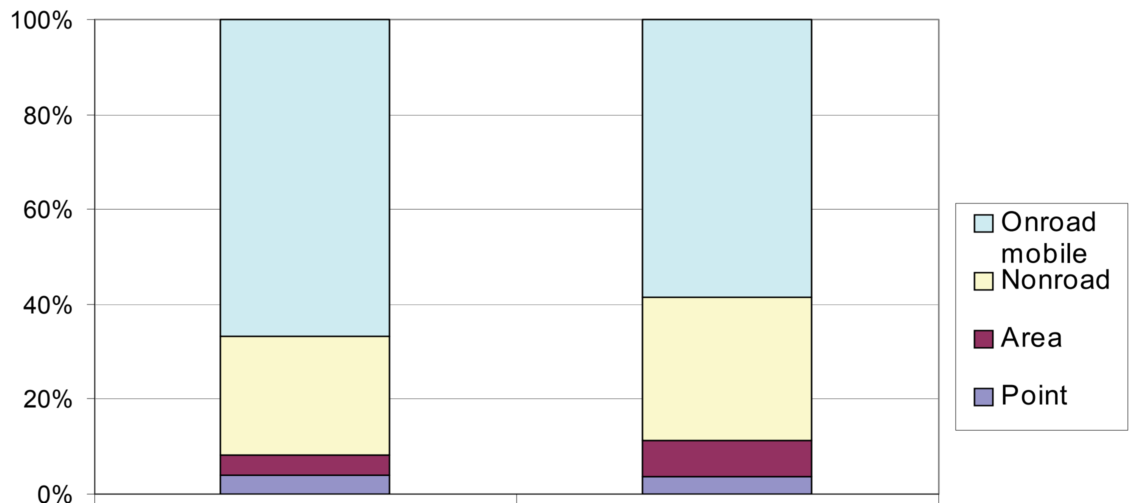
In addition, biogenic emissions increased by more than 400 percent between the 2002 and 2005 emission inventories. The substantial increase in the 2005 biogenic VOC emissions is due to the application of a new biogenic model (MEGAN) with updated emission rates based on field measurements of local vegetation.

Therefore, there have been no recent major changes in NOx emissions. Anthropogenic VOC emissions in the MNA increased, which may be attributed to changes in modeling assumptions, as well as residential population growth. Although biogenic VOC emissions are much higher in 2005, this is due to the improved MEGAN model and local emission rates, rather than changes in land use.

Table 3. Power plants operating in Maricopa County

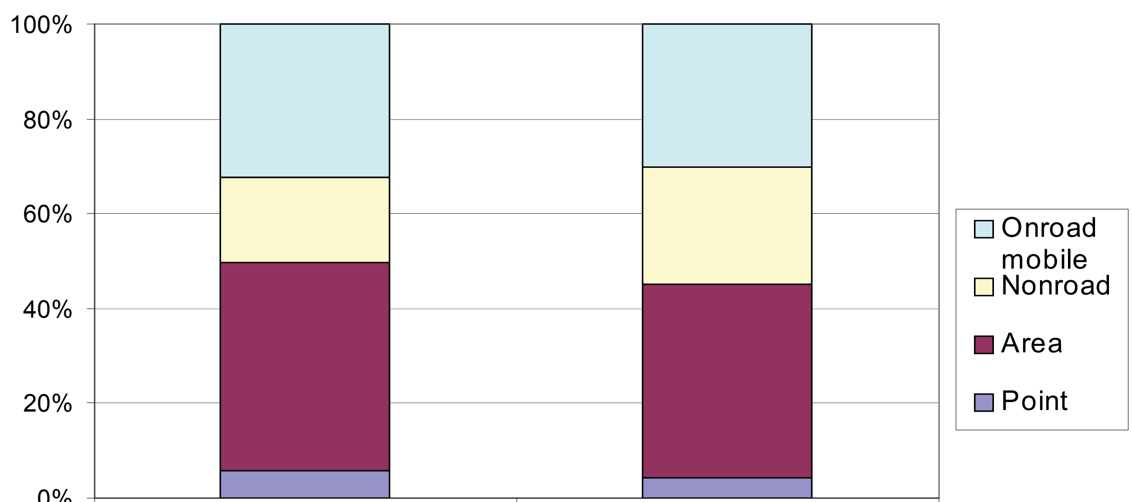
Power Plant	**2002**	**2005**
APS West Phoenix Power Plant	✓	✓
Duke Energy Arlington Valley	✓	✓
New Harquahaha Generating Co.		✓
Mesquite Generating Station		✓
Ocotillo Power Plant	✓	✓
Gila River Power Plant		✓
Redhawk Generating Station (Pinnacle)	✓	✓
Santan Generating Plant	✓	✓
SRP Agua Fria Generating Station	✓	✓
SRP Kyrene Steam Plant	✓	✓

Maricopa County: NOx Emissions Season-day



	2002	2005
Onroad mobile	66.83	58.60
Nonroad	25.00	30.06
Area	4.14	7.59
Point	4.03	3.75

Maricopa County: VOC Emissions Season-day



	2002	2005
Onroad mobile	32.17	30.25
Nonroad	18.19	24.74
Area	43.99	40.74
Point	5.65	4.27

Figure 6. Summary of 2002 and 2005 ozone season-day NOx and VOC emissions by major anthropogenic source categories in the MNA

8. Are there discernible trends in design values or other air quality indicators which have accompanied a change in emissions?

Figure 7 shows the 1996-2007 trend in the design values (three consecutive years' average of annual fourth highest daily maximum eight-hour average concentration) at monitoring sites in the MNA. In general, the trends are similar for many sites, with values gradually decreasing to a minimum in 2004 or 2005, and remaining at similar levels (± 3 ppb) thereafter. An exception is the trends at the Blue Point, Glendale, Humboldt Mountain, and South Phoenix monitoring sites, which continued decreasing at a relatively fast rate after 2004, and reached their minimum levels in 2007. In contrast, the design value at the Apache Junction site increased 7 ppb from 2005 to 2007. Another observation is that before 2002 the highest design value occurred primarily at the North Phoenix site and then shifted to the Humboldt Mountain site between 2002 and 2005.

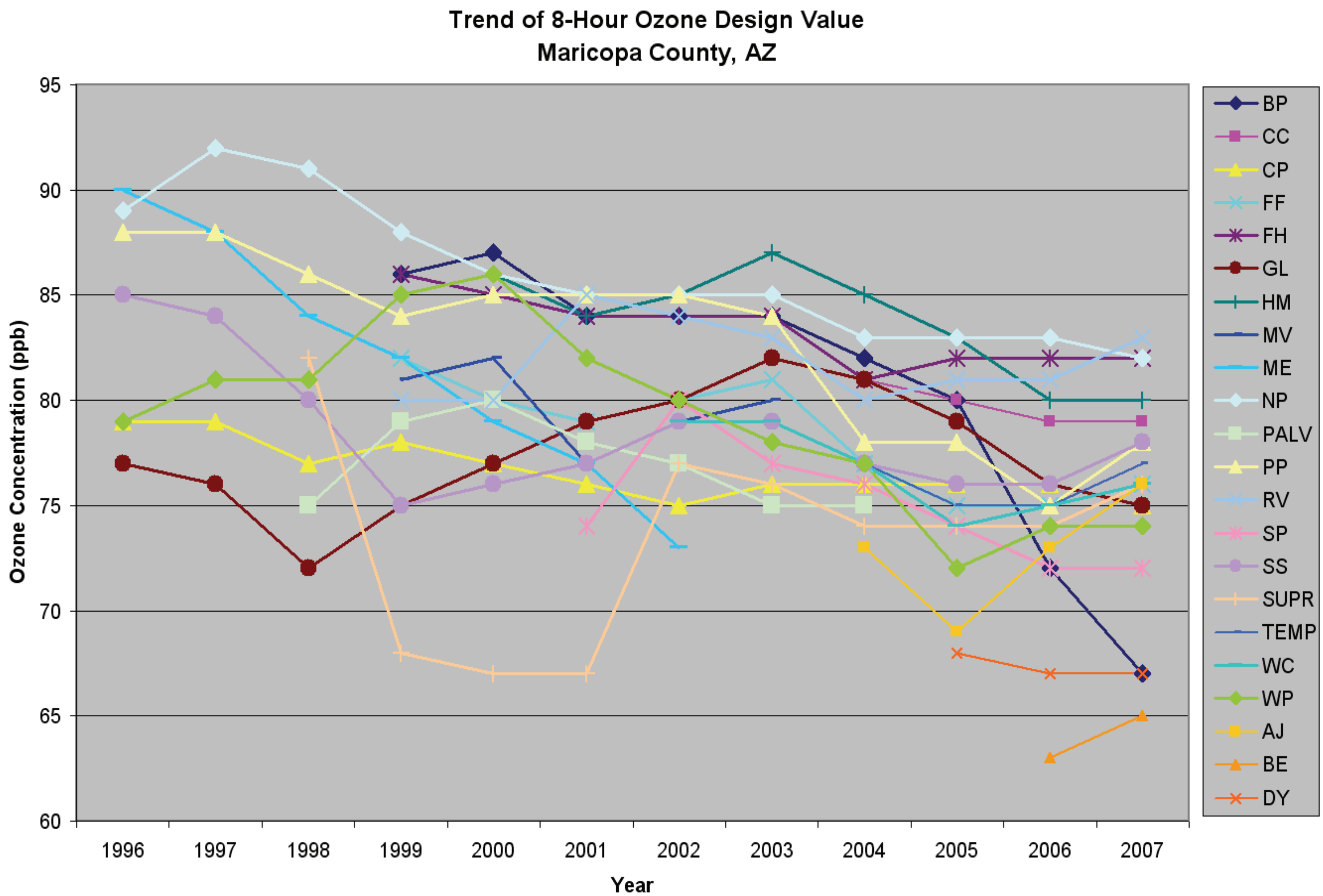


Figure 7. Trends in eight-hour ozone design values at Maricopa County monitoring sites: 1996-2007

9. Is there any apparent spatial pattern to the trends in design values?

There was no apparent spatial pattern in the trends in design values before 2004, when most sites underwent downturn changes. There was a discernible spatial pattern between 2004 and 2007. As shown in Section 8, the design values of many sites located in the Phoenix urban core remained at similar levels during this time period (e.g., Central Phoenix, North Phoenix, West Phoenix, Super Site, South Scottsdale, and Tempe monitoring sites). The sites outside the urban core generally underwent larger changes (e.g., South Phoenix, West Chandler, Pinnacle Peak, and Rio Verde monitoring sites). The sites at locations far removed from the urban core experienced even larger changes (e.g., Blue Point, Glendale, and Humboldt Mountain monitoring sites).

10. Have ambient precursor concentrations or measured VOC species profiles changed?

NOx monitors (NO and/or NO_2) have been co-located with ozone monitors at nine sites in the MNA. Four sites - Central Phoenix, West Phoenix, Super Site, and South Scottsdale - were selected for this analysis based on their complete data records during the ozone season. Data from these monitors provide an opportunity to examine the trends in NOx in the Phoenix urban core. Figure 8 depicts the annual average of daily maximum NO_2 during the ozone season from 2000 to 2007. All four sites showed a downward trend in NO_2 concentrations from 2000 to 2007.

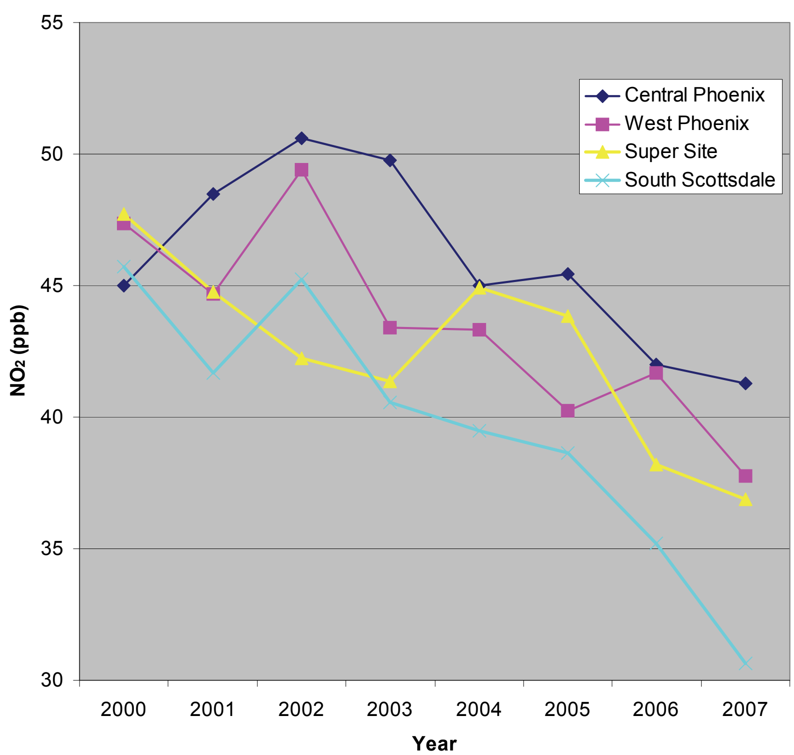


Figure 8. Annual average of daily maximum NO_2 during the ozone season from 2000 to 2007

11. What past modeling has been performed and what do the results suggest?

A nested CAMx modeling was performed for the eight-hour ozone attainment plan, with the nested inner domain encompassing the MNA (MAG, 2007). A total of three ozone episodes were simulated, which were June 3-7, 2002; July 8-14, 2002; and August 5-11, 2001.

Sensitivity tests indicated that the simulated ozone was highly sensitive to boundary conditions. The sensitivity tests demonstrated that transport of ozone and ozone precursors were not major contributors to ozone levels for the majority of the ozone episode days modeled. However, for one episode, June 2002, ozone and ozone precursors transported from outside the MNA contributed 48%-63% to the high ozone levels, while the transport contribution was smaller for the July 2002 and August 2001 episodes. The contribution of the transport of ozone and ozone precursors to high ozone levels was adequately addressed in the modeling through use of the outside 12 km grid modeling domain.

It should be noted that the contribution of background ozone to the highest design value in the MNA is generally less than 55 ppb (0.63 * 87 ppb), which implies that the transport of ozone at concentrations approaching 84 ppb is unlikely, and therefore, the cause of the MNA's eight-hour ozone exceedances are primarily due to local factors. As such, the modeling results are consistent with the conclusions of Section 1.

Additional sensitivity tests that varied emissions by source category showed that the simulated ozone is most sensitive to onroad mobile emissions and least sensitive to point source emissions. Further sensitivity tests were made by removing anthropogenic emissions of NOx and VOC separately. The analysis revealed that ozone concentrations increased with NOx reductions in the urbanized portion of the nonattainment area.

12. Are there any distinctive meteorological measurements at the surface or aloft which appear to coincide with occasions with eight-hour daily maxima greater than 84 ppb?

There is no obvious correspondence between eight-hour ozone maximums and meteorological measurements other than that high ozone levels are associated with daily maximum temperatures that are at least 89 F and surface winds that are easterly in the morning.

References:

Maricopa Association of Governments, (2007), “Eight-Hour Ozone Plan for the Maricopa Nonattainment Area”.

Maricopa County Air Quality Department, (2004), “2002 Periodic Emission Inventory for Ozone Precursors”.

Maricopa County Air Quality Department, (2008), email from Downing, B., “2005 Periodic Emission Inventory for Ozone Precursors”.

U.S. EPA, (2007), “Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze”, EPA-454/B-07-002.

ATTACHMENT II

Interagency Memorandum of Agreement

MEMORANDUM OF AGREEMENT
AMONG
THE ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY
AND
THE ARIZONA DEPARTMENT OF TRANSPORTATION
AND
MARICOPA COUNTY, BY AND THROUGH THE MARICOPA COUNTY ENVIRONMENTAL QUALITY AND COMMUNITY SERVICES AGENCY
AND
THE MARICOPA ASSOCIATION OF GOVERNMENTS

PURPOSE

The purpose of this Memorandum of Agreement is to provide the framework and guidelines to promote coordinated decision making in planning, development, and implementation, and enforcement of those actions necessary to attain and maintain the National Ambient Air Quality Standards in Maricopa County, hereafter referred to as the Nonattainment Area Plan, or NAP. This Memorandum is required pursuant to A.R.S. 49-406 D. and E. The Memorandum also provides the framework and guidelines for preparing plans designed to address other air pollution problems of regional concern.

SCOPE

This Memorandum is designed to address the control of the following pollutants: Carbon Monoxide, Ozone, Particulates, and Other Air Pollution Problems of Regional Concern.

The geographical area of concern is Maricopa County or the area specifically designated by the Administrator of the U.S. Environmental Protection Agency as not having attained the National Ambient Air Quality Standards for one or more of the pollutants named above.

RESPONSIBILITIES AND AUTHORITIES

The Arizona Department of Environmental Quality (ADEQ) has the primary authority in the State of Arizona for air pollution control and abatement. ADEQ is charged with preparation, development and maintenance of the State Implementation Plan (A.R.S. § 49-404); designation of areas of the state with respect to compliance with the National Ambient Air Quality Standards (A.R.S. § 49-405); and assuring that nonattainment area plans are implemented (A.R.S. § 49-406 J.). ADEQ has original jurisdiction and control over portable, mobile, and specific types of stationary air pollution sources (see A.R.S. § 49-402 A.). In addition, ADEQ is responsible for development of stationary source permitting procedures and standards (see A.R.S. § 49-480 B.). ADEQ is also responsible for providing technical assistance to political subdivisions of the State for implementing air pollution control programs (A.R.S. § 49-424 A.8.), conducting research on the amounts of hazardous air pollutants in ambient air and their impacts on human health (A.R.S. § 49-426.06); management and implementation of programs under the Air Quality Fee Fund (A.R.S. § 49-551), implementation of the Vehicle Emissions Inspections Program (A.R.S. § 49-521 through 550), and conducting research on vehicular emissions and clean burning fuels (A.R.S. § 49-553). The Department may delegate authority to a county for implementing air pollution control statutes (A.R.S. § 49-424 B.)

The Arizona Department of Transportation (ADOT) has exclusive control over state highways and all other state owned transportation systems (A.R.S. § 28-104). This includes the responsibility of multi-modal state transportation planning, cooperation with local governments, coordination of transportation planning with local governments, investigation of new transportation systems, and advising local governments concerning the development and operation of public transit systems (A.R.S. § 28-104).

The ADOT Director shall also enter into agreements on behalf of the state with political subdivisions for the improvement, maintenance and construction of mass transit systems, and shall provide rules for the application for and expenditure of all mass transit funds (A.R.S. § 28-108).

In addition, ADOT is authorized to conduct demonstration projects to evaluate the effectiveness of new, extended, improved or integrated public transportation services and carpooling or vanpooling activities in meeting regional transportation needs or in improving air quality (A.R.S. § 28-2611). These projects are funded by an annual distribution of $400,000 from the air quality fund (A.R.S. § 49-551). ADOT must also support ADEQ on reporting to the Legislature results of mobile source emissions Research, where applicable, per A.R.S. § 49-553.

The Maricopa County Environmental Quality and Community Services Agency (MC EQ&CSA) is the local air pollution control department for Maricopa County. The Agency has jurisdiction over air pollution sources not explicitly reserved for state jurisdiction (A.R.S. § 49-402); the Agency is delegated authority from the State of Arizona to regulate certain portable air pollution sources initially reserved for state jurisdiction (A.R.S. § 49-424); the Agency operates the Regional Travel Reduction Program (A.R.S. § 49-582 et seq), and is the principal government sponsor for the Voluntary No Drive Days Program (A.R.S. § 49-506). The Agency is also responsible for monitoring the ambient air quality of the region (A.R.S. § 49-473) through collecting and analyzing air quality data.

Within the Maricopa County Environmental Quality and Community Services Agency, the Assistant County Manager of the Agency is designated as the Air Pollution Control Officer. The Air Pollution Control Officer has the responsibility and authority to enforce the provisions of Article 3, Chapter 3, Title 49, "County Air Pollution Control", Arizona Revised Statutes. The Control Officer also has the responsibility for assuring adequate nonattainment plan implementation as prescribed by A.R.S. § 49-406.

The Maricopa Association of Governments (MAG) is a nonprofit Arizona corporation composed of elected officials from twenty-four cities and towns, Maricopa County, Gila River Indian Community, and the Arizona Department of Transportation. MAG has been designated by the Governor of Arizona as the lead planning organization for Maricopa County that, together with the State, is responsible for determining which elements of the State Implementation Plan revision will be planned, implemented, and enforced by State and local governments in Arizona (Governor Wesley Bolin, February 7, 1978; Clean Air Act § 174(a); and A.R.S. 49-406)). MAG is responsible for providing assistance to the Maricopa County Travel Reduction Regional Task Force and for recommending third and following year travel reduction targets, policies, standards and criteria for the Maricopa County Travel Reduction Program (A.R.S. § 49-582 and 49-588). Related directly to air quality, MAG is the official designated metropolitan transportation planning organization, and the designated agency for preparing population estimates and projections for the Maricopa County area. MAG is also responsible for making transportation/air quality conformity determinations, subject to the consultation procedures as provided by law (Clean Air Act § 176).

UNDERSTANDING/AGREEMENTS

In recognition and to facilitate the accomplishment of the foregoing, IT IS HEREBY AGREED that:

1. The Arizona Department of Environmental Quality; Arizona Department of Transportation; Maricopa County Environmental Quality and Community Services Agency; and Maricopa Association of Governments will work through a coordinated effort to prepare the MAG regional air quality plans as described in Attachments One, Three, Four, and Five. Attachment One contains a description of the generalized roles and areas of expertise of the agencies, the MAG Air Quality Planning Team, and the MAG Air Quality Policy Team. Attachment Three contains the general implementation authorities for measures in the air quality plans. Attachment Four includes provisions for tracking plan implementation; determining reasonable further progress; assurances for adequate plan implementation, and adoption of control measures. Attachment Five contains the Work Programs for Preparing Air Quality Plans.

2. The Maricopa Association of Governments will maintain the MAG Regional Air Quality Planning Process for decision making as described in Attachment Two. This Attachment contains the roles of the MAG Regional Council, MAG Management Committee, MAG Air Quality Policy Committee, and ad hoc Working Groups. MAG will coordinate the preparation of the NAPs. Representatives from ADEQ, ADOT and MC EQ&CSA will be included as ex-officio members of the MAG Air Quality Policy Committee, and active members of all working groups associated with this MAG committee.

3. The Arizona Department of Environmental Quality; Arizona Department of Transportation; Maricopa County Environmental Quality and Community Services Agency; Maricopa Association of Governments will pursue commitments to implement the measures in the NAPs. The aforementioned agencies will continue to evaluate and pursue the implementation of additional air pollution control measures as a result of the evaluations performed as described in Attachment Four.

EFFECTIVE DATE

The Agreement and all Amendments shall become effective on the date it has been signed by all parties to it.

TERM

This Agreement shall remain in effect from the effective date of the Agreement until such time it is terminated or superseded by a subsequent agreement. This Agreement may be terminated by any party to it, providing written notice of intent to terminate is provided to all other parties to the Agreement thirty days prior to the effective date of withdrawal of that party from the Agreement.

AMENDMENT

This Agreement may be amended at any time upon mutual written agreement of all parties. No agent, employee or other representative of any party to this Agreement is empowered to alter any of the terms of the Agreement, unless it is done in writing and signed by the Designated Officers of the respective parties, their authorized representatives, or duly appointed successors.

ATTEST

All terms of this Memorandum of Agreement are hereby acknowledged and agreed, as certified by the signatures of the Designated Officers affixed hereto:

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

By ______________________
Edward Z. Fox, Director, Arizona Department of Environmental Quality

Date Nov 9, 1992

ARIZONA DEPARTMENT OF TRANSPORTATION

By James O. Creedon
James Creedon, Acting Director, Arizona Department of Transportation

Date Nov 9, 1992

MARICOPA COUNTY, BY AND THROUGH THE MARICOPA COUNTY ENVIRONMENTAL QUALITY AND COMMUNITY SERVICES AGENCY

By Betsy Bayless
Betsy Bayless, Chairman, Maricopa County Board of Supervisors

Date 11.2.92

MARICOPA ASSOCIATION OF GOVERNMENTS

By J. J. DeBolske
John J. DeBolske, Secretary, Maricopa Association of Governments

Date 11.2.92

ATTACHMENT ONE

MAG REGIONAL AIR QUALITY PLANNING TECHNICAL PROCESS

- All MAG regional air quality plans are prepared through a coordinated effort among the Arizona Department of Environmental Quality, Arizona Department of Transportation, Maricopa County Environmental Quality and Community Services Agency, and Maricopa Association of Governments.

MAG AIR QUALITY POLICY TEAM

Composition: Director of Arizona Department of Environmental Quality; Director of Arizona Department of Transportation; Air Pollution Control Officer of Maricopa County; MAG Secretary

- Oversees preparation of plans and overall technical planning effort
- Resolves technical problems and issues

MAG AIR QUALITY PLANNING TEAM

Composition: Staff from the Arizona Department of Environmental Quality, Arizona Department of Transportation; Maricopa County Environmental Quality and Community Services Agency; Maricopa Association of Governments

Agency Roles

- Arizona Department of Environmental Quality - air quality modeling and technical assistance, mobile source emissions research and inventory, input for the comprehensive list of measures and feasibility analysis, information relating to the Vehicle Emission Inspection Maintenance Program, stationary and portable source control strategies, air quality research studies, State Air Quality Fund administration, adoption and submittal of State Implementation Plans to the Environmental Protection Agency, tracking plan implementation, assurances, special purpose air quality and meteorological monitoring for plan development and compliance
- Arizona Department of Transportation - State Transportation Improvement Program, other transportation plans and programs, input for the comprehensive list of measures and feasibility analysis
- Maricopa County Environmental Quality and Community Services Agency - stationary source emissions inventory and controls, coordinating the comprehensive emissions inventory, air quality monitoring data,input for comprehensive list of measures and feasibility analysis, mandatory travel reduction program, trip reduction data, voluntary no drive days program, tracking plan implementation, reasonable further progress, assurances, special purpose air quality and meteorological monitoring for plan development and compliance
- Maricopa Association of Governments - demographic projections and socioeconomic data, transportation modeling, air quality modeling, Regional Transportation Improvement Program, Regional Transportation Plan, other transportation plans and programs, congestion mangement system, conformity, input for comprehensive list of measures and feasibility analysis, development of the air quality plans, interface with state, county, and local entities, recommending future year travel reduction goals, policies, and standards to Maricopa County, assistance to Maricopa County for the mandatory travel reduction program, review reasonable further progress made to reduce air pollution and plan adjustments if necessary, review plan implementation

The technical planning work is closely coordinated with EPA Region IX staff, Federal Highway Administration, and Federal Transit Administration.

ATTACHMENT TWO

MAG REGIONAL AIR QUALITY PLANNING PROCESS

MAG REGIONAL COUNCIL

Composition: *Elected officials from 24 cities and towns, Maricopa County, Gila River Indian Community, and Arizona Department of Transportation, Regional Public Transportation Authority*

- Reviews all pertinent air quality data
- Adopts regional air quality plans
- Formally requests that state, county, local, and other appropriate agencies implement measures in the plans
- Approves trip reduction goals and policies and recommends to Maricopa County
- Determines conformity, subject to the consultation procedures as provided by law (Clean Air Act § 176)
- Maintains an air quality/transportation planning process consistent with federal law

MAG MANAGEMENT COMMITTEE

Composition: *Managers from 24 cities and towns, Maricopa County, Gila River Indian Community, and Arizona Department of Transportation, Regional Public Transportation Authority*

- Reviews all pertinent air quality and transportation data
- Recommends regional air quality and transportation plans
- Recommends trip reduction goals and policies

MAG AIR QUALITY POLICY COMMITTEE

Composition: *10 elected officials from cities and towns and Maricopa County and 9 citizen representatives + ex-officio representatives from Arizona Department of Environmental Quality, Arizona Department of Transportation, and Maricopa County Environmental Quality and Community Services Agency*

- Reviews all pertinent air quality data from the technical planning process
- Reviews air quality research studies conducted by MAG, Arizona Department of Environmental Quality, EPA, Maricopa County Environmental Quality and Community Services Agency, etc.
- Reviews related data generated from other MAG regional planning areas such as transportation, transit, population, regional development, water quality, solid waste, etc.
- Studies in detail a comprehensive list of control measures. Data on the measures includes: description of the measures, air quality impacts, complementary measures, implementation responsibility, costs, advantages and disadvantages, etc.
- Recommends air quality measures for the plans
- Conducts public hearings on the plans
- Formally recommends regional air quality plans and control measures
- Recommends trip reduction goals and policies
- Conducts conformity reviews, subject to the consultation procedures as provided by law (Clean Air Act § 176)
- Reviews reasonable further progress made to reduce air pollution and recommends plan adjustments if necessary
- Provides input on the MAG congestion management system

ADDITIONAL WORKING GROUPS AS NECESSARY

IMPLEMENTATION OF MAG REGIONAL AIR QUALITY PLANS
GENERAL IMPLEMENTATION AUTHORITIES

STATE - ARIZONA DEPARTMENT OF ADMINISTRATION

- Travel reduction and adjusted work hours for state employees

STATE - ARIZONA DEPARTMENT OF COMMERCE

- Capitol Ridesharing Program

STATE - ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

- Mobile source emissions controls
- Mobile source emissions research
- Portable and some major stationary source controls
- Ambient air quality monitoring and research
- Assurances

STATE - ARIZONA DEPARTMENT OF TRANSPORTATION

- State and interstate transportation system planning, development and management (includes High Occupancy Vehicle Lanes, Freeway Management Systems, etc.)
- Vehicle registration and licensing
- Transit Assistance Grants

STATE - ARIZONA DEPARTMENT OF WEIGHTS AND MEASURES

- Oxygenated fuels
- Other fuel quality regulation (e.g. Reid Vapor Pressure)
- Stage I and Stage II vapor recovery

MARICOPA COUNTY - ENVIRONMENTAL QUALITY AND COMMUNITY SERVICES AGENCY

- Stationary source controls
- Delegated portable source controls
- Area source controls (e.g. *de minimis* sources, materials storage and handling, construction)
- Open burning control
- Mandatory Travel Reduction Program (TRP) and Voluntary No Drive Days
- Other transportation control measures in unincorporated areas
- Ambient air monitoring
- County roadways system planning, development and management
- Planning and zoning (unincorporated areas)
- Assurances

MAG CITIES AND TOWNS

- Municipal roadways system planning, development and management
- Transportation control measures (besides TRP)
- Planning and zoning
- Some area source controls (e.g. vacant land, construction practices)
- Public transit (including Regional Public Transportation Authority)

MARICOPA ASSOCIATION OF GOVERNMENTS

- Future year travel reduction goals, policies, standards, and criteria
- Ridesharing program
- Conformity determinations, as provided by law (Clean Air Act § 176)
- Allocation of Congestion Mitigation Air Quality Improvement Program Funds and Surface Transportation Program Funds

* As noted in the MAG regional air quality plans, the action taken by the MAG Regional Council to approve the Suggested Measures and Adopted Plan Measures does not commit each jurisdiction to implement those measures. As indicated in the resolutions and commitments, each jurisdiction determines which measures are reasonably available for implementation by that jurisdiction.

OTHER IMPLEMENTATION AND ADOPTION FUNCTIONS

This attachment includes provisions for tracking plan implementation and determining reasonable further progress; assurances for adequate plan implementation, and procedures and responsibilities for adoption of control measures and emissions limitations.

TRACKING PLAN IMPLEMENTATION AND DETERMINING REASONABLE FURTHER PROGRESS

Each agency is afforded a review and comment period for each ongoing portion of a plan or revision to a plan being prepared by another agency. Every effort will be made to incorporate the comments of the reviewing agency into each portion of the plan being prepared by another agency.

Maricopa County will develop monitoring guidelines with respect to reasonable further progress which will be consistent with the needs of the Arizona Department of Environmental Quality and U.S. EPA. Maricopa County will be responsible for tracking emissions from point, area and non-road mobile sources and for tracking implementation of control strategies. MAG will be responsible for tracking on-road mobile source emissions and conformity. Maricopa County will integrate the MAG information and reports with the Maricopa County information and submit it to the Arizona Department of Environmental Quality.

For the EPA, the primary means of demonstrating the rate of progress will be through the periodic inventories (i.e., complete, actual inventories) submitted every 3 years. EPA has indicated in the General Preamble Section III.A.3 (d) that they currently intend to rely on existing reporting requirements such as emission statements, periodic inventories, annual Aerometric Information Retrieval System update, and conformity reviews.

ASSURANCES FOR ADEQUATE PLAN IMPLEMENTATION

In order to comply with the Clean Air Act, State law provides an approach for assurances that State and local committed measures will be adequately implemented (A.R.S. §49-406 L and J.). If any person (includes State, County, local governments, regional agencies, and other entities) fails to implement a committed measure, the County would file an action in Superior Court to have the court order that the measure be implemented. Likewise, the ADEQ Director will backstop the County if it fails to implement a committed measure or if the County fails to backstop the local governments and regional agencies.

Regarding committed measures, A.R.S. §49-406 G. requires that each agency that commits to implement any control measure contained in the State Implementation Plan must describe the commitment in a resolution. The resolution must be adopted by the appropriate governing body of the agency. State law also requires the resolution to specify the following: (1) Its authority for implementing the limitation or measure as provided in statute, ordinance or rule: (2) A program for the enforcement of the limitation or measure; and (3) The level of personnel and funding allocated to the implementation of the measure.

As noted in the MAG regional air quality plans, the action taken by the MAG Regional Council to approve the Suggested Measures and Adopted Plan Measures does not commit each jurisdiction to implement those measures. As indicated in the resolutions and commitments, each jurisdiction determines which measures are reasonably available for implementation by that jurisdiction.

PROCEDURES AND RESPONSIBILITIES FOR ADOPTION OF CONTROL MEASURES AND EMISSIONS LIMITATIONS

According to A.R.S. §49-404 B., the ADEQ Director may adopt rules that describe procedures for adoption of revisions to the State Implementation Plan. The State, in accordance with these rules, and the governing body of the metropolitan planning organization (MAG) are required to adopt the nonattainment area plans (A.R.S. §49-406 H.).

ATTACHMENT III

CMAQ MODELING AND EVALUATION

MARICOPA ASSOCIATION OF GOVERNMENTS

OFFICE MEMORANDUM

DATE: February 22, 2008

TO: Taejoo Shin, Ieesuck Jung, and Cathy Arthur

FROM: Huiyan Yang, Air Quality Engineer II

SUBJECT: **Simulation of Ozone for the Maricopa Nonattainment Area by Using the EPA Models-3/Community Multiscale Air Quality Modeling System (CMAQ) and Comparison with the Results of the Comprehensive Air Quality Model with extensions (CAMx)**

The CAMx model was used to simulate ozone for three episodes for the Eight-Hour Ozone Plan for the Maricopa Nonattainment Area (MAG, 2007). This plan was submitted to the U.S. EPA in June 2007. The reason to conduct CMAQ simulations after doing CAMx modeling is to provide a source of ancillary model assessments for the same ozone episodes, and therefore to substantiate the attainment demonstration for the ozone season in 2008.

The U.S. EPA Models-3/CMAQ modeling system is a third generation air quality modeling tool for the regulatory and science communities. The CMAQ modeling system includes interface processors to incorporate the outputs of meteorology and emission models, and preprocessors to prepare the requisite input information for initial and boundary conditions and photolysis rates. The information is then input to the CMAQ Chemical Transport Model (CCTM), which performs chemical transport modeling for multiple pollutants on multiple scales (U.S. EPA, 1999). The latest release of CMAQ version 4.6 as of September 30, 2006 was used in this model performance study.

This report is organized into four sections. Section 1 describes the modeling domain and the chemical mechanism. Section 2 introduces how the model input data sets were prepared. Section 3 describes the results of the CMAQ simulation including an evaluation of the CMAQ results against observations and comparisons with the former CAMx simulation. Section 4 summarizes the results of the model performance evaluations of the CMAQ and CAMx models.

1. Model Setup

1.1 Modeling domain

The CMAQ modeling grids are based on the Lambert Conformal Projection (LCP) modeling domain of the Fifth Generation Mesoscale Model (MM5) that was used to develop meteorology for CAMx. The rationale is that CMAQ will use the same meteorology data as was used in the CAMx modeling. The grid parameters of the MM5 and CMAQ modeling domains are listed in Table 1 (Emery and Koo, 2007). The central latitude and longitude of the MM5 LCP coordinate are 34 N and 111 W, and the conic true latitudes are 45 N and 33 N. The boundaries of the CMAQ domains are slightly inset several grid cells on each side from the boundaries of the MM5 domains. This was done, as suggested in the Meteorology-Chemistry Interface Processor (MCIP) guidance, as a method to remove boundary “noise” near the MM5 boundaries.

Table 1. The MM5 and CMAQ Modeling Domains

The MM5 Modeling Domains		
Grid	**Grid Size**	**LCP range (km)**
36-km grid	64 by 49	(-1134, -864) to (1134, 864)
12-km grid	118 by 91	(-810, -612) to (594, 468)
4-km grid	61 by 40	(-234, -132) to (6, 24)
The CMAQ Modeling Domains		
Grid	**Grid Size**	**LCP range (km)**
12-km grid	111 by 84	(-774, -576) to (558, 432)
4-km grid	50 by 29	(-202, -112) to (-2, 4)

Note that CAMx was run in the Universal Transverse Mercator (UTM) Zone 12, as opposed to the LCP projection used for both MM5 and CMAQ. Fortunately, the MM5 LCP projection was centered on UTM Zone 12, which allows the UTM and LCP projections to align fairly well. In fact, the 12-kilometer (km) grid CMAQ modeling domain is the same as CAMx. And there is almost a 1-for-1 grid cell match up between CMAQ and CAMx for the 4-km grid modeling domain as well, except for the 2-km (half grid) discrepancy in the south-north direction. The domain origin of CAMx in the south-north direction is -110 km (converted from UTM 3652 km northing in UTM zone 12). This 2-km discrepancy between the two modeling domains is not expected to affect the overall comparison of model performance between CMAQ and CAMx.

The vertical structure used in the CMAQ modeling is the same as used in the CAMx modeling. There are 20 layers in the 12-km grid modeling domain and 23 layers in the 4-km grid modeling domain. The top level is set at ~15 km (MAG, 2007).

1.2 Chemical mechanism

To be consistent with the chemical mechanism used in CAMx, the cb5 chemical mechanism was also used in the CMAQ simulation,. More specifically, cb5_aq is used, since cb5 alone does not include wet deposition. A total of 51 species are simulated in cb5_aq, including NO, NO_2, O_3, PAN, OH, CO, and different VOC species, etc. There are a total of 156 reactions used in cb5_aq.

It should be noted that methanol and ethanol are commented out in the CMAQ cb4 mechanism, which are included in mechanism 4 in CAMx. Since methanol and ethanol have primary emissions in the MNA 4-km gridded modeling domain, and since they are also precursors of ozone, the cb5_aq chemical mechanism that was used in the CMAQ modeling was configured to include these two species. HONO was added to the emissions list. There are several primary species (ALDX, IOLE, TERP, and ETHA) that are included in CMAQ's cb5 chemical mechanism that are not included in CAMx's mechanism 4 (chemical mechanism). However, this should not affect the results of comparing the performance of the two models since there are no emissions for these species in the MNA 4-km grid modeling domain.

Preliminary analysis shows that cb5_aq produces 1 or 2 ppb more ozone than cb4_aq. Thus, the conclusions that were based on cb5_aq are not expected to change when the chemical mechanism changes to cb4_aq. The results presented in this report are based on cb5_aq.

1.3 Advection scheme

To be consistent with the CAMx modeling, the Piecewise Parobolic Method (ppm) for advection was also used in the CMAQ modeling. An experiment using the global mass-conserving scheme (yamo) is described in a separate report. The results from the global mass-conserving scheme are similar to the results described in this report.

2. Model input data

For the original CAMx modeling performed for the MAG Eight-Hour Ozone Plan, the original input data sets of meteorology, emissions, initial condition (IC) and boundary condition (BC) had been reviewed for accuracy and consistency (MAG, 2007). These same input files were used in the CMAQ modeling.

The MM5 meteorology was processed to the CMAQ I/O API format by using MCIP. The CAMx binary format emissions and IC/BC for the 12-km grid modeling domain were converted to the CMAQ format by using processors provided by ENVIRON. The ICON and BCON pre-processors were used to extract IC/BC for the 4-km grid modeling domain from the modeling results of the 12-km grid modeling domain.

The photolysis rate preprocessor (JPROC) was used to produce a clear-sky photolysis rate look-up table. Default model settings or parameters were used for this calculation. The following specific parameters were used: (1) Ultra-violet (wave length < 400nm) albedo was set to 0.05, (2) Aerosol/haze was uniformly set to have an optical depth of ~0.32, and (3) The World Meteorology Organization (WMO) 1981 monthly average total ozone column data was used and these data range from ~280 to 370 Dobson units (DU) for June, July and August in the latitudinal bands between 30 N and 40 N.

3. Results

The simulated surface ozone concentrations in the MNA 4-km grid modeling domain are discussed in the following sections. The first three days of each episode were used to spin up the model to reduce the potential errors introduced through the initial conditions. These spin-up days were not included in the analysis. The last day in each episode was missing due to the conversion from the Greenwich Mean Time (GMT) convention that was used in CMAQ modeling to the Mountain Standard Time (MST) convention used in CAMx modeling (MST is seven hours behind the GMT). Note: in this report, all references to time are in MST units.

3.1 Evaluation against observations

One-hour (hourly average) ozone observational data were obtained from EPA and the data were reorganized by MAG for use in evaluating the CMAQ's model performance. This was the same observational data set used in the CAMx evaluation. After converting the CMAQ results to the CAMx binary format, the CAMx evaluation tools were used to analyze the CMAQ results. The CAMx results cited for comparison were presented in MAG's Eight-Hour Ozone Attainment plan (MAG, 2007).

3.1.1 The June 2002 episode (June 3 to June 6)

Figure 1 depicts the time series of simulated one-hour ozone concentrations overlaid with the observed one-hour ozone values from 21 ozone monitoring sites located in the MNA. The model predictions are fairly consistent with observations on the timing of net positive ozone production, which is approximately 7 am. The maximum ozone occurs between 3 and 7 pm, and the minimum is usually reached at approximately 6 am. The diurnal cycle is stronger at sites located closer to central Phoenix, such as the Phoenix sites WP, NP, CP, SUPR; the Tempe site TEMP; and the MESA site ME. These sites sometimes have the lowest ozone level of approximately 1 ppb at night, since these sites are more heavily influenced by urban conditions.

The diurnal variation is less prominent at sites farther away from central Phoenix, such as the Scottsdale site PP, and the Cave Creek sites CC and HM. These sites are more heavily influenced by the background ozone or transported ozone. The variation trend of diurnal cycles in the model is consistent with the observations, which suggests that the local production and long-range transport of ozone, and therefore the spatial distribution, are generally captured in the model.

CMAQ overpredicted ozone levels on June 5th and 6th. ENVIRON staff suggested that the dry deposition schemes, RADM and M3DRY, should be tested and compared (Emery, personal communication, 2007) to determine if they are involved in the over-prediction. It turned out the two dry deposition schemes produced almost the same results. This bolsters the argument that the over-prediction of ozone in CMAQ is possibly caused by its strong vertical mixing scheme, as was suggested by ENVIRON (Emery, personal communication, 2007) and Timin et al. (2007). In contrast, the CAMx model used a weak vertical mixing scheme OB70 and it performed much better.

However, it is out of the scope of this project to conduct a test of different vertical mixing schemes in CMAQ due to the constraints of module implementation. Another major inconsistency between model prediction and observations occurs at night. This may be a result of the strong vertical mixing scheme used in the CMAQ model causing NOx at the surface to be heavily diluted and subsequently leading to weak ozone destruction.

The time series of the eight-hour (eight-hour average) ozone is depicted in Figure 2. This curve is relatively smooth when compared with a similar curve for one-hour ozone, and the peak hour is shifted to approximately 12 pm. The agreement of CMAQ's simulated eight-hour ozone with observations is generally better in the morning than in the afternoon, when there is an over-prediction, especially at sites close to central Phoenix. June 6th is an exception, since the over-prediction of one-hour ozone occurs in the morning for most sites on this day. The sites farther away from central Phoenix are generally better predicted. Figure 3 gives the scatter plot of eight-hour ozone levels. As expected, the over-prediction occurs mainly for ozone concentrations lower than 60 ppb, which typically occurs at night. The predicted ozone values are more consistent with the observations at high ozone levels during the day.

The statistical evaluation indices of CMAQ and CAMx model performance are presented in Table 2. EPA's recommended goals for model performance are: (1) Unpaired peak prediction accuracy (UPPA) is < ± 20%, (2) Normalize Bias (NB) is < ±15%, and (3) Normalized Error (NE) is < 35% of the average prediction. The modeling evaluation index results that are outside of the range of the EPA goals are highlighted in red bold text in Table 2. The definitions for all the statistical indices are discussed in MAG's Eight-Hour Ozone Attainment Plan (MAG, 2007).

Table 2 shows that indices with 60 ppb thresholds are generally within the range of the EPA goals, except for the UPPA and NB on June 3rd when there was no exceedance of the daily maximum eight-hour ozone. The NB and NE, without thresholds, for both the one-hour and eight-hour ozone are outside the range of EPA goals due to the CMAQ model's over-prediction at night (previously described in this section). The UPPA is the same with or without a threshold, since the peak ozone is above the threshold of 60 ppb.

Table 2. Summary of the Statistical Modeling Evaluation for the June 2002 Episode

	6/3	6/4	6/5	6/6
One-Hour with a 60 ppb threshold (CMAQ)				
Unpaired Peak Prediction Accuracy (%)	**-22.5**	-5.8	8.4	11.6
Normalized Bias (%)	**-22.3**	-2.5	11.9	10.2
Normalized Error (%)	22.4	11.3	14.7	12.5
One-Hour with a 60 ppb threshold (CAMx)				
Unpaired Peak Prediction Accuracy (%)	**-25.6**	1.4	1.7	5.1
Normalized Bias (%)	**-28.9**	-5.5	5.1	-0.5
Normalized Error (%)	28.9	10.0	10.3	8.9
Eight-Hour with a 60 ppb threshold (CMAQ)				
Unpaired Peak Prediction Accuracy (%)	**-30.7**	-4.4	8.9	6.4
Normalized Bias (%)	**-19.8**	0.8	13.2	12.3
Normalized Error (%)	19.9	9.9	14.1	13.2
Eight-Hour with a 60 ppb threshold (CAMx)				
Unpaired Peak Prediction Accuracy (%)	**-28.6**	1.0	7.7	-1.8
Normalized Bias (%)	**-25.1**	-3.3	7.8	0.2
Normalized Error (%)	25.1	7.9	9.8	8.0
Note: Modeling Evaluation Indices outside of EPA's goals are shown in bold red font.				

3.1.2 The July 2002 episode (July 8 to July 13)

The time series of one-hour and eight-hour ozone concentrations are plotted in Figure 4 and Figure 5, respectively. Figure 6 contains a scatter plot of the results. Table 3 lists the results of the statistical evaluation. The general feature of the diurnal variation of ozone for the July 2002 episode is similar to the June 2002 episode, except when it was under-predicted in the July 2002 episode (mainly July 9th to July 12th).

Table 3. Summary of the Statistical Modeling Evaluation for the July 2002 Episode

	7/8	7/9	7/10	7/11	7/12	7/13
One-Hour with a 60 ppb threshold (CMAQ)						
Unpaired Peak Prediction Accuracy (%)	-4.1	**-28.1**	**-34.6**	**-36.5**	**-29.0**	-5.5
Normalized Bias (%)	-12.7	**-30.6**	**-32.5**	**-38.7**	**-30.6**	**-19.1**
Normalized Error (%)	14.7	30.8	32.7	**38.8**	30.7	19.5
One-Hour with a 60 ppb threshold (CAMx)						
Unpaired Peak Prediction Accuracy (%)	12.4	-11.4	-7.6	-9.0	-10.8	1.5
Normalized Bias (%)	-4.4	**-23.8**	**-20.3**	**-31.0**	**-22.4**	**-21.4**
Normalized Error (%)	11.6	25.1	26.1	32.2	23.1	22.0
Eight-Hour with a 60 ppb threshold (CMAQ)						
Unpaired Peak Prediction Accuracy (%)	-9.1	**-29.7**	**-35.0**	**-34.6**	**-28.1**	-9.4
Normalized Bias (%)	-12.5	**-31.4**	**-33.6**	**-37.1**	**-30.4**	-14.8
Normalized Error (%)	12.6	31.4	33.6	**37.1**	30.5	14.8
Eight-Hour with a 60 ppb threshold (CAMx)						
Unpaired Peak Prediction Accuracy (%)	2.5	-17.0	-16.9	**-20.6**	-17.0	-8.0
Normalized Bias (%)	-5.8	**-25.7**	**-22.3**	**-30.1**	**-23.4**	**-16.3**
Normalized Error (%)	9.0	25.8	23.8	30.4	23.5	16.4
Note: Modeling Evaluation Indices outside of EPA's goals are shown in bold red font.						

A close inspection of Figure 4 reveals that when CMAQ's worst under-prediction occurred on July 10th and 11th, it was wide spread over sites located in or near the central Phoenix (e.g., Phoenix sites MV, WP, CP, SURP, and NP). In contrast, the predicted ozone is slightly more consistent with observations at many sites away from the Phoenix urban core (e.g., Surprise SU, at Scottsdale PP, at Fountain Hills FH, and at Rio Verde RV). However, there is serious under-prediction again at the remote sites at Palo Verde PALV and at Cave Creek HM.

The emissions inventory used in MAG's Eight-Hour Ozone Plan indicated that the major NOx emission sources are concentrated in and around central Phoenix, while the VOC emission sources are more scattered in the 4-km grid modeling domain (MAG, 2007), since on-road mobile sources are the dominant NOx emissions source, and biogenic sources are the dominant VOC emissions source. A previous study found that the Phoenix urban core is VOC sensitive, while the area outside of the urban core is NOx sensitive (MAG, 2007). Given the above evidence, MAG proposes that the simulated MM5 wind on July 10th and 11th may be too weak to transport enough NOx out from the urban core, which renders the predicted ozone to be lower than the observed ozone in both the urban core and at remote sites. In addition, the weak winds may also have reduced the transport of ozone to remote areas. Another possible explanation is that the vertical mixing scheme used in CMAQ may not be strong enough to dilute the surface NOx or VOC in order to reach optimum ozone production. Further tests will be made to confirm this hypothesis and to improve the model's performance.

3.1.3 The August 2001 episode (August 5 to August 10)

The time series of one-hour and eight-hour ozone are plotted in Figure 7 and Figure 8, respectively. Figure 9 contains a scatter plot of the results. Table 4 lists the results of the statistical evaluation. Figures 7 and 8, and Table 4 show that there is an even worse under-prediction of ozone in the August 2001 episode than in the July 2002 episode, since the serious under-prediction occurs throughout the modeling domain. The possible reason is again suspected to be the MM5 meteorology, given the similar pattern of under-predictions in both CMAQ and CAMx.

Table 4. Summary of the Statistical Modeling Evaluation for the August 2001 Episode

	8/5	8/6	8/7	8/8	8/9	8/10
One-Hour with a 60 ppb threshold (CMAQ)						
Unpaired Peak Prediction Accuracy (%)	**-38.6**	**-37.0**	**-24.7**	**22.3**	**-30.3**	**-27.0**
Normalized Bias (%)	**-49.9**	**-38.5**	**-27.9**	**-21.6**	**-37.0**	**-34.8**
Normalized Error (%)	**49.9**	**38.6**	28.0	29.2	**37.0**	**35.4**
One-Hour with a 60 ppb threshold (CAMx)						
Unpaired Peak Prediction Accuracy (%)	-17.6	-13.0	1.4	**47.4**	**-24.7**	-18.6
Normalized Bias (%)	**-44.9**	**-28.0**	**-21.4**	**-20.3**	**-38.7**	**-32.7**
Normalized Error (%)	**45.0**	28.8	22.4	33.3	**38.7**	34.6
Eight-Hour with a 60 ppb threshold (CMAQ)						
Unpaired Peak Prediction Accuracy (%)	**-38.2**	**-31.2**	**-27.2**	7.4	**-30.8**	**-24.9**
Normalized Bias (%)	**-48.5**	**-38.2**	**-27.5**	**-17.1**	**-37.0**	**-35.2**
Normalized Error (%)	**48.5**	**38.2**	27.5	18.5	**37.0**	**35.2**
Eight-Hour with a 60 ppb threshold (CAMx)						
Unpaired Peak Prediction Accuracy (%)	**-22.2**	-12.1	-12.5	17.2	**-24.8**	-13.7
Normalized Bias (%)	**-43.8**	**-27.5**	**-22.4**	-12.6	**-38.9**	**-33.5**
Normalized Error (%)	**43.8**	27.5	22.4	19.0	**38.9**	33.9
Note: Modeling Evaluation Indices outside of EPA's goals are shown in bold red font						

3.2 Comparison with the CAMx results

For the June 2002 episode, the general features of ozone simulated in CMAQ are similar to those in CAMx, which can be seen in the time series of one-hour and eight-hour ozone in Figures 1 and 2. CAMx has better agreement with observations than CMAQ at sites closer to the Phoenix urban core (e.g., Phoenix sites WP, NP and CP) where the rapid ozone depletion after the peak hour is better captured. The simulation on June 5th and 6th in CAMx is more consistent with observations as well, when there is no apparent over-prediction. Some of these subtle differences are reflected in the scatter plots in Figure 3. The prediction in CAMx aligns closer to the 1:1 line with the observations, and the correlation coefficient between predictions and observations (R^2 ~ 0.66) is larger than that in CMAQ (R^2 ~0.63) as well. The statistical evaluations with 60 ppb thresholds between CAMx and CMAQ are similar (Table 2), with the scores of CAMx generally better than CMAQ. The NB and NE without thresholds in CAMx are smaller than in CMAQ, which implies that CAMx performs better at night.

For the July 2002 episode, the general features of ozone simulated in CMAQ are similar to those in CAMx (Figures 4 & 5). And it can be seen that there is an under-prediction in both simulations. The big difference is the peak prediction. The UPPA's in CAMx are almost all within the EPA range, while in CMAQ, four days are under-predicted and outside EPA's range (Table 3). Figure 6 shows that the correlation coefficient between predictions and observations in CMAQ (R^2 ~0.61) is close to the one in CAMx (R^2 ~ 0.61).

For the August 2001 episode, the general features of ozone simulation in CMAQ are similar to those in CAMx as well (Figure 7 & 8). And similar to the July 2002 episode, there is an under-prediction in both simulations in the August 2001 episode. CMAQ's under-prediction is even worse than CAMx's under-prediction (Table 4). Figure 9 shows that the correlation coefficient between predictions and observations in CMAQ (R^2 ~0.42) is smaller than the one in CAMx (R^2 ~ 0.51).

4. Summary of Results

The U.S. EPA CMAQ modeling system was used to simulate three episodes of ozone for the MNA. The CMAQ model reproduces the strong diurnal variation of ozone at sites close to the central Phoenix, with the peak hour occurring between 3 and 7 pm, and the minimum ozone levels at approximately 6 am. The diurnal variation of ozone is less prominent at sites away from central Phoenix. Evaluating CMAQ's predicted ozone levels against observed ozone levels shows that its model performance is acceptable for the June 2002 episode according to the EPA standards. However, many days in the episodes of July 2002 and August 2001 are under-predicted and outside of the EPA ranges for model performance. The comparison with the former CAMx simulation shows that the general features of the two simulations are similar, with CAMx having better overall model performance than CMAQ.

References:

Emery, C. and B. Koo, (2007), Memorandum, "Definition of a CMAQ ozone modeling grid for MAG applications", ENVIRON International Corp, Novato, CA.

Maricopa Association of Governments, (2007), "Eight-Hour Ozone Plan for the Maricopa Nonattainment Area".

Timin, B., K. Wesson, P. Dolwick, N. Possiel, S. Philips, (2007), "An exploration of model concentration differences between CMAQ and CAMx", presented at the 6th Annual CMAS Conference, Chapel Hill, NC.

U.S. EPA, (1999), "Science Algorithms of the EPA Models-3 Community Multiscale Air Quality (CMAQ) Modeling System", EPA/600/R-99/030.

Figure Captions:

Figure 1 Time series of simulated one-hour ozone overlaid with the observed values (dots) for the episode of June 2002. The solid line represents the CMAQ results; the dash line represents the CAMx results.

Figure 2 Time series of simulated eight-hour ozone overlaid with the observed values (dots) for the episode of June 2002. The solid line represents the CMAQ results; the dash line represents the CAMx results.

Figure 3 Scatter plots of simulated and observed eight-hour ozone in the MNA for the June 2002 episode: (a) CMAQ results; (b) CAMx results.

Figure 4 Time series of simulated one-hour ozone overlaid with the observed values (dots) for the episode of July 2002. The solid line represents the CMAQ results; the dash line represents the CAMx results.

Figure 5 Time series of simulated eight-hour ozone overlaid with the observed values (dots) for the episode of July 2002. The solid line represents the CMAQ results; the dash line represents the CAMx results.

Figure 6 Scatter plots of simulated and observed eight-hour ozone in the MNA for the July 2002 episode: (a) CMAQ results; (b) CAMx results.

Figure 7 Time series of simulated one-hour ozone overlaid with the observed values (dots) for the episode of August 2001. The solid line represents the CMAQ results; the dash line represents the CAMx results.

Figure 8 Time series of simulated eight-hour ozone overlaid with the observed values (dots) for the episode of August 2001. The solid line represents the CMAQ results; the dash line represents the CAMx results.

Figure 9 Scatter plots of simulated and observed eight-hour ozone in the MNA for the August 2001 episode: (a) CMAQ results; (b) CAMx results.

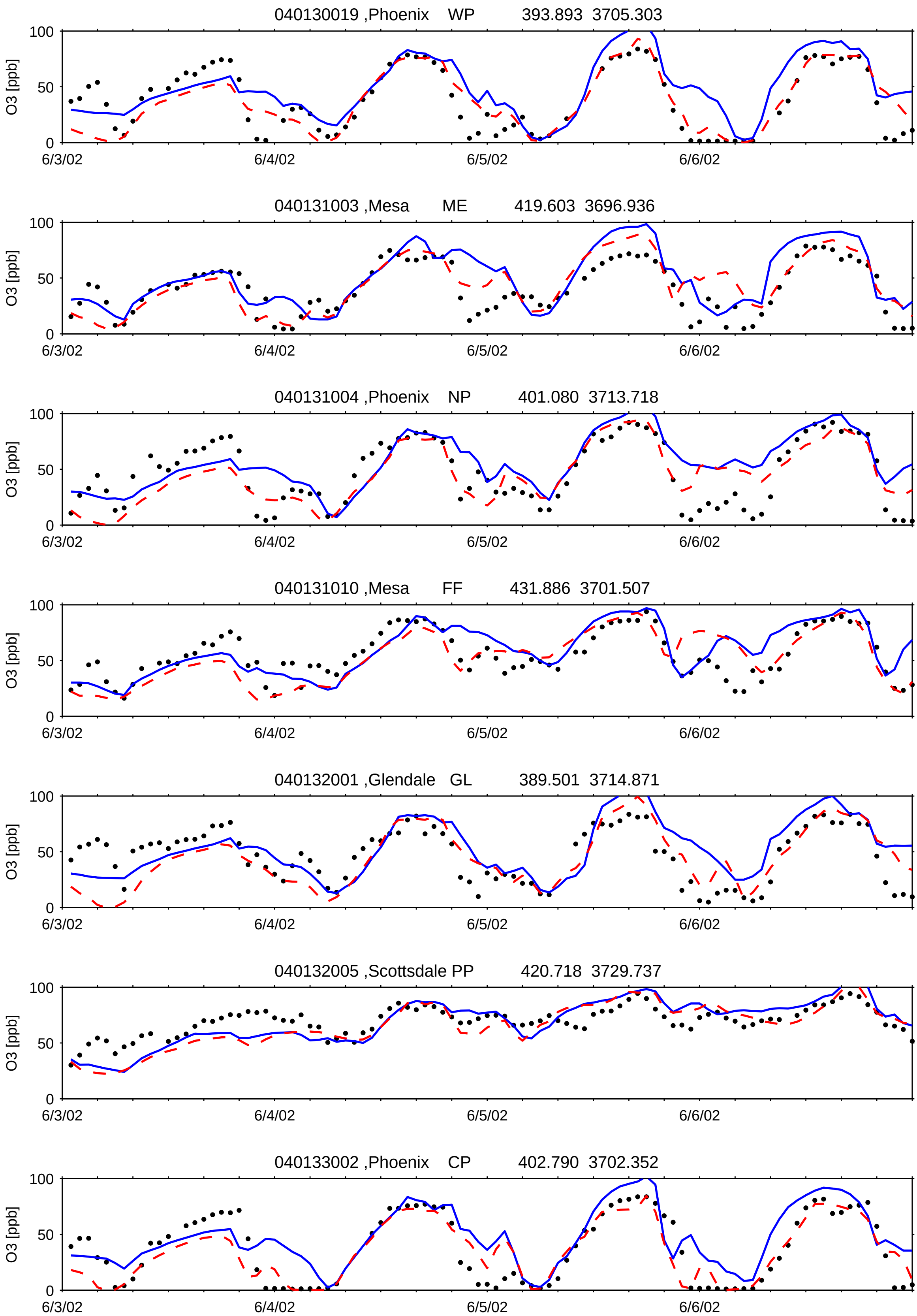


Figure 1(a).One−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

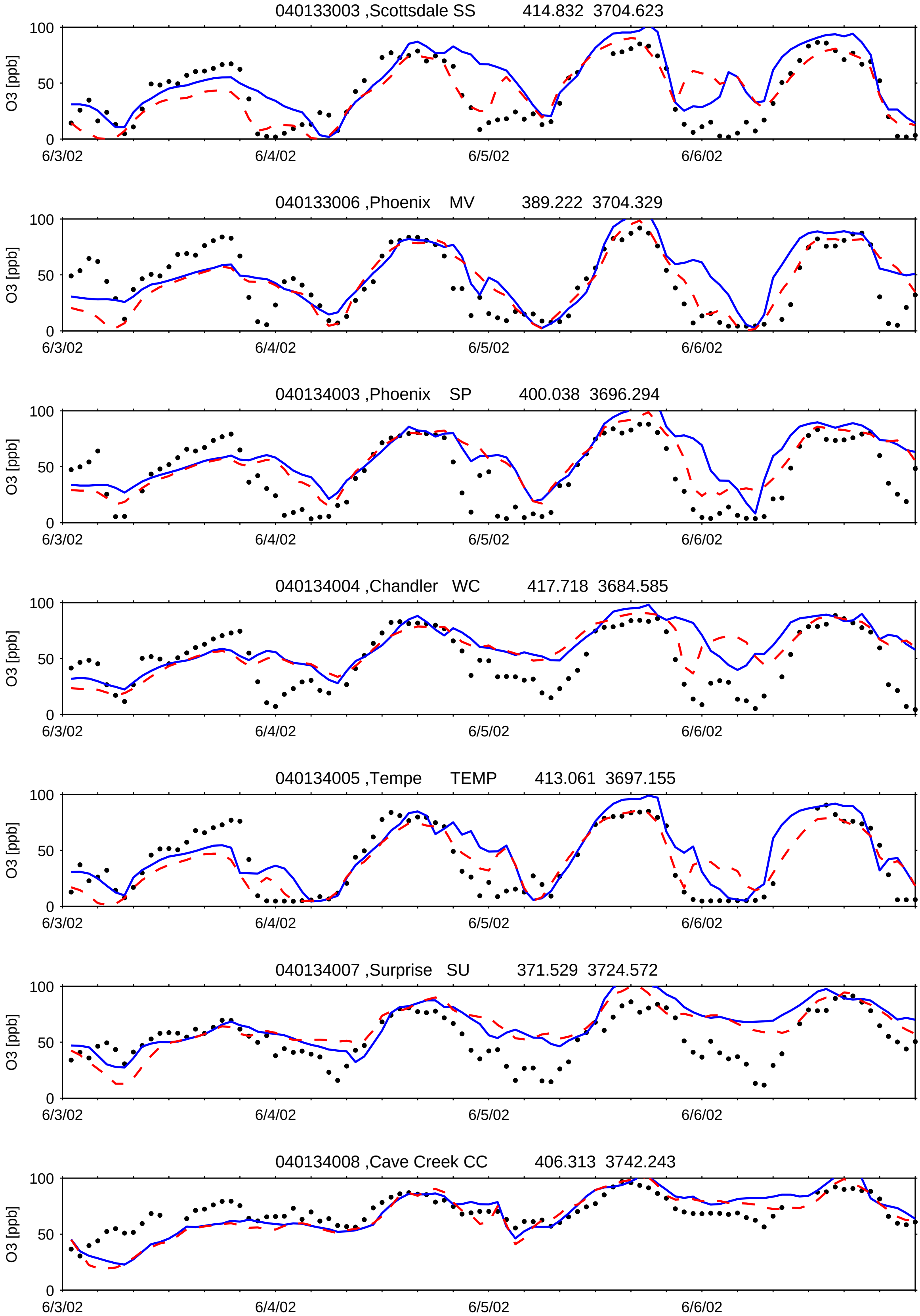


Figure 1(b).One−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

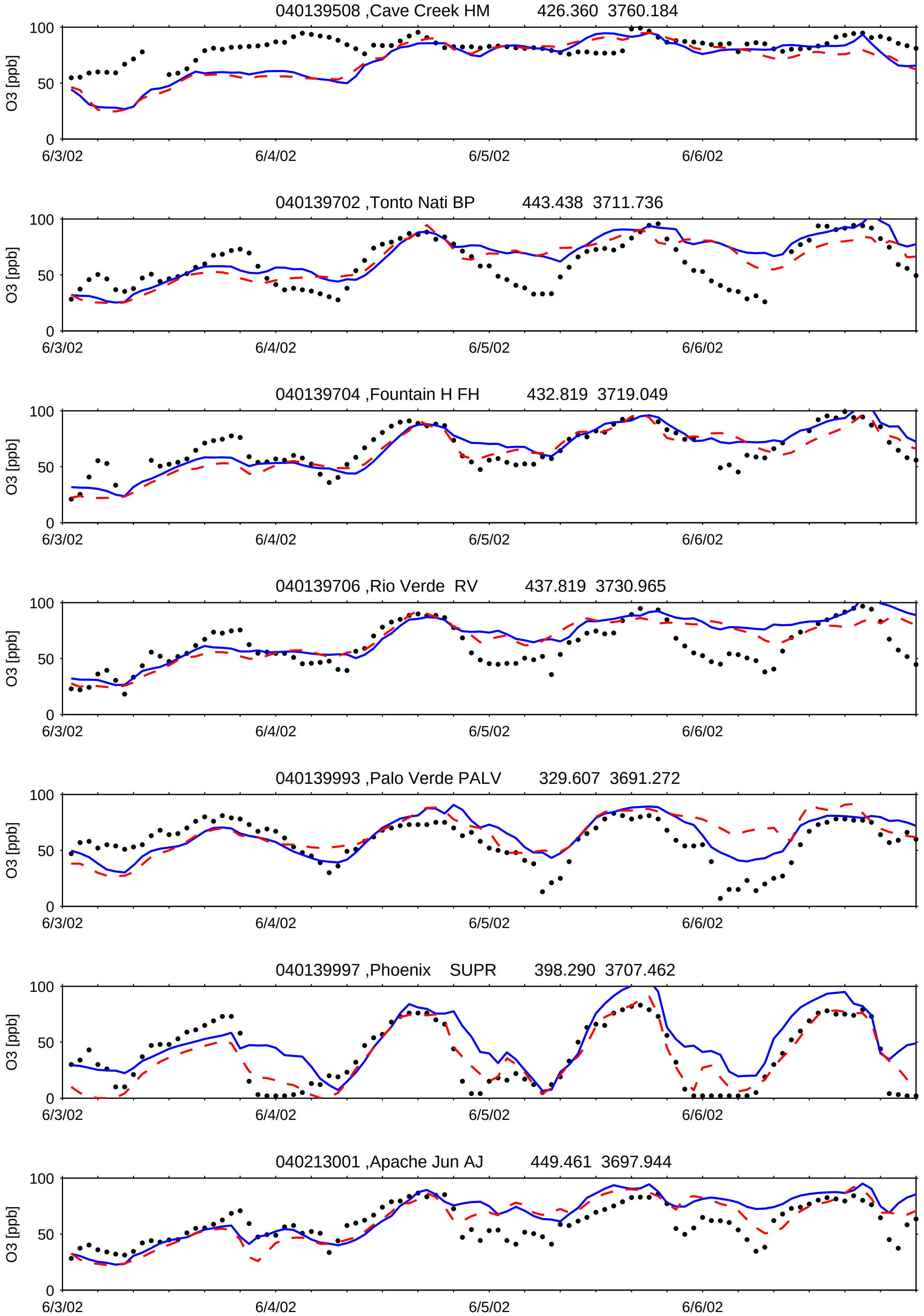


Figure 1(c).One−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

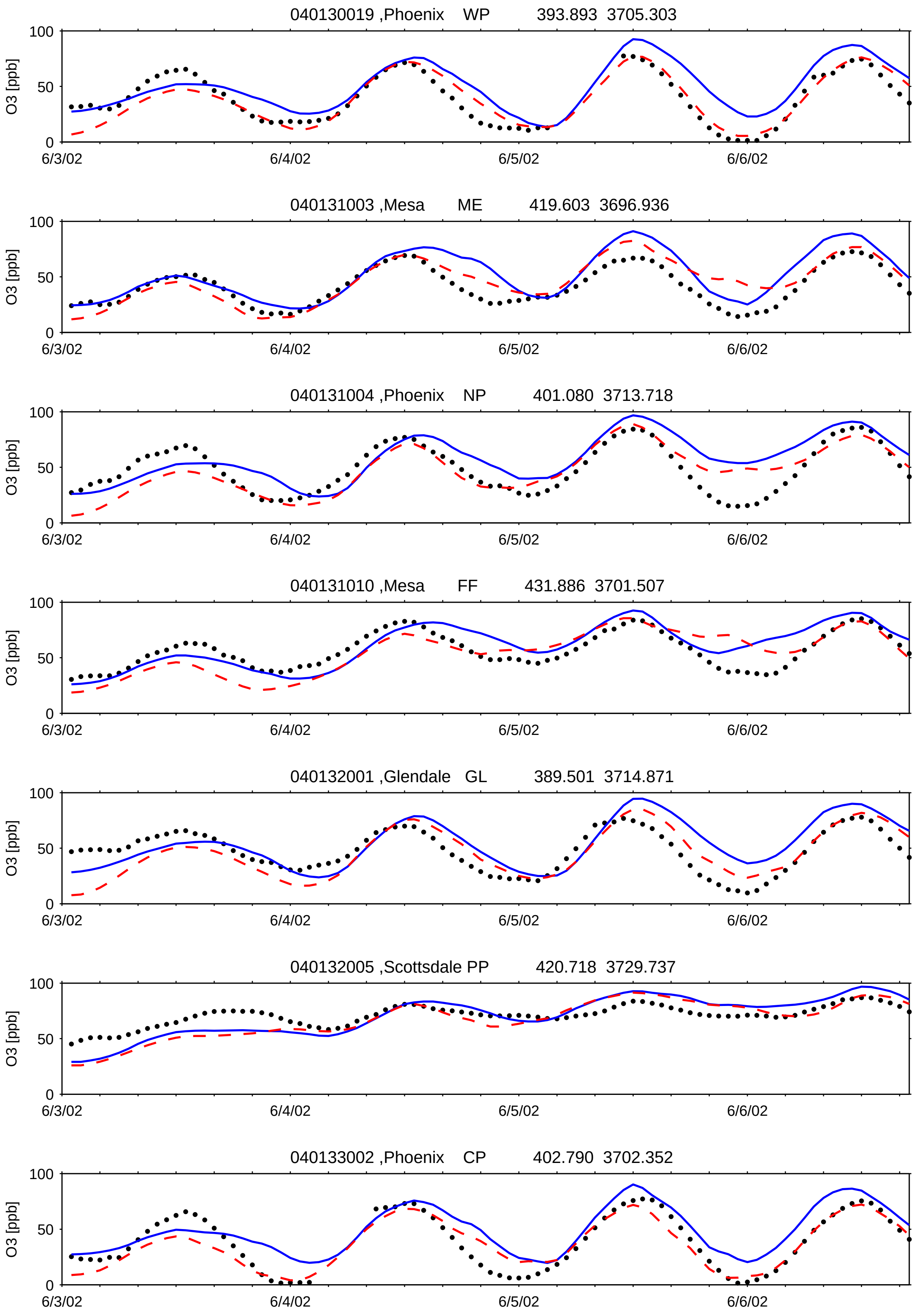


Figure 2(a).Eight−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

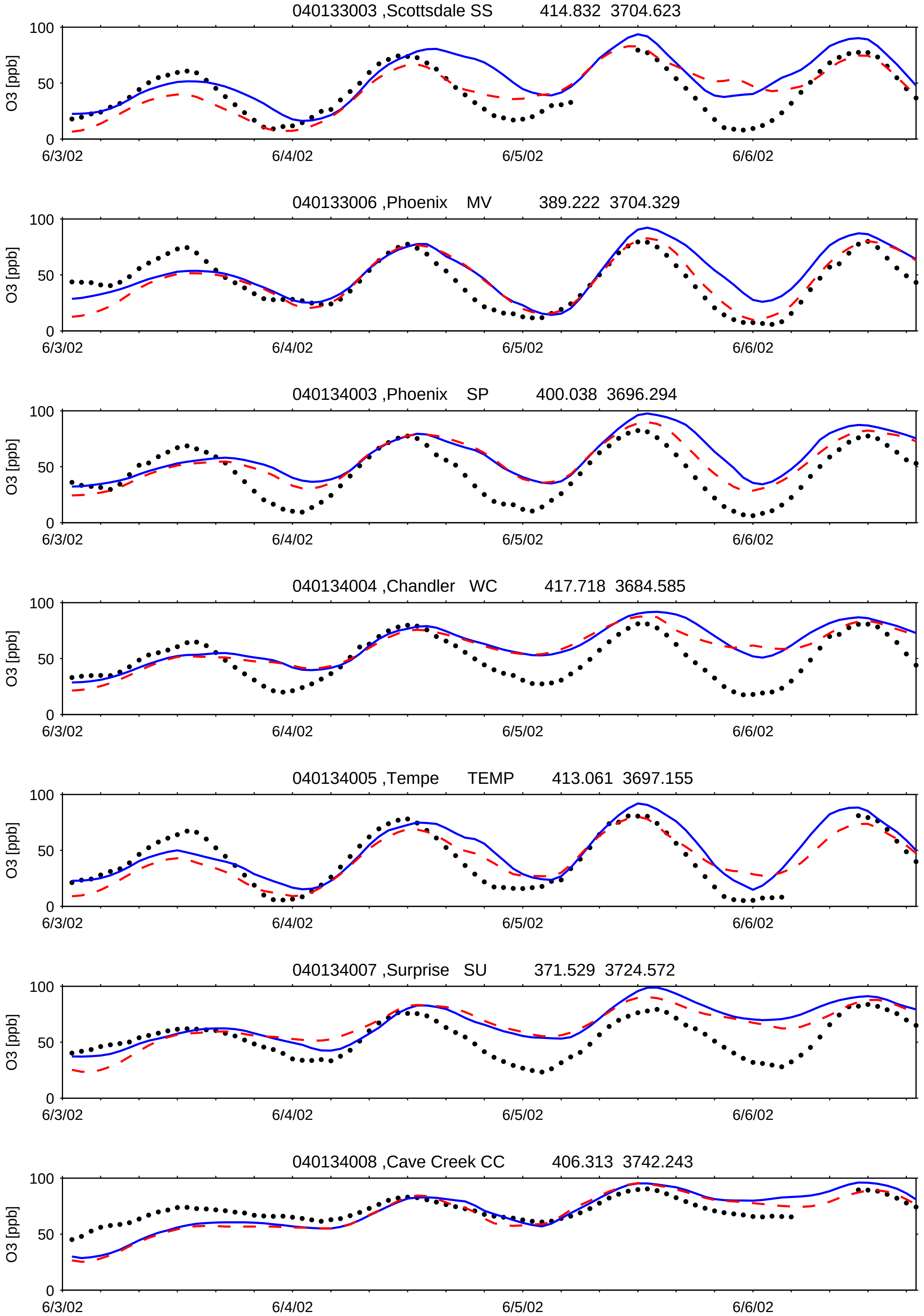


Figure 2(b).Eight−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

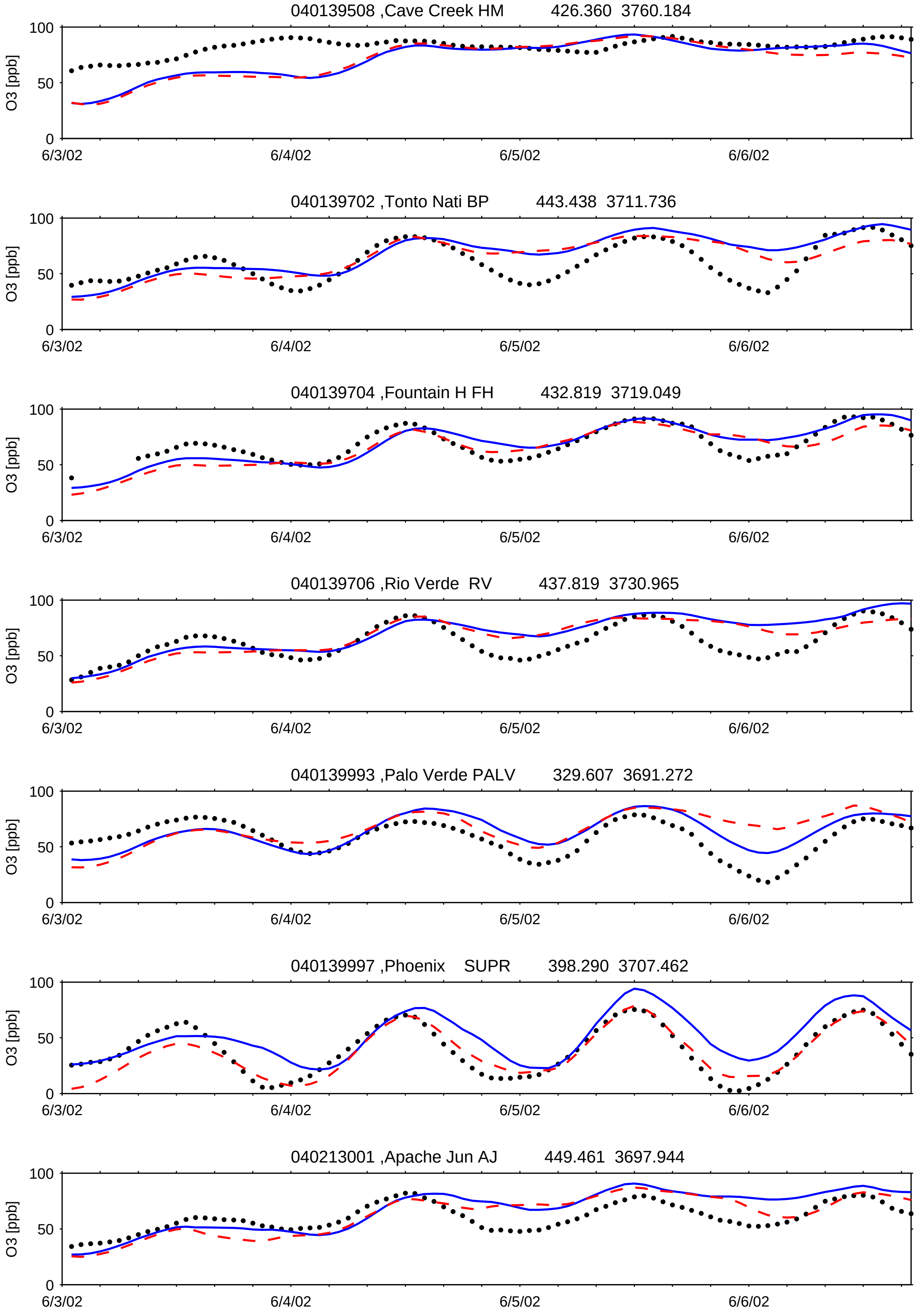


Figure 2(c).Eight−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

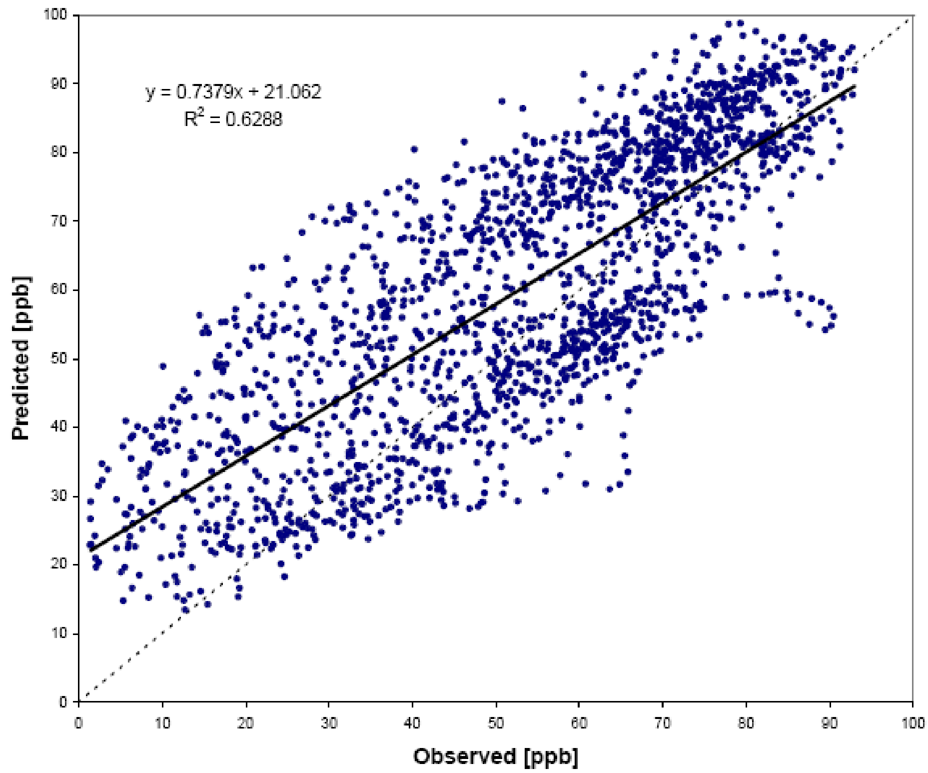


Figure 3(a) CMAQ eight-hour ozone in the MNA (June 3-6, 2002)

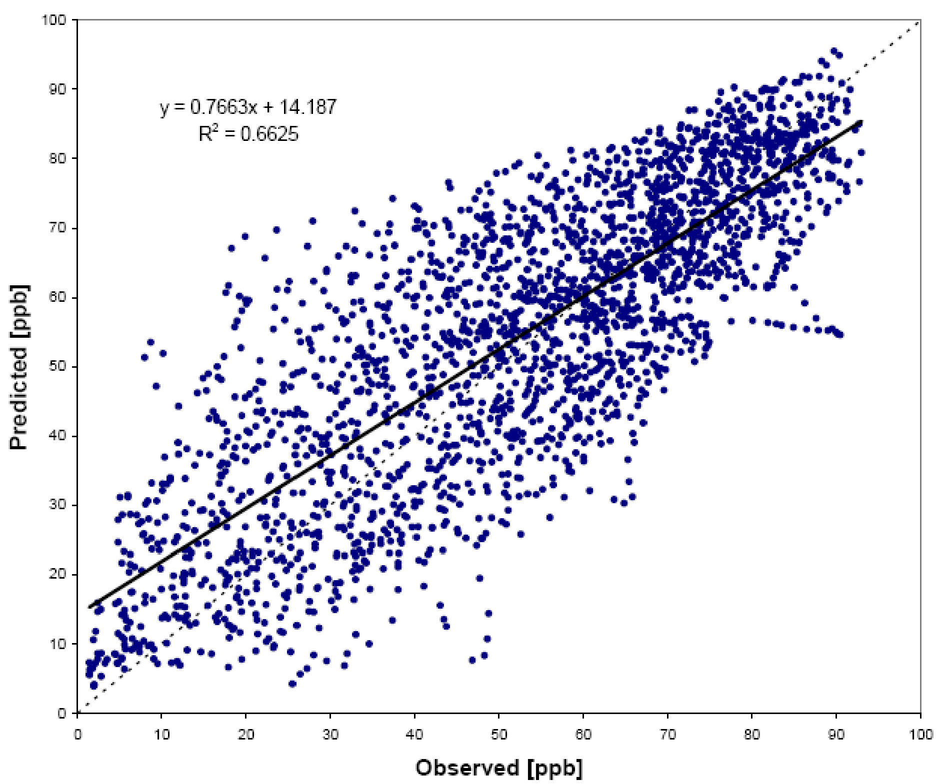


Figure 3(b) CAMx eight-hour ozone in the MNA (June 3-7, 2002)

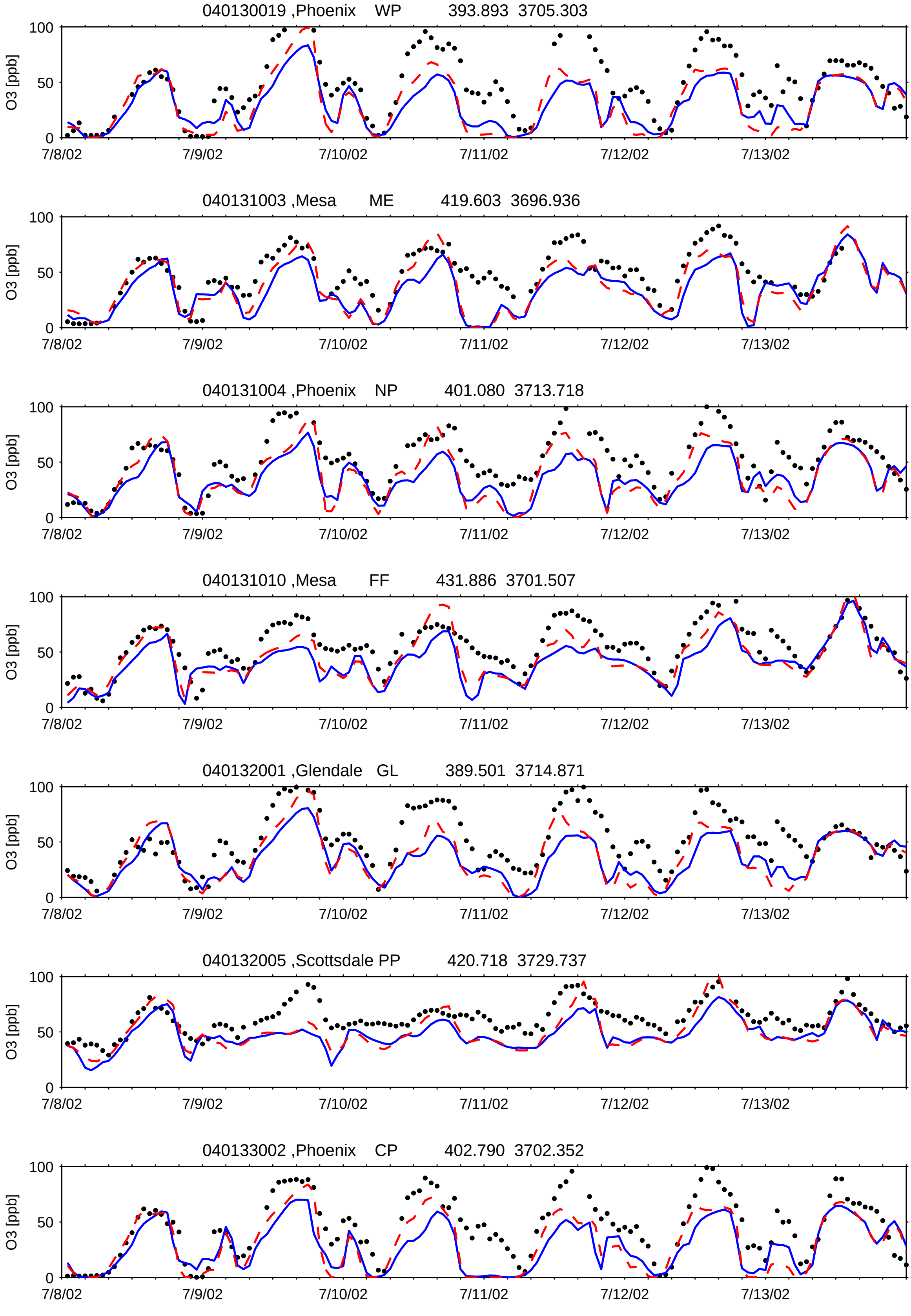


Figure 4(a).One−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

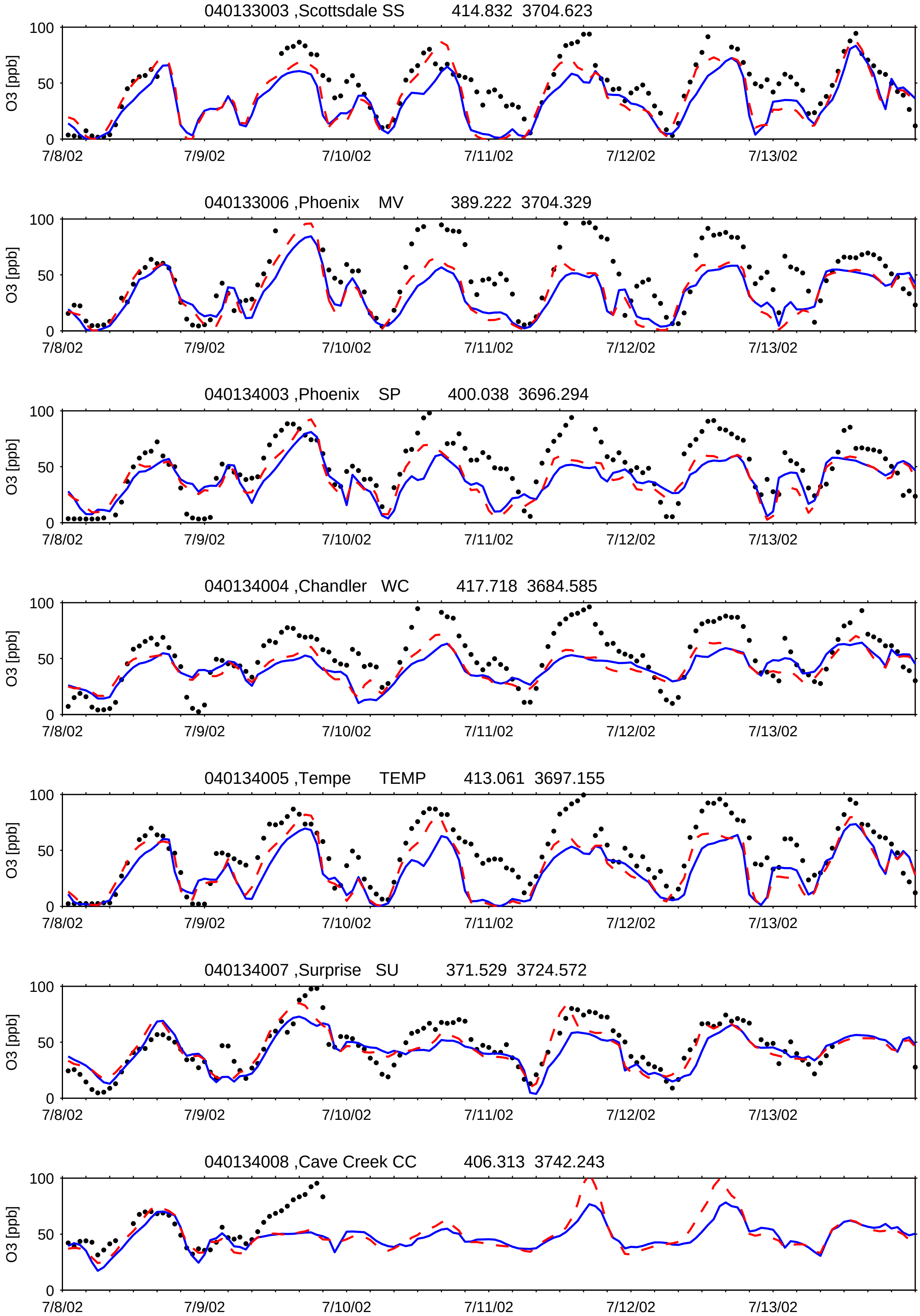


Figure 4(b).One−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

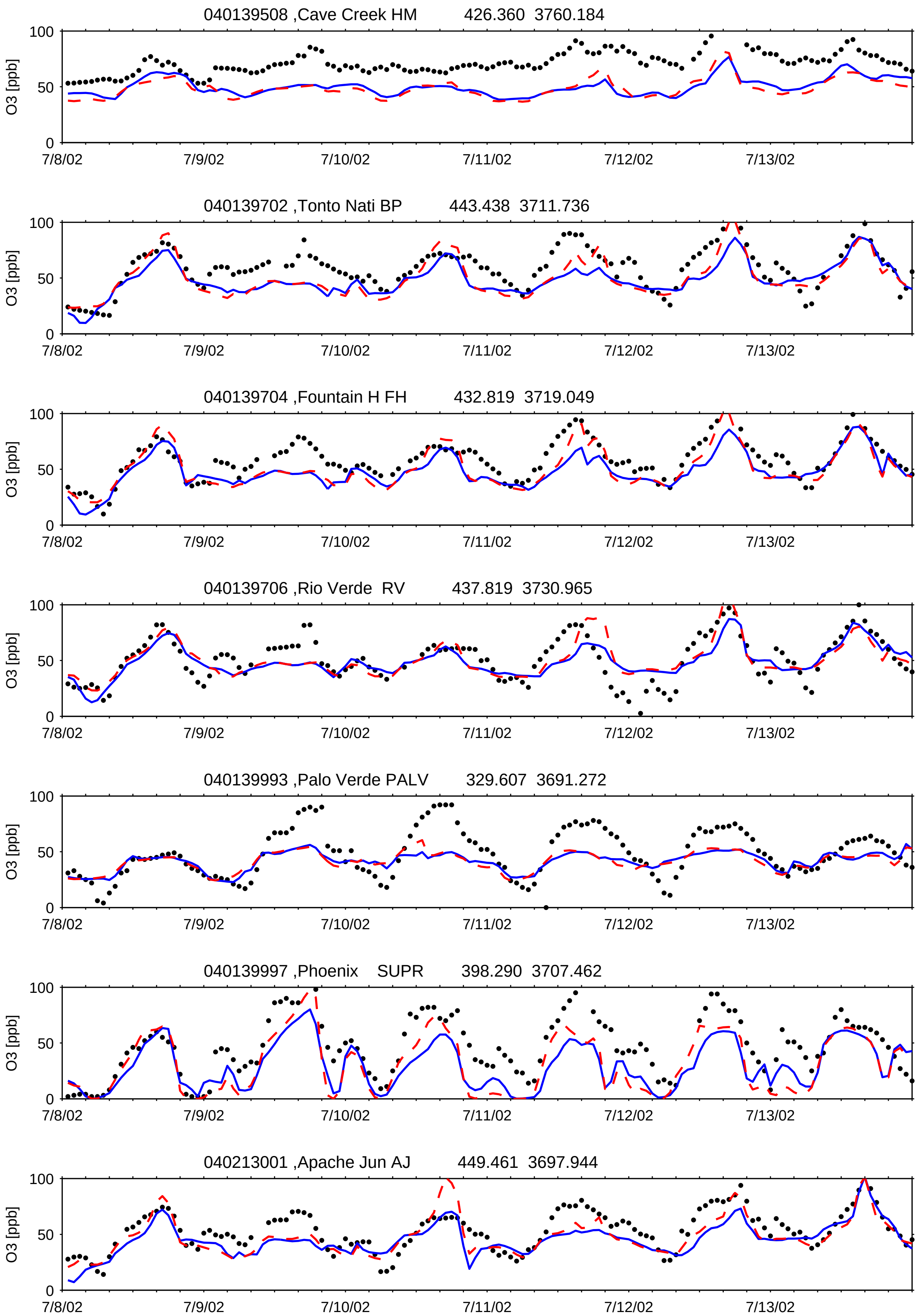


Figure 4(c).One−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

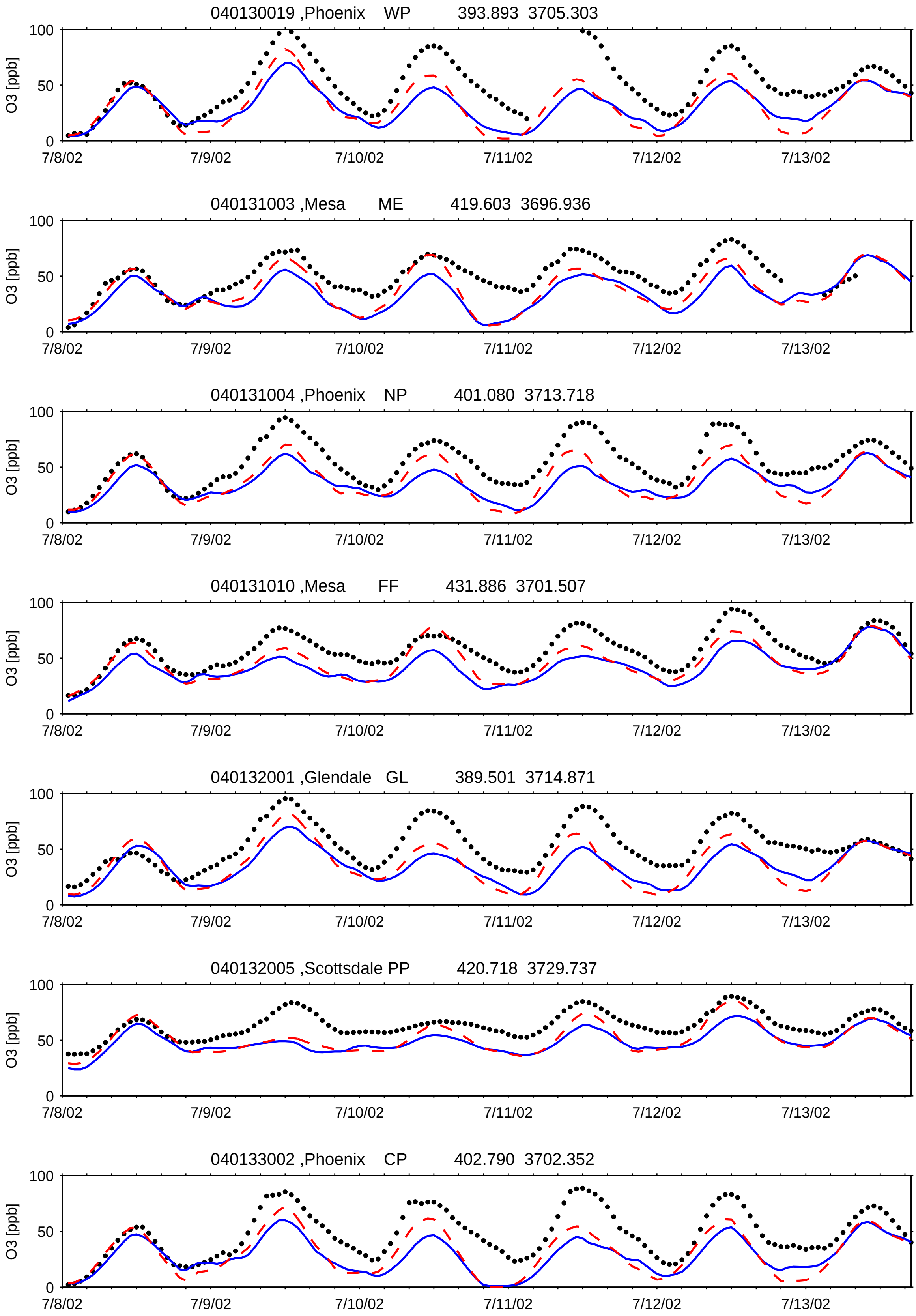


Figure 5(a).Eight−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

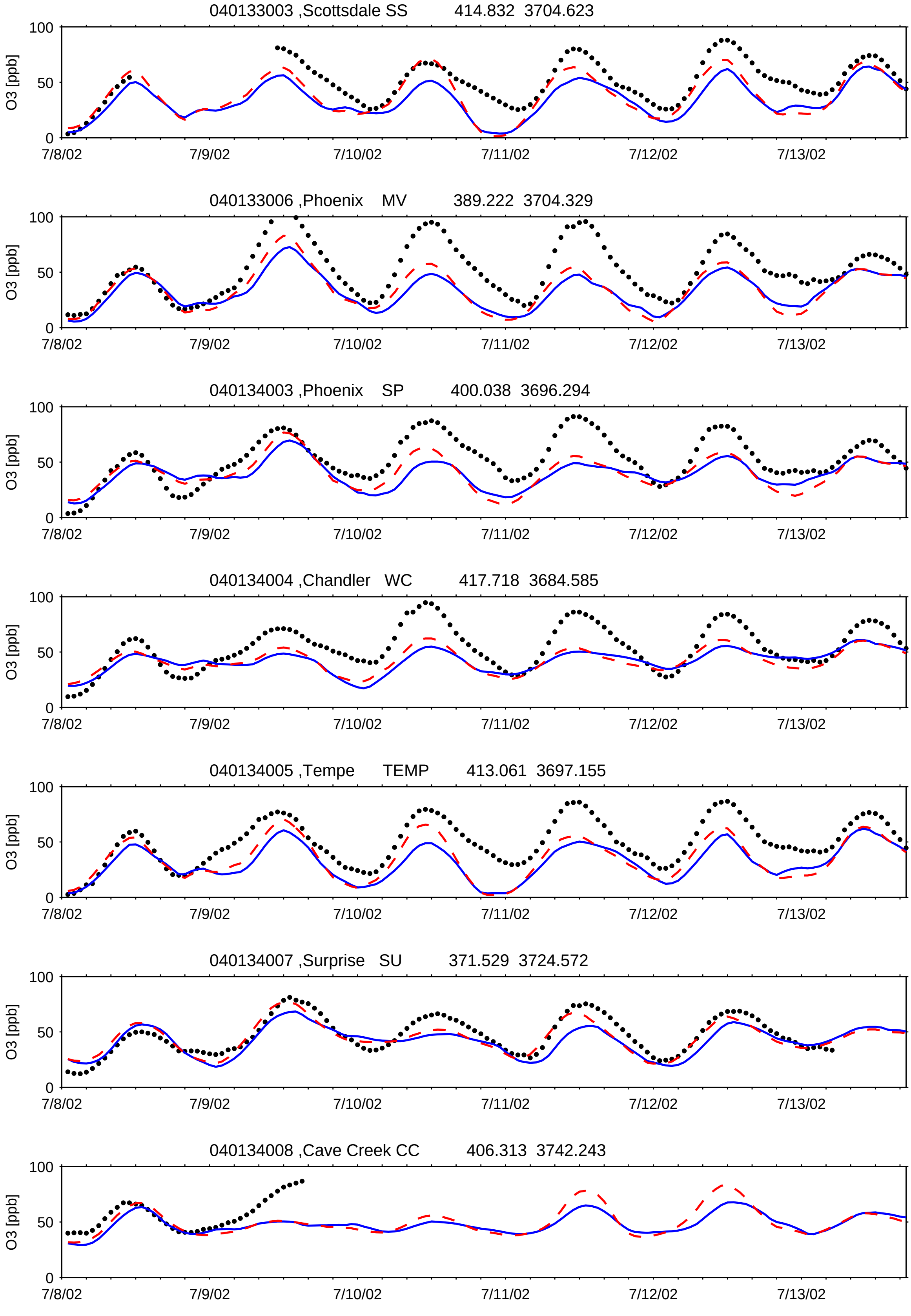


Figure 5(b).Eight−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

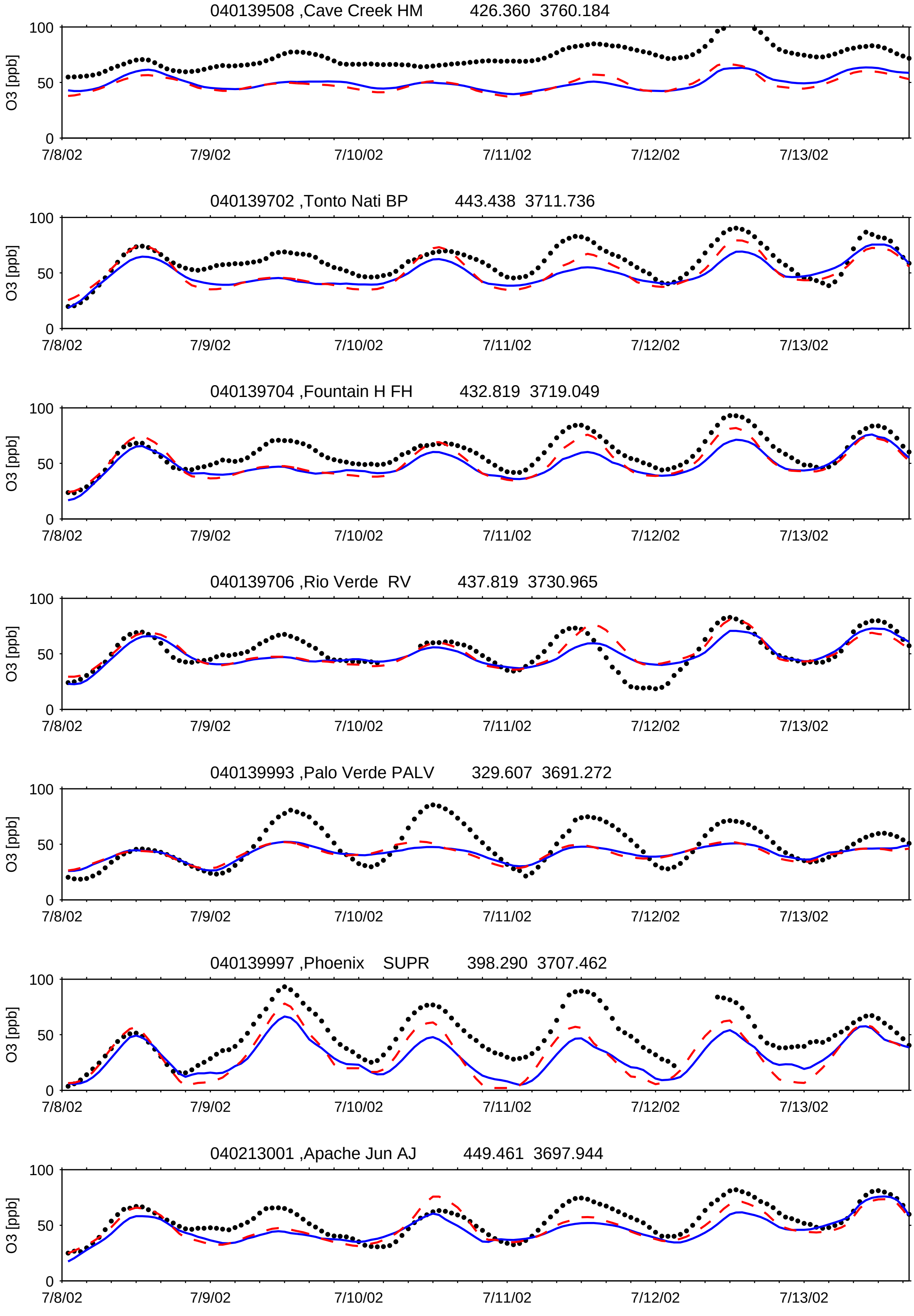


Figure 5(c).Eight−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

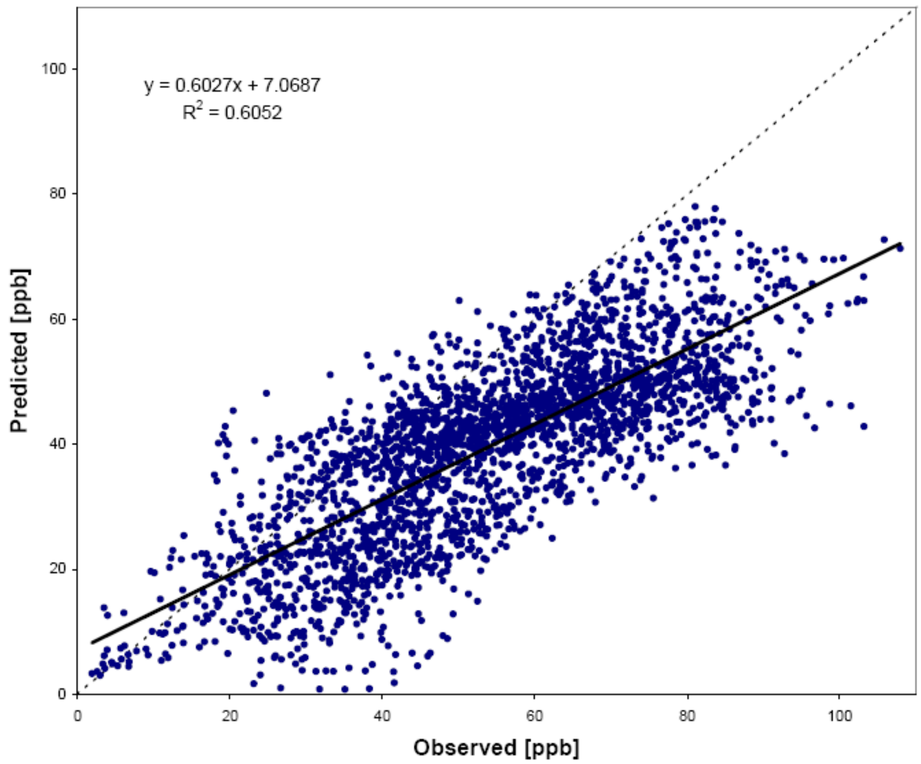


Figure 6(a) CMAQ eight-hour ozone in the MNA (July 8-13, 2002)

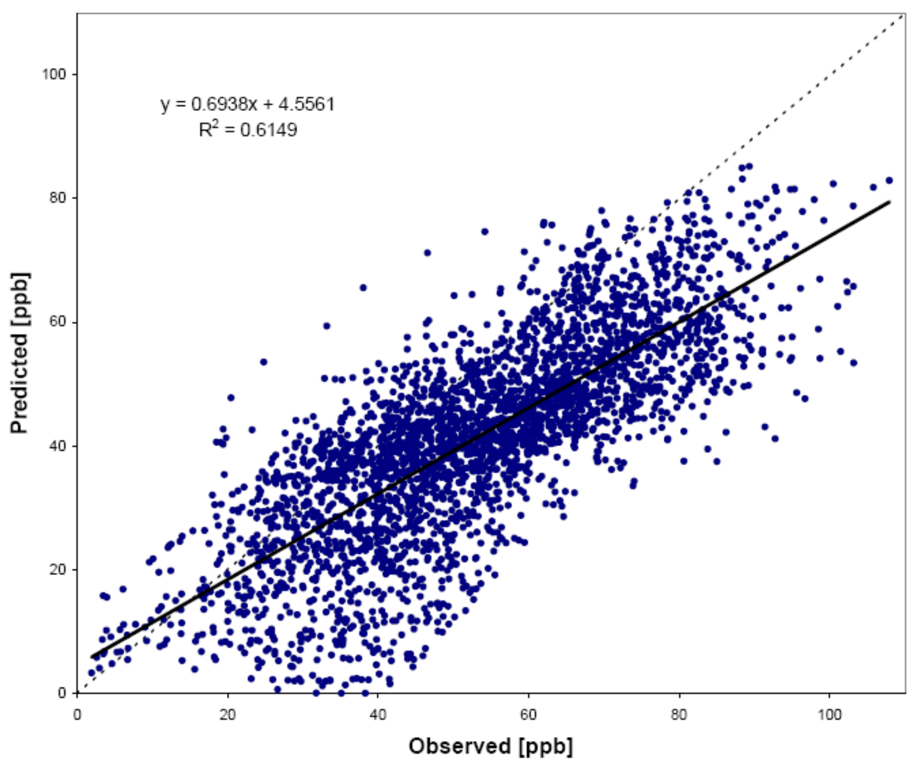


Figure 6(b) CAMx eight-hour ozone in the MNA (July 8-14, 2002)

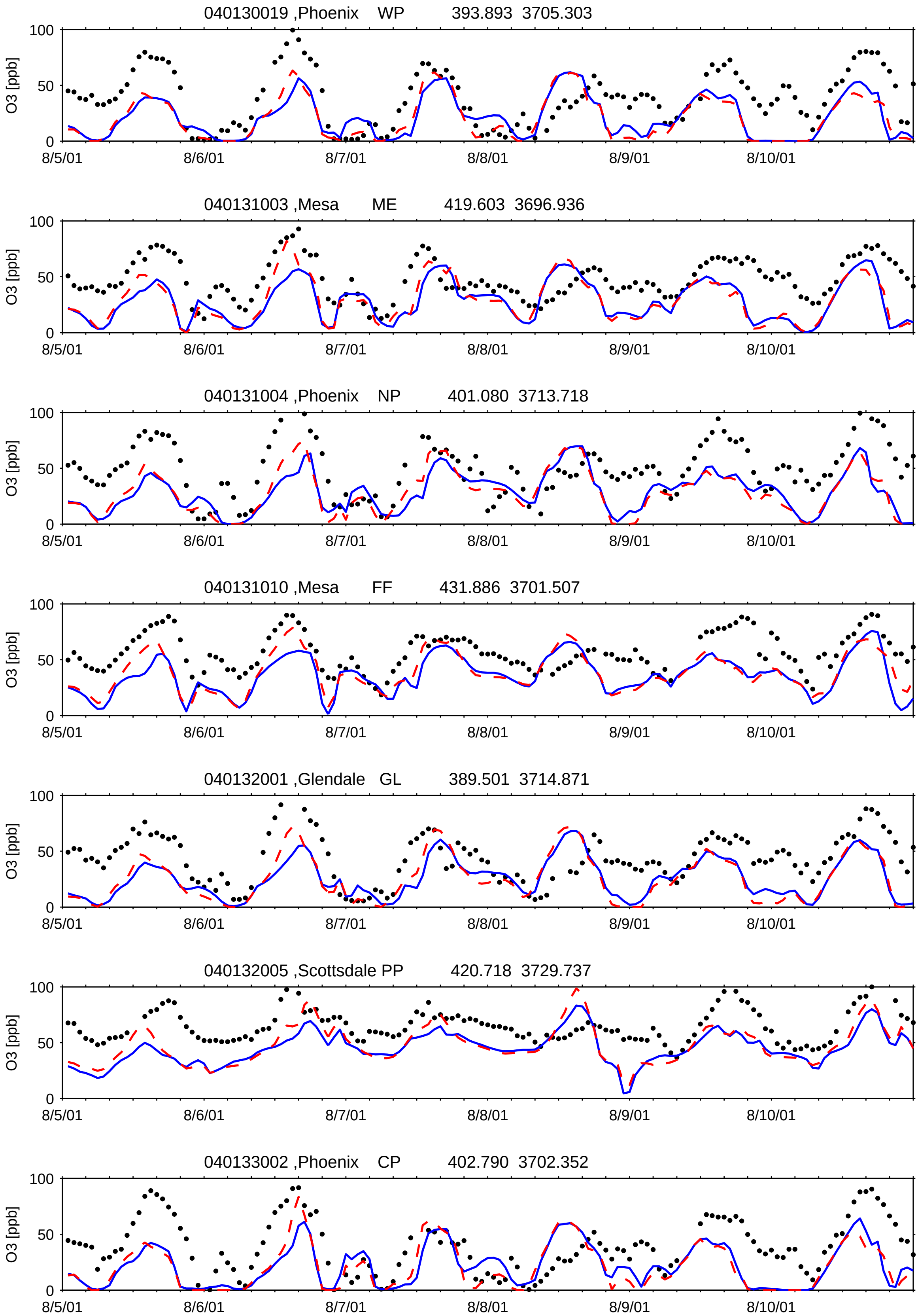


Figure 7(a).One−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

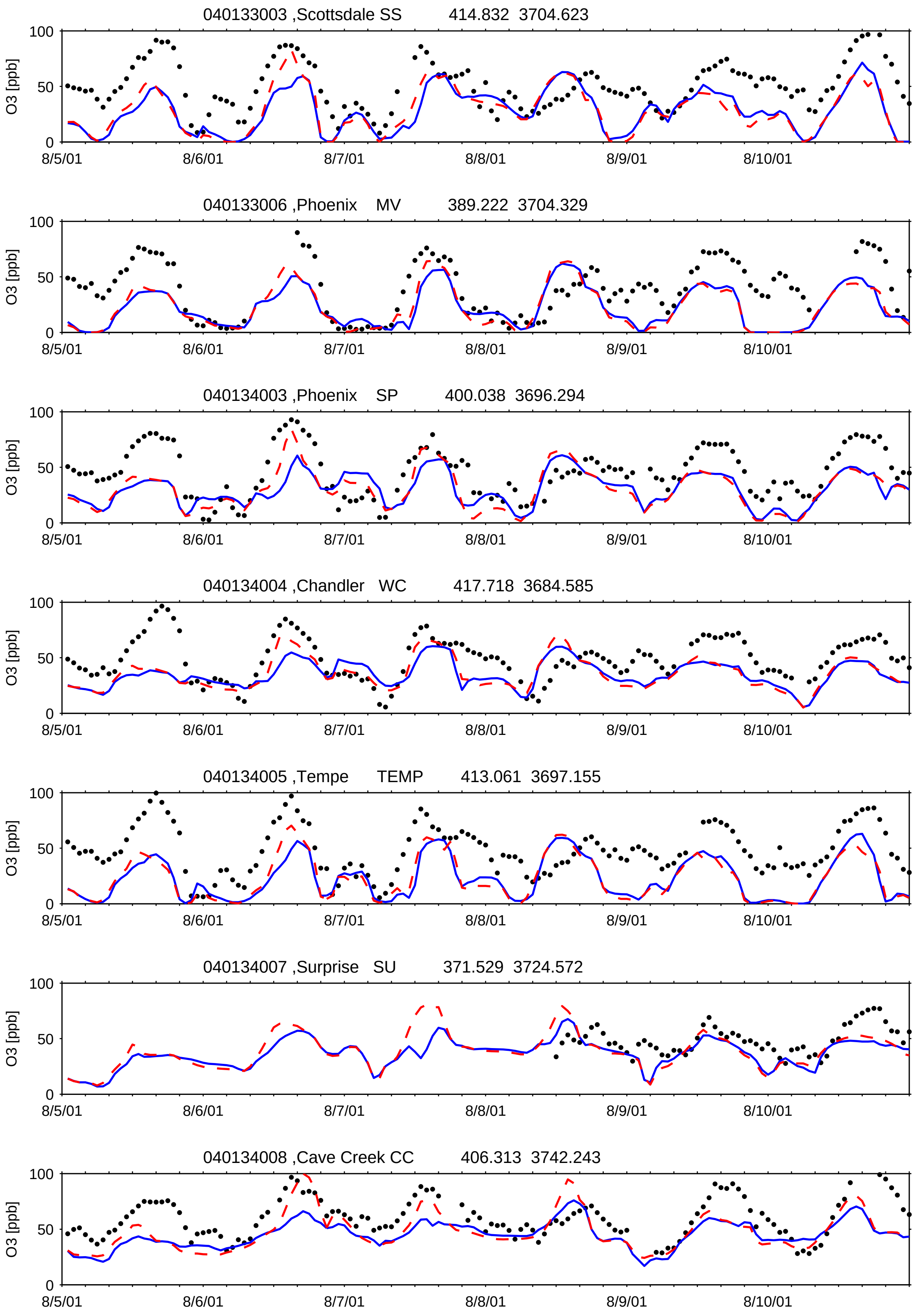


Figure 7(b).One−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

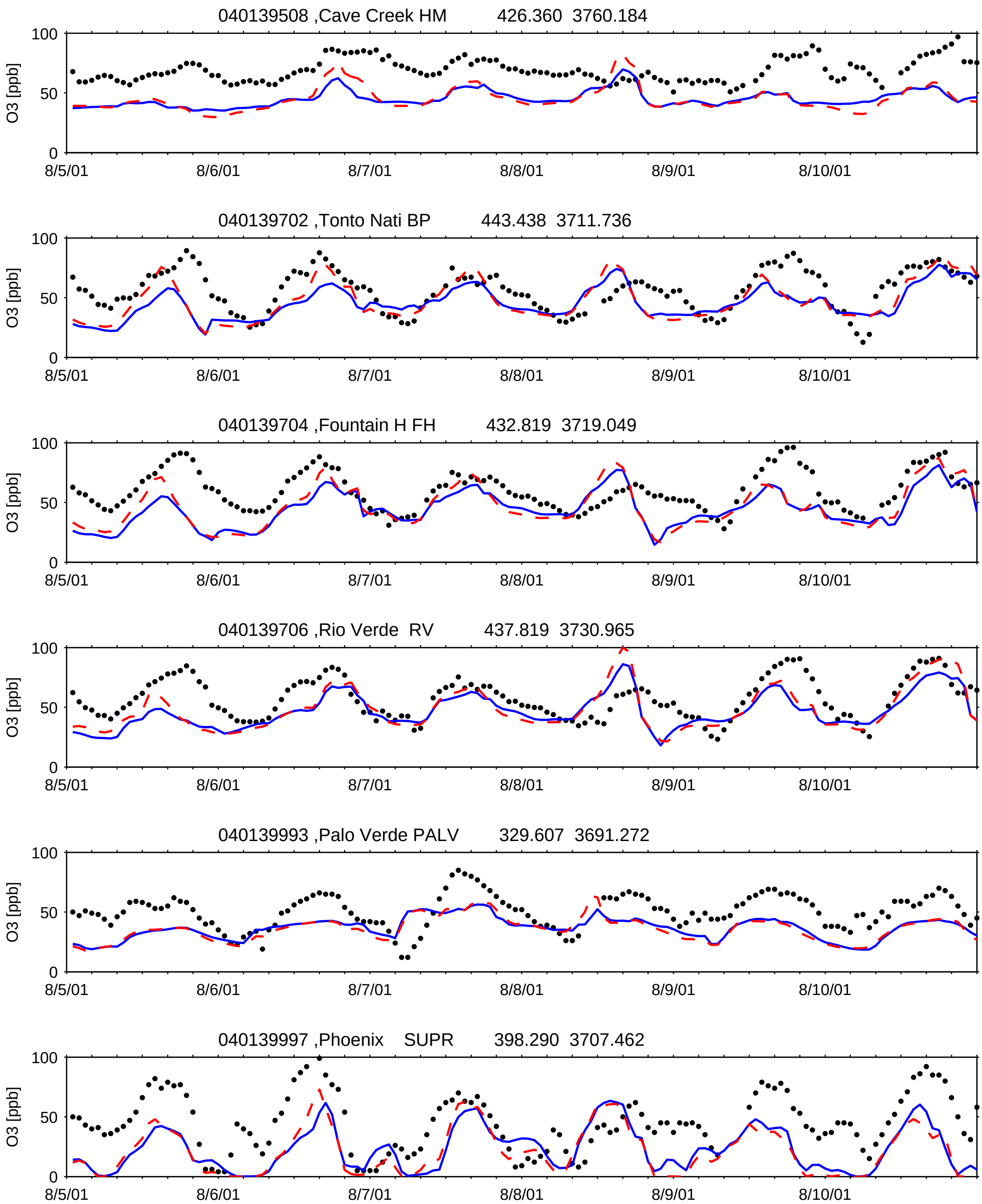


Figure 7(c).One−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

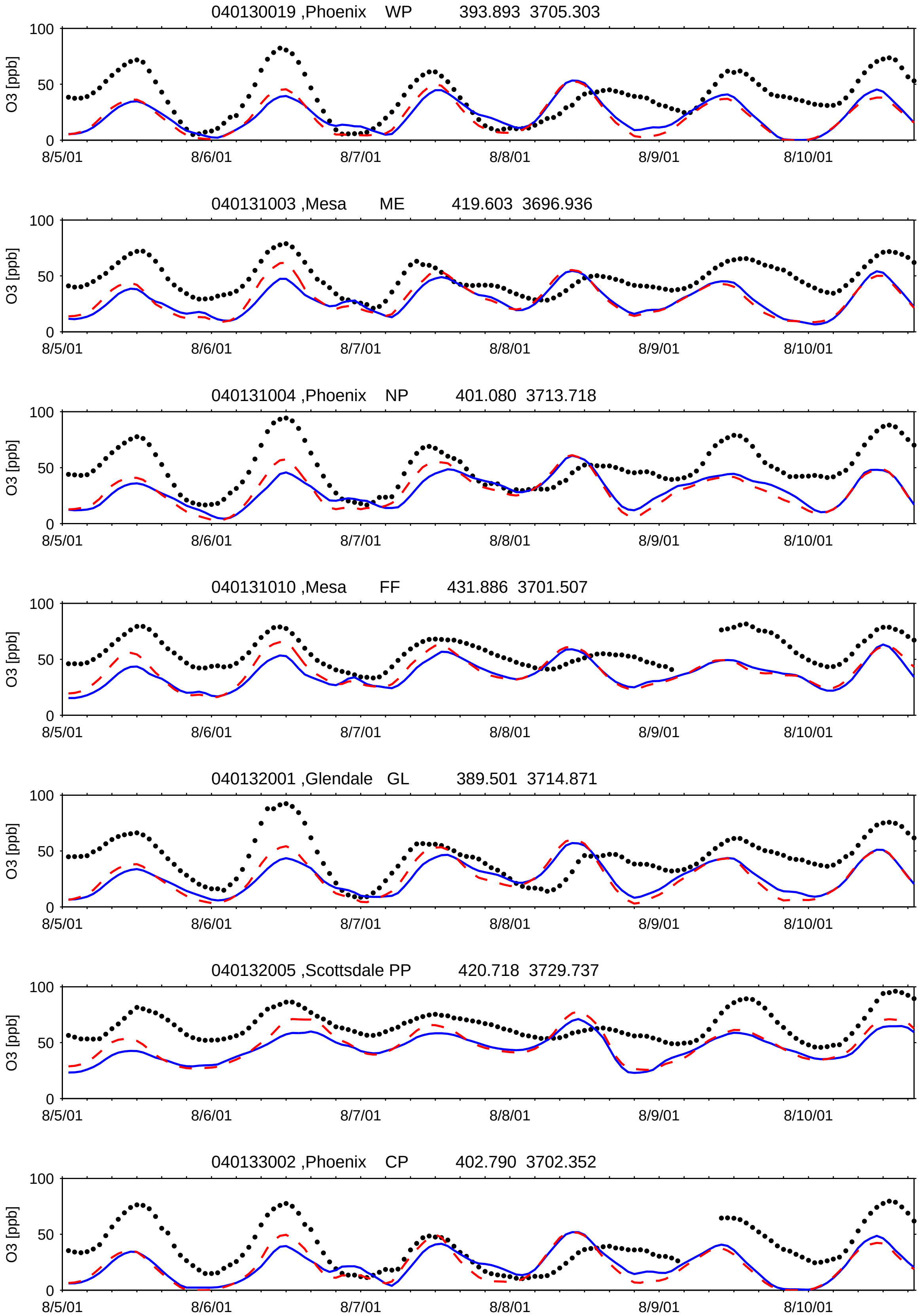


Figure 8(a).Eight−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

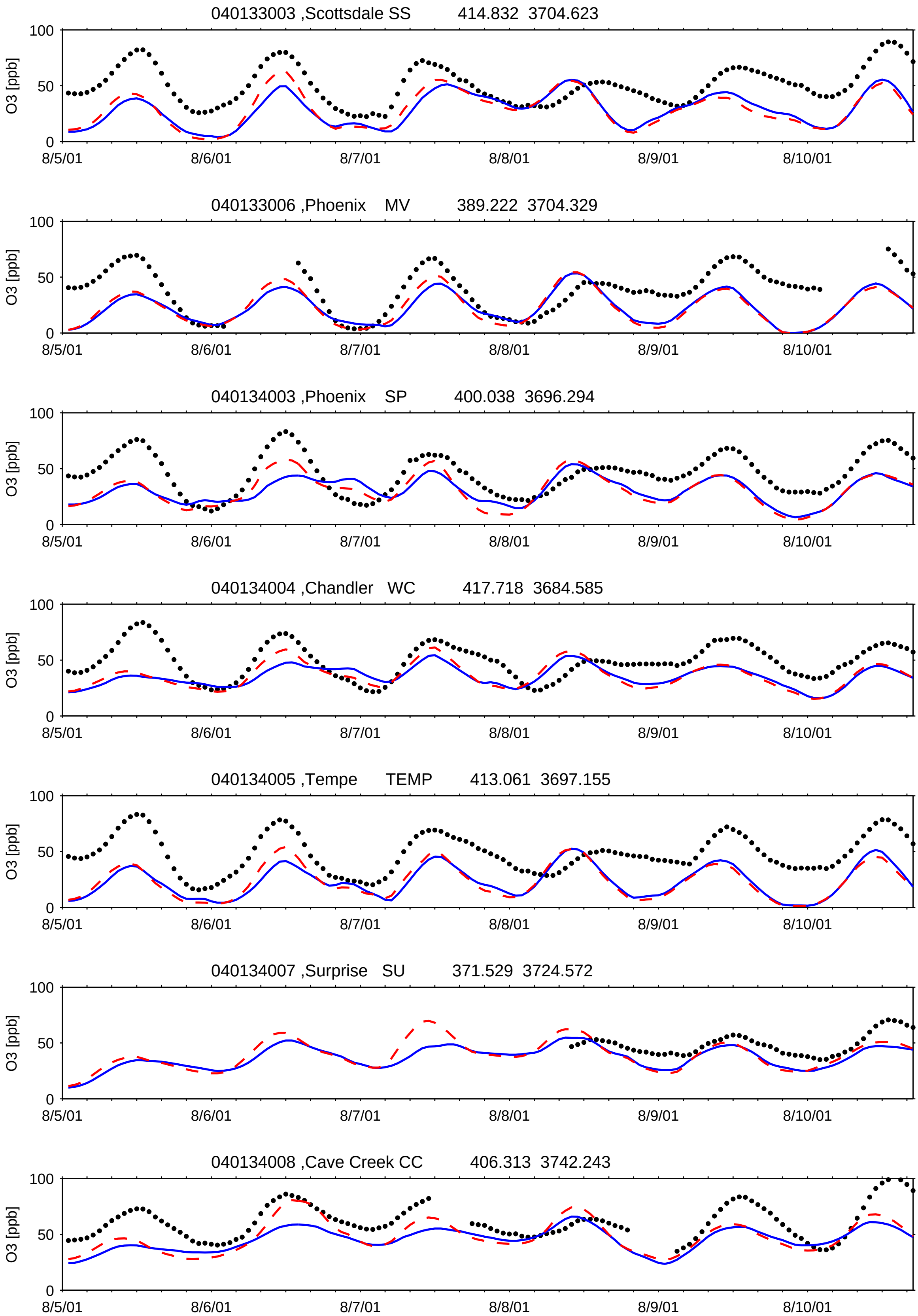


Figure 8(b).Eight−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

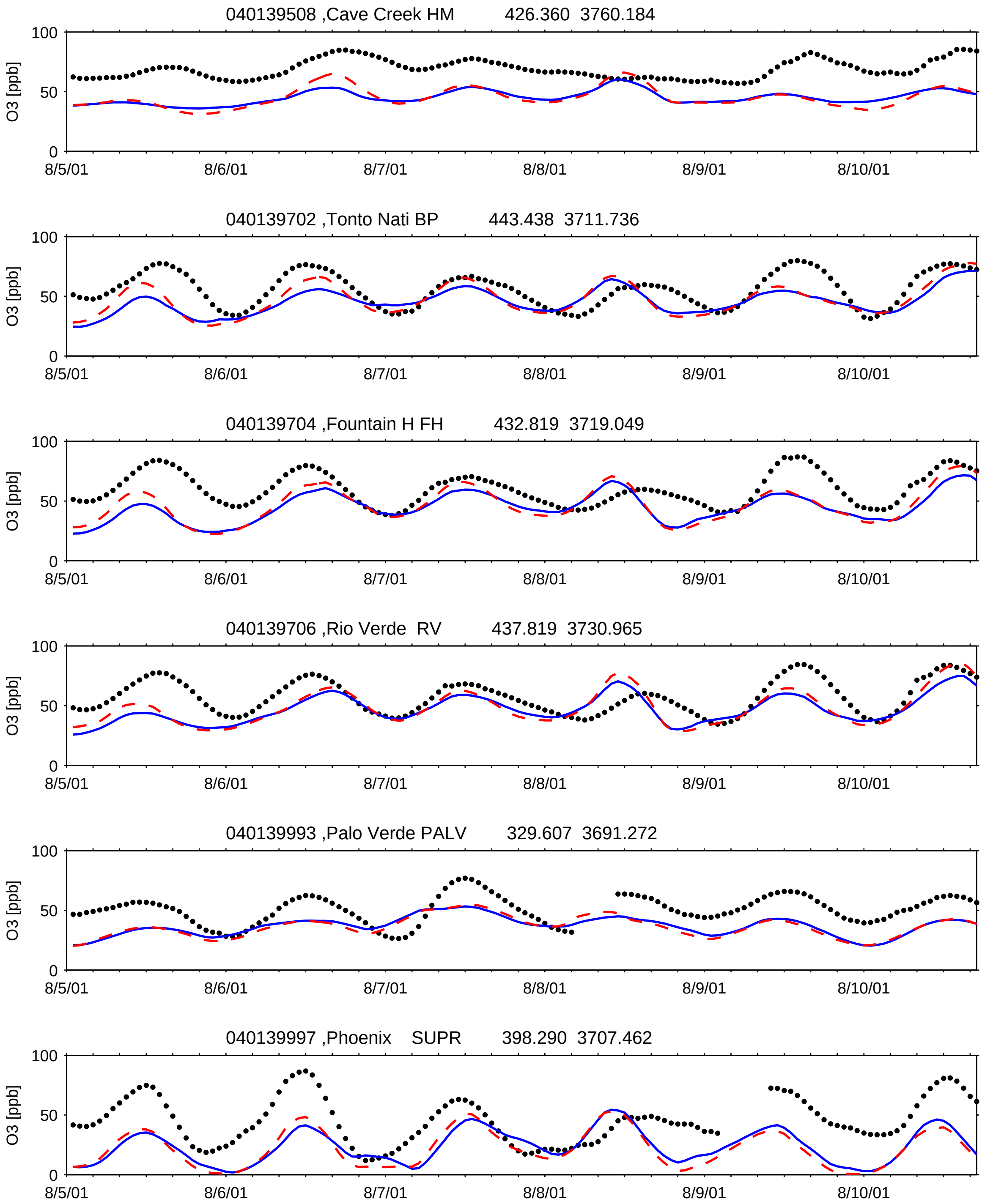


Figure 8(c).Eight−hour ozone. dots: observation; solid line: CMAQ; dash line: CAMx

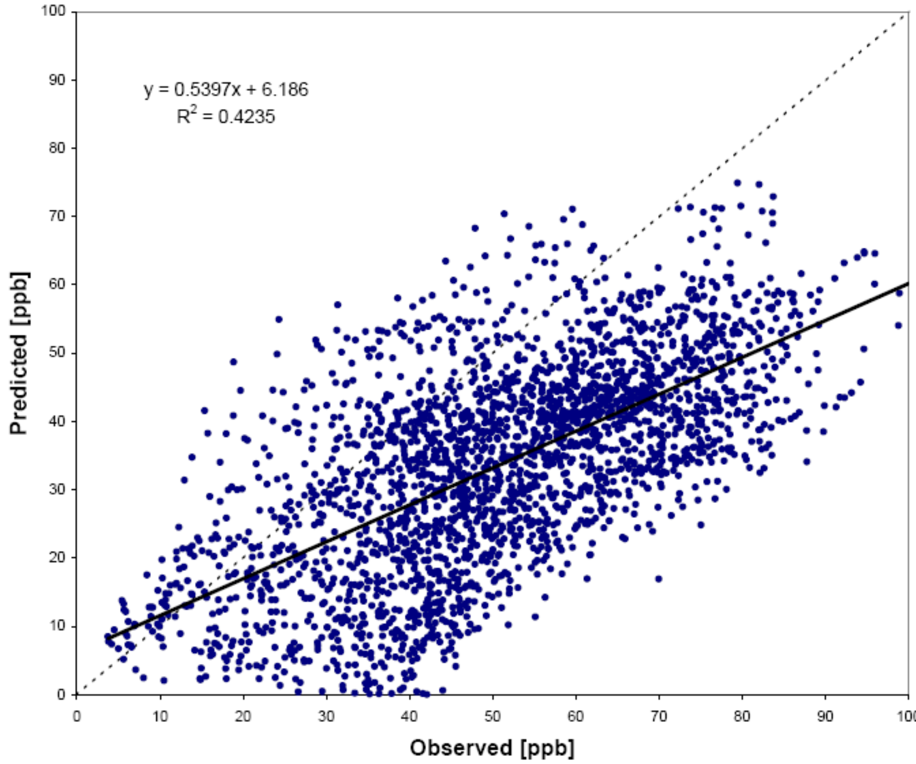


Figure 9(a) CMAQ eight-hour ozone in the MNA (August 5-10, 2001)

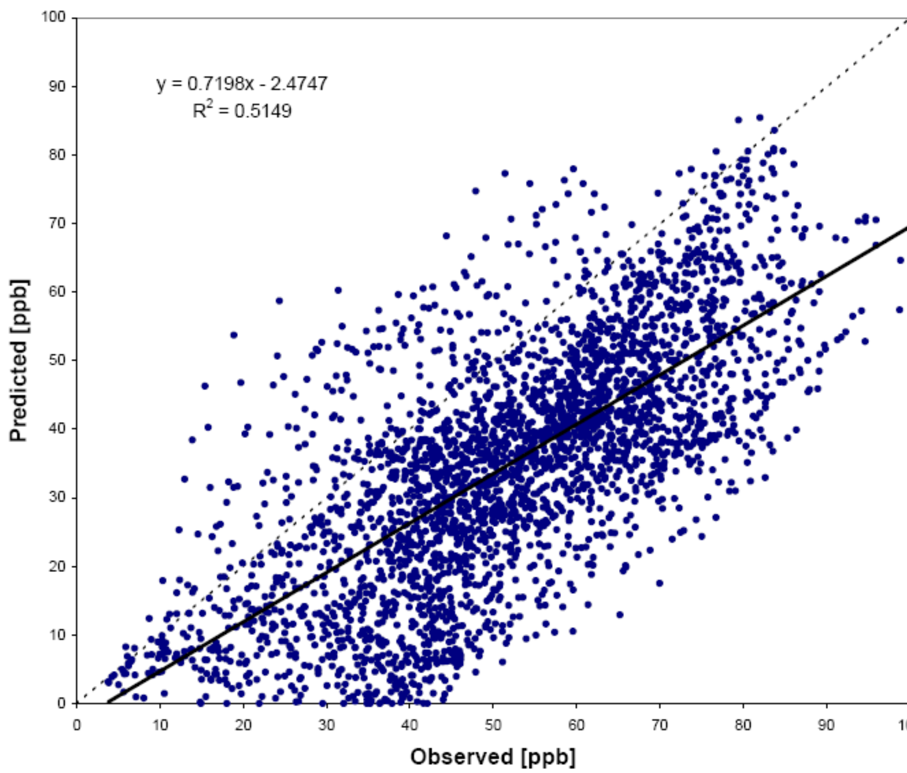


Figure 9(b) CAMx eight-hour ozone in the MNA (August 5-11, 2001)

Appendix I-ii

Files Used for the Air Quality Modeling in Support of the Eight-Hour Ozone Maintenance Plan

Directory structure for the data files

```
Root
├───MetModels
│    ├───WRF
│    │    ├───data
│    │    │    ├───jun2002
│    │    │    ├───jul2002
│    │    │    └───aug2001
│    │    ├───run
│    │    │    ├───jun2002
│    │    │    ├───jul2002
│    │    │    └───aug2001
│    │    └───bin
│    │         ├───jun
│    │         └───jul&aug
│    └───MM5
│         ├───TERRAIN
│         ├───200108
│         │    └───run9
│         ├───200205
│         │    ├───run4
│         │    └───run5
│         └───200207
│              └───run9
├───EmissionModels
│    ├───Camx2Cmaq
│    │    ├───inputs
│    │    ├───job
│    │    └───outputs
│    └───EPS3.0
│         ├───data
│         │    ├───inputs
│         │    │    ├───4km
│         │    │    └───12km
│         │    ├───outputs
│         │    └───emiss_source
│         │         ├───4km
│         │         │    ├───Nonroad
│         │         │    │    └───Nonroadmodel
│         │         │    │         ├───July
│         │         │    │         ├───August
│         │         │    │         ├───May
│         │         │    │         └───June
│         │         │    ├───Onroad
│         │         │    │    ├───medexplora
│         │         │    │    │    ├───util
│         │         │    │    │    ├───outputs
│         │         │    │    │    ├───srcPrecise
│         │         │    │    │    ├────ozinp
│         │         │    │    │    └───ozjob
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│         │         │    │    │    ├───2005
│         │         │    │    │    └───2025
│         │         │    │    ├───M6LinkPart2
│         │         │    │    │    ├───2005
│         │         │    │    │    └───2025
│         │         │    │    └───MOBILE6.2
│         │         │    │         ├───2005
│         │         │    │         └───2025
│         │         │    ├───Point
│         │         │    ├───Area
│         │         │    ├───Aviation
```

```
|       |       |   └---Biogenics
|       |       └---12km
|       └---job
|           ├---4km
|           └---12km
├---P-ChemModels
|   ├---CAMx
|   |   ├---inputs
|   |   |   ├---mm5metdata
|   |   |   ├---emissions
|   |   |   └---wrfmetdata
|   |   ├---outputs
|   |   ├---postproc
|   |   |   ├---mag.test60.202505
|   |   |   ├---mag.test14.200505
|   |   |   ├---mag.test18.wrf.202508
|   |   |   ├---mag.test18.wrf.202507
|   |   |   ├---mag.test60.wrf.202505
|   |   |   ├---mag.test11.wrf.200508
|   |   |   ├---mag.test11.wrf.200507
|   |   |   ├---mag.test14.wrf.200505
|   |   |   ├---mag.test18.202508
|   |   |   ├---mag.test11.200508
|   |   |   ├---mag.test18.202507
|   |   |   └---mag.test11.200507
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|   |   |   ├---mm5camx
|   |   |   |   └---src
|   |   |   ├---tuv
|   |   |   |   ├---DATAE1
|   |   |   |   |   ├---O2
|   |   |   |   |   ├---O3
|   |   |   |   |   ├---GRIDS
|   |   |   |   |   ├---ATM
|   |   |   |   |   ├---SO2
|   |   |   |   |   ├---SUN
|   |   |   |   |   └---NO2
|   |   |   |   ├---DATAJ2
|   |   |   |   |   ├---IUPAC
|   |   |   |   |   └---KFA
|   |   |   |   ├---DATAS1
|   |   |   |   ├---src
|   |   |   |   └---DATAJ1
|   |   |   |       ├---IUPAC04
|   |   |   |       |   └---raw_data
|   |   |   |       ├---CH3COCH3
|   |   |   |       ├---ABS
|   |   |   |       ├---C2H5CHO
|   |   |   |       ├---CH2O
|   |   |   |       ├---CHOCHO
|   |   |   |       ├---CH3OOH
|   |   |   |       ├---YLD
|   |   |   |       ├---SAPRC99
|   |   |   |       ├---CH3CHO
|   |   |   |       ├---CB_2002
|   |   |   |       ├---RONO2
|   |   |   |       ├---SAPRC97
|   |   |   |       ├---CH3COCHO
|   |   |   |       └---CHLORINE
|   |   |   ├---ahomap
|   |   |   |   ├---src
|   |   |   |   └---ozcol_data
|   |   |   ├---kvpatch
|   |   |   ├---ems_hono
```

```
|   |   |   └---wrfcamx_v2.0
|   |   ├---runfiles
|   |   └---src.v4.4
|   └---CMAQ
|       ├---run
|       |   └---scripts
|       |       ├---cctm
|       |       |   ├---cmaq-mm5
|       |       |   |   ├---test3nest_jun2005
|       |       |   |   ├---test3nest_aug2005
|       |       |   |   ├---test3nest_jul2025
|       |       |   |   ├---test3nest_jul2005
|       |       |   |   ├---test3nest_jun2025
|       |       |   |   ├---test3nest_aug2025
|       |       |   |   ├---test3_aug2005
|       |       |   |   ├---test3_aug2025
|       |       |   |   ├---test3_jul2025
|       |       |   |   ├---test3_jun2025
|       |       |   |   ├---test3_jul2005
|       |       |   |   ├---test3_jun2005
|       |       |   |   ├---test3_aug2001
|       |       |   |   ├---test3_jul2002
|       |       |   |   ├---test3_jun2002
|       |       |   |   ├---test3nest_aug2001
|       |       |   |   ├---test3nest_jul2002
|       |       |   |   └---test3nest_jun2002
|       |       |   └---cmaq-wrf
|       |       |       ├---test18_jul2005
|       |       |       ├---test18_jul2025
|       |       |       ├---test18nest_jul2005
|       |       |       ├---test18nest_jul2025
|       |       |       ├---test19_aug2005
|       |       |       ├---test19_aug2025
|       |       |       ├---test19nest_aug2005
|       |       |       ├---test19nest_aug2025
|       |       |       ├---test20_jun2005
|       |       |       ├---test20_jun2025
|       |       |       ├---test18_jul2002
|       |       |       ├---test20nest_jun2005
|       |       |       ├---test20nest_jun2025
|       |       |       ├---test18nest_jul2002
|       |       |       ├---test19_aug2001
|       |       |       ├---test20nest_jun2002
|       |       |       ├---test20_jun2002
|       |       |       └---test19nest_aug2001
|       |       ├---bcon
|       |       |   ├---test3nest
|       |       |   ├---test18nest
|       |       |   ├---test19nest
|       |       |   └---test20nest
|       |       ├---icon
|       |       |   ├---test3nest
|       |       |   ├---test18nest
|       |       |   ├---test19nest
|       |       |   └---test20nest
|       |       ├---jproc
|       |       |   └---BLD.test3
|       |       └---mcip
|       |           ├---mm5
|       |           |   ├---200207
|       |           |   |   └---run9
|       |           |   |       ├---MCIP_MNA_12km
|       |           |   |       ├---MCIP_MNA_4km
|       |           |   |       └---MCIP_MNA_12km_PBL2
|       |           |   |
```

```
|         |             |    ├───200205
|         |             |    |    └───run5
|         |             |    |         ├───MCIP_MNA_12km
|         |             |    |         └───MCIP_MNA_4km_PBLmax
|         |             |    └───200108
|         |             |         └───run9
|         |             |              ├───MCIP_MNA_12km
|         |             |              └───MCIP_MNA_4km
|         |             └───wrf
|         |                  ├───200108
|         |                  |    └───wrf_test13
|         |                  |         ├───MCIP_MNA_12km_ddep
|         |                  |         └───MCIP_MNA_4km_ddep
|         |                  ├───200205
|         |                  |    └───wrf_test12
|         |                  |         ├───MCIP_MNA_12km_ddep
|         |                  |         └───MCIP_MNA_4km_ddep
|         |                  └───200207
|         |                       └───wrf_test11
|         |                            ├───MCIP_MNA_12km_ddep
|         |                            └───MCIP_MNA_4km_ddep
|         ├───data
|         |    ├───bcon
|         |    |    ├───cmaq-wrf
|         |    |    └───cmaq-mm5
|         |    ├───icon
|         |    ├───cctm
|         |    |    ├───cmaq-mm5
|         |    |    |    ├───test3nest_jun2005
|         |    |    |    ├───test3nest_jun2002
|         |    |    |    ├───test3nest_jul2005
|         |    |    |    ├───test3nest_jul2002
|         |    |    |    ├───test3nest_aug2005
|         |    |    |    ├───test3nest_aug2001
|         |    |    |    ├───test3_jun2002
|         |    |    |    ├───test3_jul2002
|         |    |    |    ├───test3_aug2001
|         |    |    |    ├───test3nest_jun2025
|         |    |    |    ├───test3nest_jul2025
|         |    |    |    ├───test3nest_aug2025
|         |    |    |    ├───test3_jun2005
|         |    |    |    ├───test3_jun2025
|         |    |    |    ├───test3_jul2005
|         |    |    |    ├───test3_jul2025
|         |    |    |    ├───test3_aug2005
|         |    |    |    └───test3_aug2025
|         |    |    └───cmaq-wrf
|         |    |         ├───test19_aug2005
|         |    |         ├───test20nest_jun2005
|         |    |         ├───test20nest_jun2002
|         |    |         ├───test19nest_aug2005
|         |    |         ├───test19nest_aug2001
|         |    |         ├───test18nest_jul2005
|         |    |         ├───test18nest_jul2002
|         |    |         ├───test20_jun2002
|         |    |         ├───test19_aug2001
|         |    |         ├───test18_jul2002
|         |    |         ├───test20nest_jun2025
|         |    |         ├───test19nest_aug2025
|         |    |         ├───test18nest_jul2025
|         |    |         ├───test20_jun2005
|         |    |         ├───test20_jun2025
|         |    |         ├───test18_jul2005
|         |    |         └───test18_jul2025
```

```
|       |   ├───mag_emis
|       |   └───ICBC
|       ├───lib
|       └───models
└───MATS
    ├───inputs
    └───outputs
```

Complete File List

Root:
EmissionModels MATS MetModels P-ChemModels

./EmissionModels:
Camx2Cmaq EPS3.0

./EmissionModels/Camx2Cmaq:
inputs job outputs

./EmissionModels/Camx2Cmaq/inputs:
2005.zip 2025.zip

./EmissionModels/Camx2Cmaq/job:
stitch_ncf_4km_0506.job stitch_ncf_4km_2507.job x2q_emis_4k_0508.job
stitch_ncf_4km_0507.job stitch_ncf_4km_2508.job x2q_emis_4k_2506.job
stitch_ncf_4km_0508.job x2q_emis_4k_0506.job x2q_emis_4k_2507.job
stitch_ncf_4km_2506.job x2q_emis_4k_0507.job x2q_emis_4k_2508.job

./EmissionModels/Camx2Cmaq/outputs:
2005.zip 2025.zip

./EmissionModels/EPS3.0:
data job

./EmissionModels/EPS3.0/data:
emiss_source inputs outputs

./EmissionModels/EPS3.0/data/emiss_source:
12km 4km

./EmissionModels/EPS3.0/data/emiss_source/12km:
camx.emiss.010802.12km.CB4.bin
camx.emiss.010803.12km.CB4.bin
camx.emiss.010804.12km.CB4.bin
camx.emiss.010805.12km.CB4.bin
camx.emiss.010806.12km.CB4.bin
camx.emiss.010807.12km.CB4.bin
camx.emiss.010808.12km.CB4.bin
camx.emiss.010809.12km.CB4.bin
camx.emiss.010810.12km.CB4.bin
camx.emiss.010811.12km.CB4.bin
camx.emiss.020531.12km.CB4.bin
camx.emiss.020601.12km.CB4.bin
camx.emiss.020602.12km.CB4.bin
camx.emiss.020603.12km.CB4.bin
camx.emiss.020604.12km.CB4.bin
camx.emiss.020605.12km.CB4.bin
camx.emiss.020606.12km.CB4.bin
camx.emiss.020607.12km.CB4.bin
camx.emiss.020705.12km.CB4.bin
camx.emiss.020706.12km.CB4.bin
camx.emiss.020707.12km.CB4.bin
camx.emiss.020708.12km.CB4.bin
camx.emiss.020709.12km.CB4.bin
camx.emiss.020710.12km.CB4.bin
camx.emiss.020711.12km.CB4.bin
camx.emiss.020712.12km.CB4.bin
camx.emiss.020713.12km.CB4.bin
camx.emiss.020714.12km.CB4.bin
Mexico_area_annual_2018_mag12k_ams.srt
Mexico_nonroad_annual_2018_mag12k_ams.srt
Mexico_onroad_annual_2018_mag12k_ams.srt
mv.AD.ams.mag12k.srt
mv.annual.ams.mag12k_TX.srt
mv.Mexico.annual.ams.mag12k.srt
point_2025_2002.txt
pts.annual_2002_mag12k.afs.srt
pts.annual_2018_mag12k.afs.051208.srt
pts.annual_2018_mag12k.afs.060308.srt
pts.annual_2018_mag12k.afs.070208.srt
pts.annual_2018_mag12k.afs.srt
pts.annual.afs.mag12k.srt
pts.mexico.annual_2018_mag12k.afs.srt
pts.mexico.annual.afs.mag12k.srt
TX_area_annual_2002_mag12k_ams.srt
TX_area_annual_2018_mag12k_ams.srt
TX_area_annual_2025_mag12k_ams.srt
TX_nonroad_annual_2002_mag12k_ams.srt
TX_nonroad_annual_2018_mag12k_ams.srt
TX_nonroad_annual_2025_mag12k_ams.srt
TX_onroad_S_2018_mag12k_ams.srt
wrap_area_annual_2002_mag12k_ams.srt
wrap_area_annual_2018_mag12k_ams.srt
wrap_area_annual_2025az02_mag12k_ams.srt
wrap_area_annual_2025_mag12k_ams.srt
wrap_area_annual_2025_mag12knomag_ams.srt
wrap_nonroad_AD_2002_mag12k_ams.srt
wrap_nonroad_AD_2018_mag12k_ams.srt
wrap_nonroad_AD_2025_mag12k_ams.srt
wrap_nonroad_AD_2025_mag12knomag_ams.srt
wrap_nonroad_AD_2025_mag12knomp_ams.srt
wrap_OG_AD_2002_mag12k_ams.srt
wrap_OG_AD_2018_mag12k_ams.srt
wrap_OG_AD_2025az02_mag12k_ams.srt
wrap_OG_AD_2025_mag12k_ams.srt
wrap_onroad_AD_2002_mag12k_ams.srt
wrap_onroad_AD_2018_mag12k_ams.srt
wrap_onroad_AD_2025_mag12k_ams.srt

./EmissionModels/EPS3.0/data/emiss_source/4km:
Area Aviation Biogenics Nonroad Onroad Point

./EmissionModels/EPS3.0/data/emiss_source/4km/Area:
mc_ams05nowildfire.dat mc_ams25.v2.dat pinal_ams05.dat
pinal_ams2025.dat

./EmissionModels/EPS3.0/data/emiss_source/4km/Aviation:
airport_050531.day airport_050711.day airport_250531.day
airport_250711.day airport_050531.hr airport_050711.hr
airport_250531.hr airport_250711.hr airport_050601.day
airport_050712.day airport_250601.day airport_250712.day
airport_050601.hr airport_050712.hr airport_250601.hr
airport_250712.hr airport_050602.day airport_050713.day
airport_250602.day airport_250713.day airport_050602.hr
airport_050713.hr airport_250602.hr airport_250713.hr
airport_050603.day airport_050714.day airport_250603.day
airport_250714.day airport_050603.hr airport_050714.hr
airport_250603.hr airport_250714.hr airport_050604.day
airport_050802.day airport_250604.day airport_250802.day
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airport_050805.day airport_250607.day airport_250805.day
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airport_250705.day airport_250806.day airport_050705.hr
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airport_250708.day airport_250809.day airport_050708.hr
airport_050809.hr airport_250708.hr airport_250809.hr
airport_050709.day airport_050810.day airport_250709.day
airport_250810.day airport_050709.hr airport_050810.hr
airport_250709.hr airport_250810.hr airport_050710.day
airport_050811.day airport_250710.day airport_250811.day
airport_050710.hr airport_050811.hr airport_250710.hr
airport_250811.hr

./EmissionModels/EPS3.0/data/emiss_source/4km/Biogenics:
megan_bio010802.bin megan_bio020531.bin megan_bio020707.bin
megan_bio010803.bin megan_bio020601.bin megan_bio020708.bin
megan_bio010804.bin megan_bio020602.bin megan_bio020709.bin
megan_bio010805.bin megan_bio020603.bin megan_bio020710.bin
megan_bio010806.bin megan_bio020604.bin megan_bio020711.bin
megan_bio010807.bin megan_bio020605.bin megan_bio020712.bin
megan_bio010808.bin megan_bio020606.bin megan_bio020713.bin
megan_bio010809.bin megan_bio020607.bin megan_bio020714.bin
megan_bio010810.bin megan_bio020705.bin
megan_bio010811.bin megan_bio020706.bin

./EmissionModels/EPS3.0/data/emiss_source/4km/Nonroad:
August05.dat July05.dat June05.dat May05.dat Nonroadmodel
August25.dat July25.dat June25.dat May25.dat

./EmissionModels/EPS3.0/data/emiss_source/4km/Nonroad/Nonroadmodel:
August July June May

./EmissionModels/EPS3.0/data/emiss_source/4km/Nonroad/Nonroadmodel/August:
AUG05.ams Aug05p.opt AUG25.out Auglg05.opt AUGLG05P.out
AUGLG25.out AUG05.msg AUG25.ams Aug25p.opt AUGLG05.out
AUGLG25.ams AUGLG25P.ams Aug05.opt AUG25.msg
AUGLG05.ams AUGLG05P.ams AUGLG25.msg AUGLG25P.msg
AUG05.out Aug25.opt AUGLG05.msg AUGLG05P.msg
Auglg25.opt AUGLG25P.out

./EmissionModels/EPS3.0/data/emiss_source/4km/Nonroad/Nonroadmodel/July:
JULY05.AMS JULY05P.AMS JULY25.AMS JULY25P.AMS JULYLG05.AMS JULYLG25.AMS
JULY05.MSG JULY05P.MSG JULY25.MSG JULY25P.MSG JULYLG05.MSG JULYLG25.MSG
July05.opt July05p.opt July25.opt July25p.opt Julylg05.opt Julylg25.opt
JULY05.OUT JULY05P.OUT JULY25.OUT JULY25P.OUT JULYLG05.OUT JULYLG25.OUT

./EmissionModels/EPS3.0/data/emiss_source/4km/Nonroad/Nonroadmodel/June:
JUNE05.AMS JUNE05P.AMS JUNE25.AMS JUNE25P.AMS JUNELG05.AMSJUNELG25.AMS
JUNE05.MSG JUNE05P.MSG JUNE25.MSG JUNE25P.MSG JUNELG05.MSG
JUNELG25.MSG June05.opt June05p.opt June25.opt June25p.opt
Junelg05.opt Junelg25.opt JUNE05.OUT JUNE05P.OUT JUNE25.OUT JUNE25P.OUT
JUNELG05.out JUNELG25.out

./EmissionModels/EPS3.0/data/emiss_source/4km/Nonroad/Nonroadmodel/May:
MAY05.AMS MAY25.AMS MAYLG05.AMS Maylg05p.opt MAYLG25.OUT MAYLG25P.OUT
MAY05.MSG MAY25.MSG MAYLG05.MSG MAYLG25.AMS MAYLG25P.AMS MAYLG5P.AMS
May05.opt May25.opt Maylg05.opt MAYLG25.MSG MAYLG25P.MSG MAYLG5P.MSG
MAY05.OUT MAY25.OUT MAYLG05.OUT Maylg25.opt Maylg25p.opt MAYLG5P.OUT

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad:
M6LinkPart1 M6LinkPart2 medexplora MOBILE6.2

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/M6LinkPart1:
2005 2025

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/M6LinkPart1/2005:
m2xy.dat shape.zip

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/M6LinkPart1/2025:
m2xy.dat shape.zip

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/M6LinkPart2:
2005 2025

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/M6LinkPart2/2005:
2005.zip ozinv05.v4.job

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/M6LinkPart2/2025:
2025.zip ozinv25.v9.job

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/medexplora:
outputs ozinp ozjob srcPrecise util

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/medexplora/outputs:
outputs.zip

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/medexplora/ozinp:
chmprf.xref.thc.mag99 splitfac.thc.mag
splitfac.mag.cb5.mobile.fromSAI.ENVupdat.15jan07 userin.med

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/medexplora/ozjob:
medoz05eps2.v6.job medoz25eps2.v16.job

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/medexplora/srcPrecise:
srcPrecise.tar

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/medexplora/util:
util.tar

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/MOBILE6.2:
2005 2025

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/MOBILE6.2/2005:
02Reg05.d 2005.zip batch05.in cutpnt05.d

./EmissionModels/EPS3.0/data/emiss_source/4km/Onroad/MOBILE6.2/2025:
02reg25.d 2025.zip batch25.in cutpnt18.d

./EmissionModels/EPS3.0/data/emiss_source/4km/Point:
mc_afs25_nopower_no358.dat mc_ptehr_250705.dat mc_ptehr_250803.dat
mc_afs25_nopower_no358.tmfac.dat mc_ptehr_250706.dat
mc_ptehr_250804.dat mcpoint_2005.dat mc_ptehr_250707.dat
mc_ptehr_250805.dat mc_ptehr_250531.dat mc_ptehr_250708.dat
mc_ptehr_250806.dat mc_ptehr_250601.dat mc_ptehr_250709.dat
mc_ptehr_250807.dat mc_ptehr_250602.dat mc_ptehr_250710.dat
mc_ptehr_250808.dat mc_ptehr_250603.dat mc_ptehr_250711.dat
mc_ptehr_250809.dat mc_ptehr_250604.dat mc_ptehr_250712.dat
mc_ptehr_250810.dat mc_ptehr_250605.dat mc_ptehr_250713.dat
mc_ptehr_250811.dat mc_ptehr_250606.dat mc_ptehr_250714.dat
pinalpoint_2005.dat mc_ptehr_250607.dat mc_ptehr_250802.dat
pinalpoint_2025.dat

./EmissionModels/EPS3.0/data/inputs:
12km 4km

./EmissionModels/EPS3.0/data/inputs/12km:
chmprf.xref.eps3.voc.pts_epa_default_051208.mag
chmprf.xref.eps3.voc.pts_epa_default_mar_4_2002.mag
chmprf.xref.eps3.voc.v0598.hstn2k_0303.a0.mag
chmprf.xref.eps3.voc.v0598.hstn2k_0303.a0.mex.mag
chmprf.xref.eps3.voc.v0598.hstn2k_0303.a0.TX.mag
grdsrg_mag12k_all_02.txt.srt
grdsrg_mag12k_all_02_v2.txt.srt
grdsrg_mag12k_mex.txt
splitfac.etcog3.cb4.gy_10sep03
srgxref.eps3.04013partial.dat
srgxref.eps3.mag_all_04025.dat
srgxref.eps3.mag_all_050808.dat
srgxref.eps3.mag_all_060208.dat
srgxref.eps3.mag_all_060308.dat
srgxref.eps3.mag_all_071508.dat
srgxref.eps3.mag_all.dat
srgxref.eps3.mag_mexico_050808.dat
srgxref.eps3.mag_mexico.dat
srgxref.eps3.mag_TX.dat
tmprof_epa_default_092204.dat
tmprof_epa_default_092204_mv.dat
tmpxref_epa_default_042902.eps3.dat
tmpxref_epa_default_042902_mv.eps3.dat.mag
tmpxref_epa_default_042902_mv.eps3.dat.TX.mag
tmpxref_epa_default_042902_offroad.eps3.dat.mag
tmpxref_epa_default_042902_pts.eps3.dat
userin.mag_12km_eps3.all.pt.sat
userin.mag_12km_eps3.all.pt.sun
userin.mag_12km_eps3.all.pt.wkd
userin.mag_12km_eps3.all.sat
userin.mag_12km_eps3.all.sun
userin.mag_12km_eps3.all.wkd
userin.mag_12km_eps3.mex.pt.sat
userin.mag_12km_eps3.mex.pt.sun
userin.mag_12km_eps3.mex.pt.wkd
userin.mag_12km_eps3.mex.sat
userin.mag_12km_eps3.mex.sun
userin.mag_12km_eps3.mex.wkd

./EmissionModels/EPS3.0/data/inputs/4km:
chmprf.xref.eps3.voc.pts_epa_default_mar_4_2002.mag
chmprf.xref.eps3.voc.v0598.hstn2k_0303.a0.mag
grdsrg_mag12k_all_02.txt.srt
splitfac.etcog3.cb4.gy_10sep03
srgxref.4km.mag_2sur.dat
srgxref.eps3.mag_all.dat
sur_eps3_v6.txt
tmprl.profs.05.mc
tmprl.profs.05.pinal
tmprl.profs.25.pinal
tmprl_xref.05.mc
tmprl_xref.05.pinal
tmprl_xref.2025.nopower.mc
tmprl_xref.25.nopower.mc
tmprl_xref.25.pinal
tmprof_epa_default_092204.dat
tmpxref_epa_default_042902.eps3.dat
tmpxref_epa_default_042902_offroad.eps3.dat.mag

./EmissionModels/EPS3.0/data/outputs:
12km.zip 4km.zip

./EmissionModels/EPS3.0/job:
12km 4km

./EmissionModels/EPS3.0/job/12km:
area_02_12km_Mexico.job mrguam_25_12km_jul_area.job
area_02_12km_TX.job mrguam_25_12km_jul.job
area_02_12km_wrap.job mrguam_25_12km_jul_mv.job
area_02_12km_wrap_OG.job mrguam_25_12km_jul_offr.job
area_25_12km_Mexico.job mrguam_25_12km_jul_pt.job
area_25_12km_TX.job mrguam_25_12km_jun_area.job
area_25_12km_wrap.job mrguam_25_12km_jun.job
area_25_12km_wrap_OG.job mrguam_25_12km_jun_mv.job
mrguam_01_12km_aug_area.job mrguam_25_12km_jun_offr.job
mrguam_01_12km_aug.job mrguam_25_12km_jun_pt.job
mrguam_01_12km_aug_mv.job mv_02_12km_Mexico.job
mrguam_01_12km_aug_offr.job mv_02_12km_TX.job
mrguam_01_12km_aug_pt.job mv_02_12km_wrap.job
mrguam_02_12km_jul_area.job mv_25_12km_Mexico.job
mrguam_02_12km_jul.job mv_25_12km_TX.job
mrguam_02_12km_jul_mv.job mv_25_12km_wrap.job
mrguam_02_12km_jul_offr.job offr_02_12km_mexico.job
mrguam_02_12km_jul_pt.job offr_02_12km_TX.job
mrguam_02_12km_jun_area.job offr_02_12km_wrap.job
mrguam_02_12km_jun.job offr_25_12km_mexico.job
mrguam_02_12km_jun_mv.job offr_25_12km_TX.job
mrguam_02_12km_jun_offr.job offr_25_12km_wrap.job
mrguam_02_12km_jun_pt.job pigems_02_12km_US.job
mrguam_25_12km_aug_area.job pigems_25_12km_US.job
mrguam_25_12km_aug.job pts_02_12km_Mexico.job
mrguam_25_12km_aug_mv.job pts_02_12km_US.job
mrguam_25_12km_aug_offr.job pts_25_12km_Mexico.job
mrguam_25_12km_aug_pt.job pts_25_12km_US.job

./EmissionModels/EPS3.0/job/4km:
area_0506_mc.v6.job offr.0508.4km.v6.job
area.0506_pinal.v6.job offr.2505.4km.v17.job
area_0507_mc.v6.job offr.2506.4km.v17.job
area.0507_pinal.v6.job offr.2507.4km.v17.job
area_0508_mc.v6.job offr.2508.4km.v17.job
area.0508_pinal.v6.job pigems_0506_mc.job
area_2506_mc.v15.job pigems_0507_mc.job
area.2506_pinal.v15.job pigems_0508_mc.job
area_2507_mc.v15.job pigems_2506_mc_peakhr.v8.job
area.2507_pinal.v15.job pigems_2507_mc_peakhr.v8.job
area_2508_mc.v15.job pigems_2508_mc_peakhr.v8.job
area.2508_pinal.v15.job pts_0506_mc.job
avi_0506_4km.v3.job pts_0506_pinal.job
avi_0507_4km.v3.job pts_0507_mc.job
avi_0508_4km.v3.job pts_0507_pinal.job
avi_2506_4km.v3.job pts_0508_mc.job
avi_2507_4km.v3.job pts_0508_pinal.job
avi_2508_4km.v3.job pts_2506_mc.nopower.v6.job
mrguam.0506.4km.v12.job pts_2506_mc_ptehr.v7.job
mrguam.0507.4km.v12.job pts_2506_pinal.job
mrguam.0508.4km.v12.job pts_2507_mc.nopower.v6.job
mrguam.2506.4km.v38.job pts_2507_mc_ptehr.v7.job
mrguam.2507.4km.v38.job pts_2507_pinal.job
mrguam.2508.4km.v38.job pts_2508_mc.nopower.v6.job
offr.0505.4km.v6.job pts_2508_mc_ptehr.v7.job
offr.0506.4km.v6.job pts_2508_pinal.job
offr.0507.4km.v6.job

./MATS:
inputs
outputs
Ozone Attainment Test in the MNA for CAMx&MM5 - August 2001.asr
Ozone Attainment Test in the MNA for CAMx&MM5 - July 2002.asr
Ozone Attainment Test in the MNA for CAMx&MM5 - June 2002.asr
Ozone Attainment Test in the MNA for CAMx&WRF - August 2001.asr
Ozone Attainment Test in the MNA for CAMx&WRF - July 2002.asr
Ozone Attainment Test in the MNA for CAMx&WRF - June 2002.asr
Ozone Attainment Test in the MNA for CMAQ&MM5 - August 2001.asr
Ozone Attainment Test in the MNA for CMAQ&MM5 - July 2002.asr
Ozone Attainment Test in the MNA for CMAQ&MM5 - June 2002.asr
Ozone Attainment Test in the MNA for CMAQ&WRF - August 2001.asr
Ozone Attainment Test in the MNA for CMAQ&WRF - July 2002.asr
Ozone Attainment Test in the MNA for CMAQ&WRF - June 2002.asr

./MATS/inputs:
mag.camx&mm5.test11.200507.o3.8hr.dmax.csv
mag.camx&mm5.test11.200508.o3.8hr.dmax.csv
mag.camx&mm5.test14.200505.o3.8hr.dmax.csv
mag.camx&mm5.test18.202507.o3.8hr.dmax.csv
mag.camx&mm5.test18.202508.o3.8hr.dmax.csv
mag.camx&mm5.test60.202505.o3.8hr.dmax.csv
mag.camx&wrf.test11.200507.o3.8hr.dmax.csv
mag.camx&wrf.test11.200508.o3.8hr.dmax.csv
mag.camx&wrf.test14.200505.o3.8hr.dmax.csv
mag.camx&wrf.test18.202507.o3.8hr.dmax.csv
mag.camx&wrf.test18.202508.o3.8hr.dmax.csv
mag.camx&wrf.test60.202505.o3.8hr.dmax.csv
mag.cmaq&mm5.test101.200505.o3.8hr.dmax.csv
mag.cmaq&mm5.test101.200507.o3.8hr.dmax.csv
mag.cmaq&mm5.test101.200508.o3.8hr.dmax.csv
mag.cmaq&mm5.test101.202505.o3.8hr.dmax.csv
mag.cmaq&mm5.test101.202507.o3.8hr.dmax.csv
mag.cmaq&mm5.test101.202508.o3.8hr.dmax.csv
mag.cmaq&wrf.test100.200505.o3.8hr.dmax.csv
mag.cmaq&wrf.test100.200507.o3.8hr.dmax.csv
mag.cmaq&wrf.test100.200508.o3.8hr.dmax.csv
mag.cmaq&wrf.test100.202505.o3.8hr.dmax.csv
mag.cmaq&wrf.test100.202507.o3.8hr.dmax.csv

```
mag.cmaq&wrf.test100.202508.o3.8hr.dmax.csv
OZONE_MATS_input_9907_location corrected_v2.csv

./MATS/outputs:
Monitored Maintenance Test.camx&mm5.August.Baseline11&Future18.csv
Monitored Maintenance Test.camx&mm5.July.Baseline11&Future18.csv
Monitored Maintenance Test.camx&mm5.June.Baseline14&Future60.csv
Monitored Maintenance Test.camx&wrf.August.Baseline11&Future18.csv
Monitored Maintenance Test.camx&wrf.July.Baseline11&Future18.csv
Monitored Maintenance Test.camx&wrf.June.Baseline14&Future60.csv
Monitored Maintenance Test.cmaq&mm5.August.test101.csv
Monitored Maintenance Test.cmaq&mm5.July.test101.csv
Monitored Maintenance Test.cmaq&mm5.June.test101.csv
Monitored Maintenance Test.cmaq&wrf.August.test100.csv
Monitored Maintenance Test.cmaq&wrf.July.test100.csv
Monitored Maintenance Test.cmaq&wrf.June.test100.csv
Unmonitored Area Analysis.camx&mm5.August.Baseline11&Future18.csv
Unmonitored Area Analysis.camx&mm5.July.Baseline11&Future18.csv
Unmonitored Area Analysis.camx&mm5.June.Baseline14&Future60.csv
Unmonitored Area Analysis.camx&wrf.August.Baseline11&Future18.csv
Unmonitored Area Analysis.camx&wrf.July.Baseline11&Future18.csv
Unmonitored Area Analysis.camx&wrf.June.Baseline14&Future60.csv
Unmonitored Area Analysis.cmaq&mm5.August.test101.csv
Unmonitored Area Analysis.cmaq&mm5.July.test101.csv
Unmonitored Area Analysis.cmaq&mm5.June.test101.csv
Unmonitored Area Analysis.cmaq&wrf.August.test100.csv
Unmonitored Area Analysis.cmaq&wrf.July.test100.csv
Unmonitored Area Analysis.cmaq&wrf.June.test100.csv

./MetModels:
MM5           WRF

./MetModels/MM5:
200108        200205        200207        TERRAIN

./MetModels/MM5/200108:
BDYOUT.zip    LOWBDY.zip    MM5OBS.zip    MMINPUT.zip   run9          SFCFDDA.zip

./MetModels/MM5/200108/run9:
configure.user  mm5.deck.run9 MMOUT_DOMAIN1.zip       MMOUT_DOMAIN3.zip
log.mm5.txt     mmlif         MMOUT_DOMAIN2.zip

./MetModels/MM5/200205:
BDYOUT.zip    LOWBDY.zip    MMINPUT.zip   run4          run5          SFCFDDA.zip

./MetModels/MM5/200205/run4:
configure.user  mm5.exe       MMOUT_DOMAIN1.zip       MMOUT_DOMAIN3.zip
log.mm5.txt     mmlif         MMOUT_DOMAIN2.zip

./MetModels/MM5/200205/run5:
configure.user  mm5.deck.run5 MMOUT_DOMAIN1.zip       MMOUT_DOMAIN3.zip
log.mm5.txt     mmlif         MMOUT_DOMAIN2.zip

./MetModels/MM5/200207:
BDYOUT.zip    LOWBDY.zip    MM5OBS.zip    MMINPUT.zip   run9          SFCFDDA.zip

./MetModels/MM5/200207/run9:
configure.user  mm5.deck.run9 MMOUT_DOMAIN1.zip       MMOUT_DOMAIN3.zip
log.mm5.txt     mmlif         MMOUT_DOMAIN2.zip

./MetModels/MM5/TERRAIN:
TER.PLT.mag   TERRAIN_DOMAIN1         TERRAIN_DOMAIN2         TERRAIN_DOMAIN3

./MetModels/WRF:
bin           data          run

./MetModels/WRF/bin:
jul&aug       jun

./MetModels/WRF/bin/jul&aug:
ndown.exe     nup.exe       real.exe      wrf.exe

./MetModels/WRF/bin/jun:
ndown.exe     nup.exe       real.exe      wrf.exe

./MetModels/WRF/data:
aug2001       jul2002       jun2002

./MetModels/WRF/data/aug2001:
aug01_wps_3nest.tar         wrfout_d01.tar  wrfout_d02.tar  wrfout_d03.tar

./MetModels/WRF/data/jul2002:
jul02_wps_3nest.tar         wrfout_d01.tar  wrfout_d02.tar  wrfout_d03.tar

./MetModels/WRF/data/jun2002:
jun02_wps_3nest.tar         wrfout_d01.tar  wrfout_d02.tar  wrfout_d03.tar

./MetModels/WRF/run:
aug2001       compile       configure     jul2002       jun2002       setcase

./MetModels/WRF/run/aug2001:
CAM_ABS_DATA            gribmap.txt     ozone_lat.formatted     tr49t67
CAM_AEROPT_DATA         input_sounding  ozone_plev.formatted    tr49t85
ETAMPNEW_DATA           landFilenames   RRTM_DATA               tr67t85
ETAMPNEW_DATA_DBL       LANDUSE.TBL     RRTM_DATA_DBL           urban_param.tbl
GENPARM.TBL             namelist.input  run_test13.wrf          VEGPARM.TBL
grib2map.tbl  ozone.formatted           SOILPARM.TBL

./MetModels/WRF/run/jul2002:
CAM_ABS_DATA            gribmap.txt     ozone_lat.formatted     tr49t67
CAM_AEROPT_DATA         input_sounding  ozone_plev.formatted    tr49t85
ETAMPNEW_DATA           landFilenames   RRTM_DATA               tr67t85
ETAMPNEW_DATA_DBL       LANDUSE.TBL     RRTM_DATA_DBL           urban_param.tbl
GENPARM.TBL             namelist.input  run_test11.wrf          VEGPARM.TBL
grib2map.tbl  ozone.formatted           SOILPARM.TBL

./MetModels/WRF/run/jun2002:
CAM_ABS_DATA            gribmap.txt     ozone_plev.formatted    tr49t85
CAM_AEROPT_DATA         landFilenames   RRTM_DATA     tr67t85
ETAMPNEW_DATA           LANDUSE.TBL     RRTM_DATA_DBL           urban_param.tbl
ETAMPNEW_DATA_DBL       namelist.input  run_test12.wrf  VEGPARM.TBL
GENPARM.TBL             ozone.formatted                 SOILPARM.TBL
grib2map.tbl  ozone_lat.formatted       tr49t67

./P-ChemModels:
CAMx          CMAQ

./P-ChemModels/CAMx:
inputs        outputs       postproc      preproc       runfiles      src.v4.4

./P-ChemModels/CAMx/inputs:
ahomap.aug2001.daily.drought  emissions          tuv.mag.aug01.do_CB4
ahomap.jul2002.daily.drought  lu.mag.12km.3to11.bin           tuv.mag.do_CB4
ahomap.jun2002.daily.drought  lu.mag.4km.bin                  tuv.mag.jul02.do_CB4
CAMx4.4.chemparam.4_NONE mm5metdata     wrfmetdata

./P-ChemModels/CAMx/inputs/emissions:
2005.zip      2025.zip      bc_2005.zip   bc_2025.zip

./P-ChemModels/CAMx/inputs/mm5metdata:
200108.zip    200205.zip    200207.zip

./P-ChemModels/CAMx/inputs/wrfmetdata:

./P-ChemModels/CAMx/outputs:
mag.test11.200507.zip       mag.test14.200505.zip       mag.test18.wrf.202507.zip
mag.test11.200508.zip       mag.test14.wrf.200505.zip   mag.test18.wrf.202508.zip
mag.test11.wrf.200507.zip   mag.test18.202507.zip       mag.test60.202505.zip
mag.test11.wrf.200508.zip   mag.test18.202508.zip       mag.test60.wrf.202505.zip

./P-ChemModels/CAMx/postproc:
mag.test11.200507           postproc.mag.200505.test14.job
mag.test11.200508           postproc.mag.200505.test14.wrf.job
mag.test11.wrf.200507       postproc.mag.200507.test11.job
mag.test11.wrf.200508       postproc.mag.200507.test11.wrf.job
mag.test14.200505           postproc.mag.200508.test11.job
mag.test14.wrf.200505       postproc.mag.200508.test11.wrf.job
mag.test18.202507           postproc.mag.202505.test60.job
mag.test18.202508           postproc.mag.202505.test60.wrf.job
mag.test18.wrf.202507       postproc.mag.202507.test18.job
mag.test18.wrf.202508       postproc.mag.202507.test18.wrf.job
mag.test60.202505           postproc.mag.202508.test18.job
mag.test60.wrf.202505       postproc.mag.202508.test18.wrf.job

./P-ChemModels/CAMx/postproc/mag.test11.200507:
CAMx.mag.test11.020705.o3.8hr.avrg      obsmax.8hr.020714
CAMx.mag.test11.020705.o3.avrg          predobs.o3.020705
CAMx.mag.test11.020706.o3.8hr.avrg      predobs.o3.020706
CAMx.mag.test11.020706.o3.avrg          predobs.o3.020707
CAMx.mag.test11.020707.o3.8hr.avrg      predobs.o3.020708
CAMx.mag.test11.020707.o3.avrg          predobs.o3.020709
CAMx.mag.test11.020708.o3.8hr.avrg      predobs.o3.020710
CAMx.mag.test11.020708.o3.avrg          predobs.o3.020711
CAMx.mag.test11.020709.o3.8hr.avrg      predobs.o3.020712
CAMx.mag.test11.020709.o3.avrg          predobs.o3.020713
CAMx.mag.test11.020710.o3.8hr.avrg      predobs.o3.020714
CAMx.mag.test11.020710.o3.avrg          predobs.o3_8hr.020705.mag
CAMx.mag.test11.020711.o3.8hr.avrg      predobs.o3_8hr.020706.mag
CAMx.mag.test11.020711.o3.avrg          predobs.o3_8hr.020707.mag
CAMx.mag.test11.020712.o3.8hr.avrg      predobs.o3_8hr.020708.mag
CAMx.mag.test11.020712.o3.avrg          predobs.o3_8hr.020709.mag
CAMx.mag.test11.020713.o3.8hr.avrg      predobs.o3_8hr.020710.mag
CAMx.mag.test11.020713.o3.avrg          predobs.o3_8hr.020711.mag
CAMx.mag.test11.020714.o3.8hr.avrg      predobs.o3_8hr.020712.mag
CAMx.mag.test11.020714.o3.avrg          predobs.o3_8hr.020713.mag
CAMx.mag.test11.alldays.o3.8hr.avrg     predobs.o3_8hr.020714.mag
CAMx.mag.test11.alldays.o3.avrg         predobs.o3_8hr.jul02.mag.test11
extstats.o3_8hr.jul02.mag.test11        predobs.o3.jul02.mag.test11
extstats.o3.jul02.mag.test11            stats.o3.020705
obsmax.020705.o3                        stats.o3.020706
obsmax.020706.o3                        stats.o3.020707
obsmax.020707.o3                        stats.o3.020708
obsmax.020708.o3                        stats.o3.020709
obsmax.020709.o3                        stats.o3.020710
obsmax.020710.o3                        stats.o3.020711
obsmax.020711.o3                        stats.o3.020712
obsmax.020712.o3                        stats.o3.020713
obsmax.020713.o3                        stats.o3.020714
obsmax.020714.o3                        stats.o3_8hr.020705.mag
obsmax.8hr.020705                       stats.o3_8hr.020706.mag
obsmax.8hr.020706                       stats.o3_8hr.020707.mag
obsmax.8hr.020707                       stats.o3_8hr.020708.mag
obsmax.8hr.020708                       stats.o3_8hr.020709.mag
obsmax.8hr.020709                       stats.o3_8hr.020710.mag
obsmax.8hr.020710                       stats.o3_8hr.020711.mag
obsmax.8hr.020711                       stats.o3_8hr.020712.mag
obsmax.8hr.020712                       stats.o3_8hr.020713.mag
obsmax.8hr.020713                       stats.o3_8hr.020714.mag

./P-ChemModels/CAMx/postproc/mag.test11.200508:
CAMx.mag.test11.010802.o3.8hr.avrg      obsmax.8hr.010811
CAMx.mag.test11.010802.o3.avrg          predobs.o3.010802
CAMx.mag.test11.010803.o3.8hr.avrg      predobs.o3.010803
CAMx.mag.test11.010803.o3.avrg          predobs.o3.010804
CAMx.mag.test11.010804.o3.8hr.avrg      predobs.o3.010805
CAMx.mag.test11.010804.o3.avrg          predobs.o3.010806
CAMx.mag.test11.010805.o3.8hr.avrg      predobs.o3.010807
CAMx.mag.test11.010805.o3.avrg          predobs.o3.010808
CAMx.mag.test11.010806.o3.8hr.avrg      predobs.o3.010809
CAMx.mag.test11.010806.o3.avrg          predobs.o3.010810
CAMx.mag.test11.010807.o3.8hr.avrg      predobs.o3.010811
CAMx.mag.test11.010807.o3.avrg          predobs.o3_8hr.010802.mag
CAMx.mag.test11.010808.o3.8hr.avrg      predobs.o3_8hr.010803.mag
CAMx.mag.test11.010808.o3.avrg          predobs.o3_8hr.010804.mag
CAMx.mag.test11.010809.o3.8hr.avrg      predobs.o3_8hr.010805.mag
CAMx.mag.test11.010809.o3.avrg          predobs.o3_8hr.010806.mag
```

CAMx.mag.test11.010810.o3.8hr.avrg	predobs.o3_8hr.010807.mag
CAMx.mag.test11.010810.o3.avrg	predobs.o3_8hr.010808.mag
CAMx.mag.test11.010811.o3.8hr.avrg	predobs.o3_8hr.010809.mag
CAMx.mag.test11.010811.o3.avrg	predobs.o3_8hr.010810.mag
CAMx.mag.test11.alldays.o3.8hr.avrg	predobs.o3_8hr.010811.mag
CAMx.mag.test11.alldays.o3.avrg	predobs.o3_8hr.aug01.mag.test11
extstats.o3_8hr.aug01.mag.test11	predobs.o3.aug01.mag.test11
extstats.o3.aug01.mag.test11	stats.o3.010802
obsmax.010802.o3	stats.o3.010803
obsmax.010803.o3	stats.o3.010804
obsmax.010804.o3	stats.o3.010805
obsmax.010805.o3	stats.o3.010806
obsmax.010806.o3	stats.o3.010807
obsmax.010807.o3	stats.o3.010808
obsmax.010808.o3	stats.o3.010809
obsmax.010809.o3	stats.o3.010810
obsmax.010810.o3	stats.o3.010811
obsmax.010811.o3	stats.o3_8hr.010802.mag
obsmax.8hr.010802	stats.o3_8hr.010803.mag
obsmax.8hr.010803	stats.o3_8hr.010804.mag
obsmax.8hr.010804	stats.o3_8hr.010805.mag
obsmax.8hr.010805	stats.o3_8hr.010806.mag
obsmax.8hr.010806	stats.o3_8hr.010807.mag
obsmax.8hr.010807	stats.o3_8hr.010808.mag
obsmax.8hr.010808	stats.o3_8hr.010809.mag
obsmax.8hr.010809	stats.o3_8hr.010810.mag
obsmax.8hr.010810	stats.o3_8hr.010811.mag

./P-ChemModels/CAMx/postproc/mag.test11.wrf.200507:

CAMx.mag.test11.wrf.020705.o3.8hr.avrg	obsmax.8hr.020714
CAMx.mag.test11.wrf.020705.o3.avrg	predobs.o3.020705
CAMx.mag.test11.wrf.020706.o3.8hr.avrg	predobs.o3.020706
CAMx.mag.test11.wrf.020706.o3.avrg	predobs.o3.020707
CAMx.mag.test11.wrf.020707.o3.8hr.avrg	predobs.o3.020708
CAMx.mag.test11.wrf.020707.o3.avrg	predobs.o3.020709
CAMx.mag.test11.wrf.020708.o3.8hr.avrg	predobs.o3.020710
CAMx.mag.test11.wrf.020708.o3.avrg	predobs.o3.020711
CAMx.mag.test11.wrf.020709.o3.8hr.avrg	predobs.o3.020712
CAMx.mag.test11.wrf.020709.o3.avrg	predobs.o3.020713
CAMx.mag.test11.wrf.020710.o3.8hr.avrg	predobs.o3.020714
CAMx.mag.test11.wrf.020710.o3.avrg	predobs.o3_8hr.020705.mag
CAMx.mag.test11.wrf.020711.o3.8hr.avrg	predobs.o3_8hr.020706.mag
CAMx.mag.test11.wrf.020711.o3.avrg	predobs.o3_8hr.020707.mag
CAMx.mag.test11.wrf.020712.o3.8hr.avrg	predobs.o3_8hr.020708.mag
CAMx.mag.test11.wrf.020712.o3.avrg	predobs.o3_8hr.020709.mag
CAMx.mag.test11.wrf.020713.o3.8hr.avrg	predobs.o3_8hr.020710.mag
CAMx.mag.test11.wrf.020713.o3.avrg	predobs.o3_8hr.020711.mag
CAMx.mag.test11.wrf.020714.o3.8hr.avrg	predobs.o3_8hr.020712.mag
CAMx.mag.test11.wrf.020714.o3.avrg	predobs.o3_8hr.020713.mag
CAMx.mag.test11.wrf.alldays.o3.8hr.avrg	predobs.o3_8hr.020714.mag
CAMx.mag.test11.wrf.alldays.o3.avrg	predobs.o3_8hr.jul02.mag.test11.wrf
extstats.o3_8hr.jul02.mag.test11.wrf	predobs.o3.jul02.mag.test11.wrf
extstats.o3.jul02.mag.test11.wrf	stats.o3.020705
obsmax.020705.o3	stats.o3.020706
obsmax.020706.o3	stats.o3.020707
obsmax.020707.o3	stats.o3.020708
obsmax.020708.o3	stats.o3.020709
obsmax.020709.o3	stats.o3.020710
obsmax.020710.o3	stats.o3.020711
obsmax.020711.o3	stats.o3.020712
obsmax.020712.o3	stats.o3.020713
obsmax.020713.o3	stats.o3.020714
obsmax.020714.o3	stats.o3_8hr.020705.mag
obsmax.8hr.020705	stats.o3_8hr.020706.mag
obsmax.8hr.020706	stats.o3_8hr.020707.mag
obsmax.8hr.020707	stats.o3_8hr.020708.mag
obsmax.8hr.020708	stats.o3_8hr.020709.mag
obsmax.8hr.020709	stats.o3_8hr.020710.mag
obsmax.8hr.020710	stats.o3_8hr.020711.mag
obsmax.8hr.020711	stats.o3_8hr.020712.mag
obsmax.8hr.020712	stats.o3_8hr.020713.mag
obsmax.8hr.020713	stats.o3_8hr.020714.mag

./P-ChemModels/CAMx/postproc/mag.test11.wrf.200508:

CAMx.mag.test11.wrf.010802.o3.8hr.avrg	obsmax.8hr.010811
CAMx.mag.test11.wrf.010802.o3.avrg	predobs.o3.010802
CAMx.mag.test11.wrf.010803.o3.8hr.avrg	predobs.o3.010803
CAMx.mag.test11.wrf.010803.o3.avrg	predobs.o3.010804
CAMx.mag.test11.wrf.010804.o3.8hr.avrg	predobs.o3.010805
CAMx.mag.test11.wrf.010804.o3.avrg	predobs.o3.010806
CAMx.mag.test11.wrf.010805.o3.8hr.avrg	predobs.o3.010807
CAMx.mag.test11.wrf.010805.o3.avrg	predobs.o3.010808
CAMx.mag.test11.wrf.010806.o3.8hr.avrg	predobs.o3.010809
CAMx.mag.test11.wrf.010806.o3.avrg	predobs.o3.010810
CAMx.mag.test11.wrf.010807.o3.8hr.avrg	predobs.o3.010811
CAMx.mag.test11.wrf.010807.o3.avrg	predobs.o3_8hr.010802.mag
CAMx.mag.test11.wrf.010808.o3.8hr.avrg	predobs.o3_8hr.010803.mag
CAMx.mag.test11.wrf.010808.o3.avrg	predobs.o3_8hr.010804.mag
CAMx.mag.test11.wrf.010809.o3.8hr.avrg	predobs.o3_8hr.010805.mag
CAMx.mag.test11.wrf.010809.o3.avrg	predobs.o3_8hr.010806.mag
CAMx.mag.test11.wrf.010810.o3.8hr.avrg	predobs.o3_8hr.010807.mag
CAMx.mag.test11.wrf.010810.o3.avrg	predobs.o3_8hr.010808.mag
CAMx.mag.test11.wrf.010811.o3.8hr.avrg	predobs.o3_8hr.010809.mag
CAMx.mag.test11.wrf.010811.o3.avrg	predobs.o3_8hr.010810.mag
CAMx.mag.test11.wrf.alldays.o3.8hr.avrg	predobs.o3_8hr.010811.mag
CAMx.mag.test11.wrf.alldays.o3.avrg	predobs.o3_8hr.aug01.mag.test11.wrf
extstats.o3_8hr.aug01.mag.test11.wrf	predobs.o3.aug01.mag.test11.wrf
extstats.o3.aug01.mag.test11.wrf	stats.o3.010802
obsmax.010802.o3	stats.o3.010803
obsmax.010803.o3	stats.o3.010804
obsmax.010804.o3	stats.o3.010805
obsmax.010805.o3	stats.o3.010806
obsmax.010806.o3	stats.o3.010807
obsmax.010807.o3	stats.o3.010808
obsmax.010808.o3	stats.o3.010809
obsmax.010809.o3	stats.o3.010810
obsmax.010810.o3	stats.o3.010811
obsmax.010811.o3	stats.o3_8hr.010802.mag
obsmax.8hr.010802	stats.o3_8hr.010803.mag
obsmax.8hr.010803	stats.o3_8hr.010804.mag
obsmax.8hr.010804	stats.o3_8hr.010805.mag
obsmax.8hr.010805	stats.o3_8hr.010806.mag
obsmax.8hr.010806	stats.o3_8hr.010807.mag
obsmax.8hr.010807	stats.o3_8hr.010808.mag
obsmax.8hr.010808	stats.o3_8hr.010809.mag
obsmax.8hr.010809	stats.o3_8hr.010810.mag
obsmax.8hr.010810	stats.o3_8hr.010811.mag

./P-ChemModels/CAMx/postproc/mag.test14.200505:

CAMx.mag.test14.020531.o3.8hr.avrg	obsmax.8hr.020607
CAMx.mag.test14.020531.o3.avrg	predobs.o3.020531
CAMx.mag.test14.020601.o3.8hr.avrg	predobs.o3.020601
CAMx.mag.test14.020601.o3.avrg	predobs.o3.020602
CAMx.mag.test14.020602.o3.8hr.avrg	predobs.o3.020603
CAMx.mag.test14.020602.o3.avrg	predobs.o3.020604
CAMx.mag.test14.020603.o3.8hr.avrg	predobs.o3.020605
CAMx.mag.test14.020603.o3.avrg	predobs.o3.020606
CAMx.mag.test14.020604.o3.8hr.avrg	predobs.o3.020607
CAMx.mag.test14.020604.o3.avrg	predobs.o3_8hr.020531.mag
CAMx.mag.test14.020605.o3.8hr.avrg	predobs.o3_8hr.020601.mag
CAMx.mag.test14.020605.o3.avrg	predobs.o3_8hr.020602.mag
CAMx.mag.test14.020606.o3.8hr.avrg	predobs.o3_8hr.020603.mag
CAMx.mag.test14.020606.o3.avrg	predobs.o3_8hr.020604.mag
CAMx.mag.test14.020607.o3.8hr.avrg	predobs.o3_8hr.020605.mag
CAMx.mag.test14.020607.o3.avrg	predobs.o3_8hr.020606.mag
CAMx.mag.test14.alldays.o3.8hr.avrg	predobs.o3_8hr.020607.mag
CAMx.mag.test14.alldays.o3.avrg	predobs.o3_8hr.jun02.mag.test14
extstats.o3_8hr.jun02.mag.test14	predobs.o3.jun02.mag.test14
extstats.o3.jun02.mag.test14	stats.o3.020531
obsmax.020531.o3	stats.o3.020601
obsmax.020601.o3	stats.o3.020602
obsmax.020602.o3	stats.o3.020603
obsmax.020603.o3	stats.o3.020604
obsmax.020604.o3	stats.o3.020605
obsmax.020605.o3	stats.o3.020606
obsmax.020606.o3	stats.o3.020607
obsmax.020607.o3	stats.o3_8hr.020531.mag
obsmax.8hr.020531	stats.o3_8hr.020601.mag
obsmax.8hr.020601	stats.o3_8hr.020602.mag
obsmax.8hr.020602	stats.o3_8hr.020603.mag
obsmax.8hr.020603	stats.o3_8hr.020604.mag
obsmax.8hr.020604	stats.o3_8hr.020605.mag
obsmax.8hr.020605	stats.o3_8hr.020606.mag
obsmax.8hr.020606	stats.o3_8hr.020607.mag

./P-ChemModels/CAMx/postproc/mag.test14.wrf.200505:

CAMx.mag.test14.wrf.020531.o3.8hr.avrg	obsmax.8hr.020607
CAMx.mag.test14.wrf.020531.o3.avrg	predobs.o3.020531
CAMx.mag.test14.wrf.020601.o3.8hr.avrg	predobs.o3.020601
CAMx.mag.test14.wrf.020601.o3.avrg	predobs.o3.020602
CAMx.mag.test14.wrf.020602.o3.8hr.avrg	predobs.o3.020603
CAMx.mag.test14.wrf.020602.o3.avrg	predobs.o3.020604
CAMx.mag.test14.wrf.020603.o3.8hr.avrg	predobs.o3.020605
CAMx.mag.test14.wrf.020603.o3.avrg	predobs.o3.020606
CAMx.mag.test14.wrf.020604.o3.8hr.avrg	predobs.o3.020607
CAMx.mag.test14.wrf.020604.o3.avrg	predobs.o3_8hr.020531.mag
CAMx.mag.test14.wrf.020605.o3.8hr.avrg	predobs.o3_8hr.020601.mag
CAMx.mag.test14.wrf.020605.o3.avrg	predobs.o3_8hr.020602.mag
CAMx.mag.test14.wrf.020606.o3.8hr.avrg	predobs.o3_8hr.020603.mag
CAMx.mag.test14.wrf.020606.o3.avrg	predobs.o3_8hr.020604.mag
CAMx.mag.test14.wrf.020607.o3.8hr.avrg	predobs.o3_8hr.020605.mag
CAMx.mag.test14.wrf.020607.o3.avrg	predobs.o3_8hr.020606.mag
CAMx.mag.test14.wrf.alldays.o3.8hr.avrg	predobs.o3_8hr.020607.mag
CAMx.mag.test14.wrf.alldays.o3.avrg	predobs.o3_8hr.jun02.mag.test14.wrf
extstats.o3_8hr.jun02.mag.test14.wrf	predobs.o3.jun02.mag.test14.wrf
extstats.o3.jun02.mag.test14.wrf	stats.o3.020531
obsmax.020531.o3	stats.o3.020601
obsmax.020601.o3	stats.o3.020602
obsmax.020602.o3	stats.o3.020603
obsmax.020603.o3	stats.o3.020604
obsmax.020604.o3	stats.o3.020605
obsmax.020605.o3	stats.o3.020606
obsmax.020606.o3	stats.o3.020607
obsmax.020607.o3	stats.o3_8hr.020531.mag
obsmax.8hr.020531	stats.o3_8hr.020601.mag
obsmax.8hr.020601	stats.o3_8hr.020602.mag
obsmax.8hr.020602	stats.o3_8hr.020603.mag
obsmax.8hr.020603	stats.o3_8hr.020604.mag
obsmax.8hr.020604	stats.o3_8hr.020605.mag
obsmax.8hr.020605	stats.o3_8hr.020606.mag
obsmax.8hr.020606	stats.o3_8hr.020607.mag

./P-ChemModels/CAMx/postproc/mag.test18.202507:

CAMx.mag.test18.020705.o3.8hr.avrg	obsmax.8hr.020714
CAMx.mag.test18.020705.o3.avrg	predobs.o3.020705
CAMx.mag.test18.020706.o3.8hr.avrg	predobs.o3.020706
CAMx.mag.test18.020706.o3.avrg	predobs.o3.020707
CAMx.mag.test18.020707.o3.8hr.avrg	predobs.o3.020708
CAMx.mag.test18.020707.o3.avrg	predobs.o3.020709
CAMx.mag.test18.020708.o3.8hr.avrg	predobs.o3.020710
CAMx.mag.test18.020708.o3.avrg	predobs.o3.020711
CAMx.mag.test18.020709.o3.8hr.avrg	predobs.o3.020712
CAMx.mag.test18.020709.o3.avrg	predobs.o3.020713
CAMx.mag.test18.020710.o3.8hr.avrg	predobs.o3.020714
CAMx.mag.test18.020710.o3.avrg	predobs.o3_8hr.020705.mag
CAMx.mag.test18.020711.o3.8hr.avrg	predobs.o3_8hr.020706.mag
CAMx.mag.test18.020711.o3.avrg	predobs.o3_8hr.020707.mag
CAMx.mag.test18.020712.o3.8hr.avrg	predobs.o3_8hr.020708.mag
CAMx.mag.test18.020712.o3.avrg	predobs.o3_8hr.020709.mag
CAMx.mag.test18.020713.o3.8hr.avrg	predobs.o3_8hr.020710.mag
CAMx.mag.test18.020713.o3.avrg	predobs.o3_8hr.020711.mag
CAMx.mag.test18.020714.o3.8hr.avrg	predobs.o3_8hr.020712.mag
CAMx.mag.test18.020714.o3.avrg	predobs.o3_8hr.020713.mag
CAMx.mag.test18.alldays.o3.8hr.avrg	predobs.o3_8hr.020714.mag
CAMx.mag.test18.alldays.o3.avrg	predobs.o3_8hr.jul02.mag.test18
extstats.o3_8hr.jul02.mag.test18	predobs.o3.jul02.mag.test18

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extstats.o3.jul02.mag.test18                 stats.o3.020705
obsmax.020705.o3                             stats.o3.020706
obsmax.020706.o3                             stats.o3.020707
obsmax.020707.o3                             stats.o3.020708
obsmax.020708.o3                             stats.o3.020709
obsmax.020709.o3                             stats.o3.020710
obsmax.020710.o3                             stats.o3.020711
obsmax.020711.o3                             stats.o3.020712
obsmax.020712.o3                             stats.o3.020713
obsmax.020713.o3                             stats.o3.020714
obsmax.020714.o3                             stats.o3_8hr.020705.mag
obsmax.8hr.020705                            stats.o3_8hr.020706.mag
obsmax.8hr.020706                            stats.o3_8hr.020707.mag
obsmax.8hr.020707                            stats.o3_8hr.020708.mag
obsmax.8hr.020708                            stats.o3_8hr.020709.mag
obsmax.8hr.020709                            stats.o3_8hr.020710.mag
obsmax.8hr.020710                            stats.o3_8hr.020711.mag
obsmax.8hr.020711                            stats.o3_8hr.020712.mag
obsmax.8hr.020712                            stats.o3_8hr.020713.mag
obsmax.8hr.020713                            stats.o3_8hr.020714.mag

./P-ChemModels/CAMx/postproc/mag.test18.202508:
CAMx.mag.test18.010802.o3.8hr.avrg           obsmax.8hr.010811
CAMx.mag.test18.010802.o3.avrg               predobs.o3.010802
CAMx.mag.test18.010803.o3.8hr.avrg           predobs.o3.010803
CAMx.mag.test18.010803.o3.avrg               predobs.o3.010804
CAMx.mag.test18.010804.o3.8hr.avrg           predobs.o3.010805
CAMx.mag.test18.010804.o3.avrg               predobs.o3.010806
CAMx.mag.test18.010805.o3.8hr.avrg           predobs.o3.010807
CAMx.mag.test18.010805.o3.avrg               predobs.o3.010808
CAMx.mag.test18.010806.o3.8hr.avrg           predobs.o3.010809
CAMx.mag.test18.010806.o3.avrg               predobs.o3.010810
CAMx.mag.test18.010807.o3.8hr.avrg           predobs.o3.010811
CAMx.mag.test18.010807.o3.avrg               predobs.o3_8hr.010802.mag
CAMx.mag.test18.010808.o3.8hr.avrg           predobs.o3_8hr.010803.mag
CAMx.mag.test18.010808.o3.avrg               predobs.o3_8hr.010804.mag
CAMx.mag.test18.010809.o3.8hr.avrg           predobs.o3_8hr.010805.mag
CAMx.mag.test18.010809.o3.avrg               predobs.o3_8hr.010806.mag
CAMx.mag.test18.010810.o3.8hr.avrg           predobs.o3_8hr.010807.mag
CAMx.mag.test18.010810.o3.avrg               predobs.o3_8hr.010808.mag
CAMx.mag.test18.010811.o3.8hr.avrg           predobs.o3_8hr.010809.mag
CAMx.mag.test18.010811.o3.avrg               predobs.o3_8hr.010810.mag
CAMx.mag.test18.alldays.o3.8hr.avrg          predobs.o3_8hr.010811.mag
CAMx.mag.test18.alldays.o3.avrg              predobs.o3_8hr.aug01.mag.test18
extstats.o3_8hr.aug01.mag.test18             predobs.o3.aug01.mag.test18
extstats.o3.aug01.mag.test18                 stats.o3.010802
obsmax.010802.o3                             stats.o3.010803
obsmax.010803.o3                             stats.o3.010804
obsmax.010804.o3                             stats.o3.010805
obsmax.010805.o3                             stats.o3.010806
obsmax.010806.o3                             stats.o3.010807
obsmax.010807.o3                             stats.o3.010808
obsmax.010808.o3                             stats.o3.010809
obsmax.010809.o3                             stats.o3.010810
obsmax.010810.o3                             stats.o3.010811
obsmax.010811.o3                             stats.o3_8hr.010802.mag
obsmax.8hr.010802                            stats.o3_8hr.010803.mag
obsmax.8hr.010803                            stats.o3_8hr.010804.mag
obsmax.8hr.010804                            stats.o3_8hr.010805.mag
obsmax.8hr.010805                            stats.o3_8hr.010806.mag
obsmax.8hr.010806                            stats.o3_8hr.010807.mag
obsmax.8hr.010807                            stats.o3_8hr.010808.mag
obsmax.8hr.010808                            stats.o3_8hr.010809.mag
obsmax.8hr.010809                            stats.o3_8hr.010810.mag
obsmax.8hr.010810                            stats.o3_8hr.010811.mag

./P-ChemModels/CAMx/postproc/mag.test18.wrf.202507:
CAMx.mag.test18.wrf.020705.o3.8hr.avrg       obsmax.8hr.020714
CAMx.mag.test18.wrf.020705.o3.avrg           predobs.o3.020705
CAMx.mag.test18.wrf.020706.o3.8hr.avrg       predobs.o3.020706
CAMx.mag.test18.wrf.020706.o3.avrg           predobs.o3.020707
CAMx.mag.test18.wrf.020707.o3.8hr.avrg       predobs.o3.020708
CAMx.mag.test18.wrf.020707.o3.avrg           predobs.o3.020709
CAMx.mag.test18.wrf.020708.o3.8hr.avrg       predobs.o3.020710
CAMx.mag.test18.wrf.020708.o3.avrg           predobs.o3.020711
CAMx.mag.test18.wrf.020709.o3.8hr.avrg       predobs.o3.020712
CAMx.mag.test18.wrf.020709.o3.avrg           predobs.o3.020713
CAMx.mag.test18.wrf.020710.o3.8hr.avrg       predobs.o3.020714
CAMx.mag.test18.wrf.020710.o3.avrg           predobs.o3_8hr.020705.mag
CAMx.mag.test18.wrf.020711.o3.8hr.avrg       predobs.o3_8hr.020706.mag
CAMx.mag.test18.wrf.020711.o3.avrg           predobs.o3_8hr.020707.mag
CAMx.mag.test18.wrf.020712.o3.8hr.avrg       predobs.o3_8hr.020708.mag
CAMx.mag.test18.wrf.020712.o3.avrg           predobs.o3_8hr.020709.mag
CAMx.mag.test18.wrf.020713.o3.8hr.avrg       predobs.o3_8hr.020710.mag
CAMx.mag.test18.wrf.020713.o3.avrg           predobs.o3_8hr.020711.mag
CAMx.mag.test18.wrf.020714.o3.8hr.avrg       predobs.o3_8hr.020712.mag
CAMx.mag.test18.wrf.020714.o3.avrg           predobs.o3_8hr.020713.mag
CAMx.mag.test18.wrf.alldays.o3.8hr.avrg      predobs.o3_8hr.020714.mag
CAMx.mag.test18.wrf.alldays.o3.avrg          predobs.o3_8hr.jul02.mag.test18.wrf
extstats.o3_8hr.jul02.mag.test18.wrf         predobs.o3.jul02.mag.test18.wrf
extstats.o3.jul02.mag.test18.wrf             stats.o3.020705
obsmax.020705.o3                             stats.o3.020706
obsmax.020706.o3                             stats.o3.020707
obsmax.020707.o3                             stats.o3.020708
obsmax.020708.o3                             stats.o3.020709
obsmax.020709.o3                             stats.o3.020710
obsmax.020710.o3                             stats.o3.020711
obsmax.020711.o3                             stats.o3.020712
obsmax.020712.o3                             stats.o3.020713
obsmax.020713.o3                             stats.o3.020714
obsmax.020714.o3                             stats.o3_8hr.020705.mag
obsmax.8hr.020705                            stats.o3_8hr.020706.mag
obsmax.8hr.020706                            stats.o3_8hr.020707.mag
obsmax.8hr.020707                            stats.o3_8hr.020708.mag
obsmax.8hr.020708                            stats.o3_8hr.020709.mag
obsmax.8hr.020709                            stats.o3_8hr.020710.mag
obsmax.8hr.020710                            stats.o3_8hr.020711.mag
obsmax.8hr.020711                            stats.o3_8hr.020712.mag
obsmax.8hr.020712                            stats.o3_8hr.020713.mag
obsmax.8hr.020713                            stats.o3_8hr.020714.mag

./P-ChemModels/CAMx/postproc/mag.test18.wrf.202508:
CAMx.mag.test18.wrf.010802.o3.8hr.avrg       obsmax.8hr.010811
CAMx.mag.test18.wrf.010802.o3.avrg           predobs.o3.010802
CAMx.mag.test18.wrf.010803.o3.8hr.avrg       predobs.o3.010803
CAMx.mag.test18.wrf.010803.o3.avrg           predobs.o3.010804
CAMx.mag.test18.wrf.010804.o3.8hr.avrg       predobs.o3.010805
CAMx.mag.test18.wrf.010804.o3.avrg           predobs.o3.010806
CAMx.mag.test18.wrf.010805.o3.8hr.avrg       predobs.o3.010807
CAMx.mag.test18.wrf.010805.o3.avrg           predobs.o3.010808
CAMx.mag.test18.wrf.010806.o3.8hr.avrg       predobs.o3.010809
CAMx.mag.test18.wrf.010806.o3.avrg           predobs.o3.010810
CAMx.mag.test18.wrf.010807.o3.8hr.avrg       predobs.o3.010811
CAMx.mag.test18.wrf.010807.o3.avrg           predobs.o3_8hr.010802.mag
CAMx.mag.test18.wrf.010808.o3.8hr.avrg       predobs.o3_8hr.010803.mag
CAMx.mag.test18.wrf.010808.o3.avrg           predobs.o3_8hr.010804.mag
CAMx.mag.test18.wrf.010809.o3.8hr.avrg       predobs.o3_8hr.010805.mag
CAMx.mag.test18.wrf.010809.o3.avrg           predobs.o3_8hr.010806.mag
CAMx.mag.test18.wrf.010810.o3.8hr.avrg       predobs.o3_8hr.010807.mag
CAMx.mag.test18.wrf.010810.o3.avrg           predobs.o3_8hr.010808.mag
CAMx.mag.test18.wrf.010811.o3.8hr.avrg       predobs.o3_8hr.010809.mag
CAMx.mag.test18.wrf.010811.o3.avrg           predobs.o3_8hr.010810.mag
CAMx.mag.test18.wrf.alldays.o3.8hr.avrg      predobs.o3_8hr.010811.mag
CAMx.mag.test18.wrf.alldays.o3.avrg          predobs.o3_8hr.aug01.mag.test18.wrf
extstats.o3_8hr.aug01.mag.test18.wrf         predobs.o3.aug01.mag.test18.wrf
extstats.o3.aug01.mag.test18.wrf             stats.o3.010802
obsmax.010802.o3                             stats.o3.010803
obsmax.010803.o3                             stats.o3.010804
obsmax.010804.o3                             stats.o3.010805
obsmax.010805.o3                             stats.o3.010806
obsmax.010806.o3                             stats.o3.010807
obsmax.010807.o3                             stats.o3.010808
obsmax.010808.o3                             stats.o3.010809
obsmax.010809.o3                             stats.o3.010810
obsmax.010810.o3                             stats.o3.010811
obsmax.010811.o3                             stats.o3_8hr.010802.mag
obsmax.8hr.010802                            stats.o3_8hr.010803.mag
obsmax.8hr.010803                            stats.o3_8hr.010804.mag
obsmax.8hr.010804                            stats.o3_8hr.010805.mag
obsmax.8hr.010805                            stats.o3_8hr.010806.mag
obsmax.8hr.010806                            stats.o3_8hr.010807.mag
obsmax.8hr.010807                            stats.o3_8hr.010808.mag
obsmax.8hr.010808                            stats.o3_8hr.010809.mag
obsmax.8hr.010809                            stats.o3_8hr.010810.mag
obsmax.8hr.010810                            stats.o3_8hr.010811.mag

./P-ChemModels/CAMx/postproc/mag.test60.202505:
CAMx.mag.test60.020531.o3.8hr.avrg           obsmax.8hr.020607
CAMx.mag.test60.020531.o3.avrg               predobs.o3.020531
CAMx.mag.test60.020601.o3.8hr.avrg           predobs.o3.020601
CAMx.mag.test60.020601.o3.avrg               predobs.o3.020602
CAMx.mag.test60.020602.o3.8hr.avrg           predobs.o3.020603
CAMx.mag.test60.020602.o3.avrg               predobs.o3.020604
CAMx.mag.test60.020603.o3.8hr.avrg           predobs.o3.020605
CAMx.mag.test60.020603.o3.avrg               predobs.o3.020606
CAMx.mag.test60.020604.o3.8hr.avrg           predobs.o3.020607
CAMx.mag.test60.020604.o3.avrg               predobs.o3_8hr.020531.mag
CAMx.mag.test60.020605.o3.8hr.avrg           predobs.o3_8hr.020601.mag
CAMx.mag.test60.020605.o3.avrg               predobs.o3_8hr.020602.mag
CAMx.mag.test60.020606.o3.8hr.avrg           predobs.o3_8hr.020603.mag
CAMx.mag.test60.020606.o3.avrg               predobs.o3_8hr.020604.mag
CAMx.mag.test60.020607.o3.8hr.avrg           predobs.o3_8hr.020605.mag
CAMx.mag.test60.020607.o3.avrg               predobs.o3_8hr.020606.mag
CAMx.mag.test60.alldays.o3.8hr.avrg          predobs.o3_8hr.020607.mag
CAMx.mag.test60.alldays.o3.avrg              predobs.o3_8hr.jun02.mag.test60
extstats.o3_8hr.jun02.mag.test60             predobs.o3.jun02.mag.test60
extstats.o3.jun02.mag.test60                 stats.o3.020531
obsmax.020531.o3                             stats.o3.020601
obsmax.020601.o3                             stats.o3.020602
obsmax.020602.o3                             stats.o3.020603
obsmax.020603.o3                             stats.o3.020604
obsmax.020604.o3                             stats.o3.020605
obsmax.020605.o3                             stats.o3.020606
obsmax.020606.o3                             stats.o3.020607
obsmax.020607.o3                             stats.o3_8hr.020531.mag
obsmax.8hr.020531                            stats.o3_8hr.020601.mag
obsmax.8hr.020601                            stats.o3_8hr.020602.mag
obsmax.8hr.020602                            stats.o3_8hr.020603.mag
obsmax.8hr.020603                            stats.o3_8hr.020604.mag
obsmax.8hr.020604                            stats.o3_8hr.020605.mag
obsmax.8hr.020605                            stats.o3_8hr.020606.mag
obsmax.8hr.020606                            stats.o3_8hr.020607.mag

./P-ChemModels/CAMx/postproc/mag.test60.wrf.202505:
CAMx.mag.test60.wrf.020531.o3.8hr.avrg       obsmax.8hr.020607
CAMx.mag.test60.wrf.020531.o3.avrg           predobs.o3.020531
CAMx.mag.test60.wrf.020601.o3.8hr.avrg       predobs.o3.020601
CAMx.mag.test60.wrf.020601.o3.avrg           predobs.o3.020602
CAMx.mag.test60.wrf.020602.o3.8hr.avrg       predobs.o3.020603
CAMx.mag.test60.wrf.020602.o3.avrg           predobs.o3.020604
CAMx.mag.test60.wrf.020603.o3.8hr.avrg       predobs.o3.020605
CAMx.mag.test60.wrf.020603.o3.avrg           predobs.o3.020606
CAMx.mag.test60.wrf.020604.o3.8hr.avrg       predobs.o3.020607
CAMx.mag.test60.wrf.020604.o3.avrg           predobs.o3_8hr.020531.mag
CAMx.mag.test60.wrf.020605.o3.8hr.avrg       predobs.o3_8hr.020601.mag
CAMx.mag.test60.wrf.020605.o3.avrg           predobs.o3_8hr.020602.mag
CAMx.mag.test60.wrf.020606.o3.8hr.avrg       predobs.o3_8hr.020603.mag
CAMx.mag.test60.wrf.020606.o3.avrg           predobs.o3_8hr.020604.mag
CAMx.mag.test60.wrf.020607.o3.8hr.avrg       predobs.o3_8hr.020605.mag
CAMx.mag.test60.wrf.020607.o3.avrg           predobs.o3_8hr.020606.mag
CAMx.mag.test60.wrf.alldays.o3.8hr.avrg      predobs.o3_8hr.020607.mag
CAMx.mag.test60.wrf.alldays.o3.avrg          predobs.o3_8hr.jun02.mag.test60.wrf
extstats.o3_8hr.jun02.mag.test60.wrf         predobs.o3.jun02.mag.test60.wrf
extstats.o3.jun02.mag.test60.wrf             stats.o3.020531
obsmax.020531.o3                             stats.o3.020601
obsmax.020601.o3                             stats.o3.020602
```

obsmax.020602.o3 stats.o3.020603
obsmax.020603.o3 stats.o3.020604
obsmax.020604.o3 stats.o3.020605
obsmax.020605.o3 stats.o3.020606
obsmax.020606.o3 stats.o3.020607
obsmax.020607.o3 stats.o3_8hr.020531.mag
obsmax.8hr.020531 stats.o3_8hr.020601.mag
obsmax.8hr.020601 stats.o3_8hr.020602.mag
obsmax.8hr.020602 stats.o3_8hr.020603.mag
obsmax.8hr.020603 stats.o3_8hr.020604.mag
obsmax.8hr.020604 stats.o3_8hr.020605.mag
obsmax.8hr.020605 stats.o3_8hr.020606.mag
obsmax.8hr.020606 stats.o3_8hr.020607.mag

./P-ChemModels/CAMx/preproc:
ahomap ems_hono kvpatch mm5camx tuv wrfcamx_v2.0

./P-ChemModels/CAMx/preproc/ahomap:
ahomap.mag.aug01.job ahomap.mag.jun02.job ozcol_data src
ahomap.mag.jul02.job ahomap.mag.out README

./P-ChemModels/CAMx/preproc/ahomap/ozcol_data:
L3_ozone_ept_20010802.txt L3_ozone_ept_20020531.txt L3_ozone_ept_20020707.txt
L3_ozone_ept_20010803.txt L3_ozone_ept_20020601.txt L3_ozone_ept_20020708.txt
L3_ozone_ept_20010804.txt L3_ozone_ept_20020602.txt L3_ozone_ept_20020709.txt
L3_ozone_ept_20010805.txt L3_ozone_ept_20020603.txt L3_ozone_ept_20020710.txt
L3_ozone_ept_20010806.txt L3_ozone_ept_20020604.txt L3_ozone_ept_20020711.txt
L3_ozone_ept_20010807.txt L3_ozone_ept_20020605.txt L3_ozone_ept_20020712.txt
L3_ozone_ept_20010808.txt L3_ozone_ept_20020606.txt L3_ozone_ept_20020713.txt
L3_ozone_ept_20010809.txt L3_ozone_ept_20020607.txt L3_ozone_ept_20020714.txt
L3_ozone_ept_20010810.txt L3_ozone_ept_20020705.txt
L3_ozone_ept_20010811.txt L3_ozone_ept_20020706.txt

./P-ChemModels/CAMx/preproc/ahomap/src:
ahomap.f juldate.f makefile strlen.f utmgeo.f
ahomap.lnx lcpgeo.f pspgeo.f TOMSprep.f

./P-ChemModels/CAMx/preproc/ems_hono:
ems_hono ems_hono.v12.200505.job
ems_hono.12km.v10.202507.job ems_hono.v14.202507.job
ems_hono.12km.v10.202508.job ems_hono.v14.202508.job
ems_hono.12km.v17.202505.job ems_hono.v39.202505.job
ems_hono.12km.v3.200505.job ems_hono.v9.200507.job
ems_hono.12km.v3.200507.job ems_hono.v9.200508.job
ems_hono.12km.v3.200508.job makefile
ems_hono.f

./P-ChemModels/CAMx/preproc/kvpatch:
makefile pbl_limit.f pbl_limit.o pbl_limit pbl_limit.jul02.MM5run9.lyr23.job

./P-ChemModels/CAMx/preproc/mm5camx:
mm5camx.20010802.12k.run9.out
mm5camx.20010802.4k.run9.ob70.lyr23.out
mm5camx.20010803.12k.run9.out
mm5camx.20010803.4k.run9.ob70.lyr23.out
mm5camx.20010804.12k.run9.out
mm5camx.20010804.4k.run9.ob70.lyr23.out
mm5camx.20010805.12k.run9.out
mm5camx.20010805.4k.run9.ob70.lyr23.out
mm5camx.20010806.12k.run9.out
mm5camx.20010806.4k.run9.ob70.lyr23.out
mm5camx.20010807.12k.run9.out
mm5camx.20010807.4k.run9.ob70.lyr23.out
mm5camx.20010808.12k.run9.out
mm5camx.20010808.4k.run9.ob70.lyr23.out
mm5camx.20010809.12k.run9.out
mm5camx.20010809.4k.run9.ob70.lyr23.out
mm5camx.20010810.12k.run9.out
mm5camx.20010810.4k.run9.ob70.lyr23.out
mm5camx.20010811.12k.run9.out
mm5camx.20010811.4k.run9.ob70.lyr23.out
mm5camx.20020531.12k.run5.cmaq.out
mm5camx.20020531.4k.run5.ob70.lyr23.out
mm5camx.20020601.12k.run5.cmaq.out
mm5camx.20020601.4k.run5.ob70.lyr23.out
mm5camx.20020602.12k.run5.cmaq.out
mm5camx.20020602.4k.run5.ob70.lyr23.out
mm5camx.20020603.12k.run5.cmaq.out
mm5camx.20020603.4k.run5.ob70.lyr23.out
mm5camx.20020604.12k.run5.cmaq.out
mm5camx.20020604.4k.run5.ob70.lyr23.out
mm5camx.20020605.12k.run5.cmaq.out
mm5camx.20020605.4k.run5.ob70.lyr23.out
mm5camx.20020606.12k.run5.cmaq.out
mm5camx.20020606.4k.run5.ob70.lyr23.out
mm5camx.20020607.12k.run5.cmaq.out
mm5camx.20020607.4k.run5.ob70.lyr23.out
mm5camx.20020705.12k.run9.out
mm5camx.20020705.4k.run9.cmaq.lyr23.out
mm5camx.20020706.12k.run9.out
mm5camx.20020706.4k.run9.cmaq.lyr23.out
mm5camx.20020707.12k.run9.out
mm5camx.20020707.4k.run9.cmaq.lyr23.out
mm5camx.20020708.12k.run9.out
mm5camx.20020708.4k.run9.cmaq.lyr23.out
mm5camx.20020709.12k.run9.out
mm5camx.20020709.4k.run9.cmaq.lyr23.out
mm5camx.20020710.12k.run9.out
mm5camx.20020710.4k.run9.cmaq.lyr23.out
mm5camx.20020711.12k.run9.out
mm5camx.20020711.4k.run9.cmaq.lyr23.out
mm5camx.20020712.12k.run9.out
mm5camx.20020712.4k.run9.cmaq.lyr23.out
mm5camx.20020713.12k.run9.out
mm5camx.20020713.4k.run9.cmaq.lyr23.out
mm5camx.20020714.12k.run9.out
mm5camx.20020714.4k.run9.cmaq.lyr23.out
mm5camx.mag.aug01.run9.cmaq.job
mm5camx.mag.aug01.run9.ob70.lyr23.job
mm5camx.mag.jul02.run9.cmaq.job
mm5camx.mag.jul02.run9.cmaq.lyr23.job
mm5camx.mag.jun02.run5.cmaq.job
mm5camx.mag.jun02.run5.ob70.lyr23.job
src

./P-ChemModels/CAMx/preproc/mm5camx/src:
clddiag.f interp_lcp.f kvcalc_tke.f mm5camx.f readmm5.f xtod.f
fields.inc juldate.f lcpgeo.f mm5camx.linuxstats.f interp_cart.f
kvcalc_cmaq.f makefile param.inc utmgeo.f interp_geo.f kvcalc_ob70.f
micromet.f README vertmap.f

./P-ChemModels/CAMx/preproc/tuv:
DATAE1 DATAS1 tuv4.0_1.mag.jul02.job tuv.inp tuv.out
DATAJ1 src tuv4.0_1.mag.jun02.job tuv.jun02.inp DATAJ2
tuv4.0_1.mag.aug01.job tuv4.0_1.mag.out tuv.jun02.out

./P-ChemModels/CAMx/preproc/tuv/DATAE1:
ATM GRIDS NO2 O2 O3 SO2 SUN wmo85

./P-ChemModels/CAMx/preproc/tuv/DATAE1/ATM:
atmmod.afglmw.100 ussa.dens ussa.ozone ussa.temp

./P-ChemModels/CAMx/preproc/tuv/DATAE1/GRIDS:
isaksen.grid kockarts.grid

./P-ChemModels/CAMx/preproc/tuv/DATAE1/NO2:
NO2_jpl94.abs NO2_ncar_00.abs

./P-ChemModels/CAMx/preproc/tuv/DATAE1/O2:
O2_jpl94.abs O2_src.abs

./P-ChemModels/CAMx/preproc/tuv/DATAE1/O3:
o3absqs.dat O3_bass.abs O3.molina.abs

./P-ChemModels/CAMx/preproc/tuv/DATAE1/SO2:
SO2.abs SO2xs.all

./P-ChemModels/CAMx/preproc/tuv/DATAE1/SUN:
a.out extsol.flx neckel.flx susim_hi.flx atlas3_1994_317_a.dat fort.20
nicolarv.flx susim_lo.flx atlas3.old lowsun3.flx solstice.flx t.f
demerj.flx modtran1.flx sunlean.flx wmo85.flx

./P-ChemModels/CAMx/preproc/tuv/DATAJ1:
ABS CB_2002 CH3CHO CH3COCHO CHLORINE IUPAC04
SAPRC97 YLD C2H5CHO CH2O CH3COCH3 CH3OOH
CHOCHO RONO2 SAPRC99

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/ABS:
BrONO2_jpl97.abs H2O2_lin.abs HNO2_jpl92.abs
CCl2O_jpl94.abs H2O_jpl94.abs HNO3.abs
CCl4_jpl94.abs Halon-1202_jpl94.abs HNO3_burk.abs
CClFO_jpl94.abs Halon-1202_jpl97.abs HNO4.abs
CF2O_jpl94.abs Halon-1211_jpl94.abs HNO4_jpl92.abs
CFC-113_jpl94.abs Halon-1211_jpl97.abs HO2_jpl94.abs
CFC-114_jpl94.abs Halon-1301_jpl94.abs ISPD_carter.abs
CFC-115_jpl94.abs Halon-1301_jpl97.abs n011.abs
CFC-11_jpl94.abs Halon-2402_jpl94.abs n011_cp.abs
CFC-12_jpl94.abs Halon-2402_jpl97.abs N2O5.abs
CH3Br_jpl94.abs HCFC-123_jpl94.abs N2O5_jpl97.abs
CH3CCl3_jpl94.abs HCFC-124_jpl94.abs N2O_jpl94.abs
CH3Cl_jpl94.abs HCFC-141b_jpl94.abs NO3_gj78.abs
CHBr3.abs HCFC-142b_jpl94.abs NO3_jpl85.abs
CHBr3.jpl97 HCFC-225ca_jpl94.abs NO3_jpl94.abs
ClONO2_jpl97.abs HCFC-225cb_jpl94.abs PAN_senum.abs
HCFC-22_jpl94.abs PAN_talukdar.abs ClOO_jpl94.abs
HCFCs_orl.abs PAN_talukdar.abs.notmp H2O2_jpl94.abs
HNO2_jpl85.abs

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/C2H5CHO:
C2H5CHO_iup.abs C2H5CHO_iup.yld

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/CB_2002:
Acro.cqy H2o2.cqy Hchos.cqy Hono_no.cqy No3no2.cqy O3o1d.cqy
Ccho.cqy Hchor.cqy Hono_no2.cqy No2.cqy No3no.cqy O3o3p.cqy

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/CH2O:
CH2O_can_hr.abs CH2O_iupac1.abs CH2O_jpl97.dat
CH2O_rog.abs CH2O_can_lr.abs CH2O_iupac.yld
CH2O_nbs.abs CH2O_ii_mad.yld CH2O_jpl94.abs
CH2O_nbs_moor.ave CH2O_i_mad.yld CH2O_jpl94.yld
CH2O_ncar.abs

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/CH3CHO:
CH3CHO_iup.abs CH3CHO_mar.abs d021_cp.abs d021_ii.yld
CH3CHO_iup.yld CH3CHO_press.yld d021_iii.yld d021_i.yld

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/CH3COCH3:
CH3COCH3_cp.abs CH3COCH3_iup.yld CH3COCH3_noaa.yld
CH3COCH3_iup.abs CH3COCH3_noaa.abs

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/CH3COCHO:
CH3COCHO_iup1.abs CH3COCHO_km.yld CH3COCHO_ncar.abs
CH3COCHO_iup2.abs

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/CH3OOH:
CH3OOH_ct.abs CH3OOH_jpl85.abs CH3OOH_jpl94.abs
CH3OOH_jpl97.abs CH3OOH_iup.abs CH3OOH_jpl92.abs
CH3OOH_ma.abs

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/CHLORINE:
cb4+_cl2_23feb04.tgz Cl2.txt HCOCl.txt HOCl.txt

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/CHOCHO:
CHOCHO_iup.abs

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/IUPAC04:

```
HCHO_H2.phf  HNO3.phf     HONO.phf     MGLY.760     N2O5.phf     O3_O1D.phf
PAN.phf      HCHO_H.phf   HO2NO2.phf   MGLY.0       MGLY.phf     NTR.phf
O3_O3P.phf   raw_data

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/IUPAC04/raw_data:
HCHO_H2.phi  HCHO_H.phi   HCHO.sig     O3_O1D.phi   O3_O3P.phi   O3.sig1      O3.sig2

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/RONO2:
CH3ONO2_cp.abs             CH3ONO2_lib.abs            CH3ONO2_tay.abs
PAN_talukdar.abs.notmp     CH3ONO2_iup1.abs           CH3ONO2_rat.abs
PAN_senum.abs              CH3ONO2_iup2.abs           CH3ONO2_tal.abs
PAN_talukdar.abs

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/SAPRC97:
ACET-93C.PHFBZCHO.PHF    GLYOXAL2.PHF               HONO.PHF     MEGLYOX2.PHF
O3O1D.PHF    ACROLEIN.PHF              CCHOR.PHF    H2O2.PHF     ISPD.PHF
NO2.PHF      O3O3P.PHF    AFG1.PHF     CO2H.PHF     HCHONEWM.PHF
KETONE.PHF   NO3NO2.PHF   RCHO.PHF     AFG2.PHF     GLYOXAL1.PHF
HCHONEWR.PHF              MEGLYOX1.PHF              NO3NO.PHF

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/SAPRC99:
ACETONE.PHF               COOH.PHF     HNO3.PHF     KETONE.PHF   O3O1D.PHF
ACROLEIN.PHF              GLY_ABS.PHF HO2NO2.PHF   MGLY_ABS.PHF
O3O3P.PHF                 BACL_ADJ.PHF              GLY_R.PHF
HONO-NO2.PHF              MGLY_ADJ.PHF              saprc99.notzip
BZCHO.PHF                 H2O2.PHF                  HONO-NO.PHF
NO2.PHF                   C2CHO.PHF                 HCHO_M.PHF
IC3ONO2.PHF               NO3NO2.PHF                CCHO_R.PHF
HCHO_R.PHF                ISPD.PHF                  NO3NO.PHF

./P-ChemModels/CAMx/preproc/tuv/DATAJ1/YLD:
N2O5.qy    NO2_calvert.yld    O3.param_jpl97.yld    O3.param.yld    O3_shetter.yld

./P-ChemModels/CAMx/preproc/tuv/DATAJ2:
IUPAC        KFA

./P-ChemModels/CAMx/preproc/tuv/DATAJ2/IUPAC:
c2h5ono2.abs  ch3o2no2.abs  ch3ooh.abs    n_c3h7ono2.abs
ch3co3no2.abs ch3ono2.abs   i_c3h7ono2.abs

./P-ChemModels/CAMx/preproc/tuv/DATAJ2/KFA:
c2h5cho.001  ch3cho.002   ch3cho.004   ch3cho.006   ch3cocho.002  ch3cocho.004
ch3cho.001   ch3cho.003   ch3cho.005   ch3cocho.001 ch3cocho.003  chocho.001

./P-ChemModels/CAMx/preproc/tuv/DATAS1:
acgih.1992   dna.setlow.new ery.anders  phaeo.bio    proro.bio    rbm.501      SCUP-h

./P-ChemModels/CAMx/preproc/tuv/src:
addpnt.f     gridz.f      pbiol1.f     rdso2xs.f    setair.f     sjo2.f
d1mach.netlib.f inter1.f  pchem.f      read1.f      setalb.f     sphers.f
fchap.f      inter2.f     ps2str.f     read2.f      setcld.f     sundis.f
fery.f       inter3.f     psndo.f      rn.f         setno2.f     tuv.f
fsum.f       inter4.f     rdetfl.f     rtlink.ps2str.f seto2.f   tuv.lnx
futr.f       lymana.f     rdno2xs.f    rtlink.psndo.f setozo.f   zenith.f
gridck.f     Makefile     rdo2xs.f     schu.f       setso2.f     zero1.f
gridw.f      params       rdo3xs.f     setaer.f     settmp.f     zero2.f

./P-ChemModels/CAMx/preproc/wrfcamx_v2.0:
camx_fields.f90lcpgeo.f90  vertmap.f90   wrfcamx.linux   camx_fields.mod
libnetcdf.a    wrfcamx.aug01.test13.04km.job wrf_fields.f90
clddiag.f90    makefile    wrfcamx.aug01.test13.12km.job wrf_fields.mod
interp_lcp.f90 micromet.f90 wrfcamx.f90  wrf_netcdf.f90  juldate.f90
netcdf.inc     wrfcamx.jul02.test11.04km.job  wrf_netcdf.mod kvcalc_cmaq.f90
README         wrfcamx.jul02.test11.12km.job  kvcalc_ob70.f90
readwrf.f90    wrfcamx.jun02.test12.04km.job  kvcalc_tke.f90  stats.f90
wrfcamx.jun02.test12.12km.job

./P-ChemModels/CAMx/runfiles:
camx.mag.200505.test14.omp.job          camx.mag.202505.test60.omp.job
camx.mag.200505.test14.wrf.omp.job      camx.mag.202505.test60.wrf.omp.job
camx.mag.200507.test11.omp.job          camx.mag.202507.test18.omp.job
camx.mag.200507.test11.wrf.omp.job      camx.mag.202507.test18.wrf.omp.job
camx.mag.200508.test11.omp.job          camx.mag.202508.test18.omp.job
camx.mag.200508.test11.wrf.omp.job      camx.mag.202508.test18.wrf.omp.job

./P-ChemModels/CAMx/src.v4.4:
src.v4.4.tar

./P-ChemModels/CMAQ:
data         lib          models       run          setcase

./P-ChemModels/CMAQ/data:
bcon         cctm         ICBC         icon         mag_emis

./P-ChemModels/CMAQ/data/bcon:
cmaq-mm5     cmaq-wrf

./P-ChemModels/CMAQ/data/bcon/cmaq-mm5:
test3nest.zip

./P-ChemModels/CMAQ/data/bcon/cmaq-wrf:
test18nest.zip   test19nest.zip   test20nest.zip

./P-ChemModels/CMAQ/data/cctm:
cmaq-mm5     cmaq-wrf

./P-ChemModels/CMAQ/data/cctm/cmaq-mm5:
test3_aug2001  test3_jul2025  test3nest_aug2005        test3nest_jun2002
test3_aug2005  test3_jun2002  test3nest_aug2025        test3nest_jun2005
test3_aug2025  test3_jun2005  test3nest_jul2002        test3nest_jun2025
test3_jul2002  test3_jun2025  test3nest_jul2005        test3_jul2005
test3nest_aug2001             test3nest_jul2025

./P-ChemModels/CMAQ/data/cctm/cmaq-mm5/test3_aug2001:
cb5_aqACONC.2001214  cb5_aqACONC.2001218  cb5_aqACONC.2001222
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./P-ChemModels/CMAQ/data/cctm/cmaq-mm5/test3_jul2025:
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cb5_aqACONC.2002188  cb5_aqACONC.2002192
cb5_aqACONC.2002189  cb5_aqACONC.2002193

./P-ChemModels/CMAQ/data/cctm/cmaq-mm5/test3_jun2002:
cb5_aqACONC.2002152  cb5_aqACONC.2002155  cb5_aqACONC.2002158
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cb5_aqACONC.2002154  cb5_aqACONC.2002157

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cb5_aqACONC.2002153  cb5_aqACONC.2002156

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cb5_aqACONC.2002153  cb5_aqACONC.2002156

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cb5_aqACONC.2002153  cb5_aqACONC.2002156

./P-ChemModels/CMAQ/data/cctm/cmaq-wrf:
test18_jul2002     test18nest_jul2025       test19nest_aug2025       test20nest_jun2005
test18_jul2005     test19_aug2001           test20_jun2002           test20nest_jun2025
test18_jul2025     test19_aug2005           test20_jun2005
test18nest_jul2002  test19nest_aug2001      test20_jun2025
test18nest_jul2005  test19nest_aug2005      test20nest_jun2002

./P-ChemModels/CMAQ/data/cctm/cmaq-wrf/test18_jul2002:
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cb5_aqACONC.2002189  cb5_aqACONC.2002193
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cb5_aqACONC.2002189 cb5_aqACONC.2002193

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cb5_aqACONC.2002188 cb5_aqACONC.2002192
cb5_aqACONC.2002189 cb5_aqACONC.2002193

./P-ChemModels/CMAQ/data/cctm/cmaq-wrf/test18nest_jul2025:
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cb5_aqACONC.2002188 cb5_aqACONC.2002192
cb5_aqACONC.2002189 cb5_aqACONC.2002193

./P-ChemModels/CMAQ/data/cctm/cmaq-wrf/test19_aug2001:
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cb5_aqACONC.2001216 cb5_aqACONC.2001220
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./P-ChemModels/CMAQ/data/cctm/cmaq-wrf/test20_jun2002:
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cb5_aqACONC.2002153 cb5_aqACONC.2002156

./P-ChemModels/CMAQ/data/ICBC:
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./P-ChemModels/CMAQ/data/icon:
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ICON_test18_MCIP_MNA_4km_2005_2002186 ICON_test20_MCIP_MNA_4km_2025_2002151
ICON_test18_MCIP_MNA_4km_2025_2002186 ICON_test3_MCIP_MNA_4km_2005_2001214
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CMAQ_4km_2025.zip

./P-ChemModels/CMAQ/lib:
lib.tar

./P-ChemModels/CMAQ/models:
models.tar

./P-ChemModels/CMAQ/run:
scripts

./P-ChemModels/CMAQ/run/scripts:
bcon cctm GRIDDESC_12km GRIDDESC_4km
icon jproc mcip

./P-ChemModels/CMAQ/run/scripts/bcon:
BCON_test2 cfg.test2 test19nest test3nest
bldit.bcon.test2 test18nest test20nest

./P-ChemModels/CMAQ/run/scripts/bcon/test18nest:
run_test18_186.bcon run_test18_2005.bcon run_test18_2025.bcon

./P-ChemModels/CMAQ/run/scripts/bcon/test19nest:
run_test19_aug2005.bcon run_test19_aug2025.bcon run_test19_aug.bcon

./P-ChemModels/CMAQ/run/scripts/bcon/test20nest:
run_test20_2005.bcon run_test20_2025.bcon run_test20.bcon

./P-ChemModels/CMAQ/run/scripts/bcon/test3nest:
BCON_test2 run_test3_186_2005.bcon run_test3_214_2025.bcon
run_test3_151_2005.bcon run_test3_186_2025.bcon run_test3_214.bcon
run_test3_151_2025.bcon run_test3_186.bcon run_test3_151.bcon
run_test3_214_2005.bcon

./P-ChemModels/CMAQ/run/scripts/cctm:
bldit.cctm.test6 CCTM_test6 cmaq-mm5 bldit.cctm.test6.log cfg.test6 cmaq-wrf

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-mm5:
test3_aug2001 test3_jul2025 test3nest_aug2005 test3nest_jun2002
test3_aug2005 test3_jun2002 test3nest_aug2025 test3nest_jun2005
test3_aug2025 test3_jun2005 test3nest_jul2002 test3nest_jun2025
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./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-mm5/test3_aug2005:
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./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-mm5/test3_aug2025:
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CCTM_test3 run_test3nest_186.cctm

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run_test3nest_jul2005.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-mm5/test3nest_jul2025:
run_test3nest_jul2025.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-mm5/test3nest_jun2002:
run_test3nest_151.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-mm5/test3nest_jun2005:
run_test3nest_jun2005.cctm

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run_test3nest_jun2025.cctm

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test18_jul2002 test18nest_jul2025 test19nest_aug2005
test20nest_jun2002 test18_jul2005 test19_aug2001
test19nest_aug2025 test20nest_jun2005 test18_jul2025
test19_aug2005 test20_jun2002 test20nest_jun2025
test18nest_jul2002 test19_aug2025 test20_jun2005
test18nest_jul2005 test19nest_aug2001 test20_jun2025

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test18_jul2002:
run_test18_186.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test18_jul2005:
run_test18_jul2005.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test18_jul2025:
run_test18_jul2025.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test18nest_jul2002:
run_test18nest_186.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test18nest_jul2005:
run_test18nest_jul2005.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test18nest_jul2025:
run_test18nest_jul2025.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test19_aug2001:
run_test19.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test19_aug2005:
run_test19_aug2005.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test19_aug2025:
run_test19_aug2025.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test19nest_aug2001:
run_test19nest.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test19nest_aug2005:
run_test19nest_aug2005.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test19nest_aug2025:
run_test19nest_aug2025.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test20_jun2002:
run_test20.cctm

./P-ChemModels/CMAQ/run/scripts/cctm/cmaq-wrf/test20_jun2005:
run_test20_jun2005.cctm

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run_test20_jun2025.cctm

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run_test20nest.cctm

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run_test20nest_jun2025.cctm

./P-ChemModels/CMAQ/run/scripts/icon:
bldit.icon.test2 ICON_test2 test19nest test3nest
cfg.test2 test18nest test20nest

./P-ChemModels/CMAQ/run/scripts/icon/test18nest:
run.icon_test18_186 run.icon_test18_186_2005 run.icon_test18_186_2025

./P-ChemModels/CMAQ/run/scripts/icon/test19nest:
run.icon_test19_214 run.icon_test19_214_2005 run.icon_test19_214_2025

./P-ChemModels/CMAQ/run/scripts/icon/test20nest:
run.icon_test20_151 run.icon_test20_151_2005 run.icon_test20_151_2025

./P-ChemModels/CMAQ/run/scripts/icon/test3nest:
ICON_test2 run.icon_test3_186 run.icon_test3_214_2005
run.icon_test3_151 run.icon_test3_186_2005 run.icon_test3_214_2025
run.icon_test3_151_2005 run.icon_test3_186_2025 run.icon_test3_151_2025
run.icon_test3_214

./P-ChemModels/CMAQ/run/scripts/jproc:
bldit.jproc.test3 cfg.test3.old jproc_test3_186.log
bldit.jproc.test3.log JPROC_test3 jproc_test3_214.log
BLD.test3 jproc_test3_151.log run_test3.jproc

./P-ChemModels/CMAQ/run/scripts/jproc/BLD.test3:
calczen.F interp.f pntavg.f readprof.f setalb.f_orig twostr.f
cfg.test3.bld jproc.F readcsqy.F readtoms.f setcld.f chj.f
JVALPARMS.EXT readet.f setaer.f srband.f index2.f
o3scal.f reado2.f setair.f subgrid.F intavg.f optics.f
reado3.f setalb.f tridiag.f

./P-ChemModels/CMAQ/run/scripts/mcip:
mm5 wrf

./P-ChemModels/CMAQ/run/scripts/mcip/mm5:
200108 200205 200207

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200108:
run9

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200108/run9:
MCIP_MNA_12km MCIP_MNA_4km

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200108/run9/MCIP_MNA_12km:
namelist.mcip run.log run.mcip_aug01_12k

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200108/run9/MCIP_MNA_4km:
namelist.mcip run.log run.mcip_aug01_4k

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200205:
run5

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200205/run5:
MCIP_MNA_12km MCIP_MNA_4km_PBLmax

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200205/run5/MCIP_MNA_12km:
namelist.mcip run.log run.mcip_may02_12k

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200205/run5/MCIP_MNA_4km_PBLmax:
namelist.mcip namelist.mcip_ddep run.mcip_may02_4k

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200207:
run9

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200207/run9:
MCIP_MNA_12km MCIP_MNA_12km_PBL2 MCIP_MNA_4km

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200207/run9/MCIP_MNA_12km:
namelist.mcip run.log run.mcip_jul02_12k

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200207/run9/MCIP_MNA_12km_PBL2:
fort.10 fort.4 namelist.mcip run.log.PBL2.DEP2
fort.11 fort.8 run.log.PBL1.DEP1 run.log.PBL2.DEP3
fort.2 fort.9 run.log.PBL2.DEP1 run.mcip_jul02_12k

./P-ChemModels/CMAQ/run/scripts/mcip/mm5/200207/run9/MCIP_MNA_4km:
namelist.mcip run.log run.log_2nd run.mcip_jul02_4k run.mcip_jul02_4k_1st

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200108 200205 200207

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200108:
wrf_test13

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200108/wrf_test13:
MCIP_MNA_12km_ddep MCIP_MNA_4km_ddep

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200108/wrf_test13/MCIP_MNA_12km_ddep:
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run0802.log run.mcip_Aug01_12k_0802 run.log run.mcip_Jul02_12k

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200108/wrf_test13/MCIP_MNA_4km_ddep:
namelist.mcip run.mcip_Aug01_4k run.mcip_Jul02_4k_0705
run0802.log run.mcip_Aug01_4k_0802 run.log run.mcip_Jul02_4k

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200205:
wrf_test12

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200205/wrf_test12:
MCIP_MNA_12km_ddep MCIP_MNA_4km_ddep

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200205/wrf_test12/MCIP_MNA_12km_ddep:
namelist.mcip run.log run.mcip_may02_12k_0531 run0531.log run.mcip_may02_12k

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200205/wrf_test12/MCIP_MNA_4km_ddep:
namelist.mcip run0531.log run.log run.mcip_may02_4k run.mcip_may02_4k_0531

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200207:
wrf_test11

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200207/wrf_test11:
MCIP_MNA_12km_ddep MCIP_MNA_4km_ddep

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200207/wrf_test11/MCIP_MNA_12km_ddep:
namelist.mcip run.log run.mcip_Jul02_12k_0705 run0705.log run.mcip_Jul02_12k

./P-ChemModels/CMAQ/run/scripts/mcip/wrf/200207/wrf_test11/MCIP_MNA_4km_ddep:
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APPENDIX II

DOMAIN AND DATA BASE ISSUES

Section II does not have appendix.

APPENDIX III

MODEL PERFORMANCE EVALUATION

Appendix III-i

Model Performance Evaluation by Subgroup

In addition to the Model Performance Evaluation (MPE) for all monitoring sites as a whole, supplemental MPE was conducted for two meaningful subgroups, which are urban and suburban sites as shown in Figure 1. These subgroups were defined by their characteristics of a diurnal pattern. The diurnal variations of ozone at the suburban sites are much weaker and ozone concentrations remains high (above 50 ppb at some sites) at nighttime, while the urban sites show strong diurnal variations of ozone and low ozone concentrations at nighttime. MPE results for the June, July, and August episodes are presented in Tables 1 through 3, respectively.

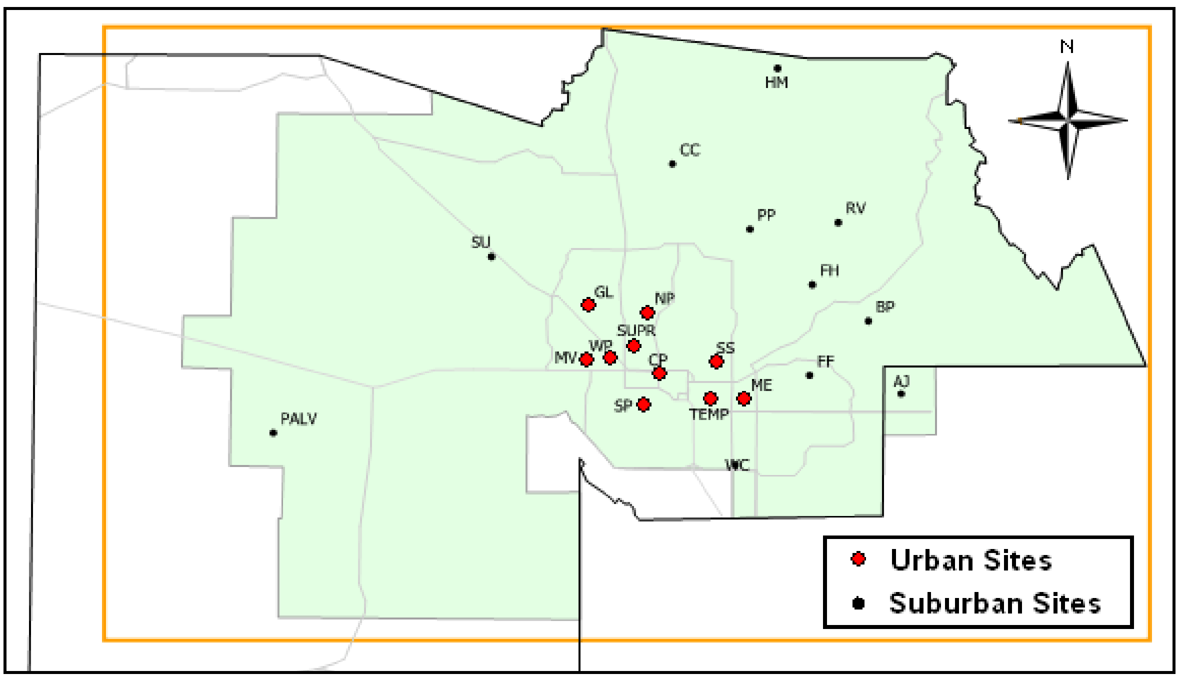

Figure 1. Monitoring sites by subgroup; 10 urban sites and 11 suburban sites

Table 1. Summary of statistical modeling performance evaluation for the June 2002 episode (eight-hour ozone with a 60 ppb threshold)

Group	Statistical Measure	EPA Standard	CAMx Simulations				
			6/3/02	6/4/02	6/5/02	6/6/02	6/7/02
All	(A)	± 15%	-25.1%	-3.3%	7.8%	0.2%	-8.6%
	(B)	< 35%	25.1%	7.9%	9.8%	8.0%	10.3%
	(C)	± 20%	-28.6%	1.0%	7.7%	-1.8%	-2.8%
Urban	(A)	± 15%	-28.7%	-2.5%	4.0%	1.0%	-12.6%
	(B)	< 35%	28.7%	7.1%	8.5%	5.9%	12.9%
	(C)	± 20%	-13.2%	16.8%	17.1%	6.4%	1.8%
Suburban	(A)	± 15%	-23.8%	-3.6%	9.3%	-0.2%	-6.2%
	(B)	< 35%	23.8%	8.2%	10.3%	9.0%	8.8%
	(C)	± 20%	-28.6%	1.0%	7.7%	-1.8%	-2.8%

Table 2. Summary of statistical modeling performance evaluation for the July 2002 episode (eight-hour ozone with a 60 ppb threshold)

Group	Statistical Measure	EPA Standard	CAMx Simulations						
			7/8/02	7/9/02	7/10/02	7/11/02	7/12/02	7/13/02	7/14/02
All	(A)	± 15%	-5.8%	-25.7%	-22.3%	-30.1%	-23.4%	-16.3%	-21.0%
	(B)	< 35%	9.0%	25.8%	23.8%	30.4%	23.5%	16.4%	21.0%
	(C)	± 20%	2.5%	-17.0%	-16.9%	-20.6%	-17.0%	-8.0%	-8.6%
Urban	(A)	± 15%	-0.2%	-21.8%	-26.5%	-36.1%	-28.5%	-17.6%	-28.8%
	(B)	< 35%	0.5%	21.8%	26.9%	36.1%	28.5%	17.6%	28.8%
	(C)	± 20%	22.6%	-17.0%	-16.9%	-20.6%	-3.6%	4.1%	5.3%
Suburban	(A)	± 15%	-6.0%	-29.1%	-18.7%	-25.4%	-19.9%	-15.6%	-17.3%
	(B)	< 35%	9.3%	29.3%	21.1%	25.9%	20.2%	15.7%	17.3%
	(C)	± 20%	2.5%	3.3%	-16.5%	-4.8%	-17.0%	-8.0%	-8.6%

Table 3. Summary of statistical modeling performance evaluation for the August 2001 episode (eight-hour ozone with a 60 ppb threshold)

	Statistical Measure	EPA Standard	CAMx Simulations						
			8/5/01	8/6/01	8/7/01	8/8/01	8/9/01	8/10/01	8/11/01
All	(A)	± 15%	-43.8%	-27.5%	-22.4%	-12.6%	-38.9%	-33.5%	-20.2%
	(B)	< 35%	43.8%	27.5%	22.4%	19.0%	38.9%	33.9%	20.2%
	(C)	± 20%	-22.2%	-12.1%	-12.5%	17.2%	-24.8%	-13.7%	3.0%
Urban	(A)	± 15%	-49.7%	-37.5%	-25.6%	n/a*	-47.6%	-48.9%	-14.9%
	(B)	< 35%	49.7%	37.5%	25.6%	n/a*	47.6%	48.9%	14.9%
	(C)	± 20%	-21.4%	-12.1%	-0.9%	n/a*	-14.9%	-3.1%	3.0%
Suburban	(A)	± 15%	-39.4%	-20.6%	-21.3%	-12.6%	-34.2%	-23.8%	-25.3%
	(B)	< 35%	39.4%	20.6%	21.3%	19.0%	34.2%	24.5%	25.3%
	(C)	± 20%	-22.2%	-3.9%	-12.5%	17.2%	-24.8%	-13.7%	5.4%

* Since the minimum concentration threshold is 60 ppb, one day predicting peak eight-hour ozone values lower than 60 ppb for all urban sites could not be evaluated. This is indicated as “n/a”.

APPENDIX IV

EMISSIONS INVENTORY DEVELOPMENT

Appendix IV-i

Development of Regional 12 km Emissions Inventory Data

ENVIRON

MEMORANDUM

To: Cathy Arthur, MAG Air Quality Modeling Program Manager

From: Gerard Mansell and Abby Hoats

Date: 19 December 2005

Subject: MAG Contract No. 245, Task Order #3:
Development of Regional 12-km Emissions Inventory Data

Introduction

In August 2005, ENVIRON provided the Maricopa Association of Governments (MAG) with recommendations regarding the development of air quality modeling approaches and databases for ozone and PM modeling efforts. These recommendations were the result of the Task 1 Scoping Study for the project and are documented in a Technical Memorandum dated August 19, 2005 (Emery, et al., 2005). Based on a review of these recommendations, and in consultation with the MAG project manager, regional emission inventory data and EPS3 processing scripts were developed based on the WRAP 2002 inventory data. Use of the WRAP emissions data in the EPS3 processing system requires a number of data processing and re-formatting steps to be completed. These efforts are documented in this Technical Memorandum, which also provides a brief overview of the EPS3 emission processing system, and describes the development of the inventory databases, EPS3 run scripts and auxiliary data specifically for MAG's regional modeling application. The MAG regional 12-km modeling domain is displayed in Figure 1.

Note that under this project task, ENVIRON is to develop and deliver to MAG all the necessary input data files and run scripts for application of the EPS3 emissions processing system to generate regional 12-km emissions data. MAG staff will be running EPS3 to generate the CAMx "model-ready" emissions files. However, ENVIRON was compelled to run through the entire EPS3 set-up as a quality assurance (QA) procedure to ensure that the converted inventory was consistent, fully populated, and all necessary cross-references were being correctly applied such that emissions were not inadvertently dropped, and that EPS3 run scripts were set up correctly.

Also note that ENVIRON did not complete a comprehensive quality assurance of the emissions data, given that the raw inventory estimates have been through a number of QA steps during the development of the WRAP regional modeling inventories. We emphasize, however, that such a major QA process is warranted and should be completed by MAG staff prior to using these emissions data in air quality modeling efforts.

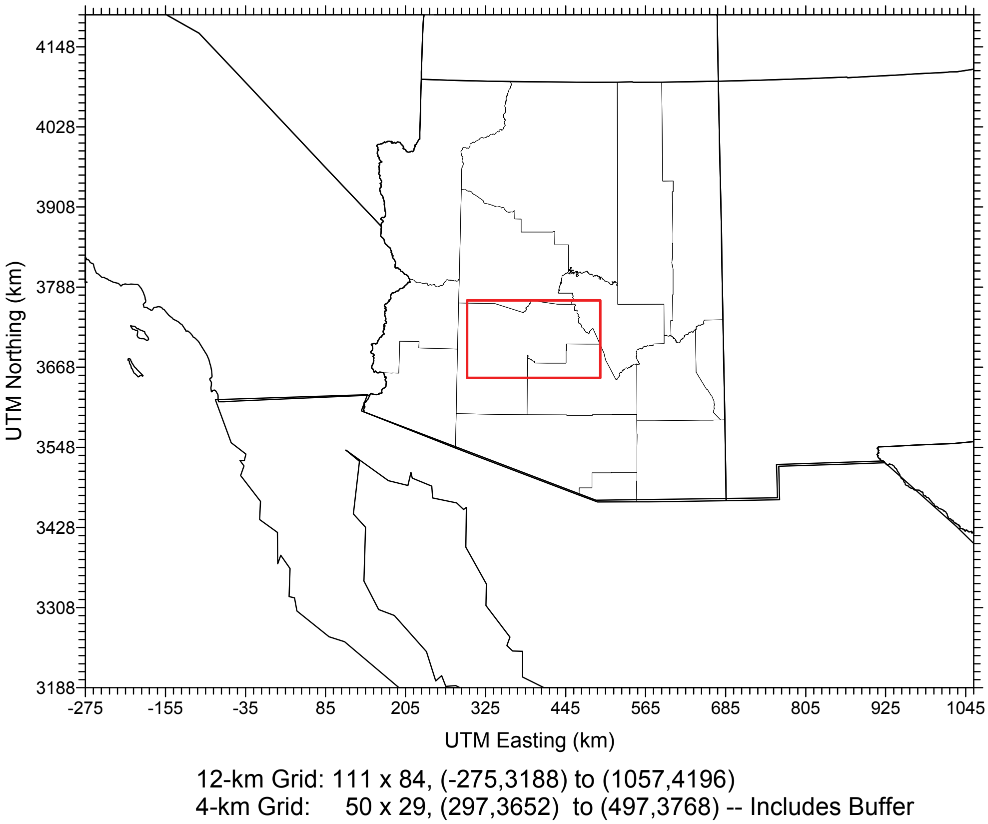

Figure 1. MAG 12-km Regional Modeling Domain

Emissions Modeling Overview

The CAMx model requires two types of emission input files:

- Surface emissions from area, mobile, off-road, low-level point and biogenic sources are processed and gridded to the modeling domain grid system. The surface emissions are injected into the lowest layer of the model.
- Elevated emissions from major point sources are injected into the air quality modeling domain at the coordinates of each source. The plume rise for each source is calculated within the air quality model. Plume rise calculations are based on stack parameters and local meteorology and the emissions are injected into the appropriate vertical layer.

Emissions for different major source groups (e.g., on-road mobile, off-road mobile, area, point and biogenic) are usually processed separately and merged together. This approach simplifies the processing and facilitates quality assurance (QA) and reporting tasks. The biogenic emissions are usually prepared using a different model because they are based on different input data and have specialized processing requirements (e.g., dependence on vegetative landcover distribution, temperature, solar radiation and drought conditions).

The emissions model performs several tasks to generate air quality model-ready emissions inputs:

- Temporal adjustments: Adjust emission rates for seasonal, day-of-week and hour-of-day effects.
- Chemical speciation: Emission estimates for total VOC are converted to the more detailed chemical speciation used by the specific chemical mechanism of the air quality model. Total unspeciated NOx emissions are allocated to NO and NO_2 components.
- Gridding: The spatial resolution of the emissions must be matched to the modeling grid(s). Area sources are often estimated at the county level, and are allocated to the grid cells within each county based on spatial surrogates (e.g., population and economic activity). Mobile source emissions may be link specific (from transportation models) so links must be allocated to grid cells.
- Growth and Controls: Emissions estimated for one year may need to be adjusted for use in a different year. Inventories for future years and/or control scenarios typically include the effects of growth and controls.
- Quality Assurance: The emissions models include QA and reporting features to keep track of the adjustments at each processing stage and ensure that data integrity is not compromised.

The outputs from the emissions model are called the "model-ready" emissions, and are day-specific, gridded, speciated and temporally (hourly) allocated.

Regional Emission Inventory Processing for MAG

The development of emissions inventories and input data for MAG's 12-km regional modeling domain were developed for Version 3 of the Emission Processing System (EPS3). ENVIRON provided MAG staff with on-site EPS3 training in October 2005. Emission inventory modeling using EPS3 is briefly summarized below. The following discussion is focused on the development of emissions data for use in the Comprehensive Airquality Model with extensions (CAMx), to be used in MAG's air quality modeling efforts. Data sources and modeling specifics related to MAG's air quality modeling efforts are described in the next section.

Emission Inventory Estimates

As with most emissions processing systems, EPS3 accepts regional or county level emission estimates for criteria pollutants. Emissions estimates are typically provided on an annual basis. Often seasonal, monthly or episodic estimates are used when available. Emissions are provided by detailed source categories specifying the particular processes and, where appropriate, fuels associated with the activity generating the emissions. Mobile source categorization also includes vehicle/engine and roadway types. The detailed source categorization is specified using Standard Industrial Classification (SIC) or Source Category Codes (SCC). These specifications are used to further disaggregate the emission estimates chemically, temporally and spatially.

Chemical Speciation

Emission estimates for total VOC must be converted to the more detailed chemical speciation used by the Carbon Bond 4 (CB4) chemical mechanism in CAMx. Total unspeciated NOx emissions are allocated to NO and NO2 components.

The overall accuracy of the emission inventory is affected by the speciation of criteria pollutants, especially VOC emissions. The VOC speciation of the emission inventory should match what is present in the ambient VOC data. Uncertainties in the emission inventory, including chemical speciation, affect the accuracy of the resulting modeling inventory and, in turn, the results of the air quality model simulation.

The EPS3 emissions model includes default speciation profiles by SIC/SCC codes. These profiles are based on EPA default data as well as various updates and improvements incorporated to account for such effects as variations in fuels, solvent composition, and chemical mechanisms used in the air quality models.

Temporal Allocation

Annual, or seasonal/monthly, emission estimates must be temporally allocated to the specific time period of the air quality model simulation. Annual estimates are first allocated to each month of the year, then to each day of the week for each month. Finally, the daily estimates are allocated to each hour of the day. The temporal allocation of emissions estimates is accomplished using temporal profiles referenced to SCCs. The temporal profile/SCC cross-references are determined by the specific activity generating the emissions.

The EPS3 emissions model includes default temporal profiles by SIC/SCC codes. These profiles are based on EPA default data as well as various updates and improvements based on revised or specific information for a given source category.

Spatial Allocation

The spatial resolution of the emissions must be matched to the CAMx grid(s) for air quality modeling. Area and off-road mobile sources are estimated at the county level, and are allocated to the grid cells within each county based on spatial surrogates (e.g., population and economic activity). Link specific mobile source emissions (from transportation models) also must be allocated to grid cells when available. Stationary point source emissions are spatially allocated based on geographic coordinates.

Spatial allocation of regional or county-level emission estimates is accomplished through the use of spatial surrogates or spatial allocation factors (SAFs) for each emission source category or group of source categories. Spatial surrogates are typically based on the proportion of a known region-wide characteristic variable that exists within the region of interest. Traditionally, the development of spatial gridding surrogates for dispersion modeling applications has been performed by a variety of methods depending on the emission source category being considered, the required spatial resolution, the geographic extent of the domain, and the particular characteristics of the geospatial data available. The same spatial allocation methodologies can also be applied to general arbitrary regions. Spatial surrogates must define the percentage of regional or county level emissions from a particular source category that is to be allocated to some spatial region, typically a modeling grid cell. For most area and off-road sources, these percentages are based on areas of a particular land use/land cover type while for on-road mobile source categories, the percentages are usually based on total length of a certain road type or a transportation network. Often human population is also used as a spatial surrogate for certain emission source categories. The processing and development of gridding surrogates is usually performed using a Geographic Information System (GIS).

Details regarding the development of input data and EPS3 processing steps specific to MAG's modeling efforts are described below. These include the development of raw criteria pollutant inventory data, development of appropriate chemical speciation and temporal allocation profiles and cross-reference files, and development of spatial allocation factors and gridding surrogates for the MAG 12-km modeling domain

Inventory Development and Data Sources

As noted previously, the development of regional emission inventories for MAG were based on the 2002 WRAP emission inventory. Regional emission inventories currently in use by WRAP were developed using the SMOKE emissions processing system for modeling domains based on the Inter-RPO Lambert Conformal Projection (LCP) coordinate system. Development of the 2002 WRAP emission inventory is documented in Adelman and Holland, 2004. Initially, the MAG regional inventories were to be generated by converting all the appropriate SMOKE data and auxiliary input files (chemical speciation and temporal profiles and cross-references) into the specific formats required by EPS3. However, due to various technical issues and limited time and budget resources, only the raw inventory data from the WRAP SMOKE modeling were converted for input to EPS3. The EPS3 temporal and chemical speciation profiles and cross-reference data were reviewed and updated for the current inventory development effort. In addition, the MAG regional modeling domain is based on a Universal Transverse Mercator (UTM) projection system (Figure 1), requiring the development of new spatial gridding surrogates specific to the MAG modeling grid and the development of regional biogenic emissions.

<u>Conversion of SMOKE Inventory Data for EPS3</u>

Annual (and seasonal/monthly) county-level emissions estimates used in the SMOKE processing system are available in ASCII IDA formatted data files. These data contain all the necessary information required for application of EPS3. Processing utilities were developed using Perl to re-format these data into AFS (point sources) and AMS (area and mobile sources) formatted data files for input to EPS3.

The specific WRAP emissions data files used in the development of the MAG regional emission inventory are summarized in Table 1.

Table 1. Summary of emissions data sources.

Category	Region	WRAP/SMOKE Data File
On-Road Mobile	US	SMOKE_2002OR_summer_nonCA.081205.ida
	California	SMOKE_2002OR_summer_CA.081205.ida
	Texas	ida_mv_nei99v2.emis
	Mexico	mbinv.BRAVO_Mexico99_ida.txt
Off-Road Mobile	US	nrinv_wrap2002_nonCA_sum_060705.ida
		nrinv_wrap2002_Comm_Marine_inshore_annual_tpd_080205.ida
		nrinv_wrap2002_Aircraft_sum_080205.ida
		nrinv_wrap2002_locomotive_annual_tpd_080205.ida
	California	nrinv_CA2003_sum_120403.ida.txt
		nrinv.CA_shipping03_v1_ida.txt
	Texas	CENRAP_NONROAD_SMOKE_INPUT_ANN_071305.txt
	Mexico	nrinv_aircraft.BRAVO_Mexico99_ida.txt
		nrinv_locomotive.BRAVO_Mexico99_ida.txt
		nrinv.BRAVO_Mexico99_ida.txt
Area	US	arinv_nodust_wrap2002_081205.ida.txt
		SMOKE_2002_OilGas_annual_tpd_082505rev.ida
	California	OilGas_CA_2002_annual.ida
	Texas	arinv_nodust_ref_nh3_cenrap2002_081705.ida.txt
	Mexico	arinv_nodust.BRAVO_Mexico99_ida.txt
Stationary Point	US	WRAP_Point_Inventory_States-rev20050908.txt
	Texas	CENRAP_POINT_SMOKE_INPUT_ANNUAL_DAILY_072505.txt
	Mexico	ptinv.BRAVO_Mexico99_ida.txt

Point Sources

Point source data were obtained from different sources, processed separately and merged prior to modeling. The data include:

- WRAP states point sources
- Texas point sources
- Mexico point sources

The point source data were converted from the SMOKE IDA format to EPS3 AFS formats. Only annual emission estimates were used even in cases where CEM data were available. This approach was taken because MAG will be modeling episodes in 2001 and 2002, whereas the CEM data is specific to 2002. The annual emissions estimates are provided for a summer weekday, Saturday and Sunday.

On-Road Mobile Sources

On-road mobile source data were obtained from different sources, processed separately and merged prior to modeling. The data include:

- WRAP states (except California) on-road mobile sources
- California on-road mobile sources
- Texas on-Road mobile sources
- Mexico on-road mobile sources

For non-California WRAP states, on-road mobile source county-level emission estimates were developed by ENVIRON on a seasonal basis. California mobile emissions were obtained from the ARB as summer season county-level estimates. The SMOKE IDA files for the summer season were converted to EPS3 AMS formats and processed as average day emissions. Mobile source emissions for the two Texas counties within the modeling domain were based on the 1999 NEI data and adjusted to 2002 using growth factors obtained from EGAS. Texas mobile source emissions were provided as annual emissions for processing within EPS3.

Mexico on-road mobile source emissions were obtained on a state/municipality level and processed as area sources. The Mexico emission inventory data is for 1999. Due to a lack of growth factor information, no attempt was made to project these data to the 2001/2002 base years.

County-level mobile source estimates are provided to EPS3 as area sources for spatially allocation using roadway lengths.

Off-Road Mobile Sources

Off-road mobile source emissions data were obtained from different sources, processed separately and merged prior to modeling. The data include:

- WRAP states (except CA) off-road sources
- California off-road sources
- California off-shore shipping sources
- Texas off-road sources
- WRAP states commercial marine sources
- WRAP states locomotive sources
- WRAP states aircraft sources
- Mexico off-road sources
- Mexico locomotive sources
- Mexico aircraft sources

All off-road emissions estimates were converted from the SMOKE IDA formats to EPS3 AMS formats for processing in EPS3. WRAP off-road emission sources, except locomotive and aircraft, are provided as summer average day estimates. Commercial marine and California shipping emissions are provided as annual emissions estimates. Texas off-road emissions were obtained from the CENRAP SMOKE IDA files, converted to AFS formats for processing as annual estimates in EPS3.

Mexico off-road mobile source emissions were obtained on a state/municipality level for EPS3 processing as area sources. The Mexico emission inventory data is for 1999. Due to a lack of growth factor information, no attempt was made to project these data to the 2001/2002 base years.

Area Sources

Area source emissions data were obtained from different sources, processed separately and merged prior to modeling. The data include:

- WRAP states area sources
- Texas area sources
- Mexico area sources
- WRAP states (except CA) Oil and Gas emissions sources
- California Oil and Gas emissions sources

All area source emissions were converted from the SMOKE IDA formats to EPS3 AMS formats for processing as annual estimates in EPS3.

Chemical Speciation

As noted previously, the development of emissions modeling inputs for MAG was to be achieved by converting and re-formatting the SMOKE data files for use in EPS3. Chemical speciation within SMOKE is based on Total Organic Gas (TOG) rather than Volatile Organic Compound (VOC). Because the raw emission estimates are in terms of VOC, an additional conversion from VOC to TOG is necessary in SMOKE prior to chemical speciation. In EPS3, speciation profiles are based on VOC, and therefore no additional conversion is necessary. Due to the limited resources, and numerous unknown cross-references in the SMOKE TOG/VOC data files, the SMOKE speciation profiles and cross-references were not used. Instead, the existing profiles and cross-reference data in EPS3 were reviewed, updated and applied for the current inventory. There were a limited number of emission records in the raw SMOKE inventory data that did not have cross-referenced speciation profiles in the EPS3 data files. These emissions were speciated using the default profiles in EPS3, which represent an average across all existing profiles.

Temporal Allocation

Temporal profiles used in the SMOKE emissions processing system are based on EPA defaults. In addition, the SMOKE temporal profiles and cross-reference data files are in a format compatible with EPS3. Nevertheless, the existing EPS3 temporal profiles and cross-references data were used in the development of the MAG regional emission inventory.

In Table 1, emissions data filenames include specifiers indicting the temporal period of the data. As seen, raw inventory data were provided on a variety of temporal periods (annual, monthly, seasonal) for certain source categories. As SMOKE IDA files may contain both annual and average day emission estimates, the most appropriate data set for the MAG episodes (summers of 2001/2002) were included for EPS3 processing. This required separate EPS3 run streams to be used for annual and average day emissions estimates.

Spatial Allocation and Surrogate Development

The MAG and WRAP regional modeling domains are based on different coordinate projections systems and therefore the existing SMOKE spatial gridding surrogates could not be used for the MAG inventory development. In addition, the SMOKE and EPS3 systems use different data structures to cross-reference gridding surrogate codes to SCCs for spatial allocation. Therefore, spatial allocation information from the SMOKE systems was not used. Instead, spatial gridding surrogates specific to the MAG modeling domain were developed. Surrogate/SCC cross-reference files corresponding to the MAG gridding surrogates were also developed independently of the SMOKE data.

Spatial surrogates were developed from several sources of spatial data describing the Land Use/Land Cover (LULC), transportation networks and population characteristics. Land use data were obtained from the USGS EROS Data Center web site (http://edcftp.cr.usgs.gov/pub/data/landcover/states) and are a subset of the National Land Cover Dataset (NLCD). This dataset provides dominant land use data for each state at a spatial resolution of 30 meters. The dataset includes 21 LULC categories based on a Modified Anderson Level 2 categorization scheme (Table 2). These data form the basis of the GIS data layers used by the EPA in the development of emissions surrogates. These data were also used in the development of gridding surrogates for SMOKE. The EPA has also assembled GIS data layers based on the 2000 US Census. These include population and housing statistics and transportation networks from the TIGER Line data files. These data were also used in the development of gridding surrogates for use in the SMOKE system. In addition to the spatial gridding surrogates derived from these data, the SMOKE system includes several more detailed surrogates based on economic and business statistics. While the raw data used for developing these more detailed surrogates are available to ENVIRON, the limited time and budget resources precluded their use in the current inventory.

Table 2. NLCD Land Cover classification codes.

Code	Description
11	Open Water
12	Perennial Ice/Snow
21	Low Intensity Residential
22	High Intensity Residential
23	Commercial/Industrial/Transportation
31	Bare Rock/Sand/Clay
32	Quarries/Strip Mines/Gravel Pits
33	Transitional
41	Deciduous Forest
42	Evergreen Forest
43	Mixed Forest
51	Shrubland

Code	Description
61	Orchards/Vineyards/Other
71	Grasslands/Herbaceous
81	Pasture/Hay
82	Row Crops
83	Small Grains
84	Fallow
85	Urban/Recreational Grasses
91	Woody Wetlands
92	Emergent Herbaceous Wetlands

Spatial allocation of Mexican emissions were based on the North American Land Cover database, transportation networks from the GIS Data Depot (data.geocomm.com) and population statistics from the Global Change Master Directory - Goddard Space Flight Center (ftp://ftp.ciesin.org/pub/data/Mexico)

The North America Land Cover (NALC) for the year 2000 (Latifovic, et al. 2002) was developed jointly by the Natural Resources Canada - Canada Centre for Remote Sensing and the USGS EROS Data Center as part of the larger Global Land Cover 2000 project implemented by the Global Vegetation Monitoring Unit, Joint Research Center (JRC) of the European Commission. The data are available as GIS raster datasets for each continent, in a geodetic coordinate system and can be obtained from the project website at http://www.gvm.sai.jrc.it/glc2000/ProductGLC2000.htm. The land use classification scheme includes 29 separate categories as presented in Table 3.

The MAG regional modeling domain includes a 4-km grid, centered over Maricopa County, nested within the regional 12-km grid. Gridding surrogate data files for Maricopa County at 4-km resolution were provide by MAG staff. These were incorporated into the development of regional 12-km gridding surrogates. Because the classification of LULC data within Maricopa County differed from that available for the regional domain, surrogate/SCC cross-reference assignments specific to the county were included in the EPS3 cross-reference files developed for this task. All other counties within the US use a common set of surrogate cross-references. In addition, Mexican emissions are processed with gridding surrogates and cross-references specific to the databases used.

Table 3. NALC 2000 LULC classification scheme.

Code	Description
1	Tropical or Sub-tropical Broadleaved Evergreen Forest - Closed Canopy
2	Tropical or Sub-tropical Broadleaved Deciduous Forest - Closed Canopy
3	Temperate or Sub-polar Broadleaved Deciduous Forest - Closed Canopy
4	Temperate or Sub-polar Needleleaved Evergreen Forest - Closed Canopy
5	Temperate or Sub-polar Needleleaved Evergreen Forest - Open Canopy
6	Temperate or Sub-polar Needleleaved Mixed Forest - Closed Canopy
7	Temperate or Sub-polar Mixed Broadleaved or Needleleaved Forest - Closed Canopy
8	Temperate or Sub-polar Mixed Broaddleleaved or Needleleaved Forest - Open Canopy
9	Temperate or Subpolar Broadleaved Evergreen Shrubland - Closed Canopy
10	Temperate or Subpolar Broadleaved Deciduous Shrubland - Open Canopy
11	Temperate or Subpolar Needleleaved Evergreen Shrubland - Open Canopy
12	Temperate or Sub-polar Mixed Broadleaved and Needleleaved Dwarf-Shrubland - Open Canopy
13	Temperate or Subpolar Grassland
14	Temperate or Subpolar Grassland with a Sparse Tree Layer
15	Temperate or Subpolar Grassland with a Sparse Shrub Layer
16	Polar Grassland with a Sparse Shrub Layer
17	Polar Grassland with a Dwarf-Sparse Shrub Layer
18	Cropland
19	Cropland and Shrubland/woodland
20	Subpolar Needleleaved Evergreen Forest Open Canopy - lichen understory
21	Unconsolidated Material Sparse Vegetation (old burnt or other disturbance)
22	Urban and Built-up
23	Consolidated Rock Sparse Vegetation
24	Water bodies
25	Burnt area (resent burnt area)
26	Snow and Ice
27	Wetlands
28	Herbaceous Wetlands
29	Tropical or Sub-tropical Broadleaved Evergreen Forest - Open Canopy

Surrogates used in the development of the US portion of the gridded emission inventory are presented in Table 4. Table 5 presents the surrogates used for the Mexican portion of the domain.

Table 4. Spatial surrogates codes and definitions used for emission inventory development (US)

MAG EPS3 Gridding Surrogates		
Surrogate Code	**GIS Data Codes**	**Description**
1	MAG1	Housing (Occupied)
2	MAG2	Industrial
3	MAG3	Non-Industrial

MAG EPS3 Gridding Surrogates		
Surrogate Code	GIS Data Codes	Description
4	MAG4	Undeveloped - Total
5	MAG5	Developed - Total
6	MAG6	Construction
7	MAG7	Agricultural - Stockyards
8	MAG8	Agricultural - Other
9	MAG9	Non-developable Forest
10	MAG10	Railroads
11	MAG11	Landfill
12	MAG12	Water
13	MAG13	Golf Courses
14	MAG14	Airports
15	21,22,23,31,32,33,41,42,43,51,61,71,81,82,83,84,85,91,92	Non-water Land Area
16	100	Population
17	110	Housing
18	120	Urban Population
19	130	Rural Population
20	1	Urban Primary Roads
21	2	Rural Primary Roads
22	3	Urband Secondary Roads
23	4	Rural Secondary Roads
24	1,2,3,4	Total Roads
25	N/A	Railroads
26	1,3	Urban Roads (Primary & Secondary)
27	2,4	Rural Roads (Primary & Secondary)
28	1,2	Primary Roads (Urban & Rural)
29	3,4	Secondary Roads (Urban & Rural)
30	N/A	Airports
31	N/A	Ports
32	N/A	Golf Courses
33	11,12	Water
34	21,22,23	Urban Land
35	31,32,33,41,42,43,51,61,71,81,82,83,84,85,91,92	Rural Land
36	21,22	Total Residential
37	22	High Density Residential
38	21	Low Density Residential
39	61,81,82,83,84	Agricultural Land - Total
40	81,82,83,84	Agricultural Land (w/o Orchards & Vineyards)
41	61	Orchards & Vineyards
42	32	Strip Mines/Quarries
43	23	Commercial/Industrial/Transportation
44	41,42,43	Forest
45	85	Urban & Recreational Grasses

Table 5. Spatial surrogates codes and definitions used for emission inventory development (Mexico)

MAG EPS3 Gridding Surrogates		
Surrogate Code	**GIS Data Codes**	**Description**
1	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,22,21,23,25,26,27,28,29	Non-water Land Area
2	N/A	Population
3	N/A	Roadways
4	N/A	Railways
5	22	Urban Land Area
6	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,23,25,26,27,28,29	Rural Land Area
7	1,2,3,4,5,6,7,8,29	Forest
8	18,19	Agricultural Land Area
9	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,20,22,21,23,25,26,27,28,29	Non-agricultural Land Area
10	24	Water Bodies

Biogenic Sources

Biogenic emissions were prepared using the GloBEIS model (Yarwood et al., 1999, Guenther et al., 2002). The GloBEIS model was developed by the National Center for Atmospheric Research and ENVIRON under sponsorship from the Texas Commission on Environmental Quality (TCEQ). Biogenic emissions developed using GloBEIS have been used previously for air quality modeling in East Texas (Yarwood et al., 2001) as well as other regions throughout the US.

GloBEIS is based on the EPA BEIS2 model with the following improvements:

- Updated emission factor algorithm (called the BEIS99 algorithm).
- Compatible with the EPA's BELD3 landuse/landcover (LULC) database.
- Ability to use solar radiation data for photosynthetically active radiation (PAR).
- Options to model leaf temperature, the effects of drought, and prolonged periods of high temperature.
- Ability to use satellite-based leaf area index (LAI) data to determine the spatial distribution of emission and/or leaf age.

The latest version of GloBEIS (version 3.1) requires input data for LULC, temperature, and solar radiation. It optionally accepts humidity, wind speed and drought index, as well as additional leaf area, age and temperature parameters. Briefly, the required data types and sources are:

- LULC: EPA BELD3 data (US EPA, 2001).
- Temperature: Gridded, hourly data from the MM5 meteorological model.
- Solar radiation: Hourly PAR based on GOES satellite data (GEWEX, 2005).

The LULC, temperature and PAR datasets were obtained for the time periods included in the three MAG episodes, and GloBEIS 3.1 was executed for the 12km and 4km modeling domains. Based on an evaluation of drought data for the region, it was determined that including this effect in the biogenic emission inventory was not warranted. Limited time and resources restricted the use of other model features pertaining to the leaf area index and the leaf temperature. Thus, only the basic GloBEIS 3.1 model parameters were employed to calculate day-specific, gridded, speciated, hourly emissions of biogenic VOCs and NOx.

EPS3 Processing Scripts

For the application of EPS3, the following directory structure was developed for emissions processing. The emissions inventory tar file contains a top directory called eps3/. Under the top directory are the following sub-directories:

`data/`	Regional inventory data
`inputs/`	“userin”, profiles and cross-reference files
`jobs/`	
`jobs/area/`	Area source run scripts
`jobs/mv/`	Mobile source run scripts
`jobs/pts/`	Stationary point source run scripts
`jobs/mrguam/`	EPS3 MRGUAM run scripts
`grdsrg/`	Area, off-road and mobile spatial surrogate files
`emiss/`	Component and final gridded emissions files
`embr/`	EPS3 EMBR files
`emar/`	EPS3 EMAR (error) files
`msg/`	EPS3 Message files
`src/`	EPS3 FORTRAN source code

All EPS3 jobs scripts are set-up and referenced to the directory structure. In general, the scripts can be run in any order, except for the “mrguam” script which must be run last to merge all anthropogenic emissions into t single file. “mrguam” is also used to merge anthropogenic and biogenic emissions to obtain a complete model-ready surface emissions data file.
Due to limited resources only a minimal amount of quality assurance was performed. This included the testing of all run scripts and reviewing all message files to ensure there were no dropped emissions due to incorrect cross-reference information. Gridding surrogate data files were also reviewed for completeness. Emissions totals after each stage of the emission processing were also review to ensure no emissions were inadvertently dropped between processing stages. Spatial displays were produced from each emissions category to check for reasonableness and completeness as were the final merged anthropogenic emission data files.

Emission Summaries

Emission inventory summaries of emissions from major source categories for a typical 2002 summer weekday are presented below. Emission density plots of NOx, VOC and CO for the low-level anthropogenic emissions are also presented for the MAG 12-km regional modeling domains.

Tables 6 through 7 present emission summaries by major source type for all counties in Arizona for NOx, VOC and CO, respectively. Tables 8 through 11 summarize the gridded emissions by major source type by state for NOx, VOC and CO, respectively.

All emission estimates in the tables presented below reflect gridded, model ready emissions. This means that for partial counties and/or states at the edge of a modeling domain, only the portion of emissions that is within the modeling domain is reported.

Emission density plots of low-level anthropogenic emissions of NOx, VOC and CO are presented in Figures 2 through 4, respectively. Displayed are typical weekday emissions on MAG 12-km regional modeling domain.

Table 6. 2002 weekday NOx emissions summary for Arizona Counties (tons/day)

NOx Emisisons (tons/day)						
County	FIPS	Area	On-road Mobile	Off-road Mobile	Stationary Points	Total Anthropogenic
Apache	4001	0.22	12.53	8.76	0.34	**21.86**
Cochise	4003	0.34	20.66	10.43	0.11	**31.54**
Coconino	4005	0.48	22.18	19.68	0.36	**42.70**
Gila	4007	0.25	4.92	1.32	0.00	**6.49**
Graham	4009	0.09	2.83	1.15	0.00	**4.07**
Greenlee	4011	0.03	0.48	0.23	0.01	**0.75**
La Paz	4012	0.08	9.07	2.95	0.00	**12.10**
Maricopa	4013	8.81	0.00	83.89	0.55	**93.25**
Mohave	4015	0.74	26.00	18.90	0.20	**45.84**
Navajo	4017	0.32	16.90	9.25	0.24	**26.71**
Pmia	4019	3.07	54.73	18.49	0.13	**76.41**
Pinal	4021	0.96	25.65	10.07	0.38	**37.06**
Santa Cruz	4023	0.14	5.79	0.78	0.00	**6.70**
Yavapai	4025	0.95	25.94	8.69	0.00	**35.57**
Yuma	4027	0.31	16.32	11.41	0.07	**28.10**
Total	**4000**	**16.77**	**244.00**	**205.99**	**2.39**	**469.15**

Table 7. 2002 weekday VOC emissions summary for Arizona Counties (tons/day)

VOC Emissions (tons/day						
County	FIPS	Area	On-road Mobile	Off-road Mobile	Stationary Points	Total Anthropogenic
Apache	4001	4.13	8.85	4.22	7.86	**25.07**
Cochise	4003	6.71	18.33	2.41	1.79	**29.24**
Coconino	4005	8.88	16.87	14.50	10.14	**50.39**
Gila	4007	4.11	5.85	11.83	0.53	**22.31**
Graham	4009	2.59	3.34	0.73	0.00	**6.66**
Greenlee	4011	0.57	0.51	0.24	2.71	**4.04**
La Paz	4012	2.10	8.16	13.74	0.02	**24.02**
Maricopa	4013	149.73	0.00	107.25	6.34	**263.32**
Mohave	4015	9.37	23.72	30.95	4.62	**68.65**
Navajo	4017	6.35	14.59	2.25	5.64	**28.83**
Pmia	4019	47.76	43.11	19.86	15.11	**125.84**
Pinal	4021	11.71	25.57	2.52	4.70	**44.50**
Santa Cruz	4023	4.47	5.43	2.91	0.00	**12.82**
Yavapai	4025	9.10	20.63	4.60	3.45	**37.79**
Yuma	4027	12.03	16.61	9.65	0.24	**38.53**
Total	**4000**	**279.6262**	**211.5857**	**227.6569**	**63.1512**	**782.02**

Table 8. 2002 weekday CO emissions summary for Arizona Counties (tons/day)

CO Emissions (tons/day)						
County	FIPS	Area	On-road Mobile	Off-road Mobile	Stationary Points	Total Anthropogenic
Apache	4001	1.96	98.60	18.09	104.26	**222.91**
Cochise	4003	1.83	187.18	20.22	22.43	**231.65**
Coconino	4005	5.90	182.83	69.96	110.99	**369.68**
Gila	4007	2.50	56.35	38.49	0.97	**98.32**
Graham	4009	1.06	31.36	5.15	0.00	**37.57**
Greenlee	4011	0.65	5.02	1.84	0.89	**8.40**
La Paz	4012	0.46	94.89	48.10	0.13	**143.59**
Maricopa	4013	18.05	0.00	1432.21	8.22	**1458.47**
Mohave	4015	12.44	241.44	152.96	3.58	**410.40**
Navajo	4017	5.18	152.67	17.65	65.46	**240.96**
Pmia	4019	6.49	376.28	321.79	19.96	**724.52**
Pinal	4021	20.16	259.27	24.91	1.68	**306.02**
Santa Cruz	4023	0.94	54.93	17.82	0.01	**73.70**
Yavapai	4025	15.93	219.27	43.74	17.15	**296.09**
Yuma	4027	0.91	165.36	59.39	1.55	**227.20**
Total	**4000**	**94.4355**	**2125.4447**	**2272.3187**	**357.277**	**4849.48**

Table 9. 2002 weekday NOx emissions summary by State (tons/day)

NOx Emissions (tons/day)					
State	**Area**	**On-road Mobile**	**Off-road Mobile**	**Stationary Points**	**Total Anthropogenic**
Arizona	16.77	244.00	205.99	2.39	**469.15**
California	182.14	833.55	549.98	9.82	**1575.49**
Colorado	6.43	13.86	13.64	0.00	**33.93**
Nevada	4.73	68.99	60.02	1.08	**134.82**
New Mexico	142.22	154.60	91.75	0.10	**388.67**
Texas	3.62	51.20	20.60	11.60	**87.02**
Utah	1.12	20.16	7.08	0.02	**28.39**
Mexico	30.60	198.30	7.68	0.00	**236.58**
Total	**387.64**	**1584.66**	**956.74**	**25.02**	**2954.06**

Table 10. 2002 weekday VOC emissions summary by State (tons/day)

VOC Emissions (tons/day)					
State	**Area**	**On-road Mobile**	**Off-road Mobile**	**Stationary Points**	**Total Anthropogenic**
Arizona	279.63	211.59	227.66	63.15	**782.02**
California	697.70	473.79	255.53	229.94	**1656.96**
Colorado	7.93	10.24	9.47	7.93	**35.56**
Nevada	36.10	70.28	46.88	8.83	**162.09**
New Mexico	247.02	92.97	41.41	76.96	**458.36**
Texas	19.83	36.70	13.08	2.16	**71.77**
Utah	15.59	12.88	12.26	2.62	**43.36**
Mexico	303.00	369.10	1.79	1.80	**675.69**
Total	**1606.79**	**1277.55**	**608.08**	**393.39**	**3885.80**

Table 11. 2002 weekday CO emissions summary by State (tons/day)

CO Emissions (tons/day)					
State	**Area**	**On-road Mobile**	**Off-road Mobile**	**Stationary Points**	**Total Anthropogenic**
Arizona	94.44	2125.44	2272.32	357.28	**4849.48**
California	302.10	4897.10	2050.37	207.75	**7457.32**
Colorado	1.63	122.82	68.34	16.00	**208.78**
Nevada	3.49	600.40	597.51	138.98	**1340.39**
New Mexico	57.93	1131.48	408.68	330.28	**1928.38**
Texas	3.53	373.10	199.67	6.37	**582.67**
Utah	4.49	163.46	91.09	2.87	**261.91**
Mexico	43.30	2994.60	10.67	11.60	**3060.17**
Total	**510.91**	**12408.41**	**5698.65**	**1071.14**	**19689.10**

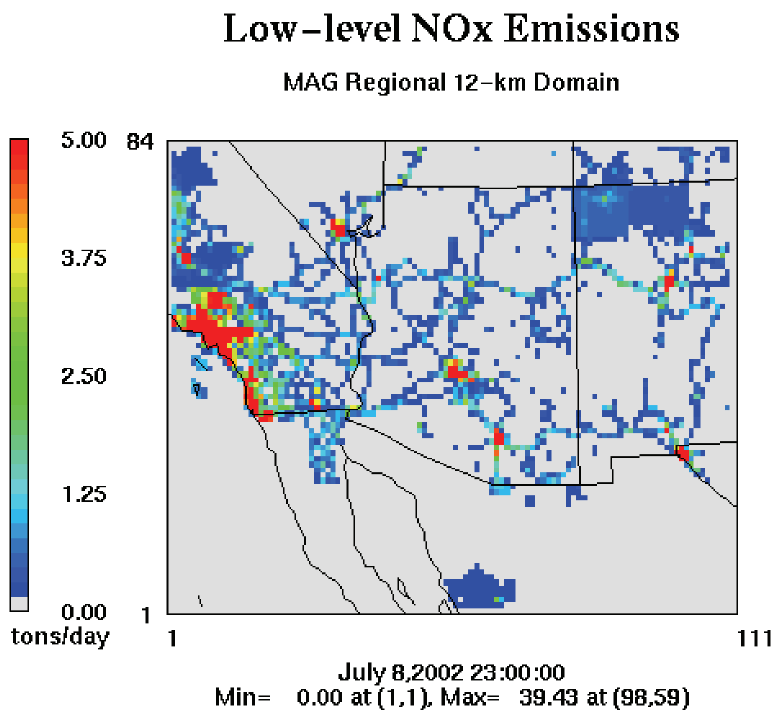

Figure 2. Anthropogenic NOx emissions (tpd)

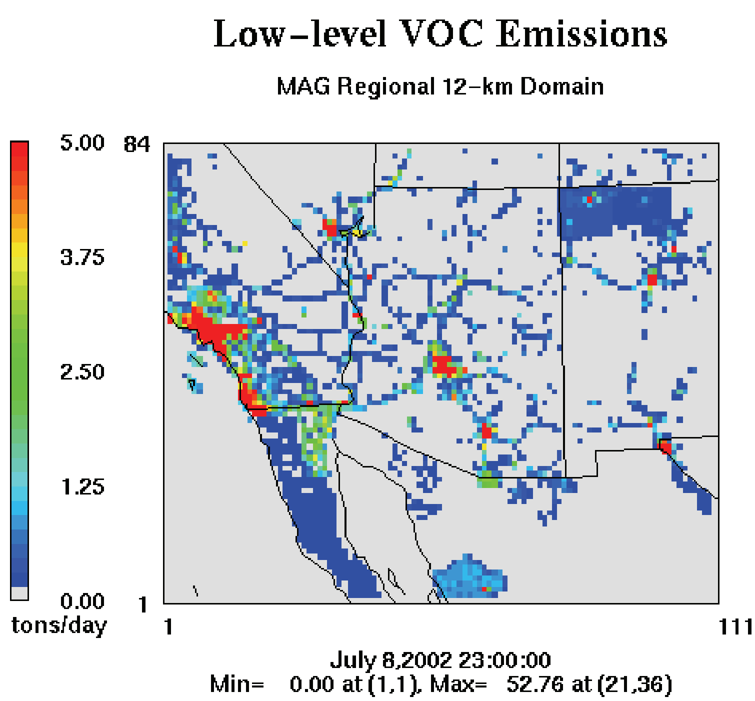

Figure 3. Anthropogenic VOC emissions (tpd)

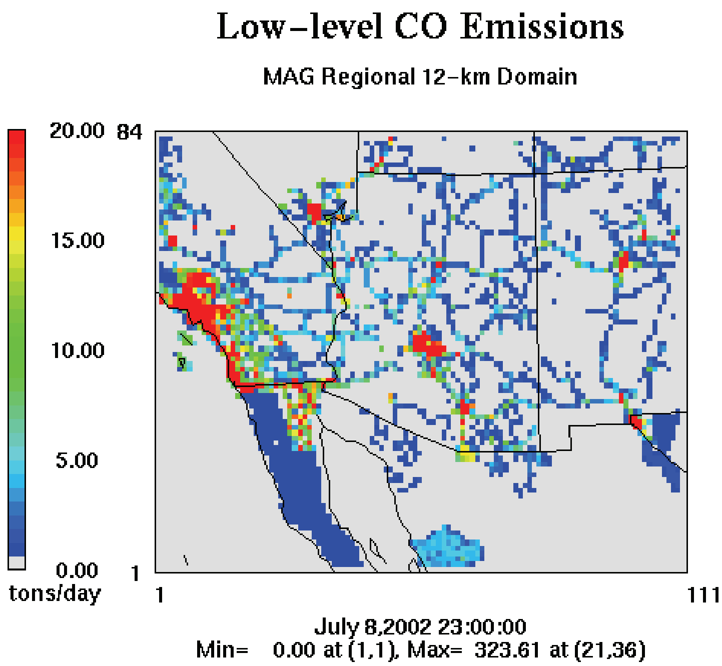

Figure 4. Anthropogenic CO emissions (tpd)

References

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Appendix IV-ii

On-Road Vehicle Emission Factor Estimation Procedure for 2005

Appendix IV-ii is followed by an attachment containing a sample of the MOBILE6.2 input files for 2005.

ONROAD VEHICLE EMISSION FACTOR ESTIMATION PROCEDURE FOR 2005

Emission Factor Model

Hydrocarbons in the form of volatile organic compounds (VOCs), carbon monoxide (CO), and oxides of nitrogen (NOx) vehicle exhaust emission factors were calculated using MOBILE6.2, a model developed by the Environmental Protection Agency (EPA) for the purpose of estimating motor vehicle emission factors. The MOBILE6.2 runs were executed by the Maricopa Association of Governments (MAG). The contact person for the MOBILE6.2 emission estimates is Ieesuck Jung (602-254-6300). More information about the MOBILE6.2 model may be found in the EPA *User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model*, August 2003, EPA420-R-02-026, which may be found at the EPA's web site (http://www.epa.gov/OMS/m6.htm).

To create a complete set of emission factors for input to the M6Link model, a series of MOBILE6.2 runs were performed for the combination of two inspection/maintenance (I/M) program scenarios, five area types, three model episodes, and two region types. Two I/M program scenarios modeled were:

* With an I/M program in place
* Without any I/M program in place

Five area types modeled were:

* Central Business District
* Urban Area
* Urban Fringe
* Suburban
* Rural

Three model episodes, which are twenty eight days in total (eight days for the June episode and ten days for the July and August episodes), were:

1. May 31 (Friday) ~ 7 (Friday), 2005
2. July 5 (Friday) ~ 14 (Sunday), 2005
3. August 2 (Thursday) ~ 11 (Saturday), 2005

Two region types, whose control measures were selectively applied to the MOBILE6.2 inputs, were:

* Area A

* Outside Area A

As for each region type, the MOBILE6.2 results of the I/M and non-I/M runs for each area type were combined to reflect the proportions of I/M and non-I/M vehicles by the M6Link program. The I/M vehicles mean the vehicles which are required to undergo an emission test and inspection under the Arizona Vehicle Inspection/Maintenance Program. It is important to note that the I/M program is assumed to be required for all vehicles of the appropriate age registered in the Area A. In addition, it is assumed that 91.6 percent of the vehicles operating within the Area A will participate in the I/M program, and that 8.4 percent will not participate in the program. Refer to ATTACHMENT ONE for the actual input files for the 2005 runs.

Development of Model Inputs

The inputs to MOBILE6.2 are grouped into three categories: Header inputs, Run inputs, and Scenario inputs. The MOBILE6.2 input values used in the model runs above are specified and explained as follows:

Header Section

1. `MOBILE6 INPUT FILE :`
   This command identifies a MOBILE6.2 input file as a regular command input file rather than a batch file.

2. `DATABASE OUTPUT    :`
   This command instructs MOBILE6.2 to report output in database format, which will be used in M6Link.

3. `WITH FIELDNAMES    :`
   This command specifies that a header record of field names is to be added to the database output file.

4. `DATABASE EMISSIONS : 2222 2222`
   This command indicates that all emissions types are reported in database output format if appropriate. The eight emission types are exhaust running emissions, exhaust start emissions, evaporative hot soak emissions, evaporative diurnal emissions, evaporative resting loss emissions, evaporative running loss emissions, evaporative crankcase emissions, and evaporative refueling emissions. For carbon monoxide and NOx, only exhaust running emissions and exhaust start emissions are relevant.

5. **DATABASE FACILITIES: Arterial Freeway Local Ramp None**
This command instructs MOBILE6.2 to report database output for each of the four roadway types modeled by MOBILE6.2, as well as emissions that are independent of roadway type, such as engine start emissions and all evaporative emissions except running losses.

6. **DATABASE VEHICLES : 22222 22222222 2 222 22222222 222**
This command instructs MOBILE6.2 to report output emission factors for all 28 vehicle classes considered by MOBILE6.2.

<u>**Run Data Section**</u>

The run data section includes information about the local inspection and maintenance program, the anti-tampering program, and local vehicle registration data.

1. **STAGE II REFUELING :**
94 1 46. 46.
This command instructs MOBILE6.2 to model the Stage II program that had 1994 as a beginning year, one year as a phased-in period, 46 percent efficiency for the LDGVs and LDGTs, and 46 percent efficiency for the HDGVs. Efficiency data was provided by the Arizona State Weights and Measures Department.

2. **NO 2007 HDDV RULE :**
This command instructs MOBILE6.2 to calculate emission factors without the effects of the 2007 heavy duty vehicle emission standards.

3. **I/M PROGRAM : 1 1995 2050 1 T/O LOADED/IDLE**
This command instructs MOBILE6.2 to model the I/M program number 1 which starts in 1995 and ends in 2050. The program is an annual program (1), a test only (T/O) program rather than test and repair program, and a loaded/idle program. It is important to note that this command (and the majority of all commands dealing with I/M settings) appears seven times in the MAG I/M run reflecting seven components of the I/M program. All I/M settings with the latest data were evaluated and provided by ADEQ.

4. **I/M MODEL YEARS : 1 1967 1980**
This command instructs MOBILE6.2 that the I/M program number 1 defined in the "I/M PROGRAM" command above is applied to vehicles whose model years are between 1967 and 1980.

5. **I/M VEHICLES : 1 22222 22222222 2**
This command instructs MOBILE6.2 which vehicle classes are subject to the I/M program number 1. The number two (2) indicates that a particular vehicle class is subject to the program and the number one (1) indicates that a particular vehicle class is not subject to the program.

6. **I/M STRINGENCY : 1 37.5**
This command defines that the expected exhaust inspection failure rate for pre-1981 model year vehicles covered by the I/M program number 1 is 37.5 percent.

7. **I/M COMPLIANCE : 1 62.9**
This command describes the expected compliance rate within the I/M program number 1 is 62.9 percent. The compliance rate is the percentage of vehicles in the fleet that complete the I/M program and receive either a certificate of compliance or a waiver.

8. **I/M WAIVER RATES : 1 0.709 0.781**
This command specifies the percentage of vehicles that fail an initial I/M test and do not pass a retest but receive a certificate of compliance. This input instructs MOBILE6.2 to set the waiver rate at 0.709 percent for pre-1981 model years and 0.781 percent for 1981 and later model years for the I/M program number 1. These values reflect the implementation of the control measure "One-time Waiver from Vehicle Emissions Test".

9. **I/M GRACE PERIOD : 1 5**
This command specifies that 5 years old and older vehicles are subject to the I/M program number 1.

10. **I/M CUTPOINTS : 2 CUTPNT05.D**
This command specifies the emission level cutpoints, which determine whether a vehicle passes or fails an I/M test, in the I/M program number 2.

11. **ANTI-TAMP PROG :**
87 75 80 22222 22222222 2 11 80.7 22111222
This command indicates information for the local anti-tampering program (ATP). Note that there may be more than one component of an anti-tampering program, requiring multiple inputs of this data. Input parameters are detailed as follows:

"**87**" indicates that the program began in 1987.
"**75**" indicates that the earliest model year covered by the program is 1975.
"**80**" indicates that the final model year covered by the program is 1980.
"**22222**" indicates that the five light duty gasoline vehicle classes considered by MOBILE6.2 are all subject to this portion of ATP.
"**22222222**" indicates that the eight heavy duty gasoline vehicle classes considered by MOBILE6.2 are all subject to this portion of ATP.
"**2**" indicates that the gasoline powered buses are subject to this portion of ATP.
"**11**" indicates that credit is to be taken for ATP and that the test is performed annually.
"80.7" indicates that the program compliance rate is 80.7 percent.
"**22111222**" indicates that ATP consists of an air pump system disablement test,

catalyst removal test, evaporative system disablement test, PCV system disablement test, and missing gas cap test. Tests omitted from the program are a fuel inlet restrictor disablement test, tailpipe lead deposit test, and EGR disablement test.

12. **REG DIST :**
02Reg05.D
This command indicates that local registration distribution data is provided for MOBILE6.2 use, rather than national default data. These data may be found in the external data file ‘02Reg05.D’.

13. **DIESEL FRACTIONS :**

```
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639
```

This command specifies local diesel fractions for 14 of the 16 composite vehicle categories by vehicle age. For all vehicle classes, MOBILE6.2 default data was used.

Scenario Data Section

1. **SCENARIO RECORD : I/M Scenario**
This command is a required field that provides a unique identifier to each scenario. The individual MOBILE6.2 runs performed by MAG have only one scenario for each model run.

2. **CALENDAR YEAR : 2005**
This command specifies the calendar year of evaluation to report emissions for 2005.

3. **EVALUATION MONTH : 7**
This command specifies the month of evaluation as July, where January and July are the only months of evaluation in MOBILE6.2. Since the modeling episodes are lied in June, July, and August, July of 2005 was selected as the closest month available.

4. **ALTITUDE : 1**
This command indicates that MOBILE6.2 calculates emissions for a low-altitude region. The low altitude flag represents approximately 500 feet above sea level and the high altitude flag represents approximately 5,500 feet above sea level.

5. **HOURLY TEMPERATURES:**
This command specifies local temperatures for each hour of the modeling day, starting at 6 a.m. and continuing through 5 a.m. the next morning. The Supersite's hourly temperatures were selected to represent the MNA's hourly temperatures. Hourly temperature values for 2005 were obtained from the EPA Air Quality System (AQS).

6. **RELATIVE HUMIDITY :**
This command specifies hourly relative humidity values for the modeling day, starting at 6 a.m. and continuing through 5 a.m. the next morning. The Supersite's hourly relative humidity values were selected to represent the MNA's hourly relative humidity. Hourly relative humidity values for 2005 were obtained from the EPA Air Quality System (AQS).

7. **BAROMETRIC PRES : 28.50**
This command specifies a daily average barometric pressure as 28.50 inches of mercury (Hg). The Supersite's barometric pressure was selected to represent the MNA's barometric pressure. Barometric pressure values for 2005 were obtained from the EPA Air Quality System (AQS).

8. **SPEED VMT : 056R1A.txt**
This command indicates that MOBILE6.2 references data stored in the external file named, '056R1A.txt', which contains hourly speed distributions for both freeway and

arterial roadway types. In this case, the file reflects a model year of 2005, a model month of June, a model day of Thursday, an area type of 1, and a region inside of Area A.

9. **FUEL PROGRAM : 4**

```
 78.4  71.6  52.5  60.4  47.8  39.3  33.0  33.0
 30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0
348.0 224.0 338.0 380.0 164.0  93.0  87.0  87.0
 80.0  80.0  80.0  80.0  80.0  80.0  80.0  80.0
```

This command indicates that MOBILE6.2 uses a user-supplied gasoline sulfur levels option directly specified with the average and maximum sulfur levels for calendar years 2000 through 2015.

10. **FUEL RVP : 6.7**

This command specifies the prevailing fuel Reid Vapor Pressure (RVP) as 6.7 pounds per square inch (psi).

Model Outputs

MOBILE6.2 was executed with the inputs described above to obtain a database of emission factors in grams per mile (g/mi) for CO, NOx, and VOC emissions. The database of emission factors represented emission factors split out by the vehicle classes, vehicle ages, hour of the day, and roadway (facility) type on which the vehicle is driving. These outputs, in the units of grams per mile, were used as an input of the M6Link system for further processing.

ATTACHMENT ONE

MOBILE6.2 INPUT FILES

This section contains a portion of the MOBILE6.2 input files for the I/M and non-I/M runs for Area A and the non-I/M run for outside Area A for the modeling year 2005. The sample inputs are presented in the order of the I/M input for Area A, the non-I/M input for Area A, and the non-I/M input for outside Area A for each modeling episode.

* I/M Run for Area A (June 6, 2005)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :
STAGE II REFUELING :
94 1 46. 46.

I/M PROGRAM        : 1 1995 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 1 1967 1980
I/M VEHICLES       : 1 22222 22222222 2
I/M STRINGENCY     : 1 37.5
I/M COMPLIANCE     : 1 62.9
I/M WAIVER RATES   : 1 0.709 0.781
I/M GRACE PERIOD   : 1 5
I/M PROGRAM        : 2 1995 2050 2 T/O IM240
I/M MODEL YEARS    : 2 1981 1995
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 37.5
I/M COMPLIANCE     : 2 70.
I/M WAIVER RATES   : 2 0.709 0.781
I/M GRACE PERIOD   : 2 5
I/M CUTPOINTS      : 2 CUTPNT05.d
I/M PROGRAM        : 3 1995 2050 2 T/O FP & GC
I/M MODEL YEARS    : 3 1981 1995
I/M VEHICLES       : 3 22222 11111111 1
I/M COMPLIANCE     : 3 70.
I/M WAIVER RATES   : 3 0.709 0.781
I/M GRACE PERIOD   : 3 5
I/M PROGRAM        : 4 2002 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 37.5
I/M COMPLIANCE     : 4 91.5
I/M WAIVER RATES   : 4 0.709 0.781
I/M GRACE PERIOD   : 4 5
I/M PROGRAM        : 5 2002 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 5 1996 2050
I/M VEHICLES       : 5 22222 11111111 1
I/M COMPLIANCE     : 5 98.3
I/M WAIVER RATES   : 5 0.709 0.781
I/M GRACE PERIOD   : 5 5
I/M PROGRAM        : 6 1989 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 6 1981 2050
I/M VEHICLES       : 6 11111 22222222 2
I/M STRINGENCY     : 6 37.5
I/M COMPLIANCE     : 6 95.2
I/M WAIVER RATES   : 6 0.709 0.781
I/M GRACE PERIOD   : 6 5
I/M PROGRAM        : 7 1992 2050 1 T/O GC
I/M MODEL YEARS    : 7 1981 2050
I/M VEHICLES       : 7 11111 22222222 2
I/M COMPLIANCE     : 7 94.2
I/M WAIVER RATES   : 7 0.709 0.781
I/M GRACE PERIOD   : 7 5

ANTI-TAMP PROG     :
87 75 80 22222 22222222 2 11 80.7 22111222
ANTI-TAMP PROG     :
87 81 03 11111 22222222 2 11 90.7 22111222

REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
```

```
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639

SCENARIO RECORD     : I/M Scenario
CALENDAR YEAR       : 2005
EVALUATION MONTH    : 7
ALTITUDE            : 1
HOURLY TEMPERATURES: 73.8 78.4 81.7 84.0 86.2 88.3 90.0 92.1 93.4 95.0 95.4 94.1
                     91.2 89.1 86.5 83.8 81.1 78.8 76.3 74.8 74.5 75.0 73.8 73.9
RELATIVE HUMIDITY   : 34.6 27.9 23.7 22.6 19.6 18.1 17.4 16.6 15.9 14.7 15.2 16.3
                     17.2 14.4 14.7 11.9 12.4 14.2 17.1 18.2 18.7 23.9 28.9 29.1
BAROMETRIC PRES     : 28.50
SPEED VMT           : 056R1A.txt
FUEL RVP            : 6.7
FUEL PROGRAM        : 4
 78.4  71.6  52.5  60.4  47.8  39.3  33.0  33.0
 30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0
348.0 224.0 338.0 380.0 164.0  93.0  87.0  87.0
 80.0  80.0  80.0  80.0  80.0  80.0  80.0  80.0

END OF RUN
```

* Non-I/M Run for Area A (June 6, 2005)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :
STAGE II REFUELING :
94 1 46. 46.

REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639

SCENARIO RECORD    : Non-I/M Scenario
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 73.8 78.4 81.7 84.0 86.2 88.3 90.0 92.1 93.4 95.0 95.4 94.1
                     91.2 89.1 86.5 83.8 81.1 78.8 76.3 74.8 74.5 75.0 73.8 73.9
RELATIVE HUMIDITY  : 34.6 27.9 23.7 22.6 19.6 18.1 17.4 16.6 15.9 14.7 15.2 16.3
                     17.2 14.4 14.7 11.9 12.4 14.2 17.1 18.2 18.7 23.9 28.9 29.1
BAROMETRIC PRES    : 28.50
SPEED VMT          : 056R1A.txt
FUEL RVP           : 6.7
```

```
FUEL PROGRAM        : 4
 78.4  71.6  52.5  60.4  47.8  39.3  33.0  33.0
 30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0
348.0 224.0 338.0 380.0 164.0  93.0  87.0  87.0
 80.0  80.0  80.0  80.0  80.0  80.0  80.0  80.0

END OF RUN
```

* Non-I/M Run for Outside Area A (June 6, 2005)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :

REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639

SCENARIO RECORD    : Non-I/M Scenario
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 73.8 78.4 81.7 84.0 86.2 88.3 90.0 92.1 93.4 95.0 95.4 94.1
                     91.2 89.1 86.5 83.8 81.1 78.8 76.3 74.8 74.5 75.0 73.8 73.9
RELATIVE HUMIDITY  : 34.6 27.9 23.7 22.6 19.6 18.1 17.4 16.6 15.9 14.7 15.2 16.3
                     17.2 14.4 14.7 11.9 12.4 14.2 17.1 18.2 18.7 23.9 28.9 29.1
BAROMETRIC PRES    : 28.50
SPEED VMT          : 056R4O.txt
FUEL RVP           : 6.7

END OF RUN
```

* I/M Run for Area A (July 9, 2005)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :
STAGE II REFUELING :
94 1 46. 46.

I/M PROGRAM        : 1 1995 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 1 1967 1980
I/M VEHICLES       : 1 22222 22222222 2
I/M STRINGENCY     : 1 37.5
I/M COMPLIANCE     : 1 62.9
I/M WAIVER RATES   : 1 0.709 0.781
I/M GRACE PERIOD   : 1 5
I/M PROGRAM        : 2 1995 2050 2 T/O IM240
I/M MODEL YEARS    : 2 1981 1995
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 37.5
I/M COMPLIANCE     : 2 70.
I/M WAIVER RATES   : 2 0.709 0.781
I/M GRACE PERIOD   : 2 5
I/M CUTPOINTS      : 2 CUTPNT05.d
I/M PROGRAM        : 3 1995 2050 2 T/O FP & GC
I/M MODEL YEARS    : 3 1981 1995
I/M VEHICLES       : 3 22222 11111111 1
I/M COMPLIANCE     : 3 70.
I/M WAIVER RATES   : 3 0.709 0.781
I/M GRACE PERIOD   : 3 5
I/M PROGRAM        : 4 2002 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 37.5
I/M COMPLIANCE     : 4 91.5
I/M WAIVER RATES   : 4 0.709 0.781
I/M GRACE PERIOD   : 4 5
I/M PROGRAM        : 5 2002 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 5 1996 2050
I/M VEHICLES       : 5 22222 11111111 1
I/M COMPLIANCE     : 5 98.3
I/M WAIVER RATES   : 5 0.709 0.781
I/M GRACE PERIOD   : 5 5
I/M PROGRAM        : 6 1989 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 6 1981 2050
I/M VEHICLES       : 6 11111 22222222 2
I/M STRINGENCY     : 6 37.5
I/M COMPLIANCE     : 6 95.2
I/M WAIVER RATES   : 6 0.709 0.781
I/M GRACE PERIOD   : 6 5
I/M PROGRAM        : 7 1992 2050 1 T/O GC
I/M MODEL YEARS    : 7 1981 2050
I/M VEHICLES       : 7 11111 22222222 2
I/M COMPLIANCE     : 7 94.2
I/M WAIVER RATES   : 7 0.709 0.781
I/M GRACE PERIOD   : 7 5

ANTI-TAMP PROG     :
87 75 80 22222 22222222 2 11 80.7 22111222
ANTI-TAMP PROG     :
87 81 03 11111 22222222 2 11 90.7 22111222

REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
```

```
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639

SCENARIO RECORD     : I/M Scenario
CALENDAR YEAR       : 2005
EVALUATION MONTH    : 7
ALTITUDE            : 1
HOURLY TEMPERATURES: 83.8 87.1 90.5 95.2 98.1 99.9 102.4 104.0 105.3 106.3 107.8 107.1
                     104.0 100.9 98.1 95.7 94.3 91.6 89.6 87.4 84.4 82.8 81.3 81.3
RELATIVE HUMIDITY   : 21.7 19.6 18.1 15.9 13.8 13.6 13.3 12.4 11.6 10.6 9.9 10.4
                     10.3 11.5 13.1 13.5 15.8 19.0 19.3 20.7 25.9 28.8 29.3 23.0
BAROMETRIC PRES     : 28.62
SPEED VMT           : 057T1A.txt
FUEL RVP            : 6.4
FUEL PROGRAM        : 4
 78.4  71.6  52.5  60.4  47.8  39.3  33.0  33.0
 30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0
348.0 224.0 338.0 380.0 164.0  93.0  87.0  87.0
 80.0  80.0  80.0  80.0  80.0  80.0  80.0  80.0

END OF RUN
```

* Non-I/M Run for Area A (July 9, 2005)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :
STAGE II REFUELING :
94 1 46. 46.

REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639

SCENARIO RECORD    : Non-I/M Scenario
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 83.8 87.1 90.5 95.2 98.1 99.9 102.4 104.0 105.3 106.3 107.8 107.1
                     104.0 100.9 98.1 95.7 94.3 91.6 89.6 87.4 84.4 82.8 81.3 81.3
RELATIVE HUMIDITY  : 21.7 19.6 18.1 15.9 13.8 13.6 13.3 12.4 11.6 10.6 9.9 10.4
                     10.3 11.5 13.1 13.5 15.8 19.0 19.3 20.7 25.9 28.8 29.3 23.0
BAROMETRIC PRES    : 28.62
SPEED VMT          : 057T1A.txt
FUEL RVP           : 6.4
```

```
FUEL PROGRAM       : 4
 78.4  71.6  52.5  60.4  47.8  39.3  33.0  33.0
 30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0
348.0 224.0 338.0 380.0 164.0  93.0  87.0  87.0
 80.0  80.0  80.0  80.0  80.0  80.0  80.0  80.0

END OF RUN
```

* Non-I/M Run for Outside Area A (July 9, 2005)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :

REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639

SCENARIO RECORD    : Non-I/M Scenario
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 83.8 87.1 90.5 95.2 98.1 99.9 102.4 104.0 105.3 106.3 107.8 107.1
                     104.0 100.9 98.1 95.7 94.3 91.6 89.6 87.4 84.4 82.8 81.3 81.3
RELATIVE HUMIDITY  : 21.7 19.6 18.1 15.9 13.8 13.6 13.3 12.4 11.6 10.6 9.9 10.4
                     10.3 11.5 13.1 13.5 15.8 19.0 19.3 20.7 25.9 28.8 29.3 23.0
BAROMETRIC PRES    : 28.62
SPEED VMT          : 057T4O.txt
FUEL RVP           : 6.4
END OF RUN
```

* I/M Run for Area A (August 10, 2005)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :
STAGE II REFUELING :
94 1 46. 46.

I/M PROGRAM        : 1 1995 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 1 1967 1980
I/M VEHICLES       : 1 22222 22222222 2
I/M STRINGENCY     : 1 37.5
I/M COMPLIANCE     : 1 62.9
I/M WAIVER RATES   : 1 0.709 0.781
I/M GRACE PERIOD   : 1 5
I/M PROGRAM        : 2 1995 2050 2 T/O IM240
I/M MODEL YEARS    : 2 1981 1995
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 37.5
I/M COMPLIANCE     : 2 70.
I/M WAIVER RATES   : 2 0.709 0.781
I/M GRACE PERIOD   : 2 5
I/M CUTPOINTS      : 2 CUTPNT05.d
I/M PROGRAM        : 3 1995 2050 2 T/O FP & GC
I/M MODEL YEARS    : 3 1981 1995
I/M VEHICLES       : 3 22222 11111111 1
I/M COMPLIANCE     : 3 70.
I/M WAIVER RATES   : 3 0.709 0.781
I/M GRACE PERIOD   : 3 5
I/M PROGRAM        : 4 2002 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 37.5
I/M COMPLIANCE     : 4 91.5
I/M WAIVER RATES   : 4 0.709 0.781
I/M GRACE PERIOD   : 4 5
I/M PROGRAM        : 5 2002 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 5 1996 2050
I/M VEHICLES       : 5 22222 11111111 1
I/M COMPLIANCE     : 5 98.3
I/M WAIVER RATES   : 5 0.709 0.781
I/M GRACE PERIOD   : 5 5
I/M PROGRAM        : 6 1989 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 6 1981 2050
I/M VEHICLES       : 6 11111 22222222 2
I/M STRINGENCY     : 6 37.5
I/M COMPLIANCE     : 6 95.2
I/M WAIVER RATES   : 6 0.709 0.781
I/M GRACE PERIOD   : 6 5
I/M PROGRAM        : 7 1992 2050 1 T/O GC
I/M MODEL YEARS    : 7 1981 2050
I/M VEHICLES       : 7 11111 22222222 2
I/M COMPLIANCE     : 7 94.2
I/M WAIVER RATES   : 7 0.709 0.781
I/M GRACE PERIOD   : 7 5

ANTI-TAMP PROG     :
87 75 80 22222 22222222 2 11 80.7 22111222
ANTI-TAMP PROG     :
87 81 03 11111 22222222 2 11 90.7 22111222

REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
```

```
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639

SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 79.2 80.4 82.2 84.9 86.0 86.7 88.3 90.7 91.4 94.1 93.4 91.4
                     88.3 84.4 84.4 84.4 83.8 83.3 82.6 82.2 82.2 81.1 80.8 80.1
RELATIVE HUMIDITY  : 80.9 78.4 74.1 68.3 64.0 62.7 61.0 55.3 50.1 44.5 45.7 47.9
                     55.1 65.3 64.3 64.3 65.3 67.4 67.8 69.0 69.5 72.7 75.3 77.9
BAROMETRIC PRES    : 28.74
SPEED VMT          : 058F1A.txt
FUEL RVP           : 6.5
FUEL PROGRAM       : 4
 78.4  71.6  52.5  60.4  47.8  39.3  33.0  33.0
 30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0
348.0 224.0 338.0 380.0 164.0  93.0  87.0  87.0
 80.0  80.0  80.0  80.0  80.0  80.0  80.0  80.0

END OF RUN
```

* Non-I/M Run for Area A (August 10, 2005)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :
STAGE II REFUELING :
94 1 46. 46.

REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639

SCENARIO RECORD    : Non-I/M Scenario
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 79.2 80.4 82.2 84.9 86.0 86.7 88.3 90.7 91.4 94.1 93.4 91.4
                     88.3 84.4 84.4 84.4 83.8 83.3 82.6 82.2 82.2 81.1 80.8 80.1
RELATIVE HUMIDITY  : 80.9 78.4 74.1 68.3 64.0 62.7 61.0 55.3 50.1 44.5 45.7 47.9
                     55.1 65.3 64.3 64.3 65.3 67.4 67.8 69.0 69.5 72.7 75.3 77.9
BAROMETRIC PRES    : 28.74
SPEED VMT          : 058F1A.txt
FUEL RVP           : 6.5
```

```
FUEL PROGRAM        : 4
 78.4  71.6  52.5  60.4  47.8  39.3  33.0  33.0
 30.0  30.0  30.0  30.0  30.0  30.0  30.0  30.0
348.0 224.0 338.0 380.0 164.0  93.0  87.0  87.0
 80.0  80.0  80.0  80.0  80.0  80.0  80.0  80.0

END OF RUN
```

* Non-I/M Run for Outside Area A (August 10, 2005)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :

REG DIST           : 02reg05.d
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
0.0006 0.0001 0.0003 0.0006 0.0013 0.0004 0.0004 0.0001 0.0027 0.0032
0.0097 0.0162 0.0241 0.0510 0.0706
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0007 0.0033
0.0048 0.0120 0.0223 0.0656 0.0616
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126
0.0110 0.0111 0.0145 0.0110 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124
0.0135 0.0169 0.0209 0.0256 0.0013
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998
0.2578 0.2510 0.3263 0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726
0.2743 0.3004 0.2918 0.2859 0.0138
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774
0.7710 0.7910 0.8105 0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842
0.6145 0.5139 0.5032 0.4277 0.0079
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606
0.8473 0.8048 0.8331 0.7901 0.7316 0.7275 0.7108 0.5647 0.3178 0.2207
0.1968 0.1070 0.0738 0.0341 0.0414
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647
0.4384 0.3670 0.4125 0.3462 0.2771 0.2730 0.2616 0.1043 0.0610 0.0383
0.0333 0.0255 0.0111 0.0049 0.0060
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300
0.6078 0.5246 0.5767 0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705
0.4525 0.4310 0.3569 0.3690 0.4413
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563
0.8443 0.7943 0.8266 0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567
0.7431 0.7261 0.6602 0.6717 0.7344
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992
0.9989 0.9987 0.9989 0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980
0.9979 0.9976 0.9969 0.9978 0.9982
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585
0.8857 0.8525 0.8795 0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733
0.5105 0.3845 0.3238 0.3260 0.2639

SCENARIO RECORD    : Non-I/M Scenario
CALENDAR YEAR      : 2005
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 79.2 80.4 82.2 84.9 86.0 86.7 88.3 90.7 91.4 94.1 93.4 91.4
                     88.3 84.4 84.4 84.4 83.8 83.3 82.6 82.2 82.2 81.1 80.8 80.1
RELATIVE HUMIDITY  : 80.9 78.4 74.1 68.3 64.0 62.7 61.0 55.3 50.1 44.5 45.7 47.9
                     55.1 65.3 64.3 64.3 65.3 67.4 67.8 69.0 69.5 72.7 75.3 77.9
BAROMETRIC PRES    : 28.74
SPEED VMT          : 058F4O.txt
FUEL RVP           : 6.5
END OF RUN
```

Appendix IV-iii

Development of Spatial Allocation Surrogates for Eight-Hour Ozone Maintenance CAMx Modeling

1. Background

Since the Comprehensive Air Quality Model With Extensions (CAMx) predicts carbon monoxide and ozone concentrations at grid level the modeler defined, it must be supplied with the same resolution of the grid-level emissions. The amount of effort needed to derive grid-level emissions varies depending on the type of emission source. Two methods are generally used to allocate emissions to grid cells: One method is to directly obtain emissions for each grid cell and the other is to use spatial surrogates of emission levels (e.g., the number of houses or acres of land use). The former is the most accurate method to obtain grid-level emissions, but it is absolutely dependent upon available resources such as time, money, and data. It has been applied to point or onroad mobile source emissions since existing databases of point and onroad mobile source emissions contain location data for each source or each link, allowing direct assignment to the appropriate grid cells. The latter assumes that emissions from each source behave spatially in the same manner as the spatial surrogate. It has been used for the spatial allocation of area and nonroad mobile source emissions because specific location data for each area or nonroad mobile source are not available. Fourteen categories of spatial surrogates shown in Table 1 were developed for area and nonroad mobile source emissions in conjunction with eight-hour ozone maintenance demonstration modeling. A typical spatial surrogate is defined as the ratio of a grid-level to the Maricopa County land use area. This document describes the development of spatial surrogates to spatially allocate area and nonroad mobile source emissions of the Maricopa County to the eight-hour ozone 4-km modeling domain. The result of this effort is gridded spatial surrogate files for use with the GRDEM module of EPS3.0.

2. Development Procedures

2.1 Gridded Domain

Gridded domain was developed using the GENERATE ARC command of ARC/INFO. The origin of the gridded domain is located at 277,000 meters and 3,596,000 meters in UTM zone 12. Gridded domain has 55 grid cells in x direction (easting) and 44 grid cells in y direction (northing) and each grid cell size is 4000 meters by 4000 meters. The gridded domain designed to include the entire area of Maricopa County. The gridded domain is used to grid the land use data of Maricopa County or Pinal County portion of the eight-hour ozone 4-km modeling domain by overlaying the grid domain over the land use data.

2.2 Spatial Surrogates

Fourteen spatial surrogates were developed for the whole Maricopa County area and Pinal County portion of the eight-hour ozone 4-km modeling area since area and nonroad mobile source emissions inventories were developed for the entire Maricopa County and Pinal County portion of the eight-hour ozone 4-km modeling domain, respectively. The latest land use data were obtained for these areas. Categories and data sources used to develop spatial surrogates are shown in Table 1.

The MAG GIS land use data were used to develop housing spatial surrogate. The MAG land use shape file was gridded by intersecting with a gridded domain shape file which includes Maricopa and Pinal counties, using INTERSECT command in ArcGIS 9.2 Arc Tool Box. Residential land use categories coded as from 100 to 199 (i.e., general residential, rural residential, estate residential,..., parking lots serving residential) were extracted from the gridded land use data, calculating the ratio of the grid-level residential area to the county residential area for grid cells.

Industrial and non-industrial spatial surrogates were based on the MAG GIS land use data. Industrial and non-industrial areas for grid cells were extracted by intersecting the MAG GIS land use data with the gridded domain. Industrial land use category in the MAG GIS land use data was used for the industrial spatial surrogate while land use categories such as business parks, commercial retail centers, warehouse/distribution centers, hotels, motels, resorts, retail centers, large assembly areas, offices and public facilities were included in developing the non-industrial spatial surrogate.

The spatial surrogates for undeveloped total, developed total, water, and airport were developed based on the MAG GIS land use data and the gridded domain. The undeveloped total spatial surrogate was based on vacant category of the MAG GIS land use data. The developed total surrogate was based on residential, commercial, industrial, office, other public, other space, and multiple use categories. The MAG GIS land use was intersected with the gridded domain. Acres of land use categories by grid cell were extracted to calculate the ratio of grid area to Maricopa County or Pinal County portion of the eight-hour ozone 4-km modeling domain.

More detailed spatial surrogates for agriculture are needed to develop with MAG GIS land use and GIS data for a better representation of agricultural emissions: agriculture-stockyard and agriculture-other crops. However, the MAG land use data contain only one category of agricultural land. In an effort to maintain the spatial distinction among agricultural land uses, MAG GIS staff developed more distinctive land use data for agricultural stockyard and agricultural-other crop. Total acres of agricultural land within each grid cell were extracted, being divided by total agricultural acres of Maricopa County or Pinal County portion of the eight-hour ozone 4-km modeling domain.

Construction spatial surrogate was developed using residential under construction, commercial under construction, industrial under construction, office under construction, employment under construction, transportation under construction, developing open space, and multiple use under construction categories of the MAG GIS land use data. The shape files for the land use categories were intersected with gridded domain, and then spatial surrogate ratio was calculated.

The MAG GIS land use coverage was used to develop the remaining spatial surrogates including non-developable forest, landfill, and golf course. Mountain preserves and washes land use category was used to develop the non-developable forest spatial surrogate. However, railroad shape file was provided by MAG GIS staff since railroad category of land use is not available from the MAG GIS land use data. The MAG GIS land use data were intersected with gridded ozone modeling domain and the acres of land use categories by each grid cell were extracted from the intersected coverage.

The separately generated fourteen spatial surrogates for Maricopa County and Pinal County portion of the eight-hour ozone 4-km modeling area were combined into one file and formatted by a FORTRAN program to use in the GRDEM module of EPS3.0. Using the GRDEM module with the developed two sets of spatial surrogates, emissions from Maricopa County and Pinal County portion of the eight-hour ozone 4-km modeling domain were separately allocated to grid cells and then the separately gridded emissions were merged with the MRGUAM module of EPS3.0.

Table 1. Spatial Surrogate Codes and Categories

Code	Categories	Data Source
1	Housing	MAG Land Use
2	Industrial	MAG Land Use
3	Non-industrial	MAG Land Use
4	Undeveloped Total	MAG Land Use
5	Developed Total	MAG Land Use
6	Construction	MAG Land Use
7	Agriculture - Stockyards	MAG GIS Data
8	Agriculture - Other Crops	MAG Land Use
9	Non-developable Forest	MAG Land Use
10	Railroad	MAG GIS Data
11	Landfill	MAG Land Use
12	Water	MAG Land Use
13	Golf Course	MAG Land Use
14	Airport	MAG Land Use

Table 2. Spatial Surrogate Assignments

Area Source Category	Spatial Surrogate Code	Source Category Description
2102004000	2	Industrial; External Combustion
2102006000	2	Industrial; Natural Gas; External Combustion
2102010000	2	Industrial; Process Gas; All Boiler Types
2102011000	2	Industrial; Kerosene; Total: All Boiler Types
2103004000	2	Commercial/Institutional Distillate Oil; Boilers and IC Engines
2103006000	2	Com/Inst; Nat Gas; External Combustion
2103007000	2	Commercial/Institutional Liquified Petroleum Gas (LPG); All Combustor Types
2103011000	2	Commercial/Institutional Kerosene; All Combustor Types
2104004000	1	Residential; Distillate Oil; All Combustor Types
2104006000	1	Residential; Nat Gas; External Combustion
2104007000	1	Residential; Liquified Petroleum Gas (LPG); All Combustor Types
2104008000	1	Residential; Barbecues/Firepits
2104011000	1	Residential; Fireplaces
2260001010	4	Off-Road Motorcycles, Gasoline, 2-stroke, Mobile
2260001030	4	All Terrain Vehicles (ATVs), Gasoline, 2-stroke, Mobile
2260001060	4	Specialty Vehicles Carts, Gasoline, 2-stroke, Mobile
2260002006	6	Tampers/Rammers, Gasoline, 2-stroke, Mobile
2260002009	6	Plate Compactors, Gasoline, 2-stroke, Mobile
2260002012	6	Concrete Pavers, Gasoline, 2-stroke, Mobile
2260002021	6	Construction and Mining Equipment/Paving Equipment
2260002027	6	Signal Boards, Gasoline, 2-stroke, Mobile
2260002039	6	Concrete/Industrial Saws, Gasoline, 2-stroke, Mobile
2260002054	6	Construction and Mining Equipment/Crushing/Processing Equipment
2260003030	2	Sweepers/Scrubbers, Gasoline, 2-stroke, Mobile
2260003040	2	Other General Industrial Equipment, Gasoline, 2-stroke, Mobile
2260004015	5	Tillers <5 HP, Gasoline, 2-stroke, Mobile
2260004016	5	Chainsaws <4 HP, Gasoline, 2-stroke, Mobile
2260004020	5	Lawn and Garden Equipment; Chain Saws < 6 HP (Residential)
2260004021	5	Lawn and Garden Equipment; Chain Saws < 6 HP (Commercial)
2260004025	5	Trimmers/Edgers/Brush Cutters, Gasoline, 2-stroke, Mobile
2260004026	5	Lawn and Garden Equipment; Trimmers/Edgers/Brush Cutters (Commercial)
2260004030	5	Leaf Blowers/Vacuums, Gasoline, 2-stroke, Mobile
2260004031	5	Lawn and Garden Equipment; Leafblowers/Vacuums (Commercial)
2260004071	5	Lawn and Garden Equipment; Turf Equipment (Commercial)
2260005035	8	Other Lawn & Garden Equipment, Gasoline, 2-stroke, Mobile
2260005050	8	Hydro Power Units, Gasoline, 2-stroke, Mobile
2260006005	3	Generator Sets <50 HP, Gasoline, 2-stroke, Mobile

Area Source Category	Spatial Surrogate Code	Source Category Description
2260006010	3	Pumps <50 HP, Gasoline, 2-stroke, Mobile
2260006015	3	Air Compressors <50 HP, Gasoline, 2-stroke, Mobile
2260006035	5	Commercial Equipment Hydro Power Units 2 Stroke
2260007005	9	Chainsaws >4 HP, Gasoline, 2-stroke, Mobile
2265001010	4	Off-Road Motorcycles, Gasoline, 4-stroke, Mobile
2265001030	4	All Terrain Vehicles (ATVs), Gasoline, 4-stroke, Mobile
2265001050	4	Golf Carts, Gasoline, 4-stroke, Mobile
2265001060	4	Specialty Vehicles Carts, Gasoline, 4-stroke, Mobile
2265002003	6	Asphalt Pavers, Gasoline, 4-stroke, Mobile
2265002006	6	Tampers/Rammers, Gasoline, 4-stroke, Mobile
2265002009	6	Plate Compactors, Gasoline, 4-stroke, Mobile
2265002015	6	Rollers, Gasoline, 4-stroke, Mobile
2265002021	6	Paving Equipment, Gasoline, 4-stroke, Mobile
2265002024	6	Surfacing Equipment, Gasoline, 4-stroke, Mobile
2265002027	6	Signal Boards, Gasoline, 4-stroke, Mobile
2265002030	6	Trenchers, Gasoline, 4-stroke, Mobile
2265002033	6	Bore/Drill Rigs, Gasoline, 4-stroke, Mobile
2265002039	6	Concrete/Industrial Saws, Gasoline, 4-stroke, Mobile
2265002042	6	Cement and Mortar Mixers, Gasoline, 4-stroke, Mobile
2265002045	6	Cranes, Gasoline, 4-stroke, Mobile
2265002054	6	Crushing/Proc. Equipment, Gasoline, 4-stroke, Mobile
2265002057	6	Rough Terrain Forklifts, Gasoline, 4-stroke, Mobile
2265002060	6	Rubber Tired Loaders, Gasoline, 4-stroke, Mobile
2265002066	6	Tractors/Loaders/Backhoes, Gasoline, 4-stroke, Mobile
2265002072	6	Skid Steer Loaders, Gasoline, 4-stroke, Mobile
2265002078	6	Dumpers/Tenders, Gasoline, 4-stroke, Mobile
2265002081	6	Other Construction Equipment, Gasoline, 4-stroke, Mobile
2265003010	2	Aerial Lifts, Gasoline, 4-stroke, Mobile
2265003020	2	Forklifts, Gasoline, 4-stroke, Mobile
2265003030	2	Sweepers/Scrubbers, Gasoline, 4-stroke, Mobile
2265003040	2	Other General Industrial Equipment, Gasoline, 4-stroke, Mobile
2265003050	2	Other Material Handling Equipment, Gasoline, 4-stroke, Mobile
2265003060	2	Industrial Equipment; AC/Refrigeration
2265003070	2	Industrial Equipment; Terminal Tractors
2265004010	5	Lawn Mowers, Gasoline, 4-stroke, Mobile
2265004011	5	Lawn and Garden Equipment; Lawn Mowers (Commercial)
2265004015	5	Tillers <5 HP, Gasoline, 4-stroke, Mobile
2265004016	5	Lawn and Garden Equipment; Rotary Tillers < 6 HP (Commercial)
2265004025	5	Trimmers/Edgers/Brush Cutters, Gasoline, 4-stroke, Mobile

Area Source Category	Spatial Surrogate Code	Source Category Description
2265004026	5	Lawn and Garden Equipment; Trimmers/Edgers/Brush Cutters (Commercial)
2265004030	5	Leaf Blowers/Vacuums, Gasoline, 4-stroke, Mobile
2265004031	5	Lawn and Garden Equipment: Leafblowers/Vacuums (Commercial)
2265004040	5	Rear Engine Riding Mowers, Gasoline, 4-stroke, Mobile
2265004041	5	Lawn and Garden Equipment; Rear Engine Riding Mowers (Commercial)
2265004046	5	Lawn and Garden Equipment; Front Mowers (Commercial)
2265004051	5	Lawn and Garden Equipment; Shredders < 6 HP (Commercial)
2265004055	5	Lawn & Garden Tractors, Gasoline, 4-stroke, Mobile
2265004056	5	Lawn and Garden Equipment; Lawn and Garden Tractors (Commercial)
2265004066	5	Lawn and Garden Equipment Chippers/Stump Grinders (Commercial)
2265004071	5	Lawn and Garden Equipment; Turf Equipment (Commercial)
2265004075	5	Other Lawn & Garden Equipment, Gasoline, 4-stroke, Mobile
2265004076	5	Lawn and Garden Equipment; Other Lawn and Garden Equipment (Commercial)
2265005010	8	2-Wheel Tractors, Gasoline, 4-stroke, Mobile
2265005015	8	Agricultural Tractors, Gasoline, 4-stroke, Mobile
2265005020	8	Agricultural Equipment Combines
2265005025	8	Combines, Gasoline, 4-stroke, Mobile
2265005030	8	Agricultural Mowers, Gasoline, 4-stroke, Mobile
2265005035	8	Sprayers, Gasoline, 4-stroke, Mobile
2265005040	8	Tillers >5 HP, Gasoline, 4-stroke, Mobile
2265005045	8	Swathers, Gasoline, 4-stroke, Mobile
2265005050	8	Hydro Power Units, Gasoline, 4-stroke, Mobile
2265005055	8	Other Agricultural Equipment, Gasoline, 4-stroke, Mobile
2265005060	8	Agricultural Equipment; Irrigation Sets
2265006005	3	Generator Sets <50 HP, Gasoline, 4-stroke, Mobile
2265006010	3	Pumps <50 HP, Gasoline, 4-stroke, Mobile
2265006015	3	Air Compressors <50 HP, Gasoline, 4-stroke, Mobile
2265006025	3	Welders <50 HP, Gasoline, 4-stroke, Mobile
2265006030	3	Pressure Washers <50 HP, Gasoline, 4-stroke, Mobile
2265006035	3	Commercial Equipment Hydro Power Units 4 Stroke
2265007010	9	Shredders >5 HP, Gasoline, 4-stroke, Mobile
2265007015	9	Skidders, Gasoline, 4-stroke, Mobile
2265008005	14	Aircraft Support Equipment, Gasoline, 4-stroke, Mobile
2265010010	2	Industrial Equipment Other Oil Field Equipment
2267001060	4	Recreational Equipment; Specialty Vehicles/Carts
2267002003	6	Construction and Mining Equipment; Pavers
2267002015	6	Construction and Mining Equipment; Rollers
2267002021	6	Construction and Mining Equipment; Paving Equipment

Area Source Category	Spatial Surrogate Code	Source Category Description
2267002024	6	Construction and Mining Equipment; Surfacing Equipment
2267002030	6	Construction and Mining Equipment; Trenchers
2267002033	6	Construction and Mining Equipment; Bore/Drill Rigs
2267002039	6	Construction and Mining Equipment; Concrete/Industrial Saws
2267002045	6	Construction and Mining Equipment; Cranes
2267002054	6	Construction and Mining Equipment; Crushing/Processing Equipment
2267002057	6	Construction and Mining Equipment; Rough Terrain Forklifts
2267002060	6	Construction and Mining Equipment; Rubber Tire Loaders
2267002066	6	Construction and Mining Equipment; Tractors/ Loaders/ Backhoes
2267002072	6	Construction and Mining Equipment; Skid Steer Loaders
2267002081	6	Construction and Mining Equipment; Other Construction Equipment
2267003010	2	Industrial Equipment; Aerial Lifts
2267003020	2	Industrial Equipment; Forklifts
2267003030	2	Industrial Equipment; Sweepers/Scrubbers
2267003040	2	Industrial Equipment; Other General Industrial Equipment
2267003050	2	Industrial Equipment; Other Material Handling Equipment
2267003070	2	Industrial Equipment; Terminal Tractors
2267004066	5	Lawn and Garden Equipment; Chippers/Stump Grinders (Commercial)
2267005050	8	Agricultural Equipment; Hydro-power Units
2267005055	8	Agricultural Equipment; Other Agricultural Equipment
2267005060	8	Agricultural Equipment; Irrigation Sets
2267006005	3	Commercial Equipment; Generator Sets
2267006010	3	Commercial Equipment; Pumps
2267006015	3	Commercial Equipment; Air Compressors
2267006025	3	Commercial Equipment; Welders
2267006030	3	Commercial Equipment; Pressure Washers
2267006035	5	Commercial Equipment; Hydro Power Units
2267008005	14	Airport Ground Support Equipment; Airport Ground Support Equipment
2268002081	6	Construction and Mining Equipment; Other Construction Equipment
2268003020	2	Industrial Equipment; Forklifts
2268003030	2	Industrial Equipment; Sweepers/Scrubbers
2268003040	2	Industrial Equipment; Other General Industrial Equipment
2268003060	2	Industrial Equipment; AC\Refrigeration
2268003070	2	Industrial Equipment; Terminal Tractors
2268005055	8	Agricultural Equipment; Other Agricultural Equipment
2268005060	8	Agricultural Equipment; Irrigation Sets
2268006005	3	Commercial Equipment; Generator Sets
2268006010	3	Commercial Equipment; Pumps
2268006015	3	Commercial Equipment; Air Compressors

Area Source Category	Spatial Surrogate Code	Source Category Description
2268006020	3	Commercial Equipment; Gas Compressors
2268010010	2	Commercial Equipment; Gas Compressors
2270001060	4	Specialty Vehicles Carts, Diesel, Mobile
2270002003	6	Asphalt Pavers, Diesel, Mobile
2270002009	6	Plate Compactors, Diesel, Mobile
2270002015	6	Rollers, Diesel, Mobile
2270002018	6	Scrapers, Diesel, Mobile
2270002021	6	Paving Equipment, Diesel, Mobile
2270002024	6	Surfacing Equipment, Diesel, Mobile
2270002027	6	Signal Boards, Diesel, Mobile
2270002030	6	Trenchers, Diesel, Mobile
2270002033	6	Bore/Drill Rigs, Diesel, Mobile
2270002036	6	Excavators, Diesel, Mobile
2270002039	6	Concrete/Industrial Saws, Diesel, Mobile
2270002042	6	Cement and Mortar Mixers, Diesel, Mobile
2270002045	6	Cranes, Diesel, Mobile
2270002048	6	Graders, Diesel, Mobile
2270002051	6	Off-Highway Trucks, Diesel, Mobile
2270002054	6	Crushing/Proc. Equipment, Diesel, Mobile
2270002057	6	Rough Terrain Forklifts, Diesel, Mobile
2270002060	6	Rubber Tired Loaders, Diesel, Mobile
2270002066	6	Tractors/Loaders/Backhoes, Diesel, Mobile
2270002069	6	Crawler Tractors, Diesel, Mobile
2270002072	6	Skid Steer Loaders, Diesel, Mobile
2270002075	6	Off-Highway Tractors, Diesel, Mobile
2270002078	6	Dumpers/Tenders, Diesel, Mobile
2270002081	6	Other Construction Equipment, Diesel, Mobile
2270003010	2	Aerial Lifts, Diesel, Mobile
2270003020	2	Forklifts, Diesel, Mobile
2270003030	2	Sweepers/Scrubbers, Diesel, Mobile
2270003040	2	Other General Industrial Equipment, Diesel, Mobile
2270003050	2	Other Material Handling Equipment, Diesel, Mobile
2270003060	2	Industrial Equipment; AC/Refrigeration
2270003070	2	Industrial Equipment; Terminal Tractors
2270004031	5	Leaf Blowers/Vacuums, Diesel, Mobile
2270004046	5	Front Mowers, Diesel, Mobile
2270004056	5	Lawn & Garden Tractors, Diesel, Mobile
2270004066	5	Chippers/Stump Grinders, Diesel, Mobile
2270004071	5	Commercial Turf Equipment, Diesel, Mobile

Area Source Category	Spatial Surrogate Code	Source Category Description
2270004076	5	Other Lawn & Garden Equipment, Diesel, Mobile
2270005010	8	2-Wheel Tractors, Diesel, Mobile
2270005015	8	Agricultural Tractors, Diesel, Mobile
2270005020	8	Combines, Diesel, Mobile
2270005025	8	Balers, Diesel, Mobile
2270005030	8	Agricultural Mowers, Diesel, Mobile
2270005035	8	Sprayers, Diesel, Mobile
2270005040	8	Tillers >5 HP, Diesel, Mobile
2270005045	8	Swathers, Diesel, Mobile
2270005050	8	Hydro Power Units, Diesel, Mobile
2270005055	8	Other Agricultural Equipment, Diesel, Mobile
2270005060	8	Agricultural Equipment; Irrigation Sets
2270006005	3	Generator Sets <50 HP, Diesel, Mobile
2270006010	3	Pumps <50 HP, Diesel, Mobile
2270006015	3	Air Compressors <50 HP, Diesel, Mobile
2270006025	3	Welders <50 HP, Diesel, Mobile
2270006030	3	Pressure Washers <50 HP, Diesel, Mobile
2270006035	5	Commercial Equipment Hydro Power Units
2270007015	9	Skidders, Diesel, Mobile
2270008005	9	Aircraft Support Equipment, Diesel, Mobile
2270010010	2	Industrial Equipment; Other Oil Field Equipment
2275001000	14	Military Aircraft; Total
2275020000	14	Commercial Aircraft; All Types
2275050000	14	General Aviation; Total
2275060000	14	Air Taxi; Total
2282005010	12	Pleasure Craft; Gasoline, 2-stroke Outboard
2282005015	12	Pleasure Craft; Gasoline, 2-stroke Sterndrive
2282010005	12	Pleasure Craft; Gasoline, 4-stroke Inboard
2282020005	12	Pleasure Craft; Diesel Inboard
2282020010	12	Pleasure Craft; Diesel Outboard
2285002000	10	Diesel; Total
2285002006	10	Railroads Locomotives
2285002010	10	Railroads Yard
2285002015	10	Diesel; Railway Maintenance
2285004015	10	Gasoline, 4-Stroke; Railway Maintenance
2285006015	10	LPG; Railway Maintenance
2294015000	2	Industrial Roads Total: Fugitives
2301000000	2	Chemical Manufacturing: SIC 28 All Processes; Total
2301010000	2	Industrial Inorganic Chemical Manufacturing; Total

Area Source Category	Spatial Surrogate Code	Source Category Description
2301030000	2	Process Emissions from Pharmaceutical Manuf (NAPAP cat. 106); Total
2302002000	2	Industrial Processes/Food and Kindred Products: SIC 20 Commercial Charbroiling
2302002100	2	Commercial Cooking - Charbroiling; Conveyorized Charbroiling
2302002200	2	Commercial Cooking - Charbroiling; Under-fired Charbroiling
2302003000	2	Commercial Cooking - Frying; Deep Fat Frying
2302003100	2	Commercial Cooking - Frying; Flat Griddle Frying
2302003200	2	Commercial Cooking - Frying; Clamshell Griddle Frying
2302050000	2	Bakery Products; Total
2304000000	2	All Processes; Total
2305000000	2	All Processes; Total
2307020000	2	Industrial Processes/Wood Products: SIC 24-Sawmills/Planing Mills
2308000000	2	All Processes; Total
2309000000	2	All Processes; Total
2312000000	2	All Processes; Total
2325000000	2	Industrial Processes/Mining and Quarrying: SIC 14j/All Processes
2325030000	9	Industrial Processes/Mining and Quarrying: SIC 14/Sand and Gravel
2399000000	2	Industrial Processes: NEC; Total
2401001000	5	Surface Coating -Architectural Coatings
2401005000	2	Surface Coating-Auto Refinishing
2401008000	6	Surface Coating-Traffic Markings
2401015000	2	Surface Coating-Factory Finished Wood
2401020000	2	Surface Coating-Wood Furniture
2401025000	2	Surface Coating-Metal Furniture
2401030000	2	Surface Coating-Papers
2401045000	2	Surface Coating- Metal Coils
2401055000	2	Surface Coating-Machinery and Equipment
2401060000	2	Surface Coating-Large Appliances
2401065000	2	Electronic and Other Electrical: SIC 36 - 363; All Solvent Types
2401070000	2	Motor Vehicles: SIC 371 Total: All Solvent Types
2401075000	2	Surface Coating-Aircraft Solvent Utilization
2401080000	2	Surface Coating-Marines
2401090000	2	Surface Coating-Misc. Manufacturing
2401100000	2	Surface Coating-Industrial Maintenance Coating
2401200000	2	Surface Coating-Other Specific Purpose Coating
2415000000	2	Degreasing -Solvent Utilization
2415105000	2	Motor Vehicles: SIC 371 Total: All Solvent Types
2415110000	2	Primary Metal Industries (SIC 33): Open Top Degreasing Total: All Solvent Types

Area Source Category	Spatial Surrogate Code	Source Category Description
2415120000	2	Fabricated Metal Products (SIC 34): Open Top Degreasing Total: All Solvent Types
2415125000	2	Industrial Machinery and Equipment (SIC 35): Open Top Degreasing;Total: All Solvent Types
2415130000	2	Electronic and Other Elec. (SIC 36): Open Top Degreasing Total: All Solvent Types
2415135000	2	Transportation Equipment (SIC 37): Open Top Degreasing Total: All Solvent Types
2415140000	2	Instruments and Related Products (SIC 38): Open Top Degreasing;Total: All Solvent Types
2415145000	2	Miscellaneous Manufacturing (SIC 39): Open Top Degreasing Total: All Solvent Types
2415305000	2	Furniture and Fixtures (SIC 25): Cold Cleaning Total: All Solvent Types
2415310000	2	Primary Metal Industries (SIC 33): Cold Cleaning Total: All Solvent Types
2415320000	2	Fabricated Metal Products (SIC 34): Cold Cleaning Total: All Solvent Types
2415325000	2	Industrial Machinery and Equipment (SIC 35): Cold Cleaning; Total: All Solvent Types
2415330000	2	Electronic and Other Elec. (SIC 36): Cold Cleaning Total: All Solvent Types
2415335000	2	Transportation Equipment (SIC 37): Cold Cleaning Total: All Solvent Types
2415340000	2	Instruments and Related Products (SIC 38): Cold Cleaning; Total: All Solvent Types
2415345000	2	Miscellaneous Manufacturing (SIC 39): Cold Cleaning Total: All Solvent Types
2415355000	2	Automotive Dealers (SIC 55): Cold Cleaning; Total: All Solvent Types
2415360000	2	Auto Repair Services (SIC 75): Cold Cleaning; Total: All Solvent Types
2415365000	2	Miscellaneous Repair Services (SIC 76): Cold Cleaning Total: All Solvent Types
2420000000	5	All Processes; Total: All Solvent Types
2420010055	5	Commercial/Industrial Cleaners Perchloroethylene
2420000370	5	All Processes-Drying Cleaning
2420020055	5	Coin-operated Cleaners Perchloroethylene
2425000000	2	All Processes; Total: All Solvent Types
2430000000	2	All Processes; Total: All Solvent Types
2440000000	2	Solvent Utilization - Misc. Industrial
2440020000	2	Adhesive (Industrial) Application Total: All Solvent Types
2460000000	2	Solvent Utilization/Miscellaneous Non-industrial: Consumer and Commercial All Processes
2460100000	1	All Personal Care Products; Total: All Solvent Types
2460200000	1	All Household Products; Total: All Solvent Types
2460500000	1	All Coatings and Related Products; Total: All Solvent Types
2460600000	1	All Adhesives and Sealants; Total: All Solvent Types

Area Source Category	Spatial Surrogate Code	Source Category Description
2460800000	1	All FIFRA Related Products; Total: All Solvent Types
2460900000	1	Miscellaneous Products (Not Otherwise Covered); Total: All Solvent Types
2461020000	2	Solvent Utilization/Miscellaneous Non-industrial: Commercial Asphalt Application: All Processes
2461021000	1	Misc. Non-Industrial: Cutback Asphalt
2461022000	1	Misc. Non-Industrial: Emulsified Asphalt
2461023000	1	Misc. Non-Industrial; Asphalt Roofing
2461800000	2	Misc. Non-Industrial; Pesticide Application
2461850000	8	Pesticide Application: Agricultural; All Processes
2465100000	1	Personal Care Products Total: All Solvent Types
2465200000	1	Household Products; Total: All Solvent Types
2465400000	1	Automotive Aftermarket Products; Total: All Solvent Types
2465600000	1	Adhesives and Sealants Total: All Solvent Types
2501010000	2	Storage and Transport/Petroleum and Petroleum Product Storage/Commercial/Industrial: Breathing Loss
2501050120	5	Bulk Stations Terminals-Breathing Loss Gasoline
2501060000	2	Storage and Transport/Petroleum and Petroleum Product Storage/Gasoline Service Stations
2501060050	5	Gasoline Service Stations; Tank Truck Unloading
2501060052	5	Gasoline Service Stations; Tank Truck Unloading
2501060053	5	Gasoline Service Stations; Stage 1: Balanced Submerged Filling
2501060100	5	Gasoline Service Stations; Vehicle Refueling
2501060201	5	Gasoline Service Stations; Underground Tank Breathing Losses
2505030120	1	Tank Truck in Transit
2505040090	15	Storage and Transport/Petroleum and Petroleum Product Transport/Pipeline
2505040120	15	Pipeline Gasoline
2510000000	2	Organic Chemical Storage and Transport
2601000000	2	On-Site Incineration Waste Disposal
2601010000	2	Industrial; Total
2601020000	2	Commercial/Institutional; Total
2610000000	11	Waste Disposal, Treatment, and Recovery/Open Burning/All Categories
2610000500	1	All Categories; Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)
2610030000	1	Residential; Household Waste (use 26-10-000-xxx for Yard Wastes)
2620000000	1	All Categories; Total
2630000000	2	All Categories; Total Processed
2630020000	2	Public Owned; Total Processed
2640000000	1	All TSDF Types; Total: All Processes
2650000000	2	Scrap and Waste Materials; Total: All Processes

Area Source Category	Spatial Surrogate Code	Source Category Description
2660000000	2	Leaking -Underground Storage Tanks
2810001000	9	Forest Wildfires
2810030000	5	Cigarette Smoke; Total
2810040000	2	Aircraft/Rocket Engine Firing and Testing; Total
2810050000	1	Motor Vehicle Fires; Total
2810060100	1	Cremation; Humans
2830000000	2	All Catastrophic/Accidential Releases; Total
2850000000	2	Hospitals; Total: All Operations

Appendix IV-iv

Comparison of the 2005 Baseline Emission Inventory
and the 2005 Periodic Emission Inventory for Ozone Precursors

The Clean Air Act Amendments require a comprehensive, accurate, and current inventory of actual emissions from all sources with periodic updates every three years. As required by the Clean Air Act Amendments, the Maricopa County Air Quality Department (MCAQD) has compiled a 2005 Periodic Emission Inventory (PEI) for ozone precursors for Maricopa County and the eight-hour ozone nonattainment area (MCAQD, 2008). MAG also has developed a 2005 baseline emission inventory for the eight-hour ozone modeling domain as part of the maintenance modeling demonstration. Table 1 provides a summary of the VOC and NOx emissions, by source category, contained in the 2005 PEI and MAG's 2005 baseline emissions inventory.

Table 1. VOC and NOx Emissions by Source Category for the 2005 Periodic Emission Inventory and the MAG 2005 Baseline Emission Inventory

	VOC (English Tons/Day)		**NOx (English Tons/Day)**	
	MAG 2005 Baseline Emission Inventory	**2005 Periodic Emission Inventory**	**MAG 2005 Baseline Emission Inventory**	**2005 Periodic Emission Inventory**
Point	10.5	10.6	7.4	6.9
Area	126.2	126.0	22.8	22.5
Onroad	94.5	92.4	186.7	181.6
Nonroad	56.3	77.0	92.1	89.6
Biogenic	419.3	248.8	8.2	5.0
Total	**706.9**	**554.8**	**317.2**	**305.6**

Note: The 2005 baseline emissions represent the eight-hour modeling domain, while the 2005 PEI emissions are for the eight-hour ozone nonattainment area (See Figure 1).

In general, Table 1 indicates that the 2005 MAG baseline and 2005 PEI estimates are similar, except for nonroad and biogenic VOC emissions. The following section compares the emissions by source category in the MAG 2005 baseline emission inventory with the 2005 PEI, and provides additional information on the methodology used to develop the 2005 baseline emission inventory, if it differed from the PEI.

Point Sources

The point source emissions (EPS3 PREPNT output emissions) in the MAG 2005 baseline emission inventory were compared with the point source emissions in the 2005 PEI. The NOx emissions for point source in the MAG 2005 baseline inventory are slightly higher than those in the 2005 PEI, while the VOC emissions in the two emission inventories are similar.

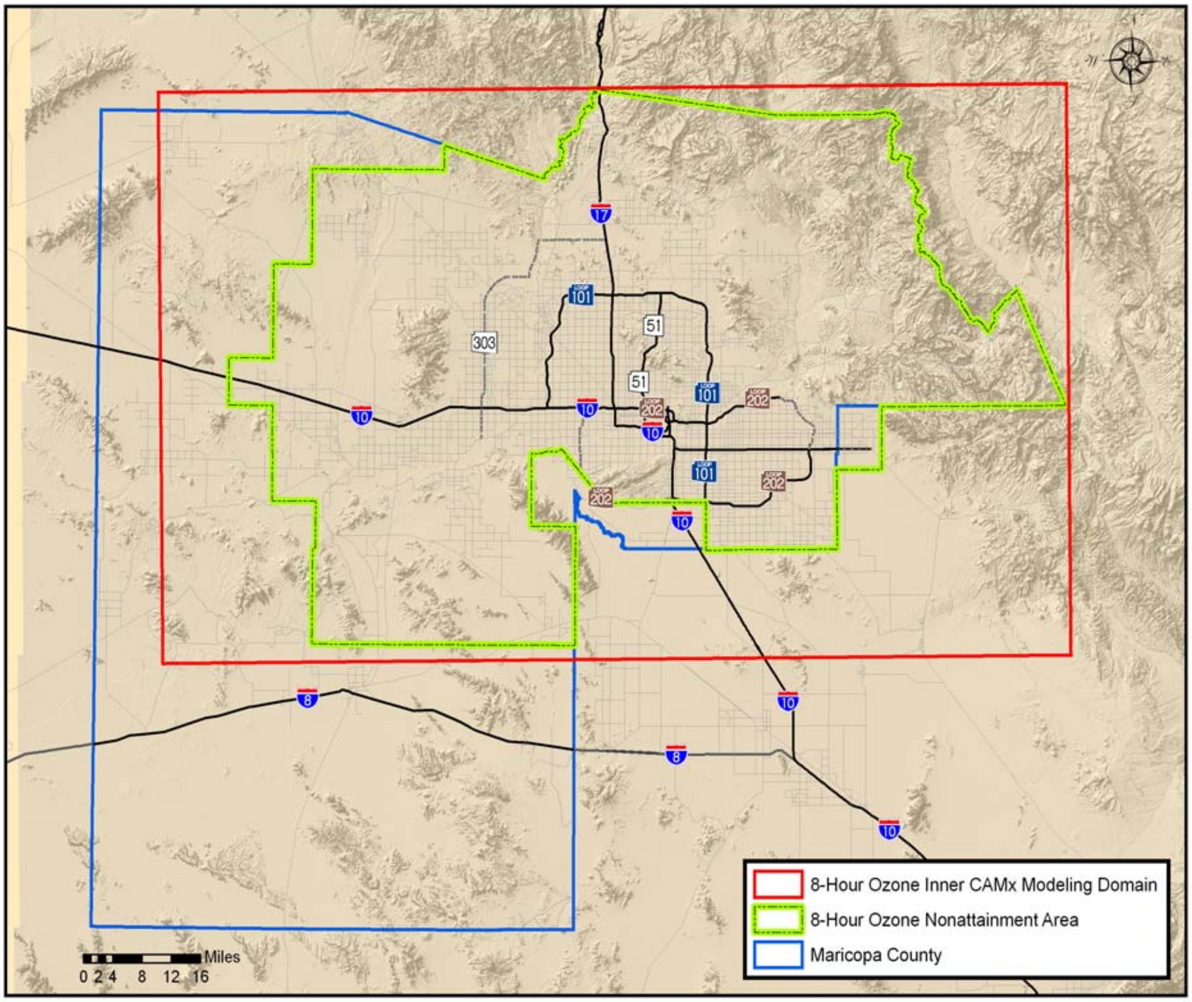

Figure 1. The eight-hour ozone MNA and modeling domain

The higher NOx emissions are due to the larger modeling domain used to develop the MAG 2005 baseline emission inventory. The VOC point source emissions are slightly lower, despite the larger modeling area, due to lower 2005 point source VOC emissions provided to MAG by MCAQD in July, 2008.

Area Sources

The area source emissions (EPS3 PREAM output emissions) in the MAG 2005 baseline emission inventory were compared with the area source emissions in the 2005 PEI. The area source emissions in the MAG 2005 baseline emission inventory are slightly higher than those in the 2005 PEI for both VOC and NOx due to the larger modeling domain used to develop the MAG 2005 baseline emission inventory.

Onroad Mobile Sources

The highest daily onroad emissions (speciated by the Carbon Bond IV chemical mechanism) in the MAG 2005 baseline emission inventory were compared with the ozone-season daily average onroad emissions (VOC and NOx emissions before chemical speciation) in the 2005 PEI. Due to the larger modeling domain and differences in methodologies discussed below, the onroad emissions in the MAG 2005 baseline emission inventory are slightly higher than those in the 2005 PEI for both VOC and NOx.

The MAG 2005 baseline emission inventory is based on the VMT estimates produced by the MAG travel demand model, while the 2005 PEI is based on the 2005 VMT estimates derived from the Highway Performance Monitoring System (HPMS) data submitted to the Federal Highway Administration (FHWA) by the Arizona Department of Transportation (ADOT). The MAG travel demand model estimates typical weekday traffic, while HPMS produces annual average daily traffic (including weekends). Also, the MAG 2005 baseline emission inventory was developed using the latest updates of the MOBILE6.2 configuration that takes into account the I/M and Anti-Tampering programs, as suggested by ADEQ (Chen, 2008), and actual meteorological conditions in 2005.

Nonroad Sources

The nonroad emissions (EPS3 PREAM output emissions) of the MAG 2005 baseline emission inventory were compared with the ozone season day nonroad emissions of the 2005 PEI. The NONROAD2002 model was run with the same model inputs and configuration for each month of 2005 to develop nonroad emissions for both the MAG 2005 baseline emission inventory and the 2005 PEI (except for aviation and locomotive emissions). Consequently, the season total nonroad emissions in the MAG 2005 baseline emission inventory are identical to those in the 2005 PEI.

The NONROAD model estimates were converted to daily emissions by applying adjustment factors as a post-processing procedure. The 2005 PEI applied the highest weekday or weekend adjustment factor to produce conservative nonroad emissions. The MAG 2005 baseline emission inventory used the EPS3.0 model which applied a weekday or weekend factor, depending on the day of the week, to estimate specific episode day emissions.

Residential lawn and garden emission sources are very high VOC emitters and make a major contribution to total nonroad VOC emissions. However, residential land and garden emission sources are very low NOx emitters. Thus, the County's use of higher weekly adjustment factors applied to the 2005 PEI nonroad emissions exerted a greater impact on VOC emissions, but a relatively small impact on NOx emissions. For this reason, the VOC emissions of the nonroad portion of the 2005 PEI are higher than those of the MAG 2005 baseline emission inventory, even though the modeling domain for the MAG 2005 baseline emission inventory is larger than the eight-hour ozone nonattainment area used for the 2005 PEI.

It should be noted that even if the post-processing methodology used by MCAQD to estimate 2005 PEI nonroad emissions had been applied in the eight-hour ozone maintenance modeling, there would have been little impact on the modeling results. This is because the PEI methodology would increase both 2005 and 2025 nonroad emissions, resulting in similar RRFs and predicted eight-hour ozone design values in 2025.

Biogenic Sources

The biogenic emissions in the MAG 2005 baseline emission inventory and the 2005 PEI are based on the daily average of biogenic emissions for the June episode days. Since the eight-hour ozone modeling domain includes Tonto National Forest which produces higher biogenic emissions, the biogenic emissions in the MAG 2005 baseline emission inventory are greater than the 2005 PEI biogenic emissions by 170.5 English tons per day of VOC and 3.2 English tons per day of NOx, which is 69 percent higher for VOC and 64 percent higher for NOx.

The 2005 emissions MAG used in modeling with CAMx are different from the 2005 PEI and MAG 2005 baseline inventory shown in Table 1. The 2005 PEI and modeling inventory are not the same for the following reasons:

- **Time Period** - The two emission inventories were developed for different time periods. The 2005 PEI is based on average daily ozone season emissions, while the MAG 2005 modeling inventory is based on high ozone day specific emissions. (See Section IV of this TSD for additional information on the MAG 2005 modeling inventory that was developed for high ozone days.)

- **Area** - As discussed above, the areas encompassed by the PEI and MAG inventories are different. The 2005 PEI is based on the eight-hour ozone nonattainment area, while the MAG 2005 inventories are based on the eight-hour ozone modeling domain (See Figure 1). The modeling domain is approximately 80 percent larger than the eight-hour ozone nonattainment area. However, it should be noted that most of the anthropogenic emissions are generated inside the nonattainment area.

- **Level of Detail** - The MAG 2005 modeling emission inventory is chemically, temporally, and spatially pre-processed through EPS3 for use in the CAMx simulations (i.e., hourly gridded Carbon Bond IV chemical species). The 2005 PEI emissions are summarized as ozone season daily average VOC and NOx emissions.

- **Methodologies** - In some cases different methodologies were used to develop the 2005 PEI and the MAG 2005 modeling inventories, as discussed by source category above.

Appendix IV-v

Development of a 2025 Regional Modeling Emission Inventory for Ozone

ENVIRON

MEMORANDUM

To: Ieesuck Jung, Taejoo Shin, Cathy Arthur

From: Gerry Mansell, Chris Emery

Date: 5 May 2008

Subject: Development of a 2025 regional modeling emission inventory for ozone

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In support of the Maricopa Association of Governments' (MAG) air quality modeling efforts, ENVIRON completed an emission inventory development task to generate county-level emission estimates of criteria pollutants for calendar year 2025. Emission estimates were developed for stationary area, on-road mobile, off-road mobile and stationary point sources for all counties within MAG's 12-km regional air quality modeling domain. Emissions for the Northern Mexican States were also estimated. ENVIRON has previously developed and provided to MAG staff all of the necessary EPS3 processing scripts, inventory databases and auxiliary data, specifically for MAG's regional modeling application. As MAG has indicated a preference to implement the EPS3 emission model in-house, under this work task, only the 2025 inventory data were developed and formatted as AMS and AFS files for use in emissions modeling. This Technical Memorandum documents the data sources and processing steps used in the development of the 2025 emission inventory.

Inventory Data Sources

The development of regional emission inventories for calendar year 2025 was based on the most recent versions of the 2002 and 2018 WRAP emission inventory:

- Plan 2002d – The 2002 Planning emission inventory represents a typical 2002 annual inventory of emissions from all source sectors derived from a number of sources, including state/county emission inventory submittals, permits, MOBILE6 modeling, or other modeled estimates based on activity levels. The planning inventories are used to provide representative baseline visibility conditions for comparisons and assessments of progress towards achieving natural visibility conditions in the future years.

- PRP 2018a – The Preliminary Reasonable Progress emission inventory for 2018 (PRP18a) incorporates growth and existing and/or planned emission controls and all projected BART emission reductions across the WRAP region.

Annual (and seasonal/monthly) county-level emissions estimates used in the SMOKE processing system are available in ASCII IDA formatted data files. These data contain all the necessary information required for application of EPS3. Processing utilities, previously developed for MAG, were applied to re-format these data into AFS (point sources) and AMS (area and mobile sources) formatted data files. Separate Perl scripts were then used to extrapolate these data out to 2025 by county and Source Classification Code (SCC) for input to EPS3.

The specific WRAP emissions data files used in the development of the MAG regional emission inventory are summarized in Tables 1 and 2.

Point Sources

Point source data were obtained from different sources, processed separately and merged prior to modeling. The data include:

- WRAP states point sources
- Texas point sources
- Mexico point sources

The point source data were converted from the SMOKE IDA format to EPS3 AFS formats. Only annual emission estimates were considered. Stationary point source emissions for calendar year 2025 were held constant at the 2018 PRP inventory level. This assumption is based on the lack of appropriate information necessary to project these data into the future, as well as the fact that the PRP 2018 inventory has already incorporated growth, existing and expected control measures and projected BART emission reductions throughout the WRAP region.

On-Road Mobile Sources

On-road mobile source data were obtained from different sources, processed separately and merged prior to modeling. The data include:

- WRAP states (except California) on-road mobile sources
- California on-road mobile sources
- Texas on-Road mobile sources
- Mexico on-road mobile sources

For non-California WRAP states, on-road mobile source county-level emission estimates were developed by ENVIRON on a seasonal basis. California mobile emissions were obtained from the ARB as summer season county-level estimates. The SMOKE IDA files for the summer season were converted to EPS3 AMS formats and processed as average day emissions for calendar years 2002 and 2018.

Table 1. Summary of emissions data sources for 2002.

Category	Region	SMOKE Data File
Stationary Point	WRAP	ptinv_wrap2002_NoAK_091707.ida
	California	ptinv_CA2002_CARBofs_v1.ida
	CENRAP	Ptinv_cenrap2002_033007.ida
	Mexico	ptinv_Mexico99phase3_border_20061025v4.ida
Area	WRAP	arinv_wrap2002_noAK.Plan02d_091407_noFD_noREF_noOGCA.ida
	WRAP	arinv_wrap2002_OilGas_annual_041207.ida
	California	arinv_CA2002_OilGas_091407.ida
	CENRAP	arinv_NoFire_nodust_ref_nh3_cenrap2002_081705.ida
	Mexico	arinv_Mexico99phase3_border_20051027v4_noD_noF_noNR.ida
Off-Road Mobile	WRAP	nrinv_wrap2002_InshoreMarine_annual_tpd_080205.ida
	WRAP	nrinv_wrap2002_noCA_v2_locomotive_annual_tpd_102705.ida
	WRAP	nrinv_wrap2002_nonCA_sum_060705.ida
	WRAP	nrinv_wrap2002_noCA_v2_Aircraft_summer_103105.ida
	California	arinv_CA2002_loco_annual_081407.ida
	California	nrinv_CA2002_offroad_sum_090707.ida
	California	nrinv_CA2002_Aircraft_sum_080707.ida
	CENRAP	nrinv_cenrap2002_annual_071305.ida
	Mexico	nrinv_Mexico99phase3_border_20061025v4.ida
	Mexico	nrniv_alm_Mexico99phase3_border_20051027v4.ida
On-Road Mobile	WRAP	mbinv_wrap2002_v2_noCA_sum_101305.ida
	California	mbinv_CA2002_sum_092707.ida
	Mexico	mbinv_Mexico99phase3_border_20051021v4.ida

Table 2. Summary of emissions data sources for 2018.

Category	Region	SMOKE Data File
Stationary Point	WRAP	ptinv_wrap_prp18a_051807.ida
	CENRAP	ptinv_o.cenrap2002_2018_nonEGU050307.ida
	CENRAP	ptinv_cenrapNonegu_2018_050707_refin_new_sources.ida
	CENRAP	Ptinv_cenrap2018_EGU_win_annual_050407.ida
	Mexico	ptinv_Mexico99phase3_border_20061025v4.ida
Area	WRAP	arinv_wrap2018.051807_noDust.ida
	WRAP	oginv_WRAP2018_annual_tpd_050707.ida
	California	arinv_CA2018_OilGas_112205.ida
	CENRAP	arinv_NoFire_nodust_ref_nh3_cenrap2002-2018_101606.ida
	Mexico	arinv_Mexico99phase3_border_20051027v4_noD_noF_noNR.ida
Off-Road Mobile	WRAP	nrinv_WRAP2018_sum_102105.ida
	WRAP	nrinv_WRAP2018_Aircraft_sum.111805.ida
	WRAP	nrinv_wrap2018_Locomotive_annual_tpd_111805.ida
	California	nrinv_CA2018_sum_111805.ida
	CENRAP	CENRAP_2018_Fnl_Nrd_Emissions091506.ida
	Mexico	nrinv_Mexico99phase3_border_20061025v4.ida
	Mexico	nrniv_alm_Mexico99phase3_border_20051027v4.ida
On-Road Mobile	WRAP	mbinv_WRAP2018_sum_102105.ida
	California	mbinv_CA2018_sum_111805.ida

Within the 2002 and 2018 WRAP modeling inventories used for this work effort, mobile source emissions for all non-WAP states were developed through implementation of MOBILE6 within the SMOKE emissions model. Therefore, for the two Texas counties within the modeling domain, county-level on-road mobile emissions by SCC were obtained by generating detailed emission summary reports in SMOKE. SMOKE was run only for a representative summer weekday for calendar year 2018. These results were then re-formatted as AMS data files for a specified temporal period (summer weekday) 2018.

Mexico on-road mobile source emissions were obtained on a state/municipality level and processed as area sources. The latest version of the Mexico emission inventory data is based on data for 1999. In the WRAP regional modeling efforts, these data were held constant for the 2002 and 2018 scenarios. For the current work effort, these data were also assumed valid for calendar year 2025.

Off-Road Mobile Sources

Off-road mobile source emissions data were obtained from different sources, processed separately and merged prior to modeling. The data include:

- WRAP states (except CA) off-road sources
- California off-road sources
- California off-shore shipping sources
- Texas off-road sources
- WRAP states commercial marine sources
- WRAP states locomotive sources
- WRAP states aircraft sources
- Mexico off-road sources
- Mexico locomotive sources
- Mexico aircraft sources

All off-road emissions estimates were converted from the SMOKE IDA formats to EPS3 AMS formats for processing in EPS3. WRAP off-road emission sources were available as summer average day estimates. The WRAP inventory data were converted to AMS formats for processing as average day estimates in EPS3. Texas off-road emissions were available from the CENRAP SMOKE IDA files as annual estimates. These data were converted to AMS formats for processing as annual estimates in EPS3.

Mexico off-road mobile source emissions were obtained on a state/municipality level for EPS3 processing as area sources. The latest version of the Mexico emission inventory data is based on data for 1999. In the WRAP regional modeling efforts, these data were held constant for the 2002 and 2018 scenarios. For the current work effort, these data were also assumed valid for calendar year 2025.

Area Sources

Area source emissions data were obtained from different sources, processed separately and merged prior to modeling. The data include:

- WRAP states area sources
- Texas area sources
- Mexico area sources
- WRAP states (except CA) Oil and Gas emissions sources
- California Oil and Gas emissions sources

All area source emissions were converted from the SMOKE IDA formats to EPS3 AMS formats for processing as annual estimates in EPS3.

Estimation of 2025 Regional Emissions

Emission estimates for calendar year 2025 were developed by extrapolation of the 2002 and 2018 emissions data. Perl scripts were developed to read each record of the AMS formatted emissions data from 2002 and 2018, and linearly extrapolate to 2025 by county, SCC and pollutant. Due to the differences in data sources, and various revisions and corrections to the both the 2002 and 2018 inventories developed by the WRAP, there are instances where emission estimates for a particular county and source categories may be present in the 2002 inventory but not the 2018 inventory, and vice versa. Therefore, for each county, SCC and pollutant, the following approach was taken to estimate emissions for 2025:

- If emission estimates are nonzero in 2002 and 2018, then 2025 estimates are obtained through linear extrapolation:

    - o If extrapolation of 2002 and 2018 data result in negative emissions in 2025, then the 2025 emission estimates are kept at 2018 levels;

- If emission estimates are zero in 2002 and nonzero in 2018, then 2025 emission estimates are set equal to the 2018 emission estimate;

- If emission estimates are nonzero in 2002 and zero in 2018, then emission estimates for 2025 are set to zero (note that the quantity of emissions for the few counties and source categories that were set to zero between 2002 and 2025 were insignificant relative to the overall 12-km emissions inventory).

All stationary point source emissions were held constant at 2018 levels, as discussed above. In addition, emission estimates for Mexico were also held constant at 2018 levels.

Emission Summaries

Emission inventory summaries of emissions from major source categories are presented below for 2002, 2018 and 2025, in tons per day. Summaries are provided for NOx, VOC and CO in Tables 3, 4 and 5, respectively.

Note that all emission estimates in the tables presented below reflect county-level emissions only for those counties within the MAG 12-km modeling domain. This means that for partial counties and/or states at the edge of a modeling domain, emissions are reported for the entire county.

Table 3. Average daily NOx emissions by source category and state (tons/day).

NOx Emission (tons/day)											
	Area			On-Road Mobile			Off-Road Mobile			Stationary Point	
State	**2002**	**2018**	**2025**	**2002**	**2018**	**2025**	**2002**	**2018**	**2025**	**2002**	**2018**
Arizona	24.8	35.1	39.5	453.8	135.8	109.6	202.6	144.6	126.3	191.7	200.2
California	186.0	223.0	226.5	1,015.4	331.1	224.8	624.3	275.6	266.1	164.0	173.2
Colorado	19.0	19.7	20.7	18.0	5.9	4.7	18.9	12.3	9.7	12.8	9.3
Nevada	7.6	9.9	11.0	65.2	21.6	8.0	61.7	36.3	27.9	105.6	107.7
New Mexico	163.8	230.5	260.7	157.5	44.7	37.8	98.2	71.0	60.8	168.8	136.1
Texas	4.9	4.1	3.7		11.5		8.4	3.6	3.3	10.6	7.7
Utah	1.8	2.0	2.1	20.8	8.5	7.5	9.3	6.3	5.2	2.4	2.2
Total	**407.9**	**524.2**	**564.3**	**1,730.7**	**559.1**	**392.4**	**1,023.3**	**549.6**	**499.3**	**656.0**	**636.4**

Table 4. Average daily VOC emissions by source category and state (tons/day).

VOC Emissions (tons/day)											
	Area			On-Road Mobile			Off-Road Mobile			Stationary Point	
State	**2002**	**2018**	**2025**	**2002**	**2018**	**2025**	**2002**	**2018**	**2025**	**2002**	**2018**
Arizona	282.1	468.4	542.2	297.6	140.8	105.0	218.2	133.3	112.0	15.0	26.5
California	523.0	643.3	664.6	602.3	201.4	160.4	393.6	174.8	172.6	84.1	80.5
Colorado	19.7	25.7	28.4	13.2	5.5	4.4	11.3	7.1	6.2	4.3	5.5
Nevada	39.7	80.0	95.6	66.7	32.7	18.9	44.7	28.7	22.4	1.0	2.2
New Mexico	419.6	597.2	671.5	94.0	38.0	25.8	43.0	28.2	24.1	29.6	47.3
Texas	20.9	27.5	30.4		31.1		4.8	4.0	4.8	2.1	2.8
Utah	14.5	19.5	21.3	13.3	7.3	5.8	13.6	9.2	8.1	0.7	1.1
Total	1,319.4	1,861.7	2,053.9	1,087.1	456.7	320.2	729.1	385.3	350.2	136.8	166.0

Table 5. Average daily CO emissions by source category and state (tons/day).

CO Emissions (tons/day)											
	Area			On-Road Mobile			Off-Road Mobile			Stationary Point	
State	**2002**	**2018**	**2025**	**2002**	**2018**	**2025**	**2002**	**2018**	**2025**	**2002**	**2018**
Arizona	136.9	213.6	247.2	3,143.9	1,334.1	742.0	2,100.3	2,591.6	2,829.4	43.6	93.3
California	347.4	379.6	395.3	5,611.2	1,764.1	972.0	2,182.4	1,788.0	1,834.1	192.1	170.4
Colorado	30.6	33.7	35.1	158.5	68.0	30.2	78.6	93.1	100.4	6.4	8.7
Nevada	11.5	14.2	15.5	572.9	305.9	190.7	549.4	689.8	756.0	8.6	16.5
New Mexico	167.0	219.5	242.6	1,155.0	562.5	321.5	399.8	504.2	555.2	59.2	102.1
Texas	6.5	6.2	6.0		250.7		70.2	31.8	28.8	5.8	7.3
Utah	12.3	12.8	13.0	170.1	90.0	61.0	90.3	119.8	133.3	2.5	3.7
Total	**712.1**	**879.6**	**954.7**	**10,811.5**	**4,375.3**	**2,317.4**	**5,471.0**	**5,818.4**	**6,237.3**	**318.1**	**402.0**

Appendix IV-vi

On-Road Vehicle Emission Factor Estimation Procedure for 2025

Appendix IV-vi is followed by an attachment containing a sample of the MOBILE6.2 input files for 2025.

ONROAD VEHICLE EMISSION FACTOR ESTIMATION PROCEDURE FOR 2025

Emission Factor Model

As described in Appendix IV-ii, a series of MOBILE6.2 runs were performed for the combination of two inspection/maintenance (I/M) program scenarios, five area types, three model episodes, and two region types.

As for each region type, the MOBILE6.2 results of the I/M and non-I/M runs for each area type were combined to reflect the proportions of I/M and non-I/M vehicles by the M6Link program. Refer to ATTACHMENT TWO for the actual input files for the 2025 runs.

Development of Model Inputs

The inputs to MOBILE6.2 are grouped into three categories: Header inputs, Run inputs, and Scenario inputs. The MOBILE6.2 input values used in the model runs above are specified and explained as follows:

Header Section

1. `MOBILE6 INPUT FILE :`
   This command identifies a MOBILE6.2 input file as a regular command input file rather than a batch file.

2. `DATABASE OUTPUT :`
   This command instructs MOBILE6.2 to report output in database format, which will be used in M6Link.

3. `WITH FIELDNAMES :`
   This command specifies that a header record of field names is to be added to the database output file.

4. `DATABASE EMISSIONS : 2222 2222`
   This command indicates that all emissions types are reported in database output format if appropriate. The eight emission types are exhaust running emissions, exhaust start emissions, evaporative hot soak emissions, evaporative diurnal emissions, evaporative resting loss emissions, evaporative running loss emissions, evaporative crankcase emissions, and evaporative refueling emissions. For carbon monoxide and NOx, only exhaust running emissions and exhaust start emissions are relevant.

5. `DATABASE FACILITIES: Arterial Freeway Local Ramp None`
   This command instructs MOBILE6.2 to report database output for each of the four roadway types modeled by MOBILE6.2, as well as emissions that are independent

of roadway type, such as engine start emissions and all evaporative emissions except running losses.

6. **`DATABASE VEHICLES : 22222 22222222 2 222 22222222 222`**
This command instructs MOBILE6.2 to report output emission factors for all 28 vehicle classes considered by MOBILE6.2.

<u>Run Data Section</u>

The run data section includes information about the local inspection and maintenance program, the anti-tampering program, and local vehicle registration data.

1. **`STAGE II REFUELING :`**
`94 1 46. 46.`
This command instructs MOBILE6.2 to model the Stage II program that had 1994 as a beginning year, one year as a phased-in period, 46 percent efficiency for the LDGVs and LDGTs, and 46 percent efficiency for the HDGVs.

2. **`NO 2007 HDDV RULE :`**
This command instructs MOBILE6.2 to calculate emission factors without the effects of the 2007 heavy duty vehicle emission standards.

3. **`I/M PROGRAM : 1 1995 2050 1 T/O LOADED/IDLE`**
This command instructs MOBILE6.2 to model the I/M program number 1 which starts in 1995 and ends in 2050. The program is an annual program (1), a test only (T/O) program rather than test and repair program, and a loaded/idle program. It is important to note that this command (and the majority of all commands dealing with I/M settings) appears seven times in the MAG I/M run reflecting seven components of the I/M program.

4. **`I/M MODEL YEARS : 1 1967 1980`**
This command instructs MOBILE6.2 that the I/M program number 1 defined in the "I/M PROGRAM" command above is applied to vehicles whose model years are between 1967 and 1980.

5. **`I/M VEHICLES : 1 22222 22222222 2`**
This command instructs MOBILE6.2 which vehicle classes are subject to the I/M program number 1. The number two (2) indicates that a particular vehicle class is covered by the I/M program.

6. **`I/M STRINGENCY : 1 37.5`**
This command defines that the expected exhaust inspection failure rate for pre-1981 model year vehicles covered by the I/M program number 1 is 37.5 percent.

7. **`I/M COMPLIANCE : 1 62.9`**

This command describes the expected compliance rate within the I/M program number 1 is 62.9 percent. The compliance rate is the percentage of vehicles in the fleet that complete the I/M program and receive either a certificate of compliance or a waiver.

8. **`I/M WAIVER RATES   : 1 0.709 0.781`**
This command specifies the percentage of vehicles that fail an initial I/M test and do not pass a retest but receive a certificate of compliance. This input instructs MOBILE6.2 to set the waiver rate at 0.709 percent for pre-1981 model years and 0.781 percent for 1981 and later model years for the I/M program number 1. These values reflect the implementation of the control measure “One-time Waiver from Vehicle Emissions Test”.

9. **`I/M GRACE PERIOD   : 1 5`**
This command specifies that 5 years old and older vehicles are subject to the I/M program number 1.

10. **`I/M CUTPOINTS      : 2 CUTPNT18.D`**
This command specifies the emission level cutpoints, which determine whether a vehicle passes or fails an I/M test, in the I/M program number 2.

11. **`ANTI-TAMP PROG     :`**
`87 75 80 22222 22222222 2 11 80.7 22111222`
This command indicates information for the local anti-tampering program (ATP). Note that there may be more than one component of an anti-tampering program, requiring multiple inputs of this data. Input parameters are detailed as follows:

“**87**" indicates that the program began in 1987.
“**75**" indicates that the earliest model year covered by the program is 1975.
“**80**" indicates that the final model year covered by the program is 1980.
“**22222**" indicates that the five light duty gasoline vehicle classes considered by MOBILE6.2 are all subject to this portion of ATP.
“**22222222**" indicates that the eight heavy duty gasoline vehicle classes considered by MOBILE6.2 are all subject to this portion of ATP.
“**2**" indicates that the gasoline powered buses are subject to this portion of ATP.
“**11**" indicates that credit is to be taken for ATP and that the test is performed annually.
“**80.7**” indicates that the program compliance rate is 80.7 percent.
“**22111222**" indicates that ATP consists of an air pump system disablement test, catalyst removal test, evaporative system disablement test, PCV system disablement test, and missing gas cap test. Tests omitted from the program are a fuel inlet restrictor disablement test, tailpipe lead deposit test, and EGR disablement test.

12. **`REG DIST           :`**

02Reg25.D

This command indicates that local registration distribution data is provided for MOBILE6.2 use, rather than national default data. These data may be found in the external data file '02Reg25.D'.

13. **DIESEL FRACTIONS :**

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0.9585 0.9585 0.9585 0.9585 0.9585
```

This command specifies local diesel fractions for 14 of the 16 composite vehicle categories by vehicle age. For all vehicle classes, MOBILE6.2 default data was used. Since EPA's default data is available up to 2020, the data for the year 2020 was used to represent the year 2025.

Scenario Data Section

1. `SCENARIO RECORD    : I/M Scenario`
   This command is a required field that provides a unique identifier to each scenario. The individual MOBILE6.2 runs performed by MAG have only one scenario for each model run.

2. `CALENDAR YEAR      : 2025`
   This command specifies the calendar year of evaluation to report emissions for 2025.

3. `EVALUATION MONTH   : 7`
   This command specifies the month of evaluation as July, where January and July are the only months of evaluation in MOBILE6.2. Since the modeling episodes are lied in June, July, and August, July of 2025 was selected as the closest month available.

4. `ALTITUDE           : 1`
   This command indicates that MOBILE6.2 calculates emissions for a low-altitude region. The low altitude flag represents approximately 500 feet above sea level and the high altitude flag represents approximately 5,500 feet above sea level.

5. `HOURLY TEMPERATURES:`
   This command specifies local temperatures for each hour of the modeling day, starting at 6 a.m. and continuing through 5 a.m. the next morning.

6. `RELATIVE HUMIDITY  :`
   This command specifies hourly relative humidity values for the modeling day, starting at 6 a.m. and continuing through 5 a.m. the next morning.

7. `BAROMETRIC PRES    : 28.50`
   This command specifies a daily average barometric pressure as 28.5 inches of mercury (Hg).

8. `SPEED VMT          : 256R1A.txt`
   This command indicates that MOBILE6.2 references data stored in the external file named, '256R1A.txt', which contains hourly speed distributions for both freeway and arterial roadway types. In this case, the file reflects a model year of 2025, a model month of June, a model day of Thursday, an area type of 1, and a region inside of Area A.

9. `FUEL PROGRAM       : 2 S`
   This command indicates that MOBILE6.2 uses a reformulated gasoline (RFG) fuel program for a southern region.

10. **FUEL RVP : 7.0**

This command specifies the prevailing fuel Reid Vapor Pressure (RVP) as 7.0 pounds per square inch (psi).

Model Outputs

MOBILE6.2 was executed with the inputs described above to obtain a database of emission factors in grams per mile (g/mi) for CO, NOx, and VOC emissions. The database of emission factors represented emission factors split out by the vehicle classes, vehicle ages, hour of the day, and roadway (facility) type on which the vehicle is driving. These outputs, in the units of grams per mile, were used as an input of the M6Link system for further processing.

ATTACHMENT TWO

MOBILE6.2 INPUT FILES

This section contains a portion of the MOBILE6.2 input files for the I/M and non-I/M runs for Area A and the non-I/M run for outside Area A for the modeling year 2025. The sample inputs are presented in the order of the I/M input for Area A, the non-I/M input for Area A, and the non-I/M input for outside Area A for each modeling episode.

* I/M Run for Area A (June 6, 2025)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

STAGE II REFUELING :
94 1 46. 46.
NO 2007 HDDV RULE  :

I/M PROGRAM        : 1 1995 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 1 1967 1980
I/M VEHICLES       : 1 22222 22222222 2
I/M STRINGENCY     : 1 37.5
I/M COMPLIANCE     : 1 62.9
I/M WAIVER RATES   : 1 0.709 0.781
I/M GRACE PERIOD   : 1 5
I/M PROGRAM        : 2 1995 2050 2 T/O IM240
I/M MODEL YEARS    : 2 1981 1995
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 37.5
I/M COMPLIANCE     : 2 70.
I/M WAIVER RATES   : 2 0.709 0.781
I/M GRACE PERIOD   : 2 5
I/M CUTPOINTS      : 2 CUTPNT18.d
I/M PROGRAM        : 3 1995 2050 2 T/O FP & GC
I/M MODEL YEARS    : 3 1981 1995
I/M VEHICLES       : 3 22222 11111111 1
I/M COMPLIANCE     : 3 70.
I/M WAIVER RATES   : 3 0.709 0.781
I/M GRACE PERIOD   : 3 5
I/M PROGRAM        : 4 2002 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 37.5
I/M COMPLIANCE     : 4 91.5
I/M WAIVER RATES   : 4 0.709 0.781
I/M GRACE PERIOD   : 4 5
I/M PROGRAM        : 5 2002 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 5 1996 2050
I/M VEHICLES       : 5 22222 11111111 1
I/M COMPLIANCE     : 5 98.3
I/M WAIVER RATES   : 5 0.709 0.781
I/M GRACE PERIOD   : 5 5
I/M PROGRAM        : 6 1989 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 6 1981 2050
I/M VEHICLES       : 6 11111 22222222 2
I/M STRINGENCY     : 6 37.5
I/M COMPLIANCE     : 6 95.2
I/M WAIVER RATES   : 6 0.709 0.781
I/M GRACE PERIOD   : 6 5
I/M PROGRAM        : 7 1992 2050 1 T/O GC
I/M MODEL YEARS    : 7 1981 2050
I/M VEHICLES       : 7 11111 22222222 2
I/M COMPLIANCE     : 7 94.2
I/M WAIVER RATES   : 7 0.709 0.781
I/M GRACE PERIOD   : 7 5

ANTI-TAMP PROG     :
87 75 80 22222 22222222 2 11 80.7 22111222
ANTI-TAMP PROG     :
87 81 03 11111 22222222 2 11 90.7 22111222

REG DIST           : 02Reg25.D
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
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SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2025
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 73.8 78.4 81.7 84.0 86.2 88.3 90.0 92.1 93.4 95.0 95.4 94.1
                     91.2 89.1 86.5 83.8 81.1 78.8 76.3 74.8 74.5 75.0 73.8 73.9
RELATIVE HUMIDITY  : 34.6 27.9 23.7 22.6 19.6 18.1 17.4 16.6 15.9 14.7 15.2 16.3
                     17.2 14.4 14.7 11.9 12.4 14.2 17.1 18.2 18.7 23.9 28.9 29.1
BAROMETRIC PRES    : 28.50
SPEED VMT          : 256R1A.txt
FUEL RVP           : 7.0
FUEL PROGRAM       : 2 S

END OF RUN
```

* Non-I/M Run for Area A (June 6, 2025)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA
STAGE II REFUELING :
94 1 46. 46.
NO 2007 HDDV RULE  :
REG DIST           : 02Reg25.D
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
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SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2025
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 73.8 78.4 81.7 84.0 86.2 88.3 90.0 92.1 93.4 95.0 95.4 94.1
                     91.2 89.1 86.5 83.8 81.1 78.8 76.3 74.8 74.5 75.0 73.8 73.9
RELATIVE HUMIDITY  : 34.6 27.9 23.7 22.6 19.6 18.1 17.4 16.6 15.9 14.7 15.2 16.3
                     17.2 14.4 14.7 11.9 12.4 14.2 17.1 18.2 18.7 23.9 28.9 29.1
BAROMETRIC PRES    : 28.50
SPEED VMT          : 256R1A.txt
FUEL RVP           : 7.0
FUEL PROGRAM       : 2 S

END OF RUN
```

* Non-I/M Run for Outside Area A (June 6, 2025)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :

REG DIST           : 02Reg25.D
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
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SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2025
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 73.8 78.4 81.7 84.0 86.2 88.3 90.0 92.1 93.4 95.0 95.4 94.1
                     91.2 89.1 86.5 83.8 81.1 78.8 76.3 74.8 74.5 75.0 73.8 73.9
RELATIVE HUMIDITY  : 34.6 27.9 23.7 22.6 19.6 18.1 17.4 16.6 15.9 14.7 15.2 16.3
                     17.2 14.4 14.7 11.9 12.4 14.2 17.1 18.2 18.7 23.9 28.9 29.1
BAROMETRIC PRES    : 28.50
SPEED VMT          : 256R4O.txt
FUEL RVP           : 7.8

END OF RUN
```

* I/M Run for Area A (July 9, 2025)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

STAGE II REFUELING :
94 1 46. 46.
NO 2007 HDDV RULE  :

I/M PROGRAM        : 1 1995 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 1 1967 1980
I/M VEHICLES       : 1 22222 22222222 2
I/M STRINGENCY     : 1 37.5
I/M COMPLIANCE     : 1 62.9
I/M WAIVER RATES   : 1 0.709 0.781
I/M GRACE PERIOD   : 1 5
I/M PROGRAM        : 2 1995 2050 2 T/O IM240
I/M MODEL YEARS    : 2 1981 1995
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 37.5
I/M COMPLIANCE     : 2 70.
I/M WAIVER RATES   : 2 0.709 0.781
I/M GRACE PERIOD   : 2 5
I/M CUTPOINTS      : 2 CUTPNT18.d
I/M PROGRAM        : 3 1995 2050 2 T/O FP & GC
I/M MODEL YEARS    : 3 1981 1995
I/M VEHICLES       : 3 22222 11111111 1
I/M COMPLIANCE     : 3 70.
I/M WAIVER RATES   : 3 0.709 0.781
I/M GRACE PERIOD   : 3 5
I/M PROGRAM        : 4 2002 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 37.5
I/M COMPLIANCE     : 4 91.5
I/M WAIVER RATES   : 4 0.709 0.781
I/M GRACE PERIOD   : 4 5
I/M PROGRAM        : 5 2002 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 5 1996 2050
I/M VEHICLES       : 5 22222 11111111 1
I/M COMPLIANCE     : 5 98.3
I/M WAIVER RATES   : 5 0.709 0.781
I/M GRACE PERIOD   : 5 5
I/M PROGRAM        : 6 1989 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 6 1981 2050
I/M VEHICLES       : 6 11111 22222222 2
I/M STRINGENCY     : 6 37.5
I/M COMPLIANCE     : 6 95.2
I/M WAIVER RATES   : 6 0.709 0.781
I/M GRACE PERIOD   : 6 5
I/M PROGRAM        : 7 1992 2050 1 T/O GC
I/M MODEL YEARS    : 7 1981 2050
I/M VEHICLES       : 7 11111 22222222 2
I/M COMPLIANCE     : 7 94.2
I/M WAIVER RATES   : 7 0.709 0.781
I/M GRACE PERIOD   : 7 5

ANTI-TAMP PROG     :
87 75 80 22222 22222222 2 11 80.7 22111222
ANTI-TAMP PROG     :
87 81 03 11111 22222222 2 11 90.7 22111222

REG DIST           : 02Reg25.D
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
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0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
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SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2025
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 83.8 87.1 90.5 95.2 98.1 99.9 102.4 104.0 105.3 106.3 107.8 107.1
                     104.0 100.9 98.1 95.7 94.3 91.6 89.6 87.4 84.4 82.8 81.3 81.3
RELATIVE HUMIDITY  : 21.7 19.6 18.1 15.9 13.8 13.6 13.3 12.4 11.6 10.6 9.9 10.4
                     10.3 11.5 13.1 13.5 15.8 19.0 19.3 20.7 25.9 28.8 29.3 23.0
BAROMETRIC PRES    : 28.62
SPEED VMT          : 257T1A.txt
FUEL RVP           : 7.0
FUEL PROGRAM       : 2 S

END OF RUN
```

* Non-I/M Run for Area A (July 9, 2025)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA
STAGE II REFUELING :
94 1 46. 46.
NO 2007 HDDV RULE  :
REG DIST           : 02Reg25.D
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
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SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2025
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 83.8 87.1 90.5 95.2 98.1 99.9 102.4 104.0 105.3 106.3 107.8 107.1
                     104.0 100.9 98.1 95.7 94.3 91.6 89.6 87.4 84.4 82.8 81.3 81.3
RELATIVE HUMIDITY  : 21.7 19.6 18.1 15.9 13.8 13.6 13.3 12.4 11.6 10.6 9.9 10.4
                     10.3 11.5 13.1 13.5 15.8 19.0 19.3 20.7 25.9 28.8 29.3 23.0
BAROMETRIC PRES    : 28.62
SPEED VMT          : 257T1A.txt
FUEL RVP           : 7.0
FUEL PROGRAM       : 2 S

END OF RUN
```

* Non-I/M Run for Outside Area A (July 9, 2025)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :

REG DIST           : 02Reg25.D
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
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SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2025
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 83.8 87.1 90.5 95.2 98.1 99.9 102.4 104.0 105.3 106.3 107.8 107.1
                     104.0 100.9 98.1 95.7 94.3 91.6 89.6 87.4 84.4 82.8 81.3 81.3
RELATIVE HUMIDITY  : 21.7 19.6 18.1 15.9 13.8 13.6 13.3 12.4 11.6 10.6 9.9 10.4
                     10.3 11.5 13.1 13.5 15.8 19.0 19.3 20.7 25.9 28.8 29.3 23.0
BAROMETRIC PRES    : 28.62
SPEED VMT          : 257T4O.txt
FUEL RVP           : 7.8
END OF RUN
```

* I/M Run for Area A (August 10, 2025)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

STAGE II REFUELING :
94 1 46. 46.
NO 2007 HDDV RULE  :

I/M PROGRAM        : 1 1995 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 1 1967 1980
I/M VEHICLES       : 1 22222 22222222 2
I/M STRINGENCY     : 1 37.5
I/M COMPLIANCE     : 1 62.9
I/M WAIVER RATES   : 1 0.709 0.781
I/M GRACE PERIOD   : 1 5
I/M PROGRAM        : 2 1995 2050 2 T/O IM240
I/M MODEL YEARS    : 2 1981 1995
I/M VEHICLES       : 2 22222 11111111 1
I/M STRINGENCY     : 2 37.5
I/M COMPLIANCE     : 2 70.
I/M WAIVER RATES   : 2 0.709 0.781
I/M GRACE PERIOD   : 2 5
I/M CUTPOINTS      : 2 CUTPNT18.d
I/M PROGRAM        : 3 1995 2050 2 T/O FP & GC
I/M MODEL YEARS    : 3 1981 1995
I/M VEHICLES       : 3 22222 11111111 1
I/M COMPLIANCE     : 3 70.
I/M WAIVER RATES   : 3 0.709 0.781
I/M GRACE PERIOD   : 3 5
I/M PROGRAM        : 4 2002 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 37.5
I/M COMPLIANCE     : 4 91.5
I/M WAIVER RATES   : 4 0.709 0.781
I/M GRACE PERIOD   : 4 5
I/M PROGRAM        : 5 2002 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 5 1996 2050
I/M VEHICLES       : 5 22222 11111111 1
I/M COMPLIANCE     : 5 98.3
I/M WAIVER RATES   : 5 0.709 0.781
I/M GRACE PERIOD   : 5 5
I/M PROGRAM        : 6 1989 2050 1 T/O LOADED/IDLE
I/M MODEL YEARS    : 6 1981 2050
I/M VEHICLES       : 6 11111 22222222 2
I/M STRINGENCY     : 6 37.5
I/M COMPLIANCE     : 6 95.2
I/M WAIVER RATES   : 6 0.709 0.781
I/M GRACE PERIOD   : 6 5
I/M PROGRAM        : 7 1992 2050 1 T/O GC
I/M MODEL YEARS    : 7 1981 2050
I/M VEHICLES       : 7 11111 22222222 2
I/M COMPLIANCE     : 7 94.2
I/M WAIVER RATES   : 7 0.709 0.781
I/M GRACE PERIOD   : 7 5

ANTI-TAMP PROG     :
87 75 80 22222 22222222 2 11 80.7 22111222
ANTI-TAMP PROG     :
87 81 03 11111 22222222 2 11 90.7 22111222

REG DIST           : 02Reg25.D
DIESEL FRACTIONS   :
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SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2025
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 79.2 80.4 82.2 84.9 86.0 86.7 88.3 90.7 91.4 94.1 93.4 91.4
                     88.3 84.4 84.4 84.4 83.8 83.3 82.6 82.2 82.2 81.1 80.8 80.1
RELATIVE HUMIDITY  : 80.9 78.4 74.1 68.3 64.0 62.7 61.0 55.3 50.1 44.5 45.7 47.9
                     55.1 65.3 64.3 64.3 65.3 67.4 67.8 69.0 69.5 72.7 75.3 77.9
BAROMETRIC PRES    : 28.74
SPEED VMT          : 258F1A.txt
FUEL RVP           : 7.0
FUEL PROGRAM       : 2 S

END OF RUN
```

* Non-I/M Run for Area A (August 10, 2025)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA
STAGE II REFUELING :
94 1 46. 46.
NO 2007 HDDV RULE  :
REG DIST           : 02Reg25.D
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
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SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2025
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 79.2 80.4 82.2 84.9 86.0 86.7 88.3 90.7 91.4 94.1 93.4 91.4
                     88.3 84.4 84.4 84.4 83.8 83.3 82.6 82.2 82.2 81.1 80.8 80.1
RELATIVE HUMIDITY  : 80.9 78.4 74.1 68.3 64.0 62.7 61.0 55.3 50.1 44.5 45.7 47.9
                     55.1 65.3 64.3 64.3 65.3 67.4 67.8 69.0 69.5 72.7 75.3 77.9
BAROMETRIC PRES    : 28.74
SPEED VMT          : 258F1A.txt
FUEL RVP           : 7.0
FUEL PROGRAM       : 2 S

END OF RUN
```

* Non-I/M Run for Outside Area A (August 10, 2025)

```
MOBILE6 INPUT FILE :
DATABASE OUTPUT    :
WITH FIELDNAMES    :
DATABASE EMISSIONS : 2222 2222
DATABASE FACILITIES: Arterial Freeway Local Ramp None
DATABASE VEHICLES  : 22222 22222222 2 222 22222222 222

RUN DATA

NO 2007 HDDV RULE  :

REG DIST           : 02Reg25.D
DIESEL FRACTIONS   :
0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009 0.0009
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SCENARIO RECORD    : I/M Scenario
CALENDAR YEAR      : 2025
EVALUATION MONTH   : 7
ALTITUDE           : 1
HOURLY TEMPERATURES: 79.2 80.4 82.2 84.9 86.0 86.7 88.3 90.7 91.4 94.1 93.4 91.4
                     88.3 84.4 84.4 84.4 83.8 83.3 82.6 82.2 82.2 81.1 80.8 80.1
RELATIVE HUMIDITY  : 80.9 78.4 74.1 68.3 64.0 62.7 61.0 55.3 50.1 44.5 45.7 47.9
                     55.1 65.3 64.3 64.3 65.3 67.4 67.8 69.0 69.5 72.7 75.3 77.9
BAROMETRIC PRES    : 28.74
SPEED VMT          : 258F4O.txt
FUEL RVP           : 7.8
END OF RUN
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Appendix IV-vii

Growth Factors

Appendix IV-vii contains growth factors based on the population and employment projections data accepted by the MAG Regional Council in May 2007.

In evaluating the maintenance of the National Ambient Air Quality Standards (NAAQS) for eight-hour ozone, an estimate of ozone precursor emissions in 2025 was necessary. MAG has created the growth factors to project point and area source emissions in the 2005 baseline year to the ozone maintenance modeling year 2025. The growth factors were developed to estimate future emissions based on changes in population, employment, aircraft operations, and vehicle miles of travel between the baseline year, 2005, and the future year, 2025.

BACKGROUND

The growth factors used to project the 2005 NOx and VOC emissions to 2025 are described below. The EPA guidance document Procedures For Preparing Emissions Projections, EPA450/4-91-019, May, 1991 was referenced to develop growth factors. The following equation, obtained from the Procedures document, illustrates the calculation of growth factors:

$$\text{Projected Year Growth Factor} = \frac{\text{Value of Growth Indicator in Projection Year}}{\text{Value of Growth Indicator in Periodic Year}}$$

Growth factors were applied to the 2005 NOx and VOC emissions for point (except power plant emissions) and area sources to determine annual projected emissions.

As indicated above, this methodology was not applied to project 2025 emissions from power plants of point source because power plant emissions in 2025 was conservatively based on the PTE emission rates. The PTE emission rates for power plants were provided by the MCAQD.

Growth Factors

Details on the growth factor estimation procedure are discussed in this section. For each standard industrial classification (SIC), growth factors were applied on the basis of the most appropriate growth indicator. The growth indicators that were applied to each SIC were reviewed by MCAQD and PCAQD. The growth factors were interpolated, since the socioeconomic data were only available in ten-year increments (i.e., 2010, 2020 and 2030).

Socioeconomic Growth Factors

In May 2007, the MAG Regional Council approved the MAG Socioeconomic Projections of Population, Housing and Employment by Municipal Planning Area and Regional Analysis Zone in Maricopa County. These projections were prepared to be consistent with the September 1, 2005 Census Survey and were prepared for July 1st of base 2005 and projected for July 1st of 2010, 2020, and 2030. These projections were based on Maricopa County population control totals developed by the AZ Department of Economic Security and the results of 2005 Census Survey. Detailed documentation on the 2007 MAG Socioeconomic Projections.

The Maricopa County population and employment for 2005 and 2025 are summarized in Table 1. The general methodology for creating a growth factor consisted of dividing the value of the growth indicator in the projection year (2025) by the value of the growth indicator in the base year (2005). For example, the growth factor from 2005 to 2025 for a category based on industrial employment is 574,600 divided by 357,700 or 1.61.

Table 1. Population, employment, and VMT for 2005 and 2025

Maricopa County		
Category	**2005**	**2025**
Population (POP)	3,681,000	5,698,200
Retail Employment (Retail)	466,200	847,700
Office Employment (Office)	384,600	737,300
Public Employment (Public)	244,200	404,400
Industrial Employment (Industrial)	357,700	574,600
Agricultural Acres	181,212	74,064
Other Employment (Other)	293,600	514,300
Total Employment (EMP)	1,746,400	3,078,300
Eight-Hour Ozone Modeling Domain (4 km)		
Category	**2005**	**2025**
Daily Vehicle Miles of Travel (VMT)	78,382,292	137,096,339

Table 2 displays the growth factors for point sources other than power plants.

It is important to note that emissions from the existing power plant units for 2025 were assumed as potential to emit (PTE). The data listed in the "Reference" column in Table 2 identifies the growth indicator from Table 1 that was used to create the growth factor for each point source. Sources based on a growth indicator of mining employment (MINING) were assumed to remain constant between 2005 and 2025.

Table 2. 2025 point source growth factors

BUSINESS NAME	INSIC	GF-2025	REFERENCE
ANDERSON CLAYTON CORP-VALENCIA GIN	0724	1.55	POP
FARMER'S GIN INC	0724	1.55	POP
PALOMA GIN PROPERTIES LLC	0724	1.55	POP
RINKER MATERIALS	1423	1	Mining
CONTRACTORS LANDFILL & RECYCLING	1442	1	Mining
HANSON AGGREGATES OF ARIZONA INC	1442	1	Mining
MADISON GRANITE SUPPLIES	1442	1	Mining
MESA MATERIALS INC	1442	1	Mining
SUN LAND MATERIALS	1442	1	Mining
SUN STATE ROCK & MATERIALS	1442	1	Mining
VULCAN MATERIALS CO	1442	1	Mining
VULCAN MATERIALS CO-WESTERN DIVISION	1442	1	Mining
WICKENBURG FACILITY	1442	1	Mining
CIRCLE H SAND & ROCK	1446	1	Mining
SUNLAND BEEF COMPANY	2011	1.61	Industrial
UNITED DAIRYMEN OF ARIZONA	2023	1.61	Industrial
WESTERN MILLING	2048	1.61	Industrial
EARTHGRAINS BAKING COMPANIES INC	2051	1.61	Industrial
HOLSUM BAKERY INC	2051	1.61	Industrial
BONDED LOGIC INC	2297	1.55	POP
BILTMORE SHUTTERS INC	2431	1.61	Industrial
BRYANT INDUSTRIES INC	2431	1.61	Industrial
CRAFTSMEN IN WOOD MFG	2431	1.61	Industrial
EXECUTIVE DOOR	2431	1.61	Industrial
HERITAGE SHUTTERS INC	2431	1.61	Industrial
BURDETTE CABINET CO INC	2434	1.61	Industrial
CHOLLA CUSTOM CABINETS INC	2434	1.61	Industrial
MASTERCRAFT CABINETS INC	2434	1.61	Industrial
OAKCRAFT INC	2434	1.61	Industrial
WOODCASE FINE CABINETRY INC	2434	1.61	Industrial
CAVCO INDUSTRIES INC	2451	1.61	Industrial
CAVCO INDUSTRIES LLC/DURANGO PLANT	2451	1.61	Industrial
CLAYTON HOMES-EL MIRAGE	2451	1.61	Industrial
FLEETWOOD HOMES OF ARIZONA INC #21	2451	1.61	Industrial
PALM HARBOR HOMES INC	2451	1.61	Industrial
SCHULT HOMES	2451	1.61	Industrial
SMURFIT STONE CONTAINER CORP	2499	1.61	Industrial
SOUTHWEST FOREST PRODUCTS INC	2499	1.61	Industrial
AF LORTS MANUFACTURING COMPANY	2511	1.61	Industrial

BUSINESS NAME	INSIC	GF-2025	REFERENCE
GOLDEN EAGLE MANUFACTURING	2511	1.61	Industrial
LEGENDS FURNITURE	2511	1.61	Industrial
NEW DIRECTIONS INCORPORATED	2511	1.61	Industrial
OAK CANYON MANUFACTURING INC	2511	1.61	Industrial
OASIS BEDROOM CO	2511	1.61	Industrial
STONE CREEK INC	2511	1.61	Industrial
THORNWOOD FURNITURE MFG	2511	1.61	Industrial
THUNDERBIRD FURNITURE	2511	1.61	Industrial
TRENDWOOD INC	2511	1.61	Industrial
CASE FURNITURE & DESIGN LLC	2521	1.61	Industrial
PACKAGING CORPORATION OF AMERICA INC	2653	1.61	Industrial
PHOENIX NEWSPAPERS INC	2711	1.61	Industrial
CENTURY GRAPHICS LLC	2752	1.61	Industrial
COURIER GRAPHICS CORP	2752	1.61	Industrial
LITHO TECH INC	2752	1.61	Industrial
O'NEIL PRINTING INC	2752	1.61	Industrial
QUEBECOR WORLD-PHOENIX DIVISION	2752	1.61	Industrial
W R MEADOWS OF AZ INC	2899	1.61	Industrial
VULCAN MATERIALS CO-WESTERN DIVISION	2951	1.61	Industrial
GOODRICH AIRCRAFT INTERIOR PRODUCTS	3069	1.61	Industrial
ROGERS CORP/ADVANCED CIRCUIT MATERIALS	3083	1.55	POP
HENRY PRODUCTS INC	3086	0.5796	(Rule 358)
HIGHLAND PRODUCTS INC	3086	0.5796	(Rule 358)
INSULFOAM	3086	0.5796	(Rule 358)
WINCUP HOLDINGS INC	3086	0.5796	(Rule 358)
DESERT SUN FIBERGLASS	3087	1.61	Industrial
L & M LAMINATES & MARBLE	3087	1.61	Industrial
MAAX SPAS ARIZONA	3087	1.61	Industrial
MESA FULLY FORMED INC	3087	1.61	Industrial
MARLAM INDUSTRIES INC	3089	1.61	Industrial
PHOENIX BRICK YARD	3251	1.61	Industrial
BUILDING PRODUCTS CO	3259	1.55	POP
CORESLAB STRUCTURES (ARIZ) INC	3272	1.61	Industrial
EAGLE ROOFING PRODUCTS	3272	1.61	Industrial
MONIER LIFETILE LLC	3272	1.61	Industrial
STACO ARCHITECTURAL ROOF TILE	3272	1.61	Industrial
TPAC A DIVISION OF KIEWIT WESTERN CO	3272	1.61	Industrial
TRENWYTH INDUSTRIES	3272	1.61	Industrial
UTILITY VAULT CO	3272	1.61	Industrial
CEMEX MESA PLANTS NO #61 & #71	3273	1.61	Industrial

BUSINESS NAME	INSIC	GF-2025	REFERENCE
RIVER RANCH PLANT #40	3273	1.61	Industrial
NATIONAL GYPSUM CO	3275	1.55	POP
RED MOUNTAIN MINING INC	3299	1.55	POP
ALLIED TUBE AND CONDUIT	3317	1.61	Industrial
DOLPHIN INC	3324	1.61	Industrial
M E GLOBAL INC	3325	1.61	Industrial
HYDRO ALUMINUM NORTH AMERICA INC	3354	1.61	Industrial
PRESTO CASTING CO	3369	1.61	Industrial
REXAM BEVERAGE CAN COMPANY	3411	1.61	Industrial
ABLE STEEL FABRICATORS	3441	1.61	Industrial
HAULMARK INDUSTRIES INC	3441	1.61	Industrial
QUINCY JOIST COMPANY	3441	1.61	Industrial
SCHUFF STEEL CO	3441	1.61	Industrial
WASTEQUIP-AG	3443	1.61	Industrial
ARIZONA GALVANIZING INC	3479	1.61	Industrial
PAN-GLO SERVICES	3479	1.61	Industrial
VALLEY INDUSTRIAL PAINTING	3479	1.61	Industrial
LITTON ELECTRO-OPTICAL SYSTEMS	3671	1.61	Industrial
NELTEC INC	3672	1.61	Industrial
SANMINA PHOENIX DIVISION	3672	1.61	Industrial
FLIPCHIP INTERNATIONAL LLC	3674	1.61	Industrial
FREESCALE SEMICONDUCTOR INC	3674	1.61	Industrial
INTEL CORP-OCOTILLO CAMPUS (FAB 12 & 22)	3674	1.61	Industrial
MICROCHIP TECHNOLOGY INC	3674	1.61	Industrial
ST MICROELECTRONICS	3674	1.61	Industrial
SUMCO SOUTHWEST CORPORATION	3674	1.61	Industrial
JABIL CIRCUIT INC	3679	1.61	Industrial
THE BOEING COMPANY	3721	1.61	Industrial
HONEYWELL ENGINES SYS & SERVICE PHX R&O	3724	1.61	Industrial
HONEYWELL-ENGINES SYSTEMS & SERVICES	3724	1.61	Industrial
PARKER HANNIFIN GTFSD	3724	1.61	Industrial
ALL PRO INDUSTRIAL FINISHES	3728	1.61	Industrial
HONEYWELL ENGINES SYSTEMS ACCESSORIES	3728	1.61	Industrial
SIMULA SAFETY SYSTEMS INC	3728	1.61	Industrial
AMERI-FAB INC	3799	1.61	Industrial
SUNTRON CORPORATION	3812	1.61	Industrial
PENN RACQUET SPORTS INC	3949	1.61	Industrial
PING INC	3949	1.61	Industrial
ARMORWORKS LLC	3999	1.61	Industrial
CALJET	4226	1.61	Industrial

BUSINESS NAME	INSIC	GF-2025	REFERENCE
APS WEST PHX POWER PLANT	4911	1	No Growth
GILA RIVER POWER STATION	4911	1	No Growth
LSP ARLINGTON VALLEY LLC	4911	1	No Growth
MESQUITE GENERATING STATION	4911	1	No Growth
OCOTILLO POWER PLANT	4911	1	No Growth
PALO VERDE NUCLEAR GENERATING STATION	4911	1	No Growth
REDHAWK GENERATING FACILITY	4911	1	No Growth
SANTAN GENERATING STATION	4911	1	No Growth
SRP AGUA FRIA GENERATING STATION	4911	1	No Growth
SRP KYRENE GENERATING STATION	4911	1	No Growth
23RD AVE WASTEWATER TREATMENT PLANT	4952	1.55	POP
91ST AVE WASTEWATER TREATMENT PLANT	4952	1.55	POP
BUTTERFIELD STATION FACILITY	4953	1.55	POP
CITY OF CHANDLER LANDFILL	4953	1.55	POP
NORTHWEST REGIONAL LANDFILL	4953	1.55	POP
SKUNK CREEK LANDFILL	4953	1.55	POP
SW REG MUNICIPAL SOLID WASTE LANDFILL	4953	1.55	POP
ADESA PHOENIX LLC	5012	1.55	POP
EMPIRE MACHINERY CO	5082	1.61	Industrial
BP WEST COAST PRODUCTS LLC/PHX TERMINAL	5171	1.61	Industrial
CALVERT OIL CO	5171	1.61	Industrial
CHEVRON USA INC	5171	1.61	Industrial
CONOCO PHILLIPS PHOENIX TERMINAL	5171	1.61	Industrial
SFPP LP PHOENIX TERMINAL	5171	1.61	Industrial
GLENN WEINBERGER TOPSOIL INC	5191	1.55	POP
WESTERN ORGANICS INC	5191	1.55	POP
BILLBOARD POSTER COMPANY INC	7312	1.61	Industrial
AMERICAN EXPRESS IPC FACILITY	7374	1.55	POP
PURCELLS WESTERN STATES TIRE	7534	1.92	Office
U HAUL INTL/TECHNICAL CENTER	7538	1.82	Retail
QUINTERO AREA WATER SYSTEM	7997	1.55	POP
ARIZONA STATE UNIVERSITY	8211	1.55	POP
DAIMLERCHRYSLER ARIZONA PROVING GROUNDS	8734	1.55	POP
LUKE AFB - 56TH FIGHTER WING	9711	1	No Growth

Note: Rule 358 was applied for the Point sources with SIC 3086 with Growth Factor as 0.5796.

Table 3 displays the growth factors for area source categories. The “Reference” column identifies the growth indicator in Table 1. The agricultural acreage growth factor was extrapolated by applying the average percent reduction of 2000 to 2004 from PM-10 Five Percent Plan and the value was applied to 2005 acreage to extrapolate 2025 acreage value. The agricultural acreage information was from historical Arizona Agricultural Statistics for Maricopa County in 2000-2005.

NONROAD Growth Factors

Table 4 shows the list of growth factors by nonroad categories for 2025, relative to the baseline year of 2005 in the NONROAD2005 model. The growth factors for Maricopa County shown in Table 4 are obtained from the EPA NONROAD2005 model.

Table 3. 2025 area source growth factors

Area Source Category	SCC	GF-2025	REFERENCE
Industrial nat. gas	2102006000	1.61	Industrial
Industrial fuel oil	2102004000	1.61	Industrial
Comm./inst. nat. gas	2103006000	1.92	Office
Comm./inst. fuel oil	2103004000	1.92	Office
Residential nat. gas	2104006000	1.55	POP
Residential wood combustion	2104008000	1	No growth
Residential fuel oil	2104004000	1.55	POP
Chemical Mfg.	2301000000	1.61	Industrial
Commercial Cooking	2302002000	1.82	Retail employment
Bakeries	2302050000	1.82	Retail employment
Secondary Metal	2304000000	1.61	Industrial
Mineral Processing	2305000000	1.61	Industrial
Rubber/Plastic	2308000000	1.61	Industrial
Machinery (Elec) Mfg.	2312000000	1.61	Industrial
DEQ-permitted portable sources	2305000000	1.61	Industrial
Ind. Processes NEC	2399000000	1.61	Industrial
Architectural coatings	2401001000	1.55	POP
Auto refinishing	2401005000	1.82	Retail employment
Traffic markings	2401008000	1.55	POP
Factory finished (flat)wood	2401015000	1.61	Industrial
Wood Furniture	2401020000	1.61	Industrial
Aircraft	2401075000	1.61	Industrial
Misc. surf. coat.	2401090000	1.61	Industrial
Degreasing	2415000000	1.61	Industrial
Dry cleaning	2420000000	1.55	POP
Graphics arts	2425000000	1.61	Industrial
Misc. Ind. Solv use	2440000000	1.61	Industrial
Ag. Pesticides	2461850000	0.013	Agricultural acreage
Consumer/comm. solvent use	2460000000	1.55	POP
Asphalt application	2461020000	1.55	POP
Bulk plants/terminals	2501050120	1.75	VMT
VOL storage/transport	2510000000	1.61	Industrial
Fuel Delivery	2501060050	1.75	VMT
Trucks in transit	2505030120	1.75	VMT
Station losses	2501060201	1.75	VMT
Vehicle refueling	2501060100	1.75	VMT
On-site incineration	2601000000	1.61	Industrial
Open Burning	2610000000	1	No grow
Landfills	2620000000	1.55	POP

Area Source Category	SCC	GF-2025	REFERENCE
POTWs	2630000000	1.55	POP
LUST	2640000000	1	No grow
Other waste	2650000000	1.55	POP
Wildfires	2810001000	0	No growth
Prescribed Fires	2810015000	1	No grow
Structure Fires	2810030000	1.55	POP
Vehicle Fires	2810050000	1.55	POP
Aircraft engine testing	2810040000	1.61	Industrial
Hospitals	2850000000	1.55	POP
Crematories	2601020000	1.55	POP
Accidental releases	2830000000	1.61	Industrial

Table 4. 2025 nonroad growth factors

NONROAD EQUIPMENT GROWTH FACTORS					
Nonroad Equipment Type	**SCC**	**CLASSIFICATION**	**Fuel Type**	**Engine Type**	**2025 GF**
Motorcycles: Off-Road	2260001010	Recreational Equipment	Gasoline	2 Stroke	1.66
ATVs	2260001030	Recreational Equipment	Gasoline	2 Stroke	1.81
Specialty Vehicles/Carts	2260001060	Recreational Equipment	Gasoline	2 Stroke	1.15
Tampers/Rammers	2260002006	Construction and Mining Equipment	Gasoline	2 Stroke	1.06
Plate Compactors	2260002009	Construction and Mining Equipment	Gasoline	2 Stroke	1.06
Paving Equipment	2260002021	Construction and Mining Equipment	Gasoline	2 Stroke	1.06
Signal Boards/Light Plants	2260002027	Construction and Mining Equipment	Gasoline	2 Stroke	1.06
Concrete/Industrial Saws	2260002039	Construction and Mining Equipment	Gasoline	2 Stroke	1.06
Crushing/Proc. Equipment	2260002054	Construction and Mining Equipment	Gasoline	2 Stroke	1.06
Rotary Tillers < 6 HP	2260004015	Lawn and Garden Equipment (Res)	Gasoline	2 Stroke	1.40
Chain Saws < 6 HP	2260004020	Lawn and Garden Equipment (Res)	Gasoline	2 Stroke	1.40
Trimmers/Edgers/Brush Cutter	2260004025	Lawn and Garden Equipment (Res)	Gasoline	2 Stroke	1.40
Leafblowers/Vacuums	2260004030	Lawn and Garden Equipment (Res)	Gasoline	2 Stroke	1.40
Sprayers	2260005035	Agricultural Equipment	Gasoline	2 Stroke	1.31
Generator Sets	2260006005	Commercial Equipment	Gasoline	2 Stroke	1.60
Pumps	2260006010	Commercial Equipment	Gasoline	2 Stroke	1.60
Air Compressors	2260006015	Commercial Equipment	Gasoline	2 Stroke	1.60
Hydro Power Units	2260006035	Commercial Equipment	Gasoline	2 Stroke	1.60
Motorcycles: Off-Road	2265001010	Recreational Equipment	Gasoline	4 Stroke	1.66
ATVs	2265001030	Recreational Equipment	Gasoline	4 Stroke	1.63
Golf Carts	2265001050	Recreational Equipment	Gasoline	4 Stroke	1.15
Specialty Vehicles/Carts	2265001060	Recreational Equipment	Gasoline	4 Stroke	1.15
Pavers	2265002003	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Tampers/Rammers	2265002006	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Plate Compactors	2265002009	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Rollers	2265002015	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Paving Equipment	2265002021	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Surfacing Equipment	2265002024	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Signal Boards/Light Plants	2265002027	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Trenchers	2265002030	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Bore/Drill Rigs	2265002033	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Concrete/Industrial Saws	2265002039	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Cement & Mortar Mixers	2265002042	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Cranes	2265002045	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Crushing/Proc. Equipment	2265002054	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Rough Terrain Forklifts	2265002057	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Rubber Tire Loaders	2265002060	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Tractors/Loaders/Backhoes	2265002066	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Skid Steer Loaders	2265002072	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Dumpers/Tenders	2265002078	Construction and Mining Equipment	Gasoline	4 Stroke	1.06

NONROAD EQUIPMENT GROWTH FACTORS					
Nonroad Equipment Type	SCC	CLASSIFICATION	Fuel Type	Engine Type	2025 GF
Other Construction Equipment	2265002081	Construction and Mining Equipment	Gasoline	4 Stroke	1.06
Lawn mowers	2265004010	Lawn and Garden Equipment (Res)	Gasoline	4 Stroke	1.40
Rotary Tillers < 6 HP	2265004015	Lawn and Garden Equipment (Res)	Gasoline	4 Stroke	1.40
Trimmers/Edgers/Brush Cutter	2265004025	Lawn and Garden Equipment (Res)	Gasoline	4 Stroke	1.40
Leafblowers/Vacuums	2265004030	Lawn and Garden Equipment (Res)	Gasoline	4 Stroke	1.40
Rear Engine Riding Mowers	2265004040	Lawn and Garden Equipment (Res)	Gasoline	4 Stroke	1.40
Lawn & Garden Tractors	2265004055	Lawn and Garden Equipment (Res)	Gasoline	4 Stroke	1.40
Other Lawn & Garden Eqp.	2265004075	Lawn and Garden Equipment (Res)	Gasoline	4 Stroke	1.40
2-Wheel Tractors	2265005010	Agricultural Equipment	Gasoline	4 Stroke	1.31
Agricultural Tractors	2265005015	Agricultural Equipment	Gasoline	4 Stroke	1.31
Combines	2265005020	Agricultural Equipment	Gasoline	4 Stroke	1.31
Balers	2265005025	Agricultural Equipment	Gasoline	4 Stroke	1.31
Agricultural Mowers	2265005030	Agricultural Equipment	Gasoline	4 Stroke	1.31
Sprayers	2265005035	Agricultural Equipment	Gasoline	4 Stroke	1.31
Tillers > 6 HP	2265005040	Agricultural Equipment	Gasoline	4 Stroke	1.31
Swathers	2265005045	Agricultural Equipment	Gasoline	4 Stroke	1.31
Other Agricultural Equipment	2265005055	Agricultural Equipment	Gasoline	4 Stroke	1.31
Irrigation Sets	2265005060	Agricultural Equipment	Gasoline	4 Stroke	1.31
Generator Sets	2265006005	Commercial Equipment	Gasoline	4 Stroke	1.60
Pumps	2265006010	Commercial Equipment	Gasoline	4 Stroke	1.60
Air Compressors	2265006015	Commercial Equipment	Gasoline	4 Stroke	1.60
Welders	2265006025	Commercial Equipment	Gasoline	4 Stroke	1.60
Pressure Washers	2265006030	Commercial Equipment	Gasoline	4 Stroke	1.60
Hydro Power Units	2265006035	Commercial Equipment	Gasoline	4 Stroke	1.60
Specialty Vehicle Carts	2267001060	Recreational Equipment	LPG	LPG	1.16
Pavers	2267002003	Construction and Mining Equipment	LPG	LPG	1.39
Rollers	2267002015	Construction and Mining Equipment	LPG	LPG	1.39
Paving Equipment	2267002021	Construction and Mining Equipment	LPG	LPG	1.39
Surfacing Equipment	2267002024	Construction and Mining Equipment	LPG	LPG	1.39
Trenchers	2267002030	Construction and Mining Equipment	LPG	LPG	1.39
Bore/Drill Rigs	2267002033	Construction and Mining Equipment	LPG	LPG	1.39
Concrete/Industrial Saws	2267002039	Construction and Mining Equipment	LPG	LPG	1.39
Cranes	2267002045	Construction and Mining Equipment	LPG	LPG	1.39
Crushing/Proc. Equipment	2267002054	Construction and Mining Equipment	LPG	LPG	1.39
Rough Terrain Forklifts	2267002057	Construction and Mining Equipment	LPG	LPG	1.39
Rubber Tire Loaders	2267002060	Construction and Mining Equipment	LPG	LPG	1.39
Tractors/Loaders/Backhoes	2267002066	Construction and Mining Equipment	LPG	LPG	1.39
Skid Steer Loaders	2267002072	Construction and Mining Equipment	LPG	LPG	1.39
Other Construction Equipment	2267002081	Construction and Mining Equipment	LPG	LPG	1.39
Aerial Lifts	2267003010	Industrial Equipment	LPG	LPG	1.53
Forklifts	2267003020	Industrial Equipment	LPG	LPG	1.53

NONROAD EQUIPMENT GROWTH FACTORS					
Nonroad Equipment Type	SCC	CLASSIFICATION	Fuel Type	Engine Type	2025 GF
Sweepers/Scrubbers	2267003030	Industrial Equipment	LPG	LPG	1.53
Other General Industrial Equipm	2267003040	Industrial Equipment	LPG	LPG	1.53
Other Material Handling Equipment	2267003050	Industrial Equipment	LPG	LPG	1.53
Terminal Tractors	2267003070	Industrial Equipment	LPG	LPG	1.53
Other Agricultural Equipment	2267005055	Agricultural Equipment	LPG	LPG	1.00
Generator Sets	2267006005	Commercial Equipment	LPG	LPG	2.01
Pumps	2267006010	Commercial Equipment	LPG	LPG	2.01
Air Compressors	2267006015	Commercial Equipment	LPG	LPG	2.01
Welders	2267006025	Commercial Equipment	LPG	LPG	2.01
Pressure Washers	2267006030	Commercial Equipment	LPG	LPG	2.01
Hydro Power Units	2267006035	Commercial Equipment	LPG	LPG	2.01
Other Construction Equipment	2268002081	Construction and Mining Equipment	CNG	CNG	1.39
Forklifts	2268003020	Industrial Equipment	CNG	CNG	1.45
Sweepers/Scrubbers	2268003030	Industrial Equipment	CNG	CNG	1.45
Other General Industrial Equipment	2268003040	Industrial Equipment	CNG	CNG	1.45
AC\Refrigeration	2268003060	Industrial Equipment	CNG	CNG	1.45
Terminal Tractors	2268003070	Industrial Equipment	CNG	CNG	1.45
Generator Sets	2268006005	Commercial Equipment	CNG	CNG	1.62
Pumps	2268006010	Commercial Equipment	CNG	CNG	1.62
Air Compressors	2268006015	Commercial Equipment	CNG	CNG	1.62
Gas Compressors	2268006020	Commercial Equipment	CNG	CNG	1.62
Speciality Vehicle Carts	2270001060	Recreational Equipment	Diesel	Diesel	1.52
Pavers	2270002003	Construction and Mining Equipment	Diesel	Diesel	1.50
Tampers/Rammers	2270002006	Construction and Mining Equipment	Diesel	Diesel	1.50
Plate Compactors	2270002009	Construction and Mining Equipment	Diesel	Diesel	1.50
Rollers	2270002015	Construction and Mining Equipment	Diesel	Diesel	1.50
Scrapers	2270002018	Construction and Mining Equipment	Diesel	Diesel	1.50
Paving Equipment	2270002021	Construction and Mining Equipment	Diesel	Diesel	1.50
Surfacing Equipment	2270002024	Construction and Mining Equipment	Diesel	Diesel	1.50
Signal Boards/Light Plants	2270002027	Construction and Mining Equipment	Diesel	Diesel	1.50
Trenchers	2270002030	Construction and Mining Equipment	Diesel	Diesel	1.50
Bore/Drill Rigs	2270002033	Construction and Mining Equipment	Diesel	Diesel	1.50
Excavators	2270002036	Construction and Mining Equipment	Diesel	Diesel	1.50
Concrete/Industrial Saws	2270002039	Construction and Mining Equipment	Diesel	Diesel	1.50
Cement & Mortar Mixers	2270002042	Construction and Mining Equipment	Diesel	Diesel	1.50
Cranes	2270002045	Construction and Mining Equipment	Diesel	Diesel	1.50
Graders	2270002048	Construction and Mining Equipment	Diesel	Diesel	1.50
Off-highway Trucks	2270002051	Construction and Mining Equipment	Diesel	Diesel	1.50
Crushing/Proc. Equipment	2270002054	Construction and Mining Equipment	Diesel	Diesel	1.50
Rough Terrain Forklifts	2270002057	Construction and Mining Equipment	Diesel	Diesel	1.50
Rubber Tire Loaders	2270002060	Construction and Mining Equipment	Diesel	Diesel	1.50

NONROAD EQUIPMENT GROWTH FACTORS					
Nonroad Equipment Type	SCC	CLASSIFICATION	Fuel Type	Engine Type	2025 GF
Tractors/Loaders/Backhoes	2270002066	Construction and Mining Equipment	Diesel	Diesel	1.50
Crawler Tractor/Dozers	2270002069	Construction and Mining Equipment	Diesel	Diesel	1.50
Skid Steer Loaders	2270002072	Construction and Mining Equipment	Diesel	Diesel	1.50
Off-Highway Tractors	2270002075	Construction and Mining Equipment	Diesel	Diesel	1.50
Dumpers/Tenders	2270002078	Construction and Mining Equipment	Diesel	Diesel	1.50
Other Construction Equipment	2270002081	Construction and Mining Equipment	Diesel	Diesel	1.50
Aerial Lifts	2270003010	Industrial Equipment	Diesel	Diesel	1.55
Forklifts	2270003020	Industrial Equipment	Diesel	Diesel	1.55
Sweepers/Scrubbers	2270003030	Industrial Equipment	Diesel	Diesel	1.55
Other General Industrial Eqp	2270003040	Industrial Equipment	Diesel	Diesel	1.55
Other Material Handling Eqp	2270003050	Industrial Equipment	Diesel	Diesel	1.55
AC\Refrigeration	2270003060	Industrial Equipment	Diesel	Diesel	1.55
Terminal Tractors	2270003070	Industrial Equipment	Diesel	Diesel	1.55
2-Wheel Tractors	2270005010	Agricultural Equipment	Diesel	Diesel	1.45
Agricultural Tractors	2270005015	Agricultural Equipment	Diesel	Diesel	1.45
Combines	2270005020	Agricultural Equipment	Diesel	Diesel	1.45
Balers	2270005025	Agricultural Equipment	Diesel	Diesel	1.45
Agricultural Mowers	2270005030	Agricultural Equipment	Diesel	Diesel	1.45
Sprayers	2270005035	Agricultural Equipment	Diesel	Diesel	1.45
Tillers > 6 HP	2270005040	Agricultural Equipment	Diesel	Diesel	1.45
Swathers	2270005045	Agricultural Equipment	Diesel	Diesel	1.45
Other Agricultural Equipment	2270005055	Agricultural Equipment	Diesel	Diesel	1.45
Irrigation Sets	2270005060	Agricultural Equipment	Diesel	Diesel	1.45
Generator Sets	2270006005	Commercial Equipment	Diesel	Diesel	1.65
Pumps	2270006010	Commercial Equipment	Diesel	Diesel	1.65
Air Compressors	2270006015	Commercial Equipment	Diesel	Diesel	1.65
Welders	2270006025	Commercial Equipment	Diesel	Diesel	1.65
Pressure Washers	2270006030	Commercial Equipment	Diesel	Diesel	1.65
Hydro Power Units	2270006035	Commercial Equipment	Diesel	Diesel	1.65
Outboard	2282005010	Pleasure Craft	Gasoline	2 Stroke	1.15
Personal Water Craft	2282005015	Pleasure Craft	Gasoline	2 Stroke	1.15
Inboard/Sterndrive	2282010005	Pleasure Craft	Gasoline	4 Stroke	1.15
Inboard/Sterndrive	2282020005	Pleasure Craft	Diesel	Diesel	1.52
Outboards	2282020010	Pleasure Craft	Diesel	Diesel	1.52
Railway Maintenance	2285002015	Railroad Equipment	Diesel	Diesel	1.62
Railway Maintenance	2285004015	Railroad Equipment	Gasoline	4 Stroke	1.22
Railway Maintenance	2285006015	Railroad Equipment	LPG	LPG	1.40
Rotary Tillers < 6 HP	2260004016	Lawn and Garden Equipment (Com)	Gasoline	2 Stroke	1.40
Chain Saws < 6 HP	2260004021	Lawn and Garden Equipment (Com)	Gasoline	2 Stroke	1.40
Trimmers/Edgers/Brush Cutter	2260004026	Lawn and Garden Equipment (Com)	Gasoline	2 Stroke	1.40
Leafblowers/Vacuums	2260004031	Lawn and Garden Equipment (Com)	Gasoline	2 Stroke	1.40

NONROAD EQUIPMENT GROWTH FACTORS					
Nonroad Equipment Type	SCC	CLASSIFICATION	Fuel Type	Engine Type	2025 GF
Commercial Turf Equipment	2260004071	Lawn and Garden Equipment (Com)	Gasoline	2 Stroke	1.40
Lawn mowers	2265004011	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Rotary Tillers < 6 HP	2265004016	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Trimmers/Edgers/Brush Cutter	2265004026	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Leafblowers/Vacuums	2265004031	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Rear Engine Riding Mowers	2265004041	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Front Mowers	2265004046	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Shredders < 6 HP	2265004051	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Lawn & Garden Tractors	2265004056	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Chippers/Stump Grinders	2265004066	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Commercial Turf Equipment	2265004071	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Other Lawn & Garden Eqp.	2265004076	Lawn and Garden Equipment (Com)	Gasoline	4 Stroke	1.40
Front Mowers	2270004046	Lawn and Garden Equipment (Com)	Diesel	Diesel	1.87
Lawn & Garden Tractors	2270004056	Lawn and Garden Equipment (Com)	Diesel	Diesel	1.87
Chippers/Stump Grinders	2270004066	Lawn and Garden Equipment (Com)	Diesel	Diesel	1.87
Commercial Turf Equipment	2270004071	Lawn and Garden Equipment (Com)	Diesel	Diesel	1.87
Other Lawn & Garden Eqp.	2270004076	Lawn and Garden Equipment (Com)	Diesel	Diesel	1.87

Appendix IV-viii

Supplemental Analysis for the Sensitivity of the Maintenance Demonstration to a Range of Power Plant Emission Rates

This supplemental analysis provides the maintenance test results of replacing the PTE emission rates in 2025 with the 2005 baseline power plant emission rates in order to determine the sensitivity of the maintenance demonstration to a range of power plant emission rates. The PTE rates are considered to be the most conservative assumption for power plant emissions in 2025, while the 2005 baseline power plant emission rates are assumed to be the minimum levels in 2025 due to the anticipated growth in population and industry between 2005 and 2025.

Table 1 presents the CAMx/MM5 modeling results for the three episodes based on the 2005 baseline power plant emission rates in the maintenance year of 2025. The maximum modeled future design values were predicted to occur at the North Phoenix monitoring site for all three episodes. The peak predicted future design values are 82 ppb for the June episode, 78 ppb for the July episode, and 81 ppb for the August episode. Ranges of the future design values are 61 - 82 ppb for the June episode, 59 - 78 ppb for the July episode, and 61 - 81 ppb for the August episode. Since all of these future design values are less than the eight-hour ozone standard of 85 ppb, the maintenance test was passed for all three episodes that were modeled for the ozone season of 2025.

In addition to the CAMx/MM5 modeling of monitored areas, an unmonitored area analysis was conducted to analyze the impact of the 2005 baseline power plant emissions on maintenance of the eight-hour ozone standard in 2025. The results of this analysis indicate that all future design values in unmonitored areas are below the eight-hour ozone standard. The maximum future design values from this unmonitored area analysis are 83 ppb for the June episode, 78 ppb for the July episode, and 84 ppb for the August episode of 2025.

Figures 1 through 3 present the isopleth plots of the unmonitored area analysis results for the modeling episodes overlaid with the modeled future year design value for each monitoring site. As a result of this supplemental analysis, it can be concluded that the modeled future design values for monitored areas range from 81 ppb (PTE rates) to 82 ppb (2005 baseline power plant emission rates), while the range of the maximum future design values in unmonitored areas is 83 ppb (PTE rates) to 84 ppb (2005 baseline power plant emission rates). These results provide convincing evidence that maintenance can be demonstrated in 2025 with power plant emission rates that range from the minimum 2005 baseline to the maximum PTE levels.

Table 1. CAMx/MM5 maintenance test results based on the 2005 baseline power plant emission rates in the maintenance year of 2025

Site Name	Site ID	AIRS	2005 Baseline Design Value (ppb)	June		July		August	
				RRF	2025 Future Design Value (ppb)	RRF	2025 Future Design Value (ppb)	RRF	2025 Future Design Value (ppb)
Tonto NM	TNM	40070010	80.3	0.9638	77.3	n/a*	n/a*	n/a*	n/a*
West Phoenix	WP	40130019	73.3	0.9983	73.1	0.9221	67.5	0.9933	72.8
North Phoenix	NP	40131004	82.7	1.0000	**82.7**	0.9490	**78.4**	0.9822	**81.2**
Falcon Field	FF	40131010	75.3	0.9881	74.4	0.9487	71.4	0.9606	72.3
Glendale	GL	40132001	76.7	1.0010	76.7	0.9221	70.7	0.9863	75.6
Pinnacle Peak	PP	40132005	77.0	0.9804	75.4	0.9332	71.8	0.9442	72.7
Central Phoenix	CP	40133002	75.7	1.0030	75.9	0.9518	72.0	0.9813	74.2
South Scottsdale	SS	40133003	76.7	1.0030	76.8	0.9350	71.7	0.9808	75.2
South Phoenix	SP	40134003	72.7	1.0020	72.8	0.9368	68.1	0.9972	72.4
West Chandler	WC	40134004	75.0	0.9793	73.4	0.9452	70.8	0.9455	70.9
Tempe	TEMP	40134005	75.7	1.0030	75.8	0.9555	72.3	0.9915	75.0
Cave Creek	CC	40134008	79.3	0.9635	76.4	0.9256	73.4	0.9553	75.7
Dysart	DY	40134010	67.3	0.9823	66.1	0.9279	62.4	0.9575	64.4
Buckeye	BE	40134011	64.0	0.9711	62.1	0.9393	60.1	0.9554	61.1
Laveen	LV	40137003	70.0	0.9699	67.8	0.9275	64.9	0.9417	65.9
Humboldt Mountain	HM	40139508	82.0	0.9522	78.0	0.9024	73.9	0.9171	75.2
Blue Point	BP	40139702	73.0	0.9767	71.2	0.9439	68.9	0.9345	68.2
Fountain Hills	FH	40139704	82.0	0.9761	80.0	0.9373	76.8	0.9238	75.7
Rio Verde	RV	40139706	81.7	0.9697	79.2	0.9095	74.3	0.9171	74.9
Super Site	SUPR	40139997	74.7	0.9971	74.4	0.9451	70.5	0.9824	73.3
Apache Junction	AJ	40213001	72.7	0.9712	70.6	0.9418	68.4	0.9290	67.5
Casa Grande	CG	40213003	71.0	0.9571	67.9	n/a*	n/a*	n/a*	n/a*
Queen Creek	QC	40213009	65.3	0.9627	62.8	0.9116	59.5	n/a*	n/a*
Maricopa	MCPA	40213010	64.0	0.9588	61.3	n/a*	n/a*	n/a*	n/a*
Sacaton	SAC	40217001	70.7	0.9553	67.5	n/a*	n/a*	n/a*	n/a*
Queen Valley	QV	40218001	80.0	0.9723	77.7	0.9188	73.5	n/a*	n/a*

* Since the minimum concentration threshold is 70 ppb, some sites predicting baseline eight-hour ozone values lower than 70 ppb for all episode days do not have an RRF or a future design value. These are indicated as “n/a”.

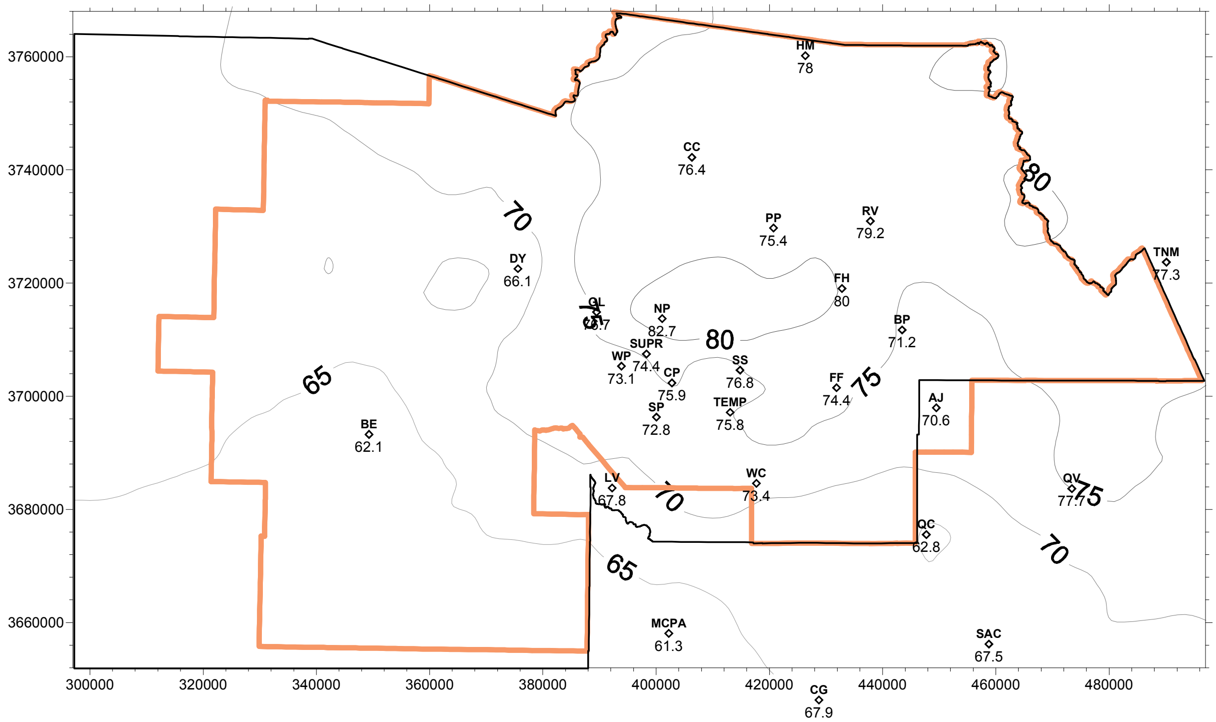

Figure 1. Contour plot showing monitored and unmonitored area analysis results for the June episode

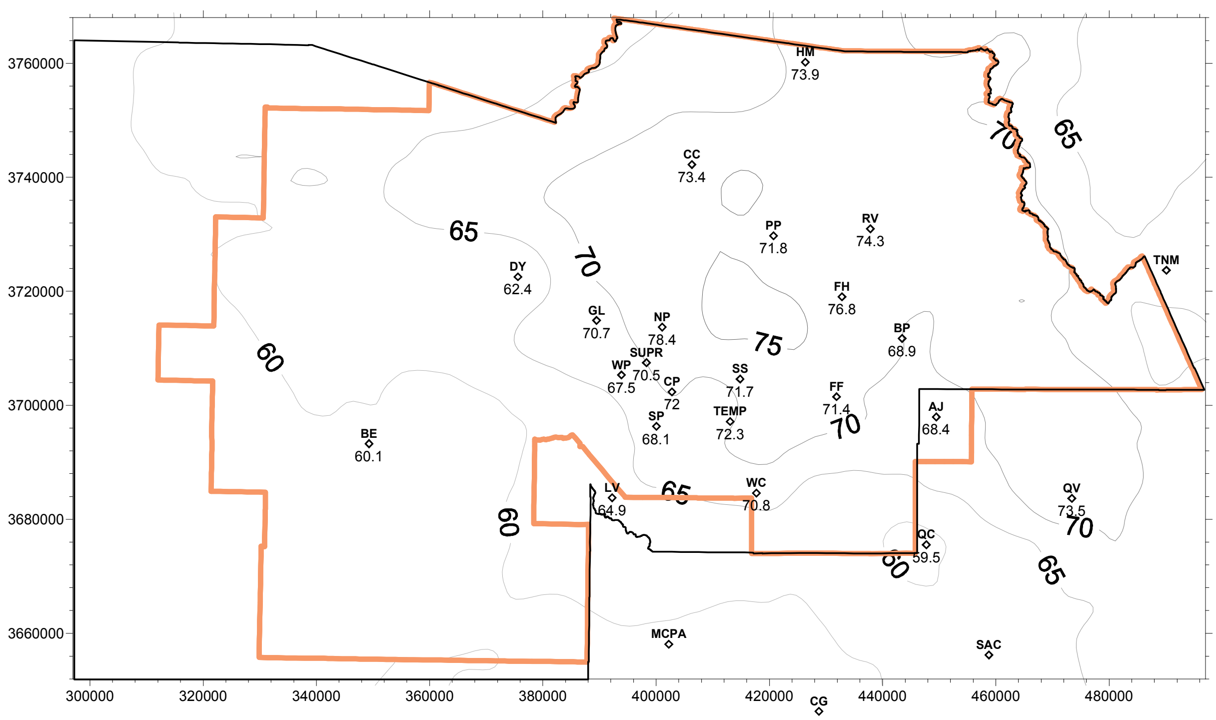

Figure 2. Contour plot showing monitored and unmonitored area analysis results for the July episode

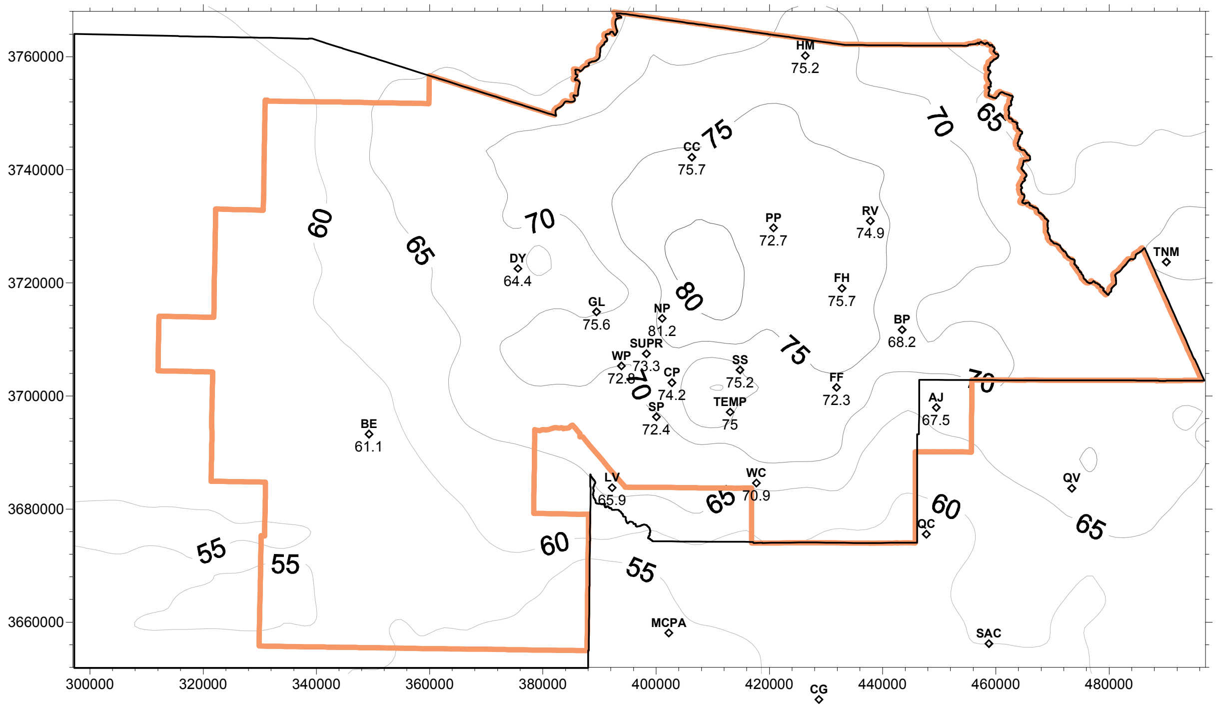

Figure 3. Contour plot showing monitored and unmonitored area analysis results for the August episode

Appendix IV-ix

Development of CAMx 2025 Regional Initial/Boundary Conditions

ENVIRON

MEMORANDUM

To: Ieesuck Jung, Taejoo Shin, Cathy Arthur

From: Bonyoung Koo, Ou Nopmongcol, Chris Emery

Date: 5 May 2008

Subject: Development of CAMx 2025 regional initial/boundary conditions

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In the one-way nesting approach, a coarse-grid domain provides the initial and boundary conditions for a finer nested domain. In this task, the interface programs ICON and BCON were used to translate three-dimensional 2018 WRAP results from 36-km CMAQ output files to initial and boundary conditions for the MAG 12-km regional grid. A similar approach was followed in preparing 2001 and 2002 episodic 12-km regional initial/boundary conditions from 2002 WRAP results. However, in this case the initial/boundary conditions extracted from 2018 WRAP results will be used to represent conditions in 2025.

The 36-km emissions inputs were developed by Western Regional Air Partnership (WRAP) to address regional PM and visibility regulations throughout the western U.S. The most updated WRAP emission database at the time of this work was the "2018 PRP" emissions database. This database was built from the WRAP 2002 inventory by projecting the impacts of activity growth and emission controls. The point and area projection report for the 2018 base case emission inventory can be found on the WRAP website (ERG, 2006). Details on data collection, emission processing and quality assurance of the WRAP emission inventory can be found in Tonnesen et al. (2006). The WRAP 2018 emissions QA plots are available at: http://pah.cert.ucr.edu/aqm/308/qa_prp18a36.shtml.

The CMAQ simulation (version 4.5.1) was performed for the summer months of 2002 on the North American 36-km unified-RPO modeling grid (148×112) with 19 vertical layers. For this application, CMAQ was run with the WRAP input databases by initializing the model 15 days prior to June 1 (May 17) and running through August 31. It was necessary to rerun CMAQ in order to generate the massive 3-D output files needed to extract hourly concentration fields for the initial/boundary conditions.

CMAQ ICON/BCON Extraction

The CMAQ ICON/BCON processors (v4.5.1) were used to extract initial and boundary condition files for the MAG 12-km grid. The ICON files were extracted at 07:00 GMT to get initial conditions at local (MST) midnight for each of the initial days of the two 2002 MAG modeling episodes. For the 2001 episode, monthly-average concentrations for August 2002 were used.

The daily BCON files were extracted in GMT (midnight-to-midnight), then cut and stitched together to provide hourly 07:00-07:00 GMT (midnight to midnight MST) boundary condition files. Again, the BCON files extracted from the 2002 August CMAQ outputs were averaged and then date-shifted to each day of the August 2001 episode. The MAG modeling domain follows the WRAP vertical layer structure through its full 19 layers (although the MAG domain includes an additional 20th layer at the model top), thus no vertical layer interpolation was needed. The 20th CAMx layer was added by simply copying data from the 19th layer.

CMAQ-to-CAMx Conversion

The CMAQ ICON/BCON files described above were then converted to CAMx IC/BC/TC input files using the CMAQ2CAMx Version 2 interface utility, which converts CMAQ input file format (I/O-API) to CAMx format (UAM-IV). Additionally, this utility converts CMAQ species to the appropriate naming conventions used by CAMx. Finally, the CMAQ2CAMx processor also shifts the time-span of the ICON/BCON files from GMT to local time (MST).

Note that no extrapolation of IC/BC data from 2018 to 2025 was performed. The IC/BC/TC inputs derived in this task represent conditions as forecast by WRAP for 2018, and are assumed to characterize conditions in 2025.

References

ERG. 2006: WRAP Point and Area Source Emissions Projections for the 2018 Base Case Inventory. Prepared for the Western Governors Association. January 2006. http://www.wrapair.org/forums/ssjf/documents/WRAP_2018_EI-Version_1-Report_Jan2006.pdf

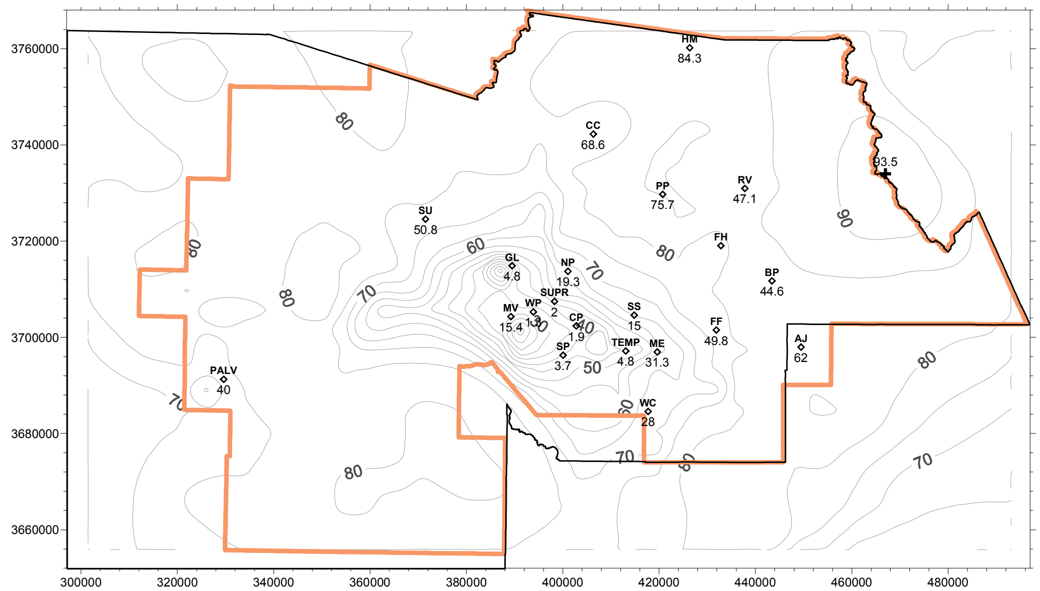
Tonnesen, G. et al., 2006: Final Report for the Western Regional Air Partnership (WRAP) 2002 Visibility Model Performance Evaluation. Prepared for the Western Governors Association. February 2006. http://pah.cert.ucr.edu/aqm/308/reports/final/2002_MPE_report_main_body_FINAL.pdf.

Appendix IV-x

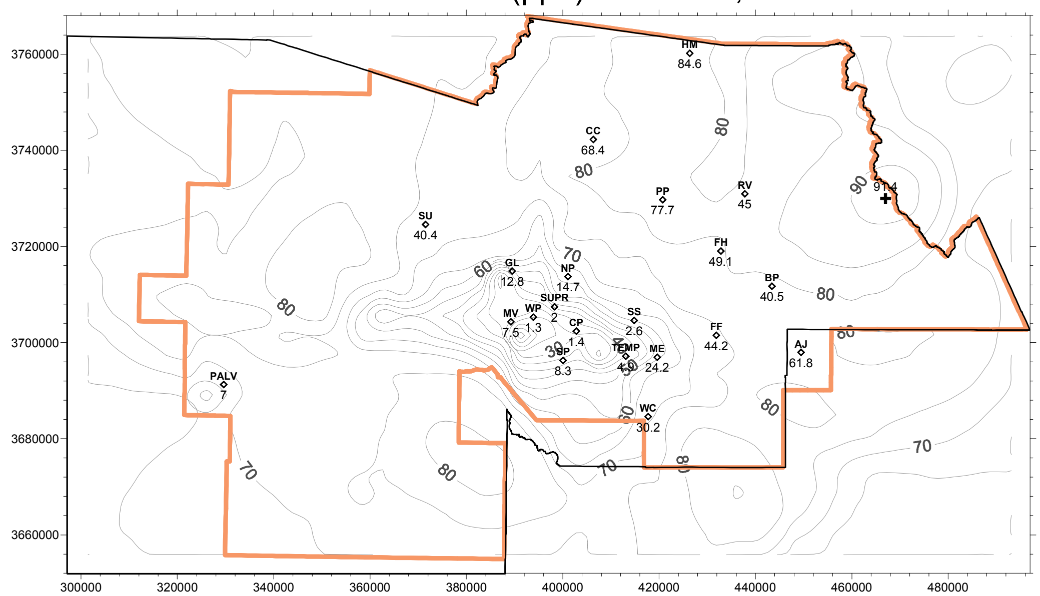
Modeled 1-Hour Ozone for the June 2005 Episode

The plots shown here are the simulated 1-hour ozone for the baseline year. These hourly ozone concentrations are from 0:00 to 24:00 LST on June 6, 2005.

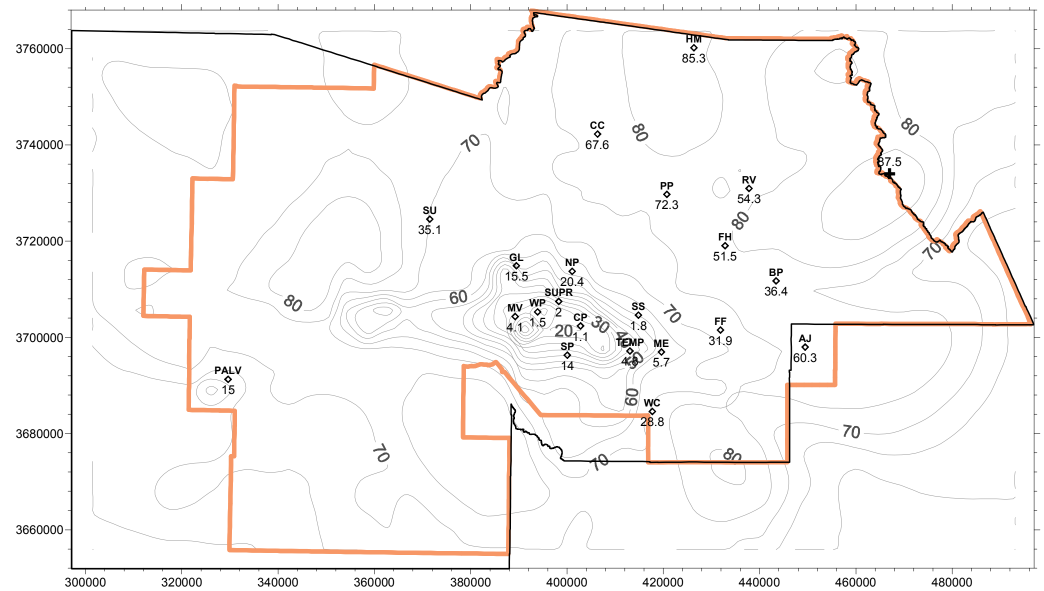
Surface 1-hour ozone concentration (ppb) on June 6, 2005 0:00-1:00 LST



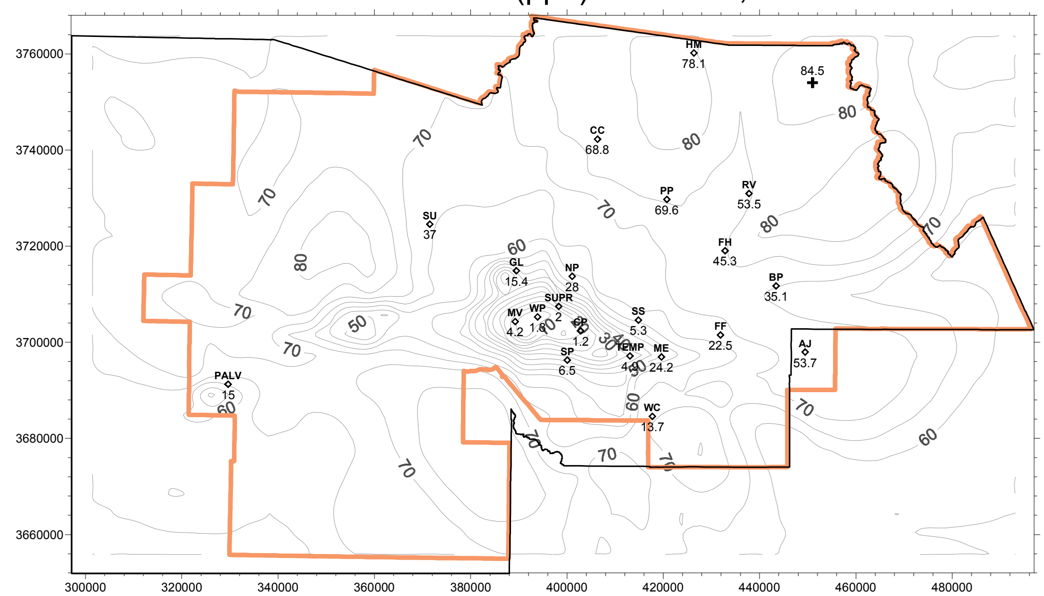
Surface 1-hour ozone concentration (ppb) on June 6, 2005 1:00-2:00 LST



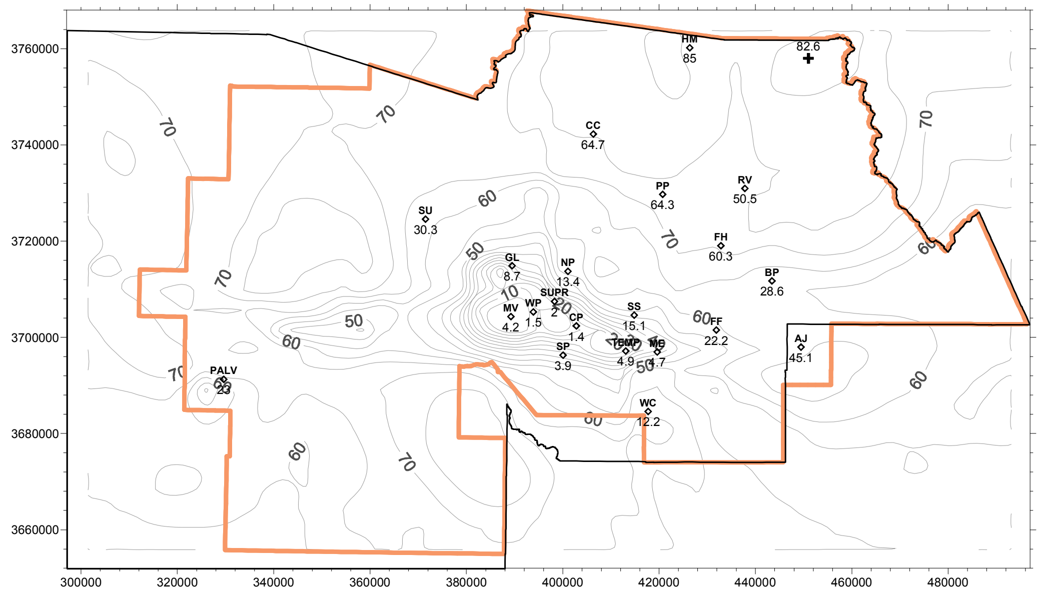
Surface 1-hour ozone concentration (ppb) on June 6, 2005 2:00-300 LST



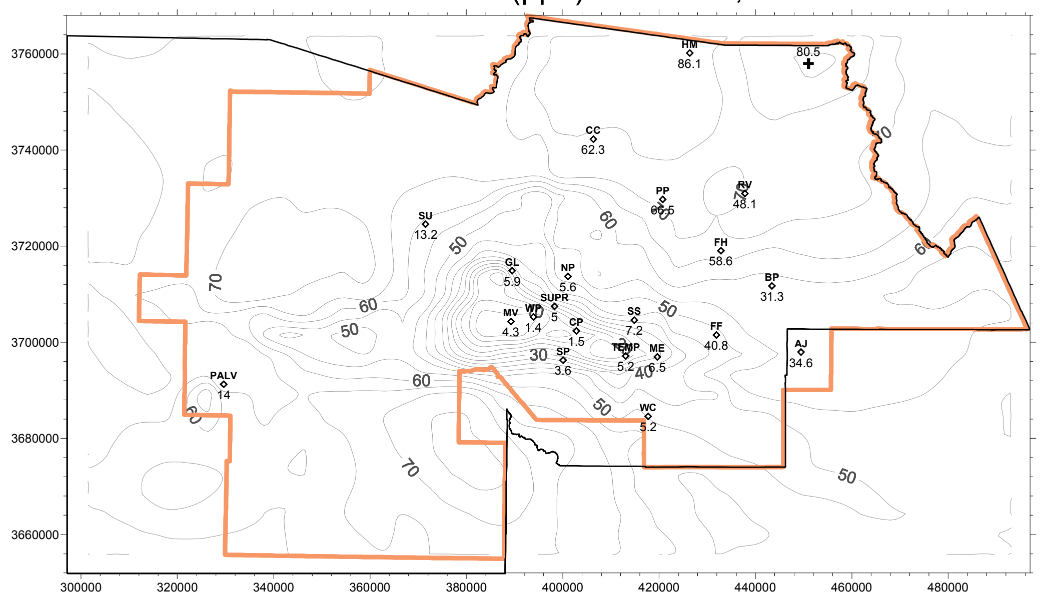
Surface 1-hour ozone concentration (ppb) on June 6, 2005 3:00-4:00 LST



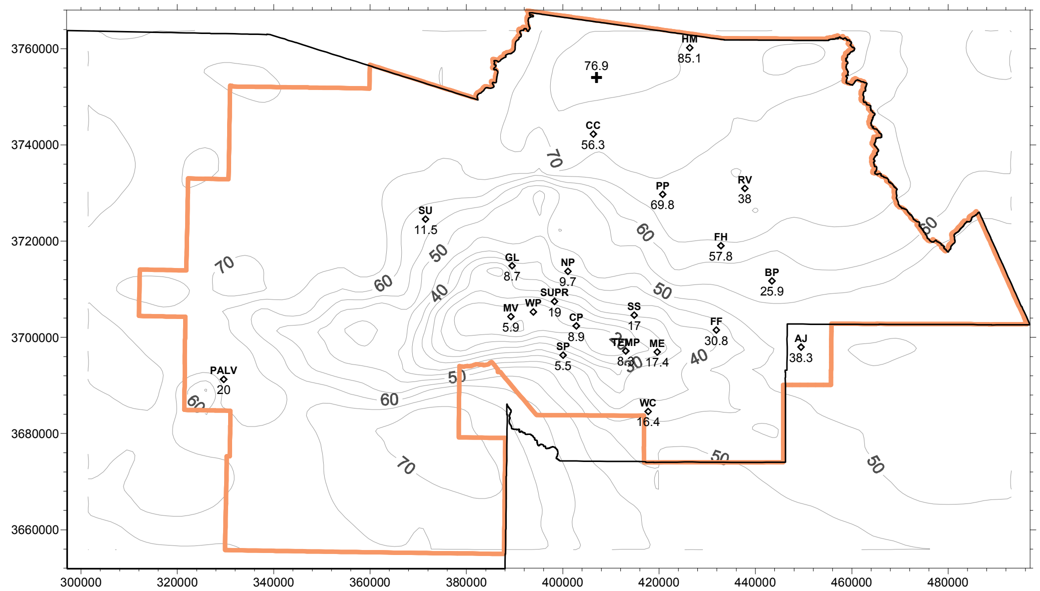
Surface 1-hour ozone concentration (ppb) on June 6, 2005 4:00-5:00 LST



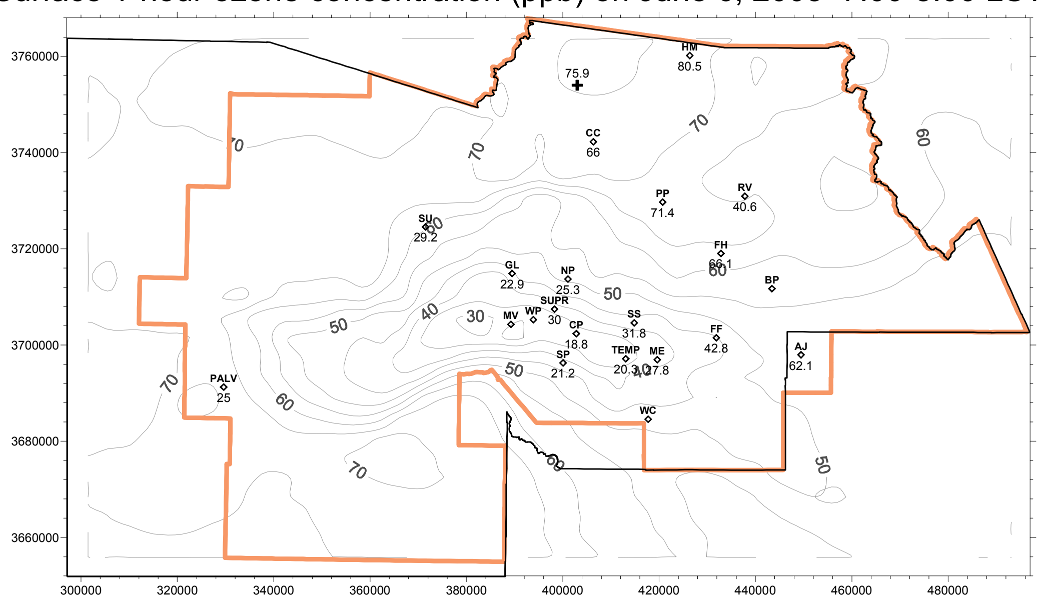
Surface 1-hour ozone concentration (ppb) on June 6, 2005 5:00-6:00 LST



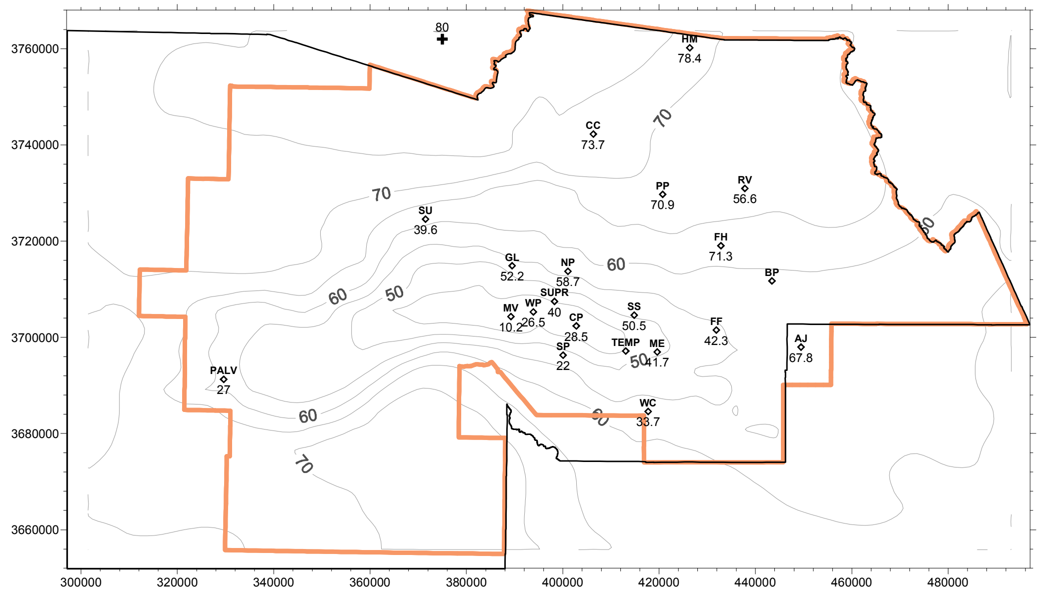
Surface 1-hour ozone concentration (ppb) on June 6, 2005 6:00-7:00 LST



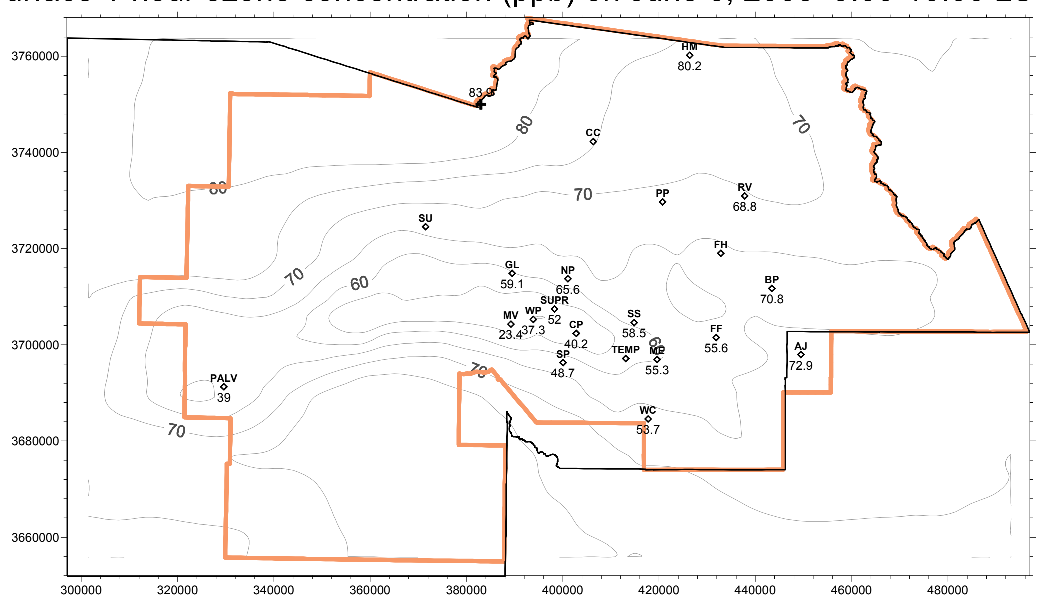
Surface 1-hour ozone concentration (ppb) on June 6, 2005 7:00-8:00 LST



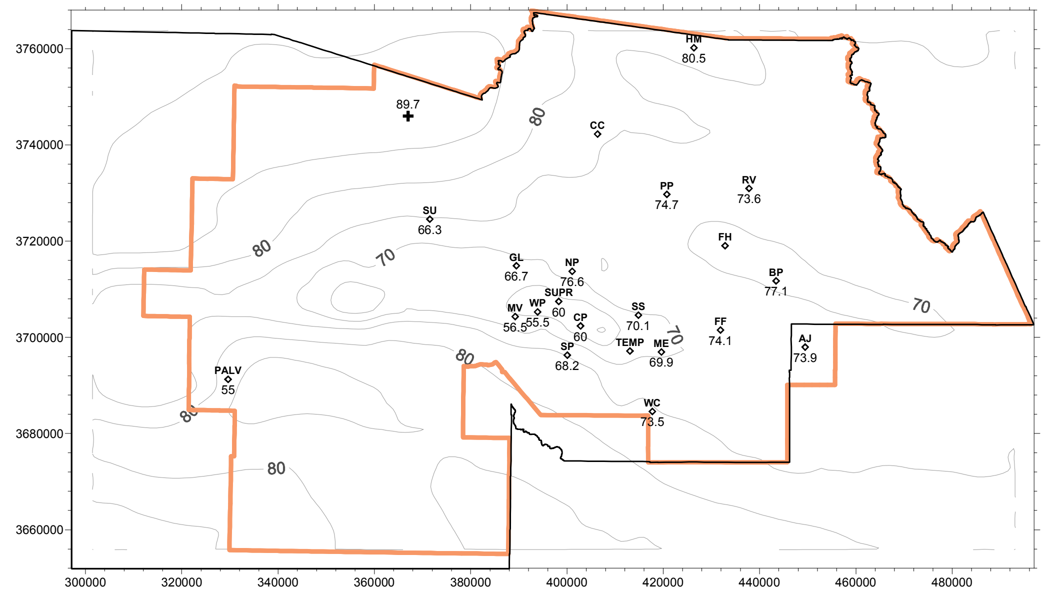
Surface 1-hour ozone concentration (ppb) on June 6, 2005 8:00-9:00 LST



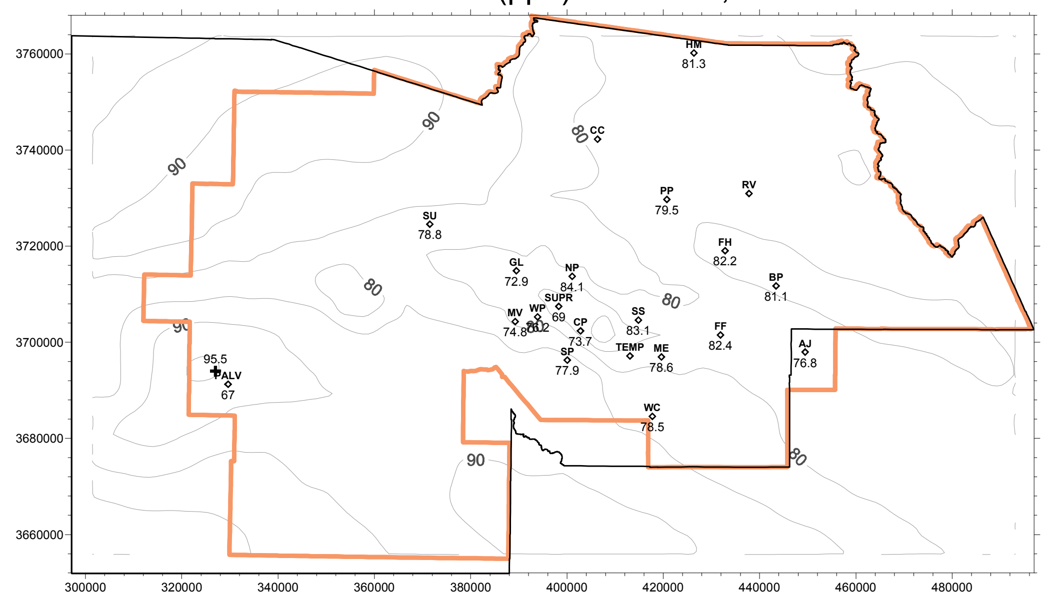
Surface 1-hour ozone concentration (ppb) on June 6, 2005 9:00-10:00 LST



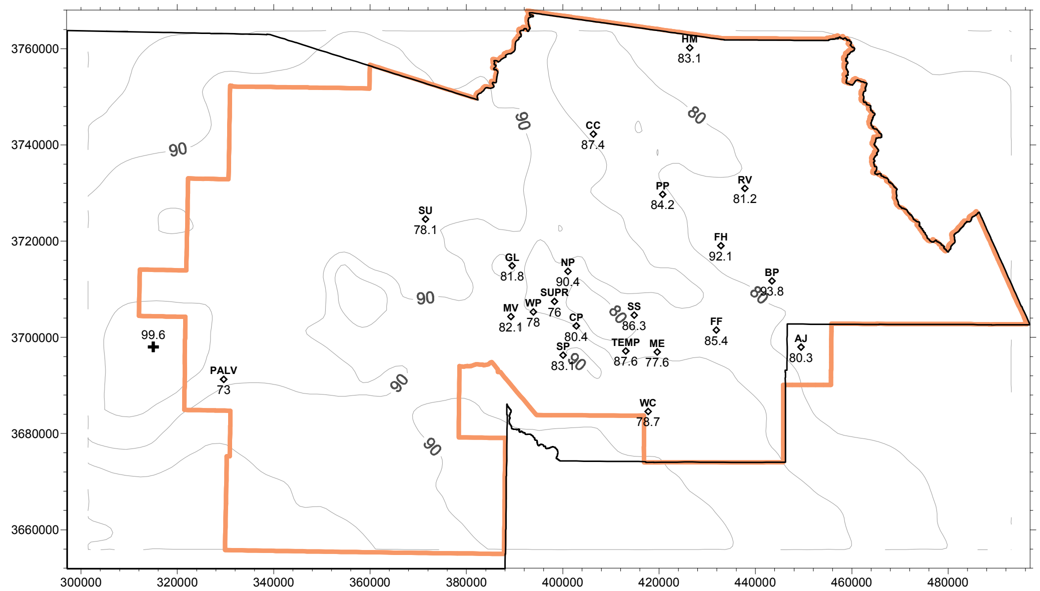
Surface 1-hour ozone concentration (ppb) on June 6, 2005 10:00-11:00 LST



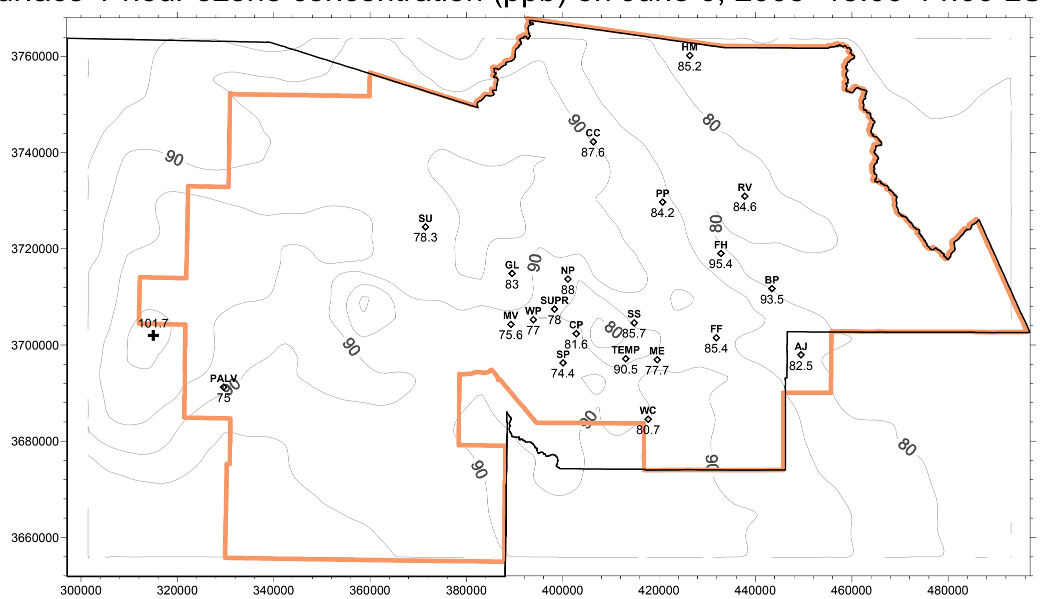
Surface 1-hour ozone concentration (ppb) on June 6, 2005 11:00-12:00 LST



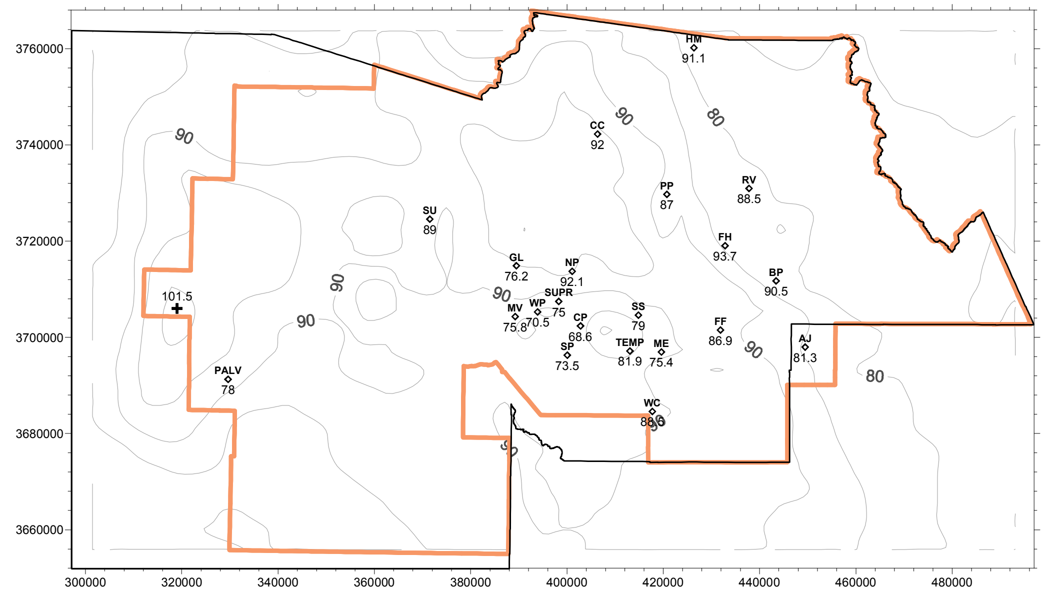
Surface 1-hour ozone concentration (ppb) on June 6, 2005 12:00-13:00 LST



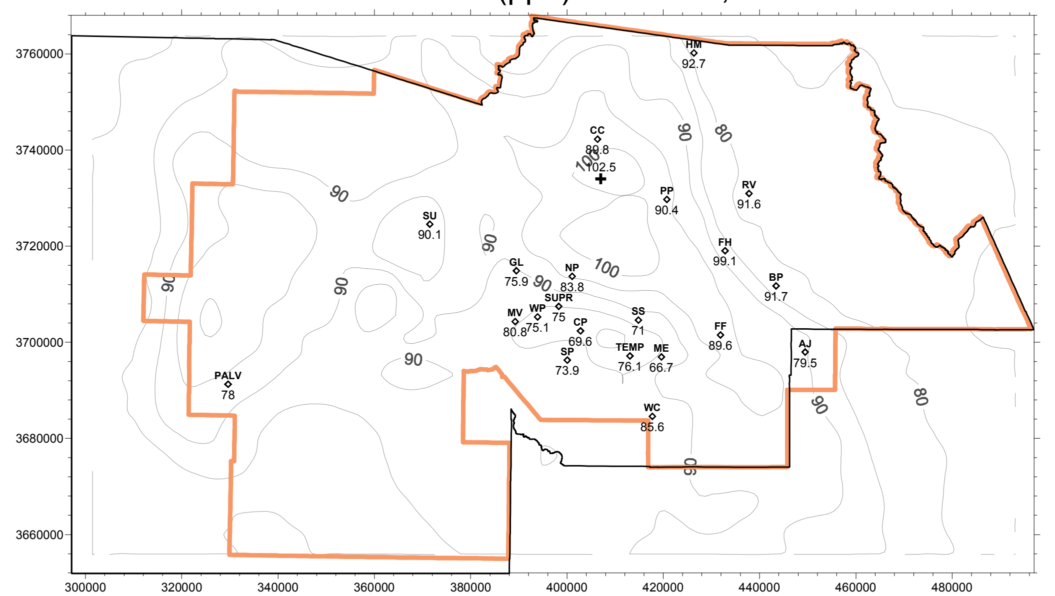
Surface 1-hour ozone concentration (ppb) on June 6, 2005 13:00-14:00 LST



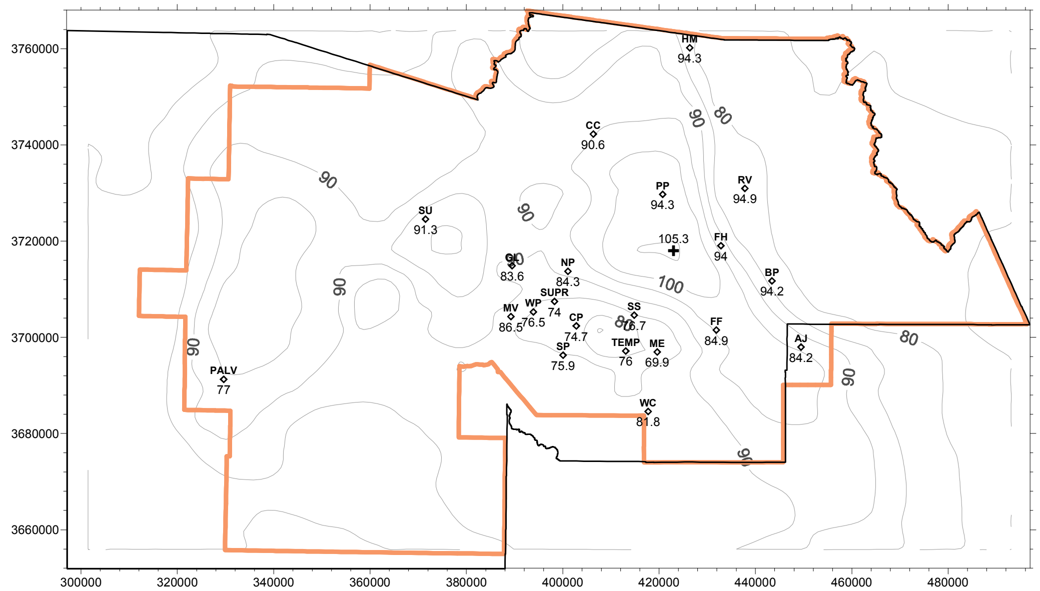
Surface 1-hour ozone concentration (ppb) on June 6, 2005 14:00-15:00 LST



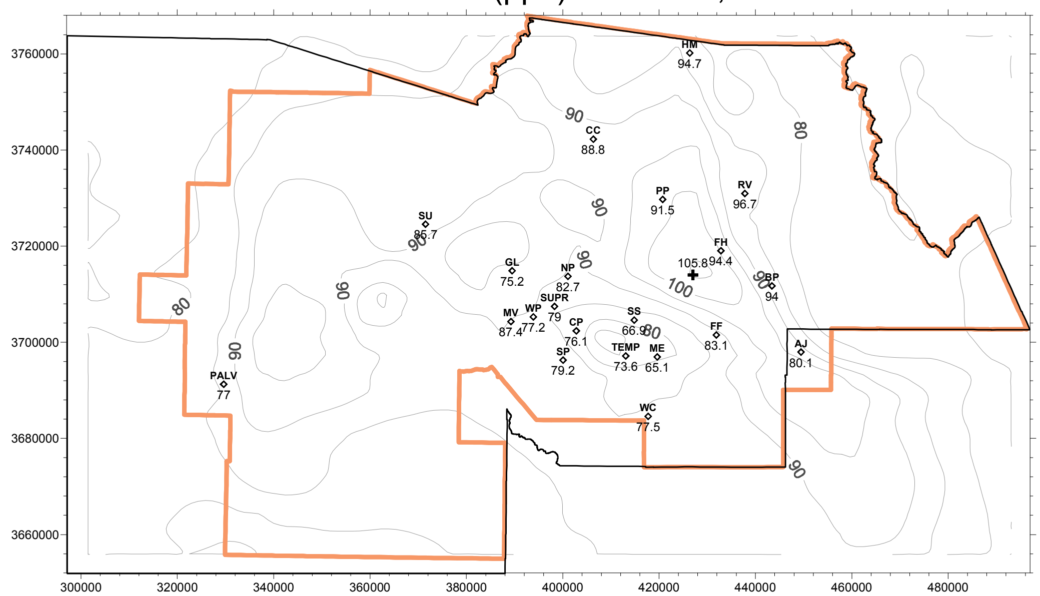
Surface 1-hour ozone concentration (ppb) on June 6, 2005 15:00-16:00 LST



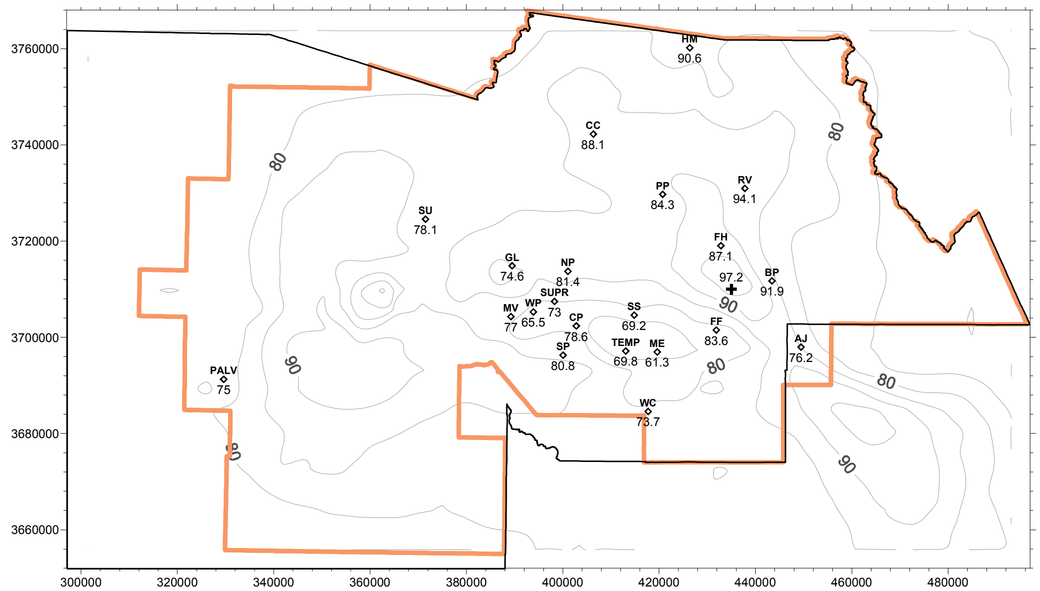
Surface 1-hour ozone concentration (ppb) on June 6, 2005 16:00-17:00 LST



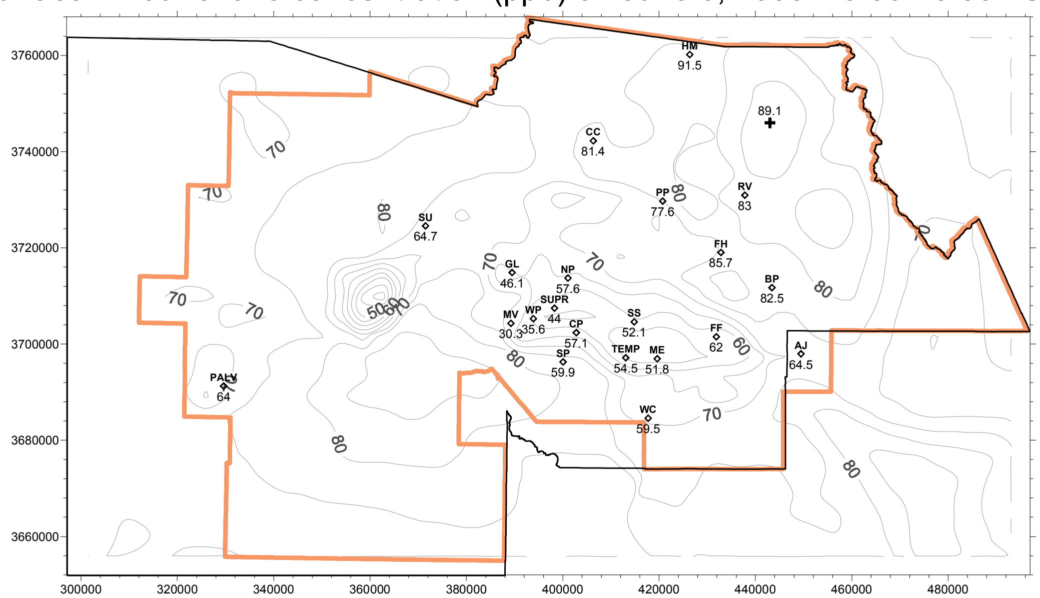
Surface 1-hour ozone concentration (ppb) on June 6, 2005 17:00-18:00 LST



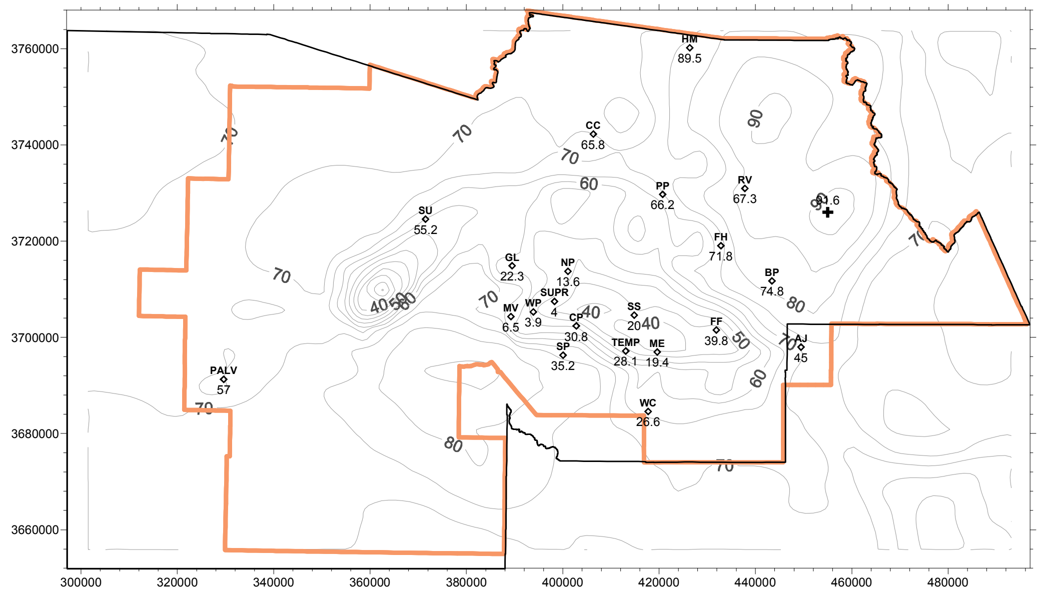
Surface 1-hour ozone concentration (ppb) on June 6, 2005 18:00-19:00 LST



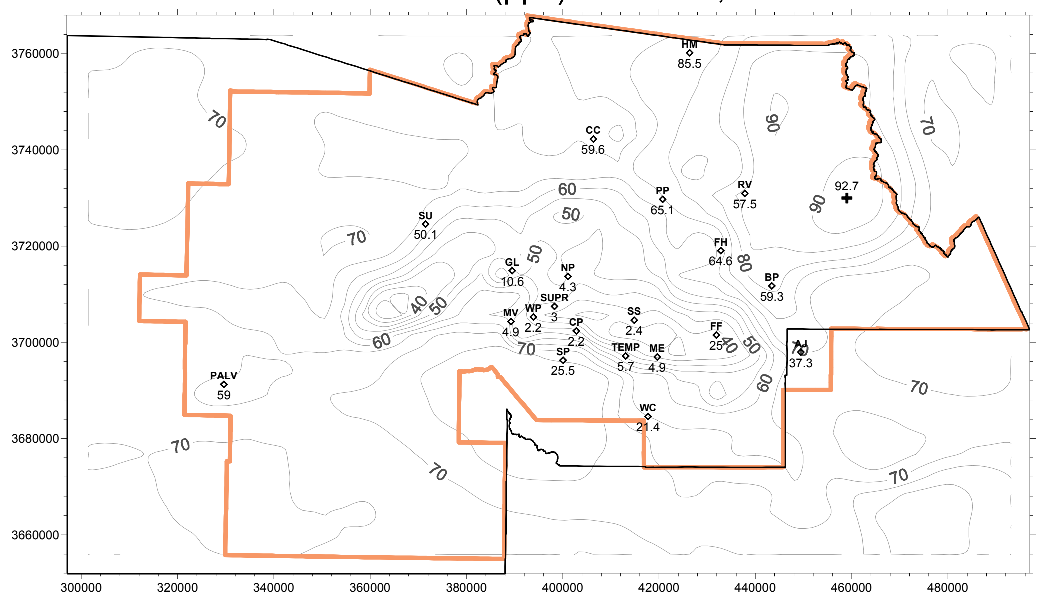
Surface 1-hour ozone concentration (ppb) on June 6, 2005 19:00-20:00 LST



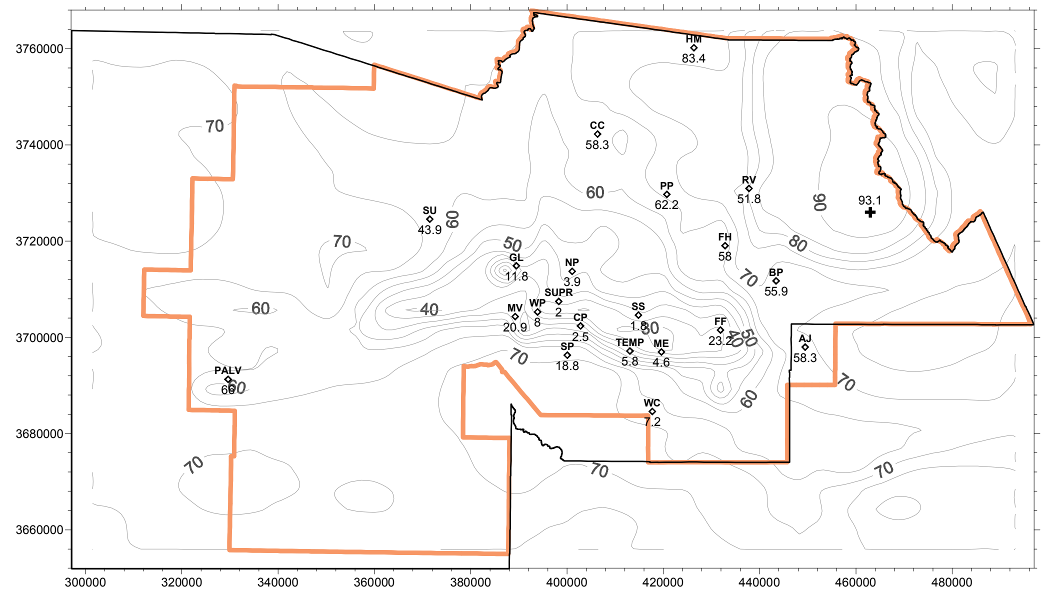
Surface 1-hour ozone concentration (ppb) on June 6, 2005 20:00-21:00 LST



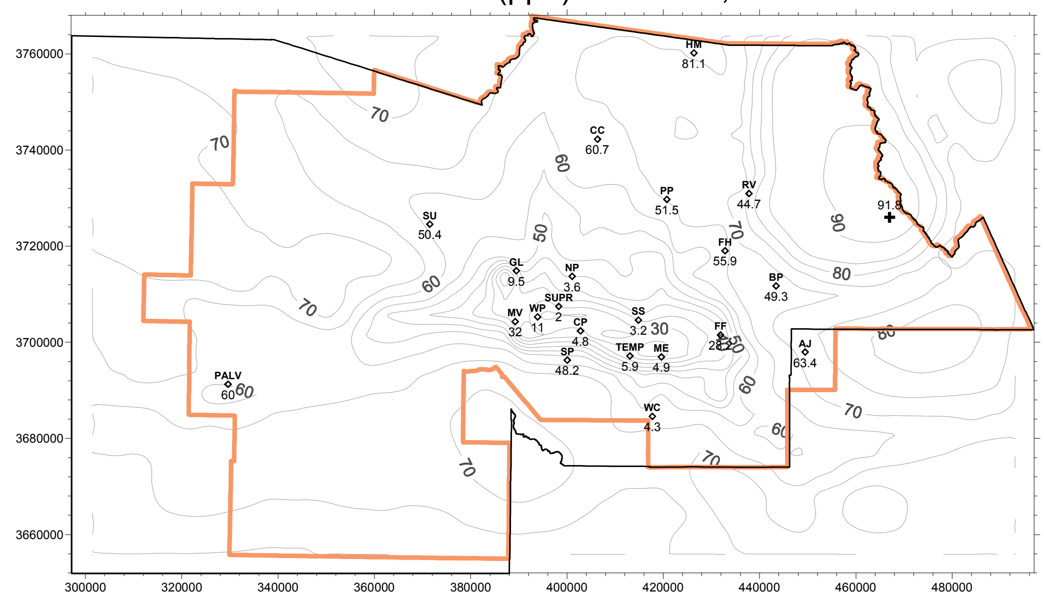
Surface 1-hour ozone concentration (ppb) on June 6, 2005 21:00-22:00 LST



Surface 1-hour ozone concentration (ppb) on June 6, 2005 22:00-23:00 LST



Surface 1-hour ozone concentration (ppb) on June 6, 2005 23:00-24:00 LST

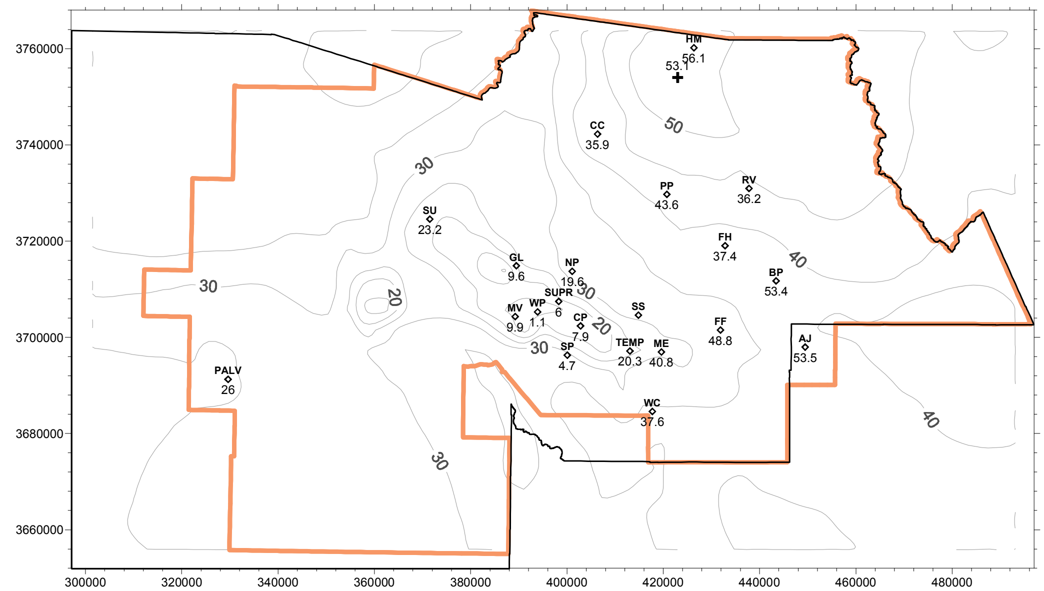


Appendix IV-xi

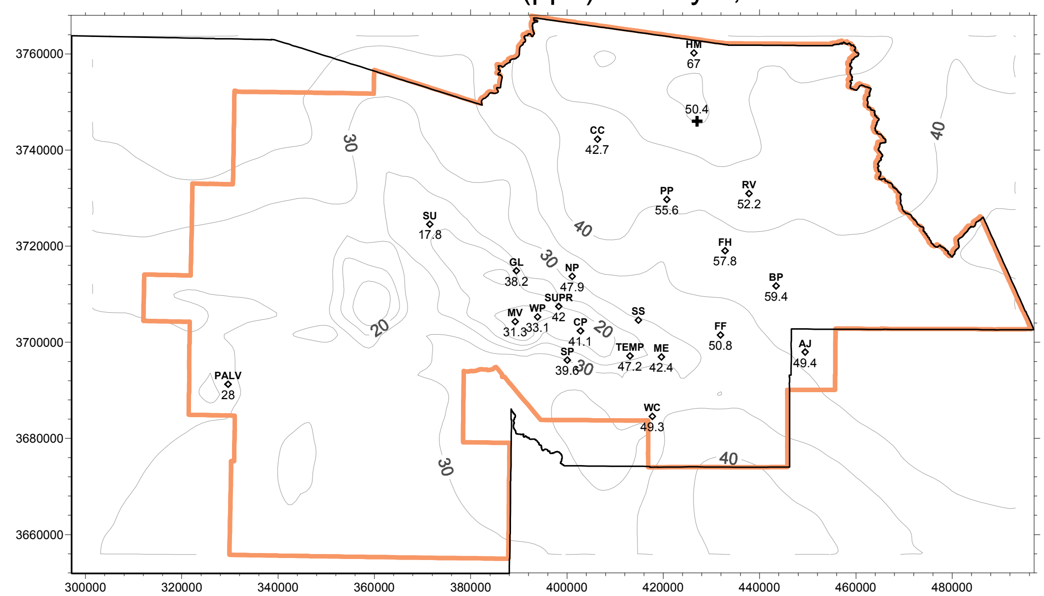
Modeled 1-Hour Ozone for the July 2005 Episode

The plots shown here are the simulated 1-hour ozone for the baseline year. These hourly ozone concentrations are from 0:00 to 24:00 LST on July 9, 2005.

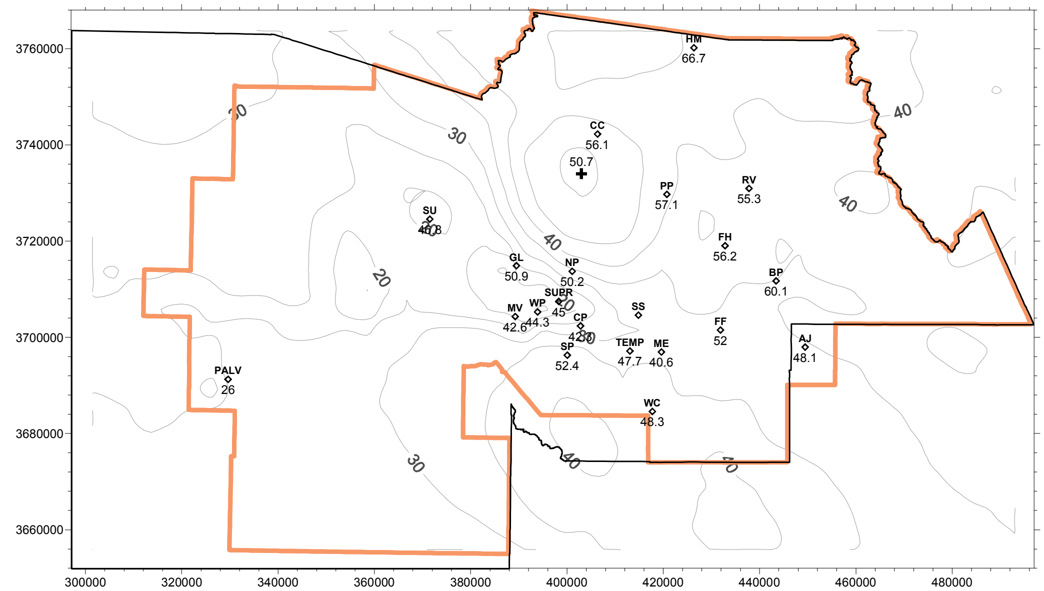
Surface 1-hour ozone concentration (ppb) on July 9, 2005 0:00-1:00 LST



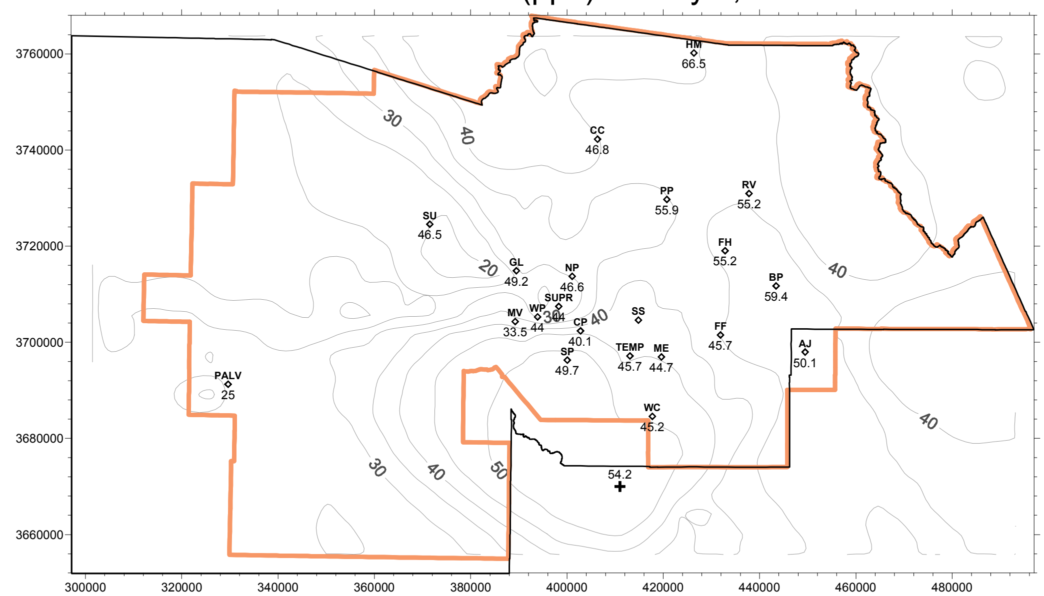
Surface 1-hour ozone concentration (ppb) on July 9, 2005 1:00-2:00 LST



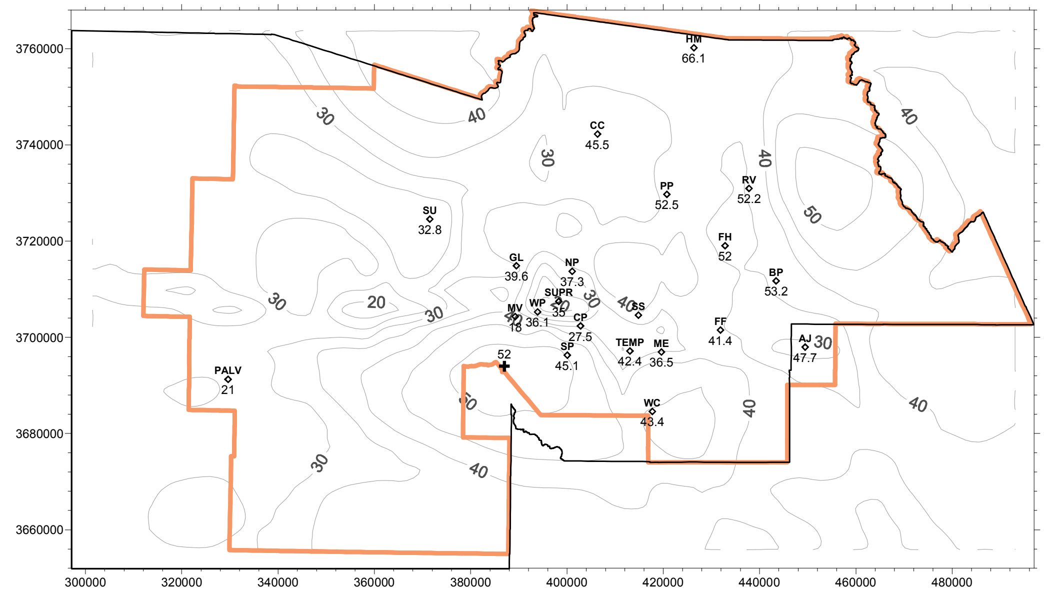
Surface 1-hour ozone concentration (ppb) on July 9, 2005 2:00-300 LST



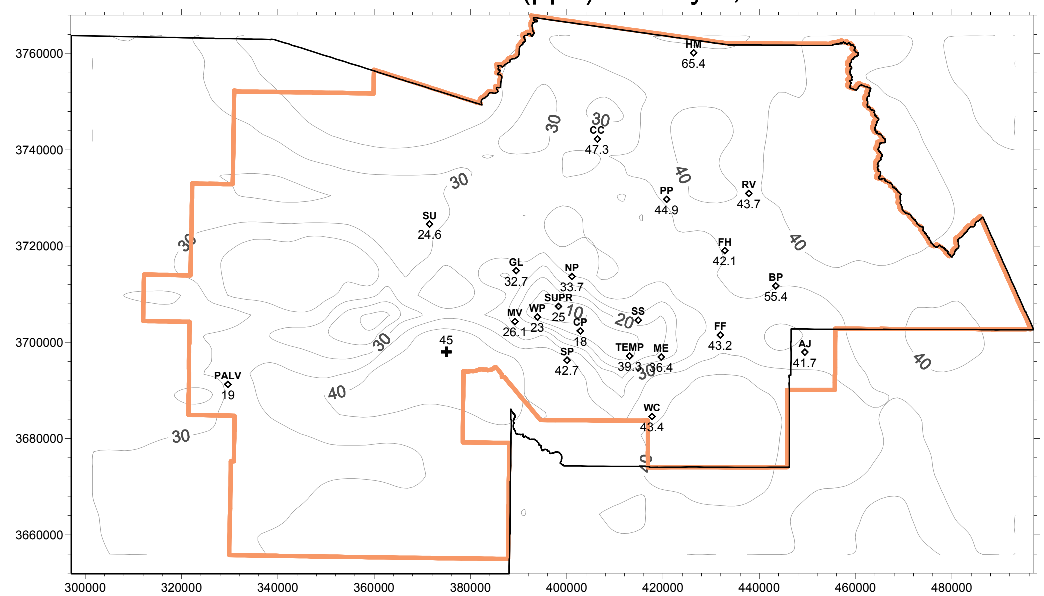
Surface 1-hour ozone concentration (ppb) on July 9, 2005 3:00-4:00 LST



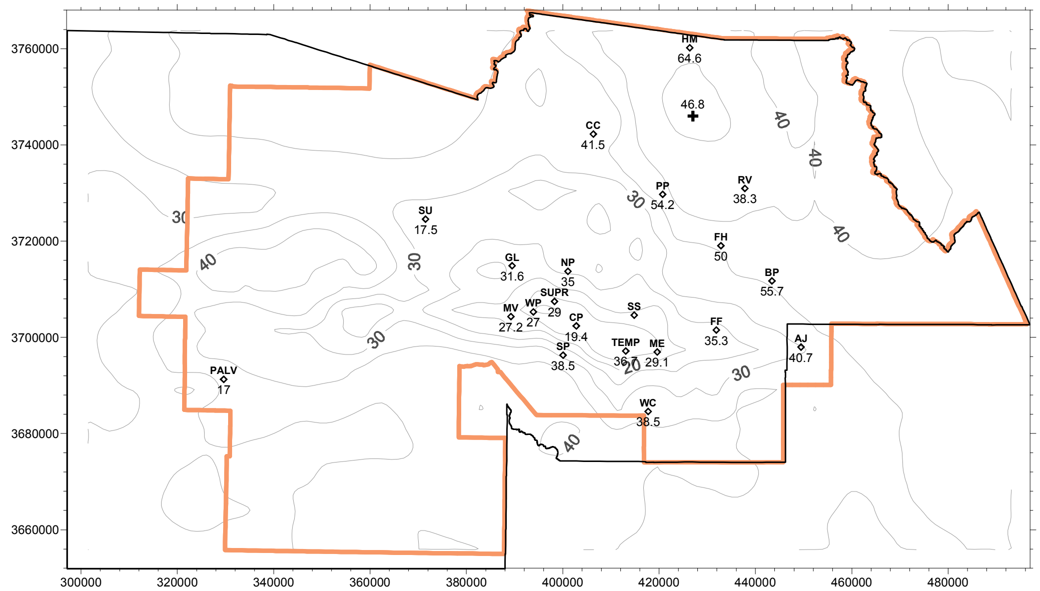
Surface 1-hour ozone concentration (ppb) on July 9, 2005 4:00-5:00 LST



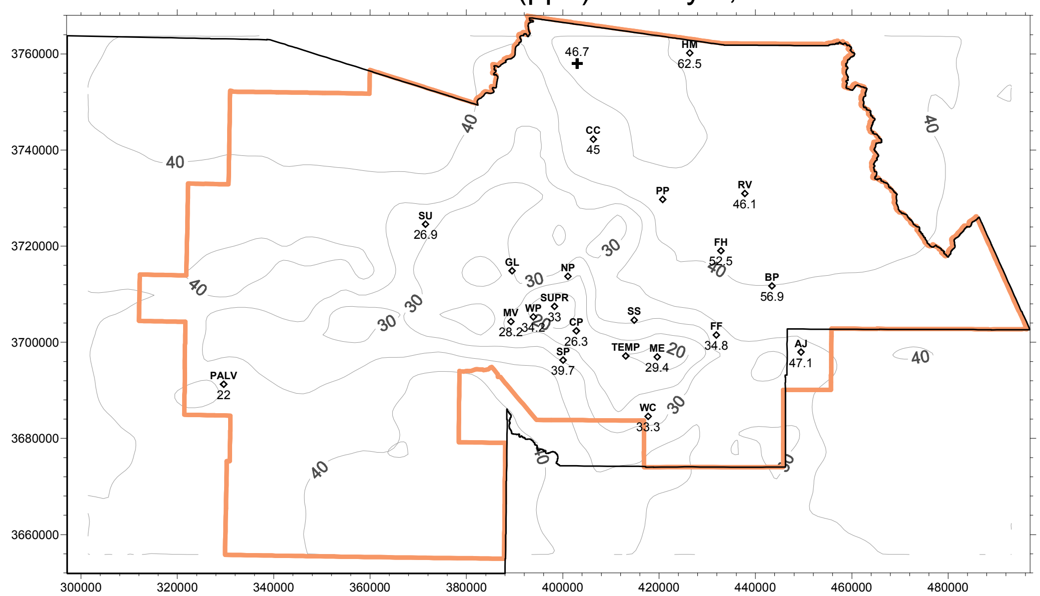
Surface 1-hour ozone concentration (ppb) on July 9, 2005 5:00-6:00 LST



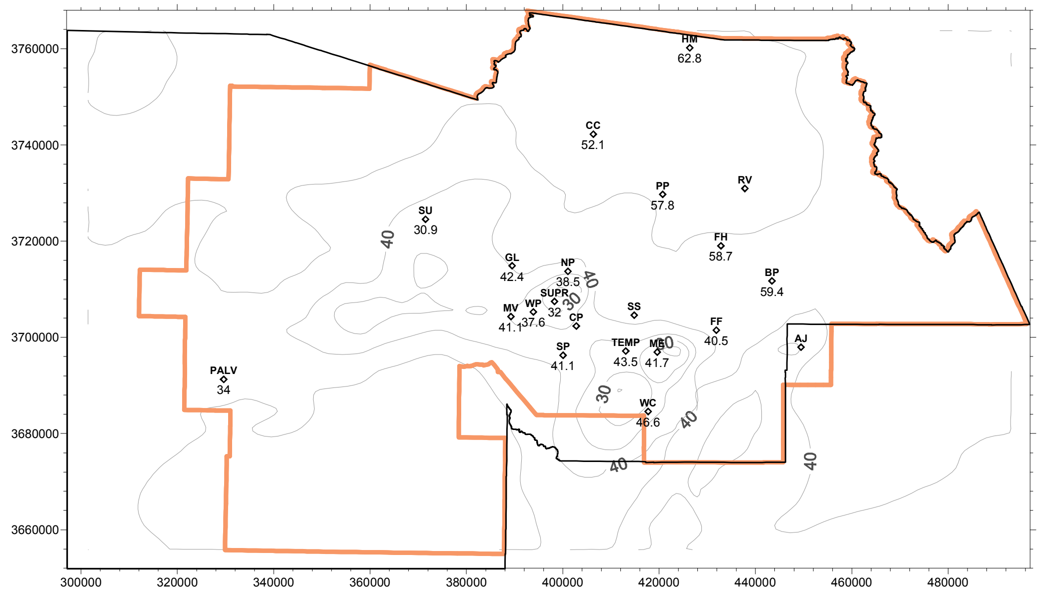
Surface 1-hour ozone concentration (ppb) on July 9, 2005 6:00-7:00 LST



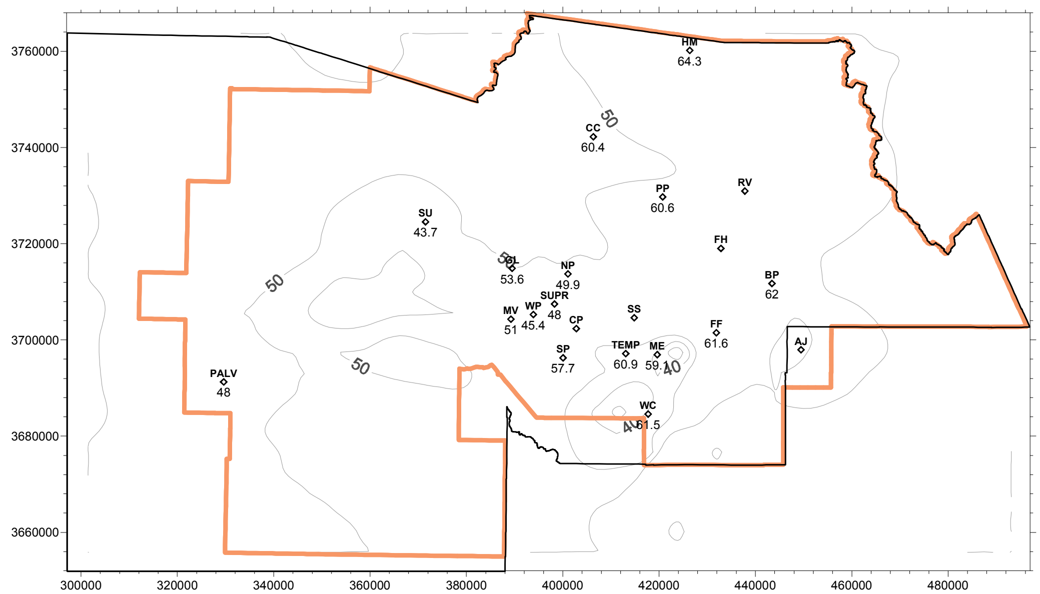
Surface 1-hour ozone concentration (ppb) on July 9, 2005 7:00-8:00 LST



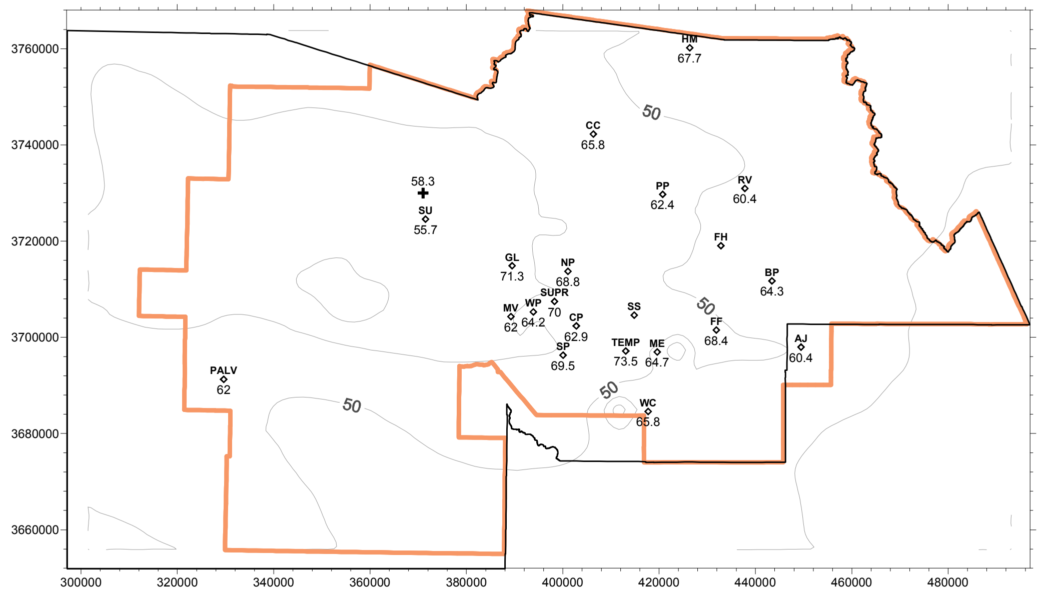
Surface 1-hour ozone concentration (ppb) on July 9, 2005 8:00-9:00 LST



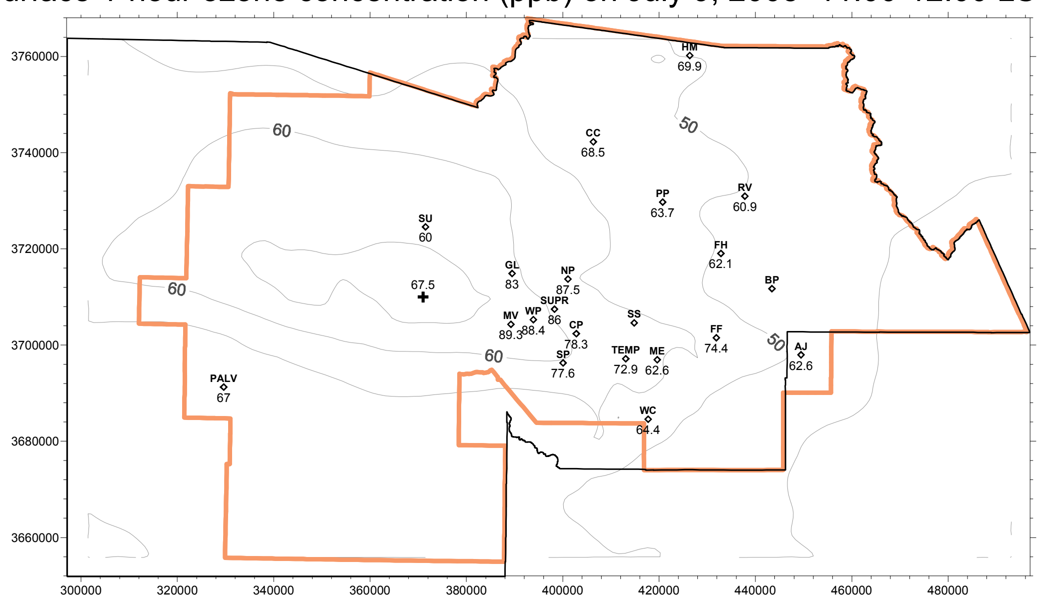
Surface 1-hour ozone concentration (ppb) on July 9, 2005 9:00-10:00 LST



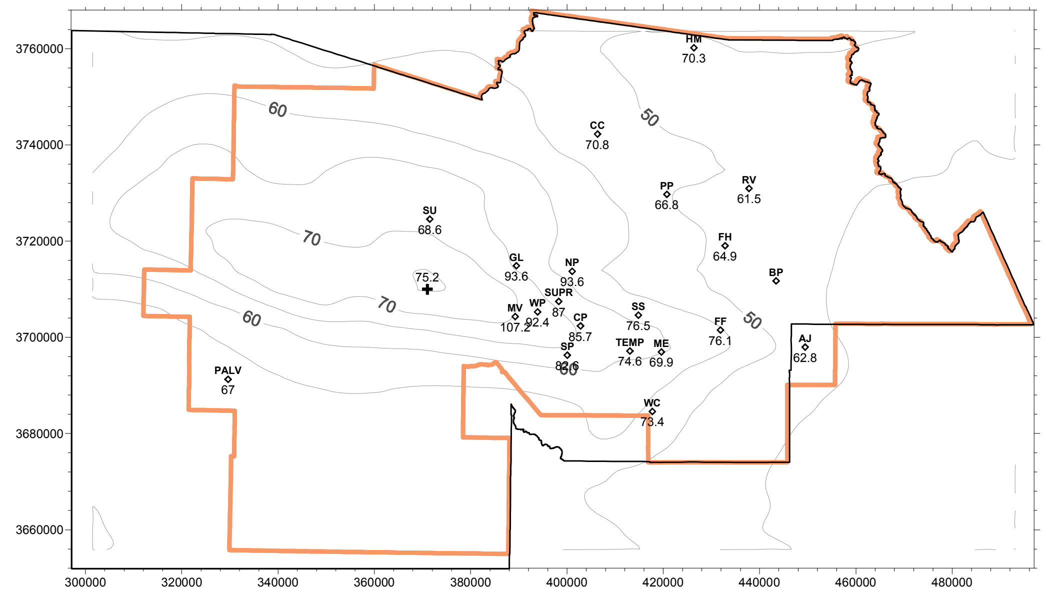
Surface 1-hour ozone concentration (ppb) on July 9, 2005 10:00-11:00 LST



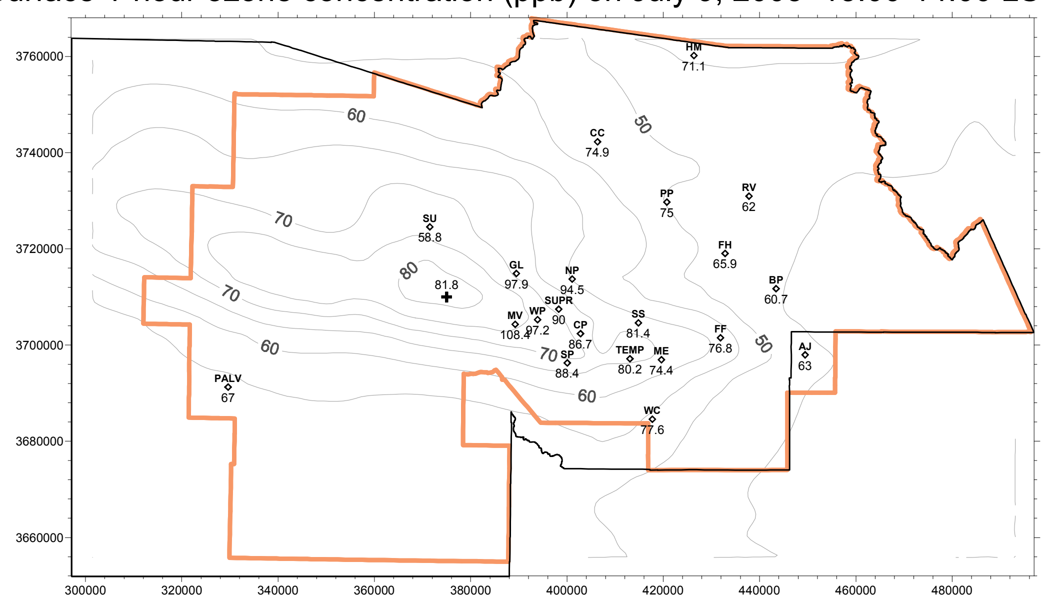
Surface 1-hour ozone concentration (ppb) on July 9, 2005 11:00-12:00 LST



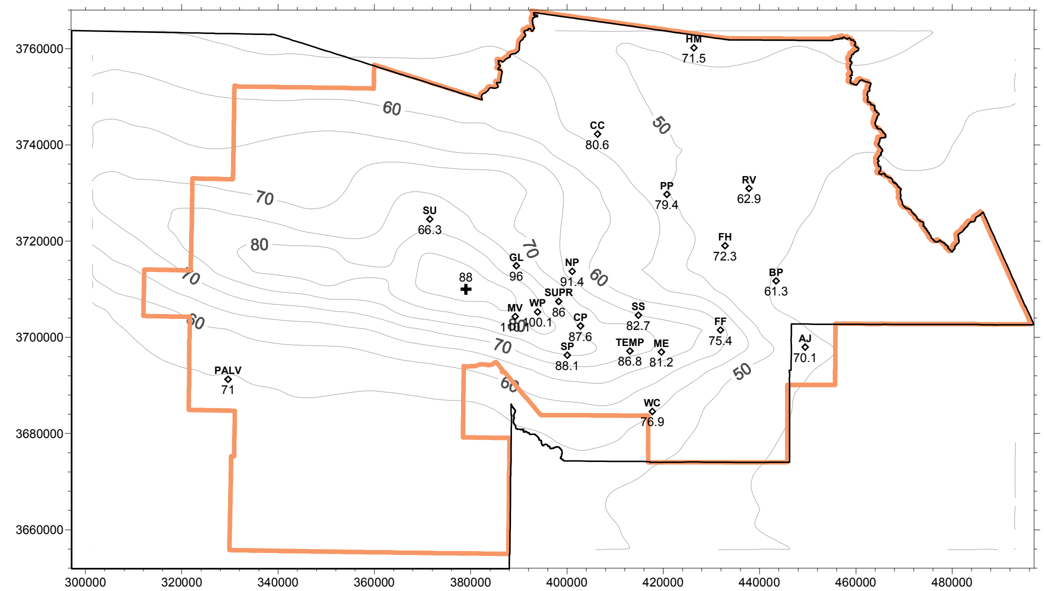
Surface 1-hour ozone concentration (ppb) on July 9, 2005 12:00-13:00 LST



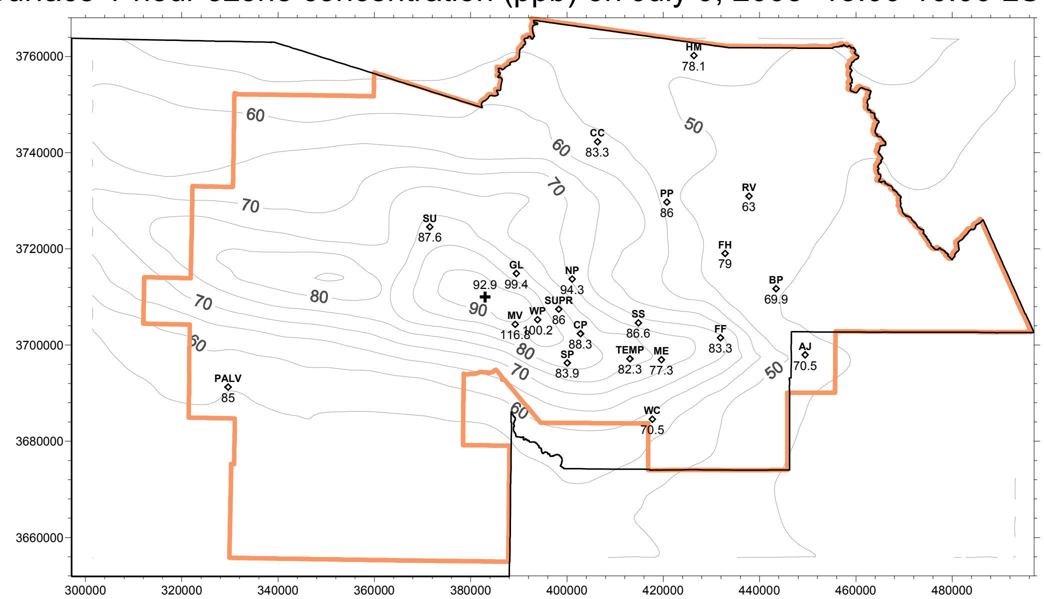
Surface 1-hour ozone concentration (ppb) on July 9, 2005 13:00-14:00 LST



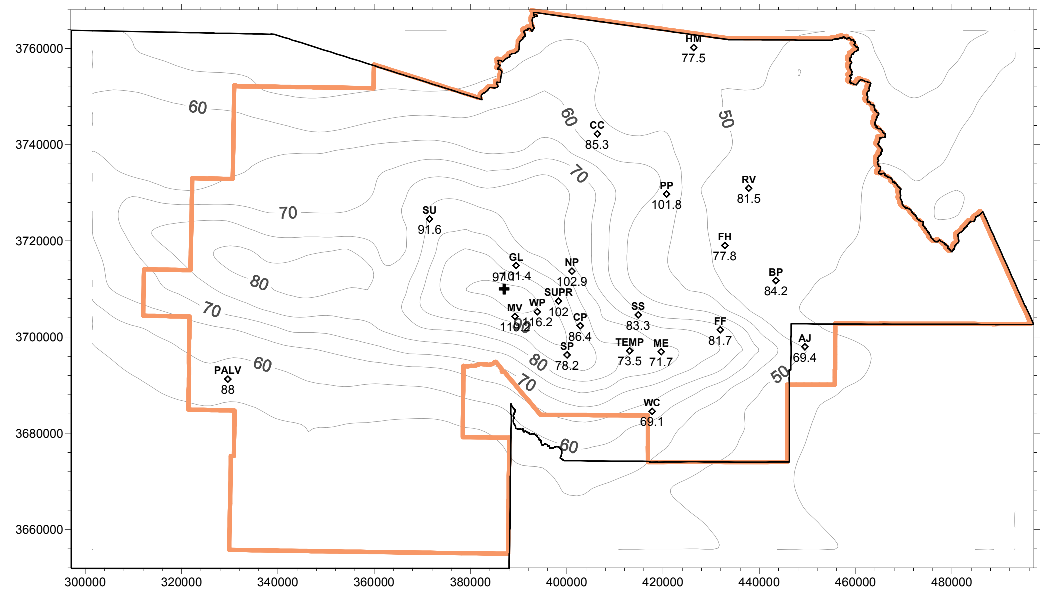
Surface 1-hour ozone concentration (ppb) on July 9, 2005 14:00-15:00 LST



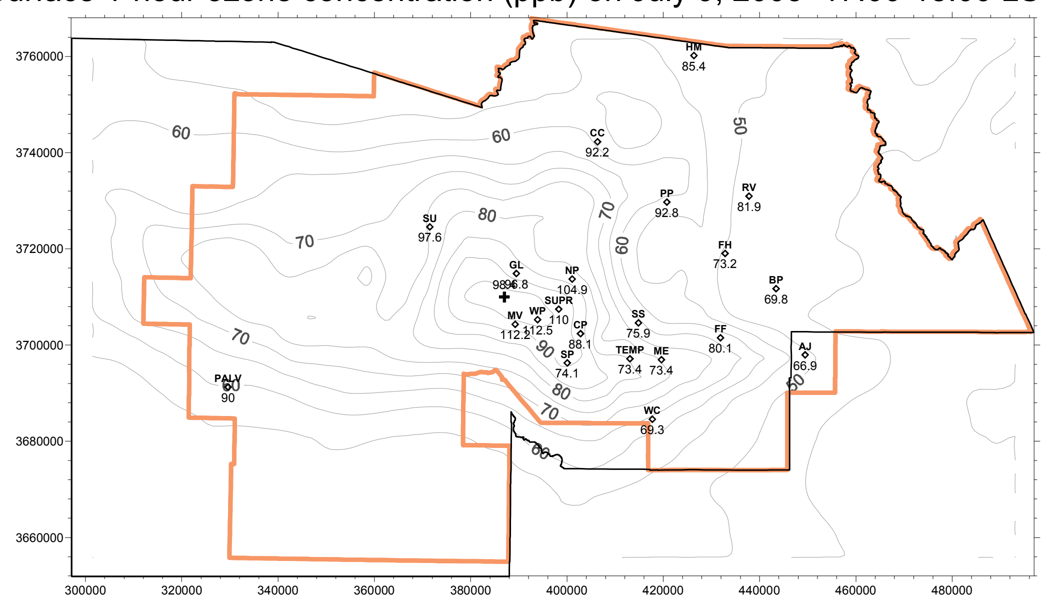
Surface 1-hour ozone concentration (ppb) on July 9, 2005 15:00-16:00 LST



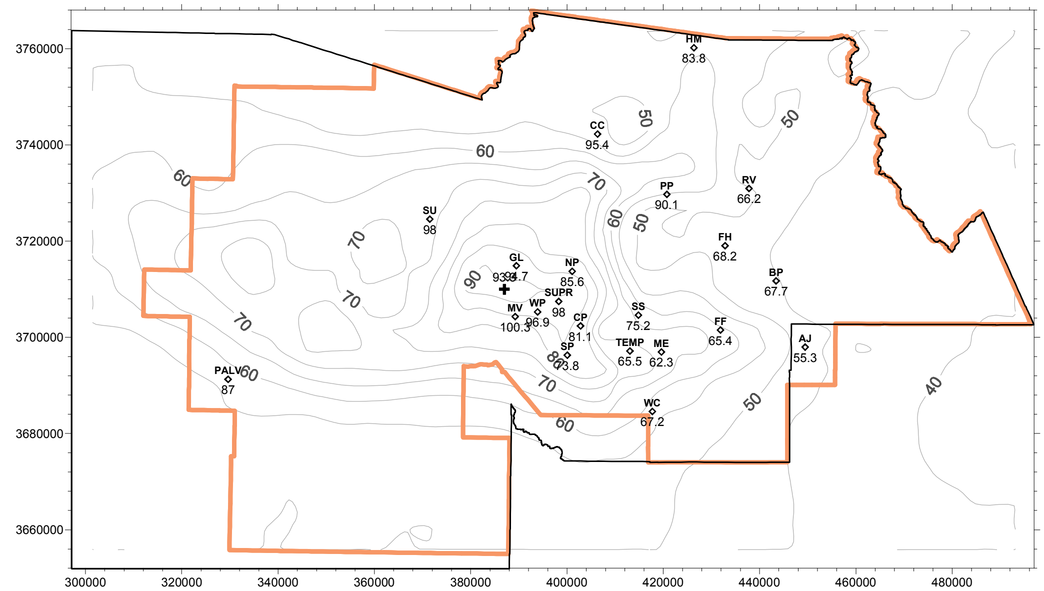
Surface 1-hour ozone concentration (ppb) on July 9, 2005 16:00-17:00 LST



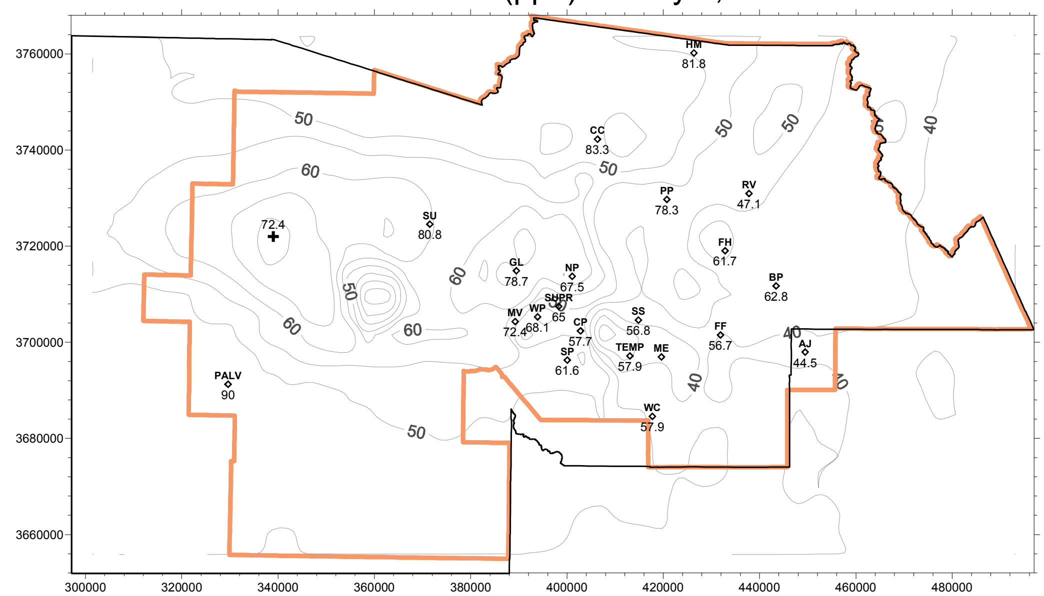
Surface 1-hour ozone concentration (ppb) on July 9, 2005 17:00-18:00 LST



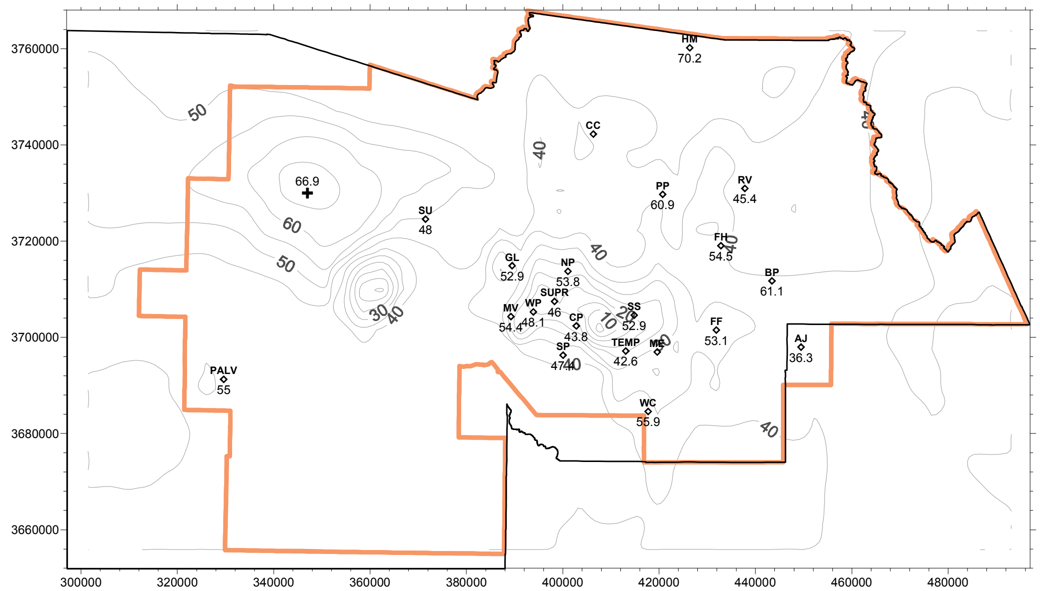
Surface 1-hour ozone concentration (ppb) on July 9, 2005 18:00-19:00 LST



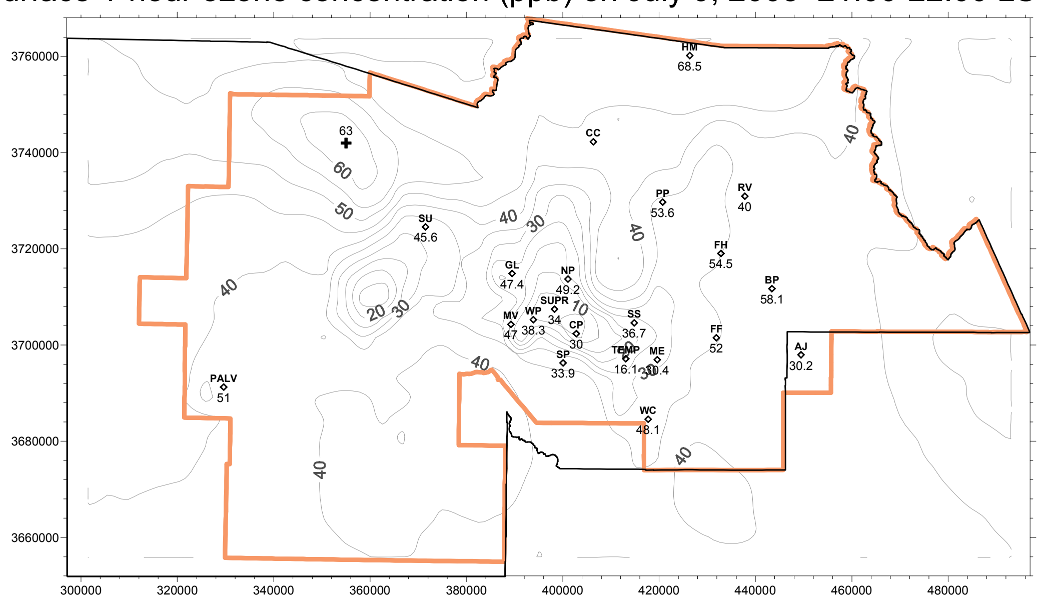
Surface 1-hour ozone concentration (ppb) on July 9, 2005 19:00-20:00 LST



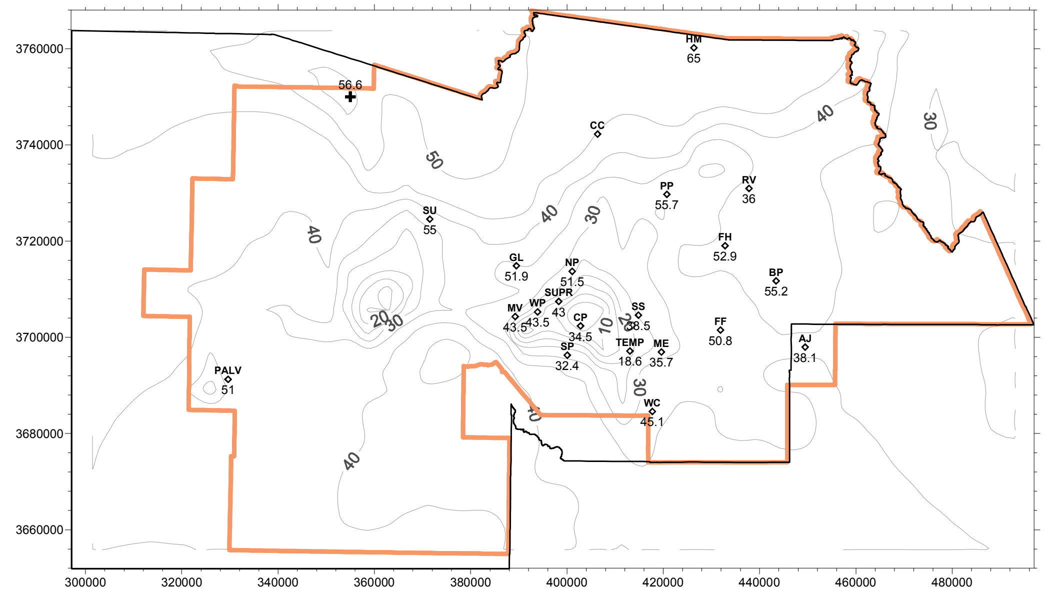
Surface 1-hour ozone concentration (ppb) on July 9, 2005 20:00-21:00 LST



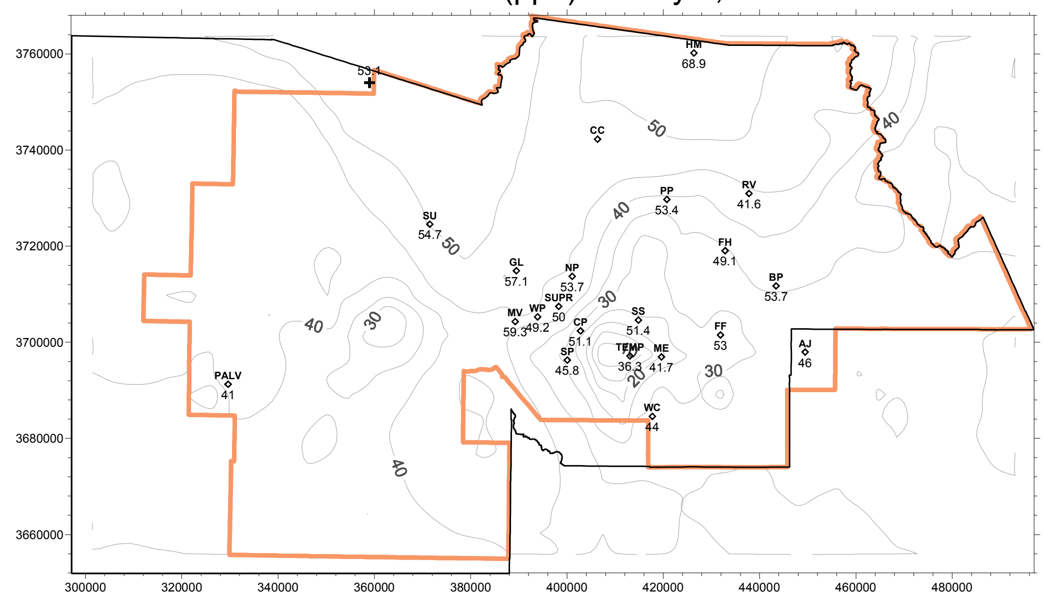
Surface 1-hour ozone concentration (ppb) on July 9, 2005 21:00-22:00 LST



Surface 1-hour ozone concentration (ppb) on July 9, 2005 22:00-23:00 LST



Surface 1-hour ozone concentration (ppb) on July 9, 2005 23:00-24:00 LST

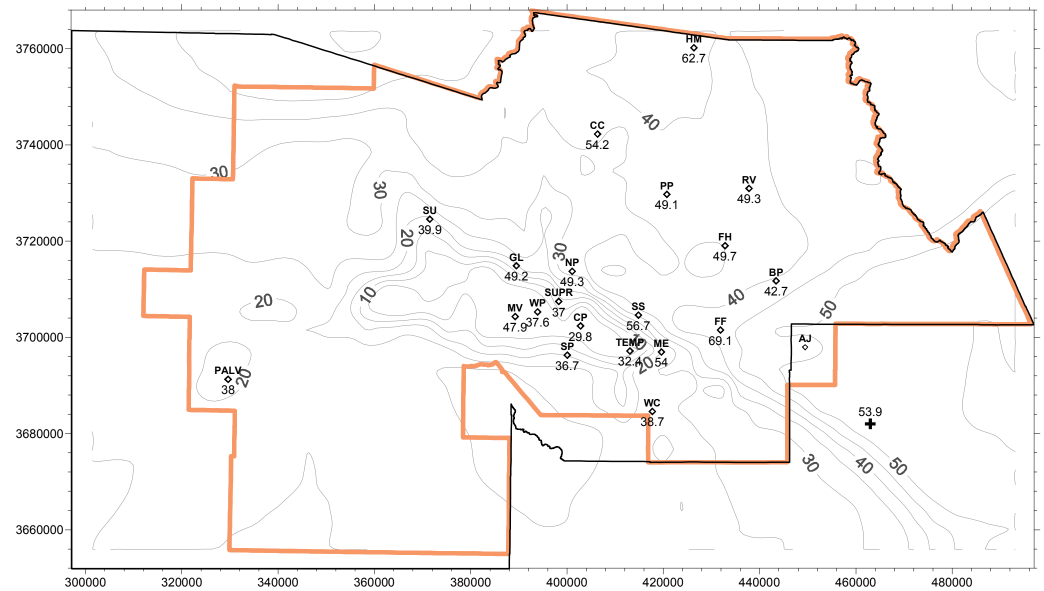


Appendix IV-xii

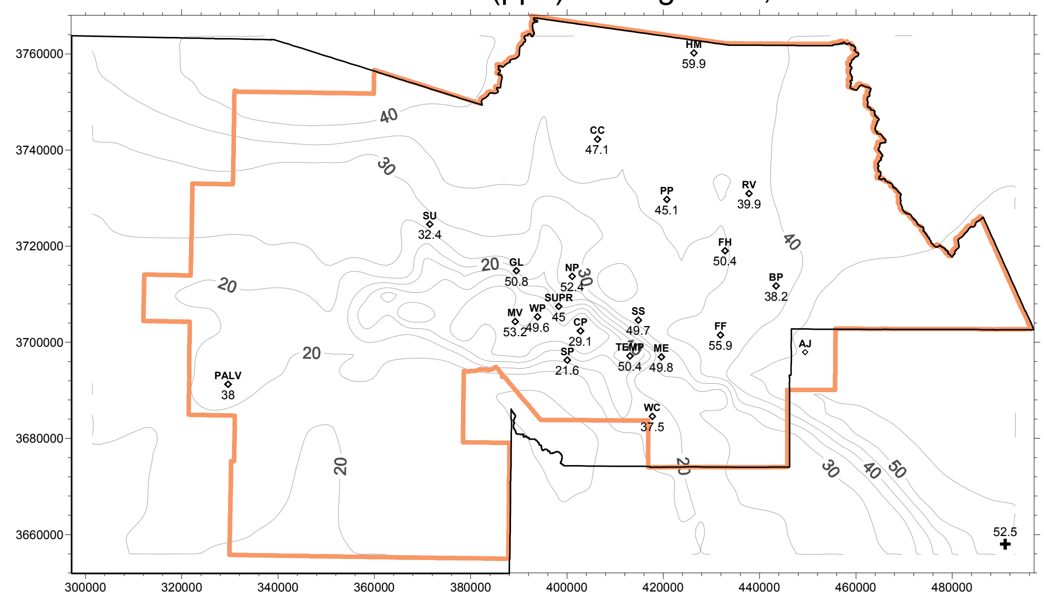
Modeled 1-Hour Ozone for the August 2005 Episode

The plots shown here are the simulated 1-hour ozone for the baseline year. These hourly ozone concentrations are from 0:00 to 24:00 LST on August 10, 2005.

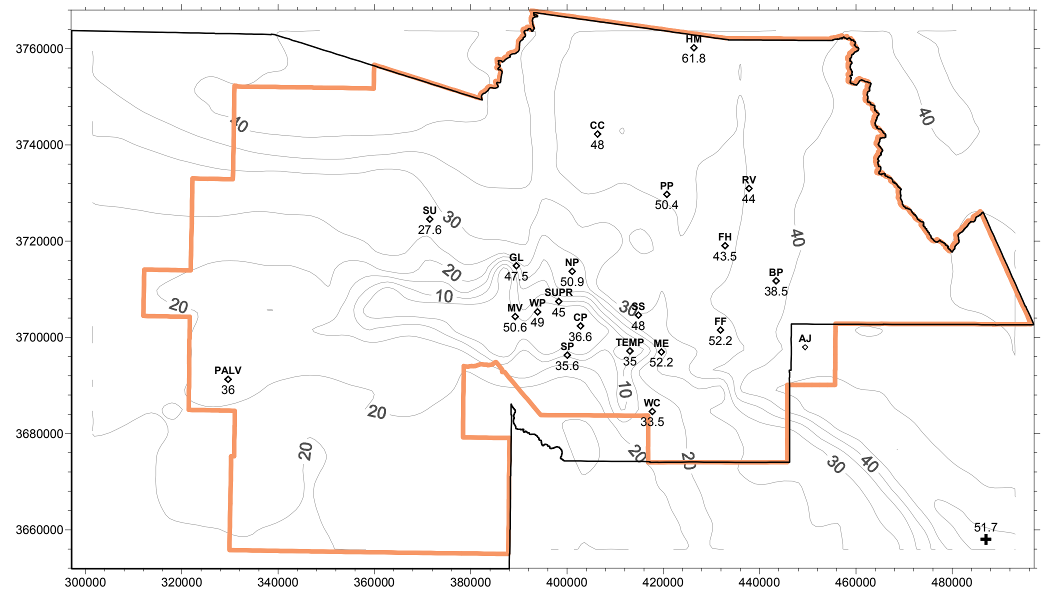
Surface 1-hour ozone concentration (ppb) on August 10, 2005 0:00-1:00 LST



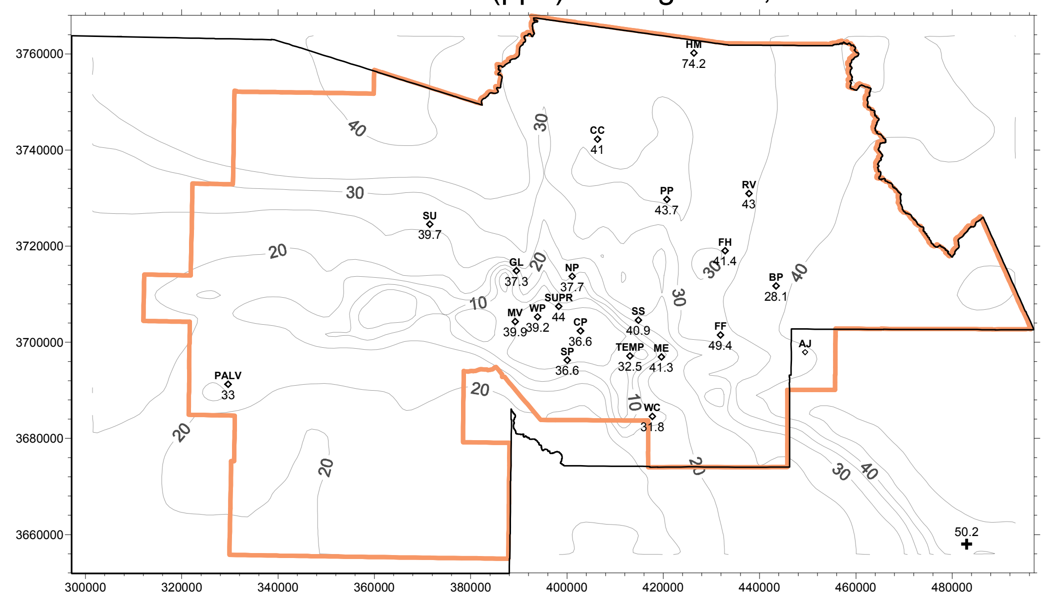
Surface 1-hour ozone concentration (ppb) on August 10, 2005 1:00-2:00 LST



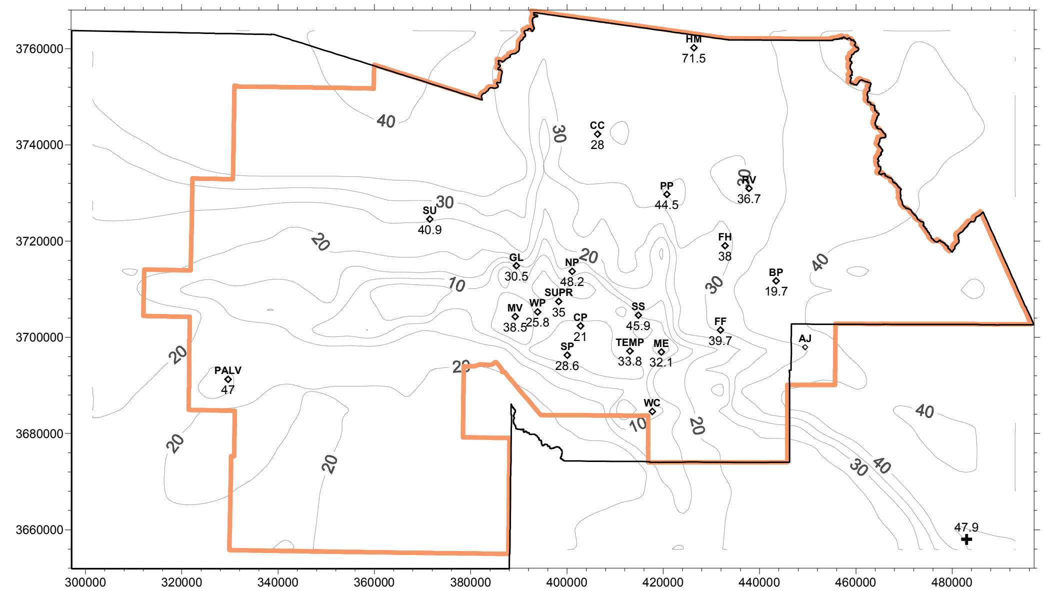
Surface 1-hour ozone concentration (ppb) on August 10, 2005 2:00-300 LST



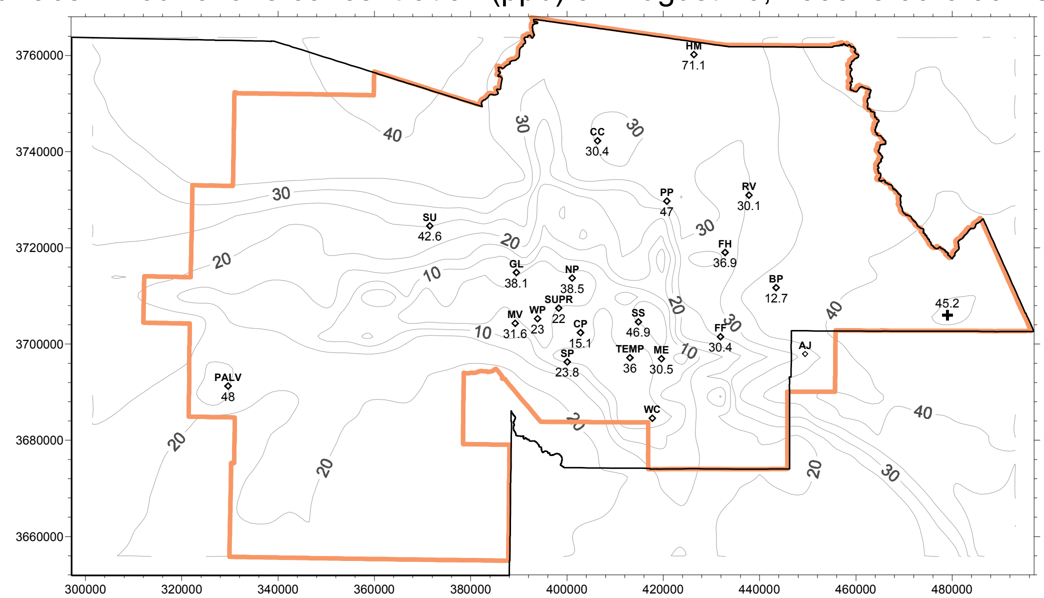
Surface 1-hour ozone concentration (ppb) on August 10, 2005 3:00-4:00 LST



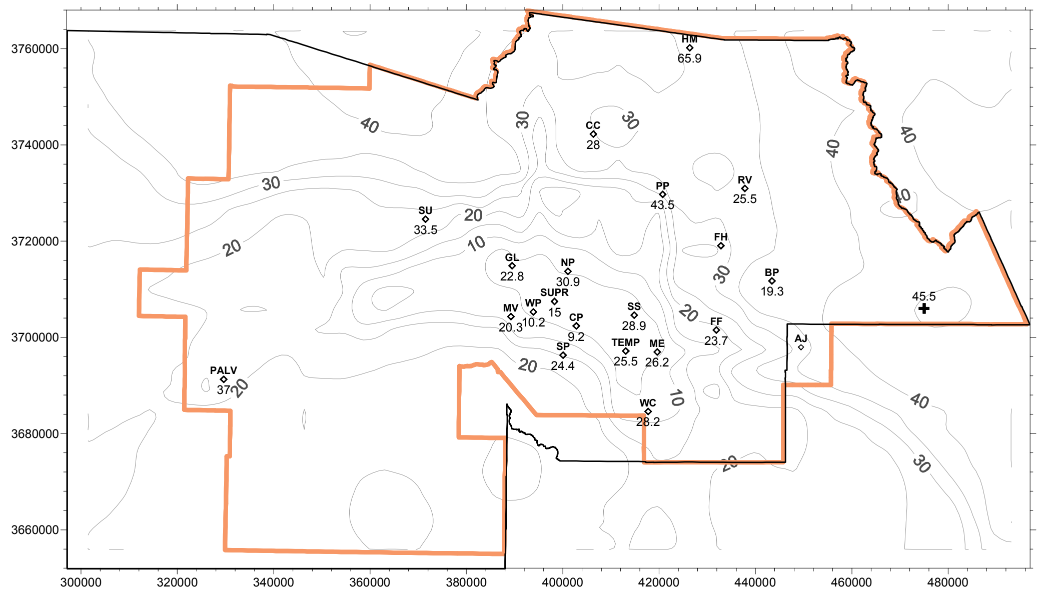
Surface 1-hour ozone concentration (ppb) on August 10, 2005 4:00-5:00 LST



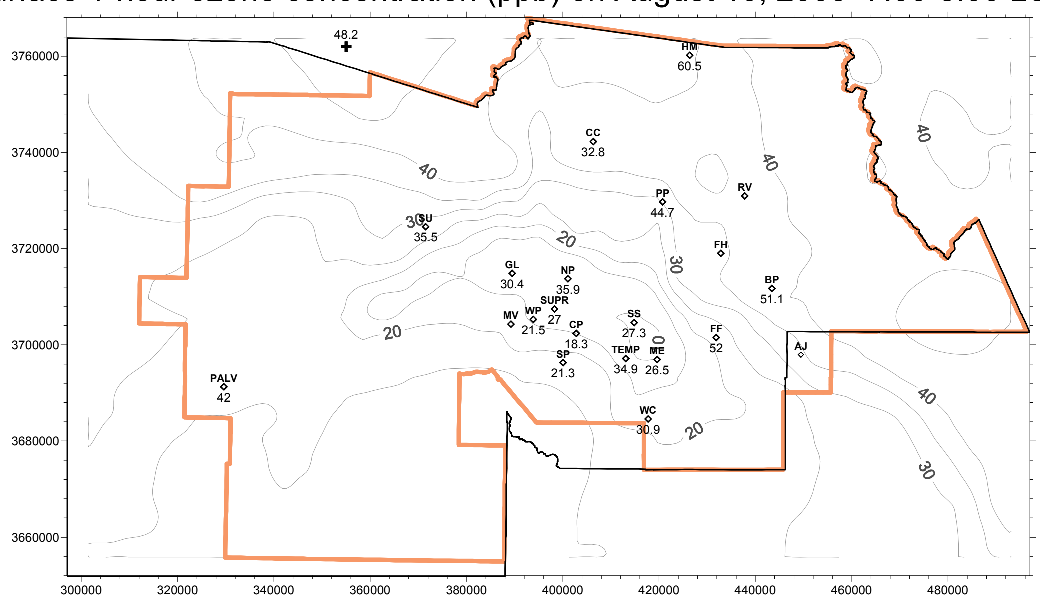
Surface 1-hour ozone concentration (ppb) on August 10, 2005 5:00-6:00 LST



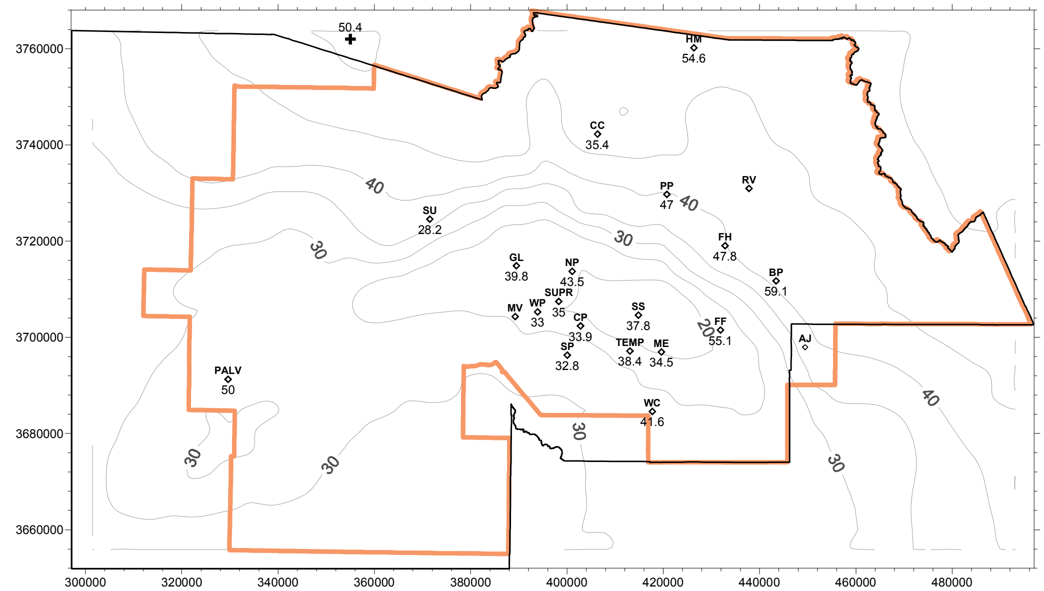
Surface 1-hour ozone concentration (ppb) on August 10, 2005 6:00-7:00 LST



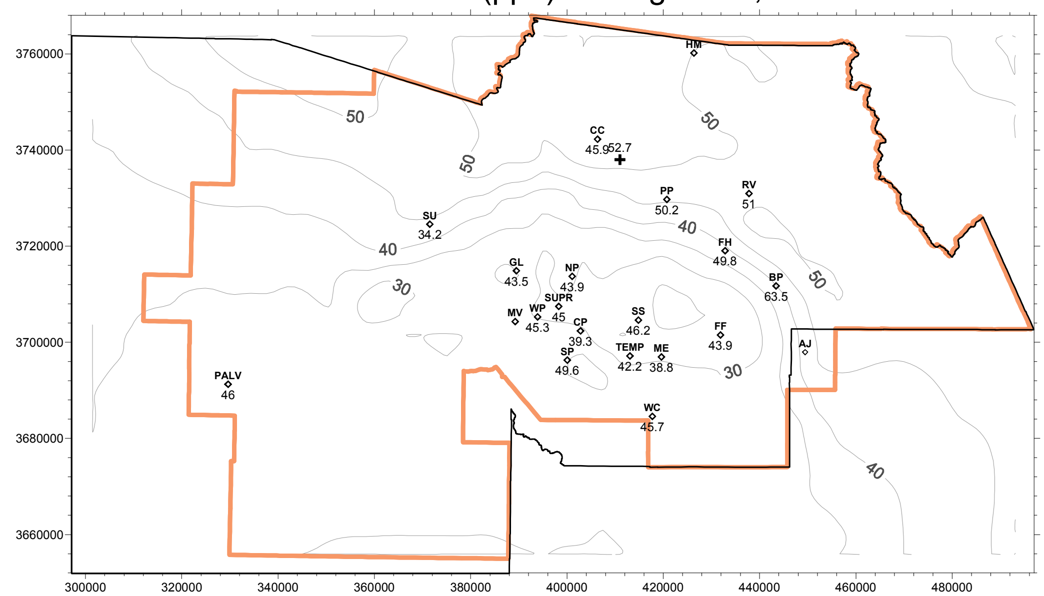
Surface 1-hour ozone concentration (ppb) on August 10, 2005 7:00-8:00 LST



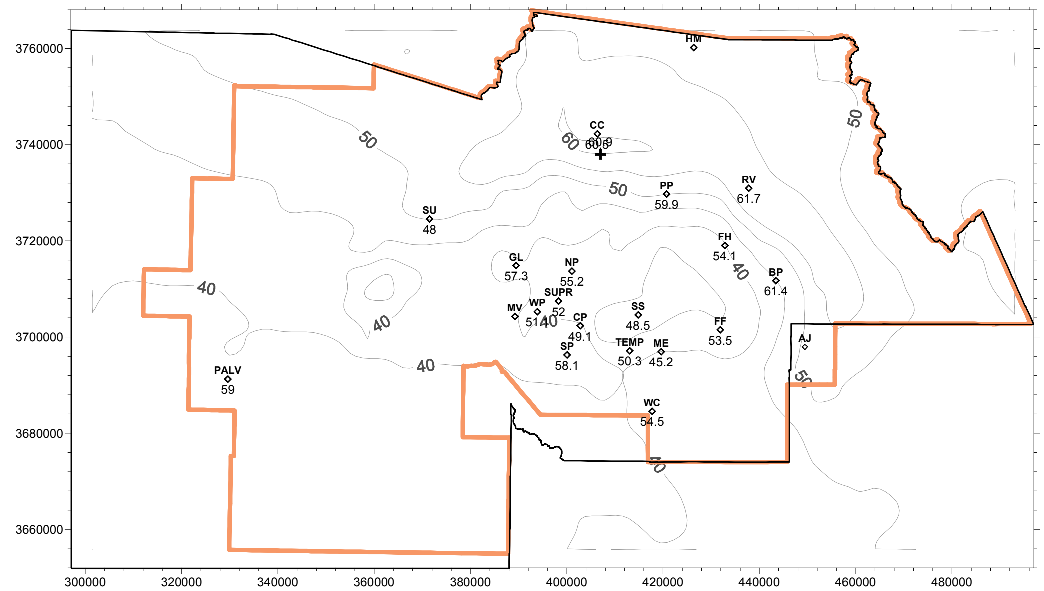
Surface 1-hour ozone concentration (ppb) on August 10, 2005 8:00-9:00 LST



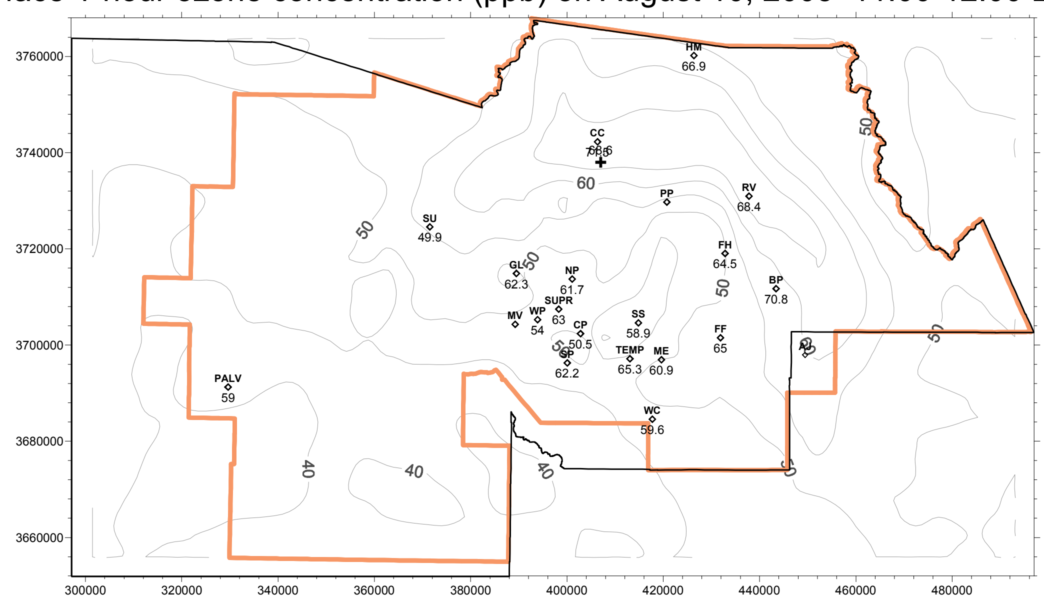
Surface 1-hour ozone concentration (ppb) on August 10, 2005 9:00-10:00 LST



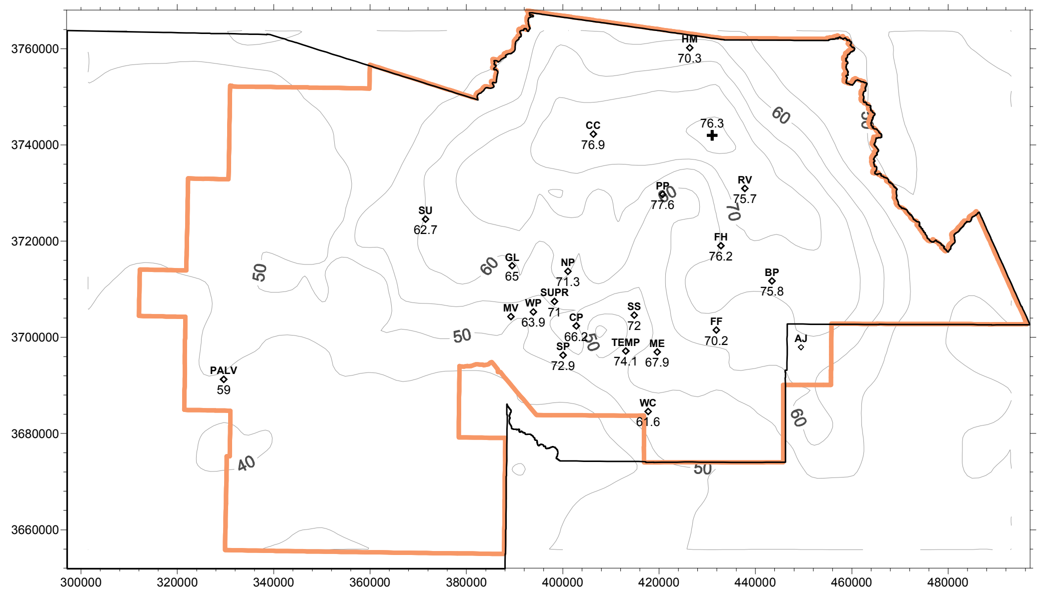
Surface 1-hour ozone concentration (ppb) on August 10, 2005 10:00-11:00 LST



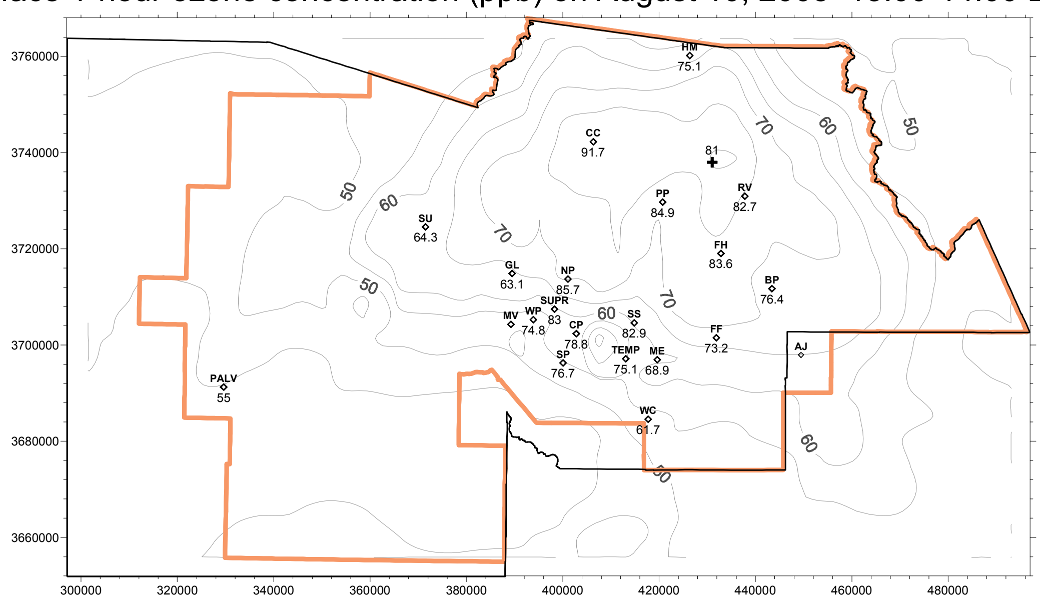
Surface 1-hour ozone concentration (ppb) on August 10, 2005 11:00-12:00 LST



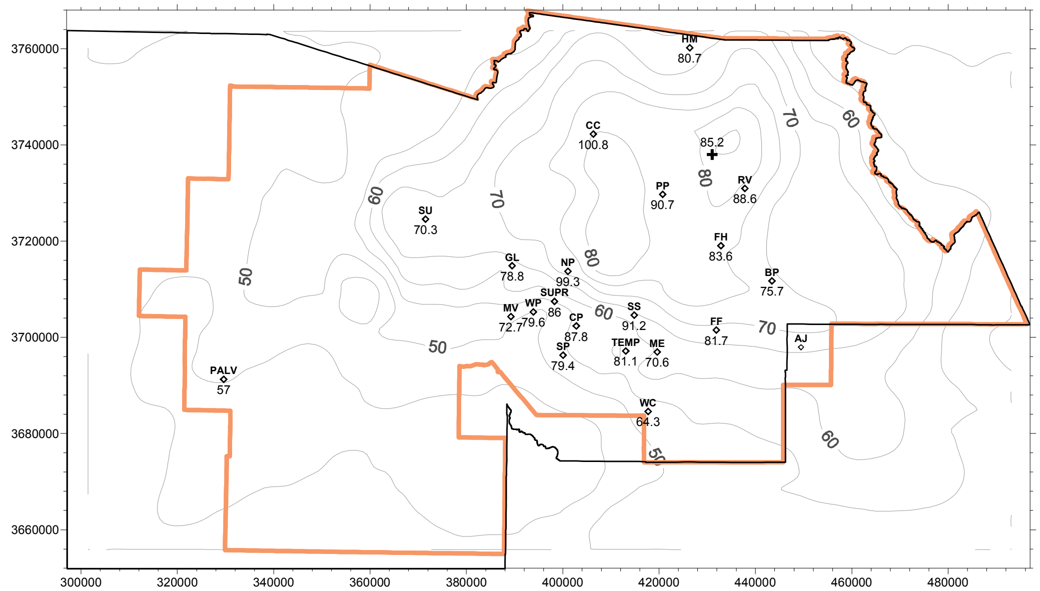
Surface 1-hour ozone concentration (ppb) on August 10, 2005 12:00-13:00 LST



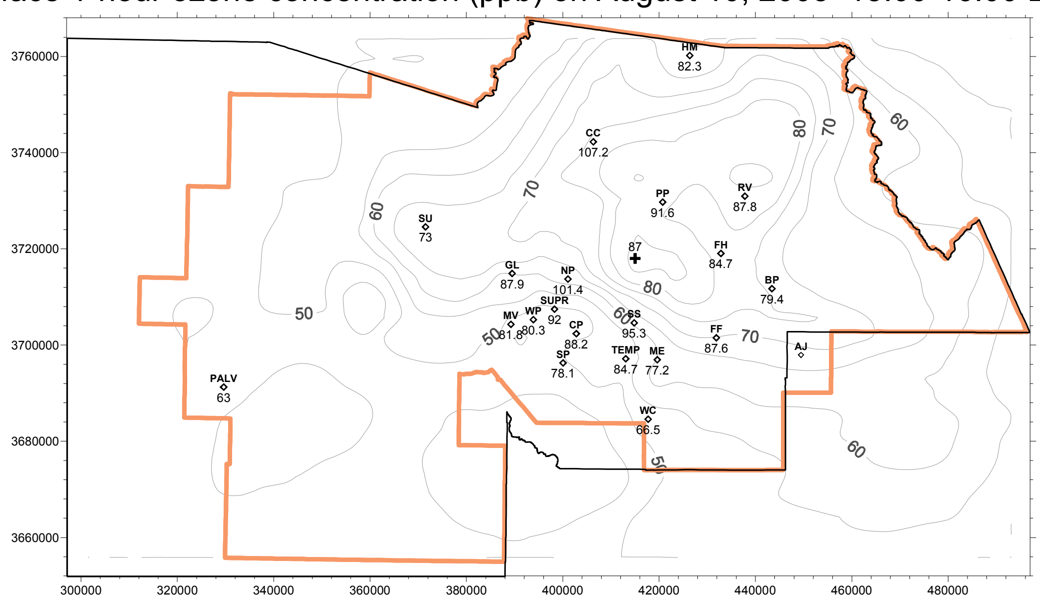
Surface 1-hour ozone concentration (ppb) on August 10, 2005 13:00-14:00 LST



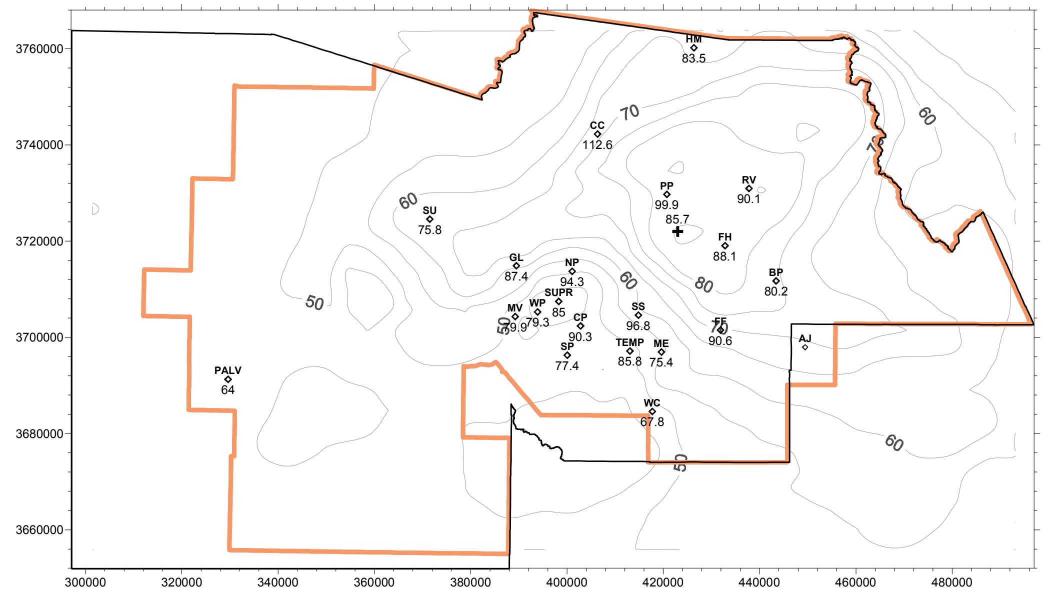
Surface 1-hour ozone concentration (ppb) on August 10, 2005 14:00-15:00 LST



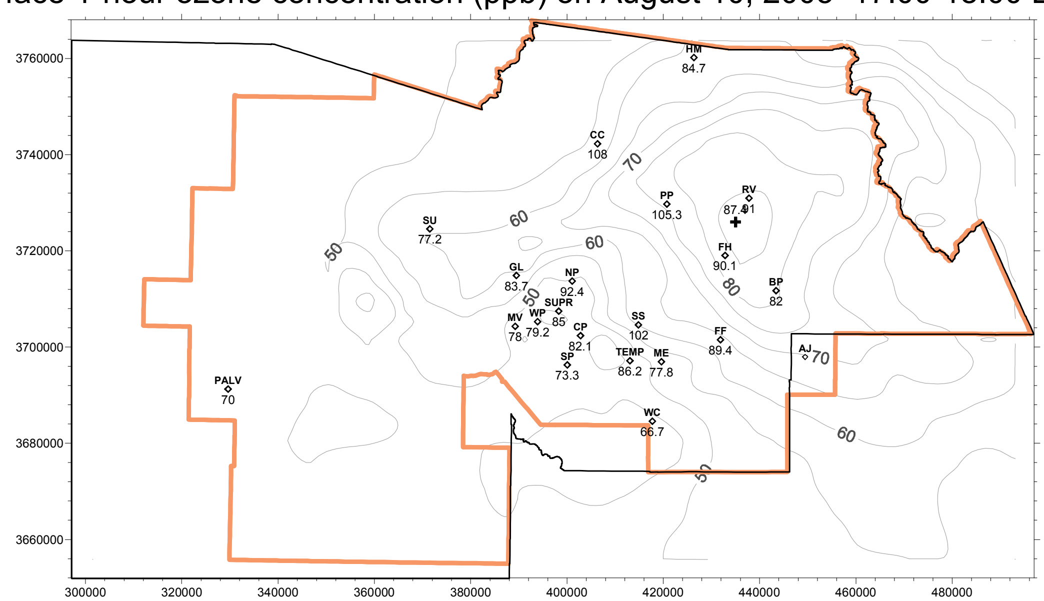
Surface 1-hour ozone concentration (ppb) on August 10, 2005 15:00-16:00 LST



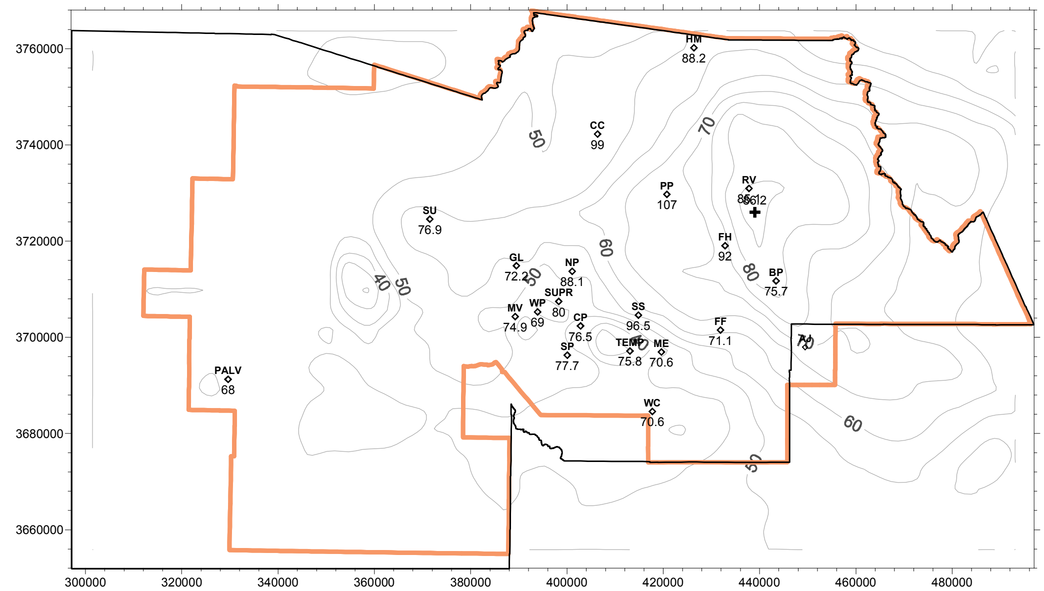
Surface 1-hour ozone concentration (ppb) on August 10, 2005 16:00-17:00 LST



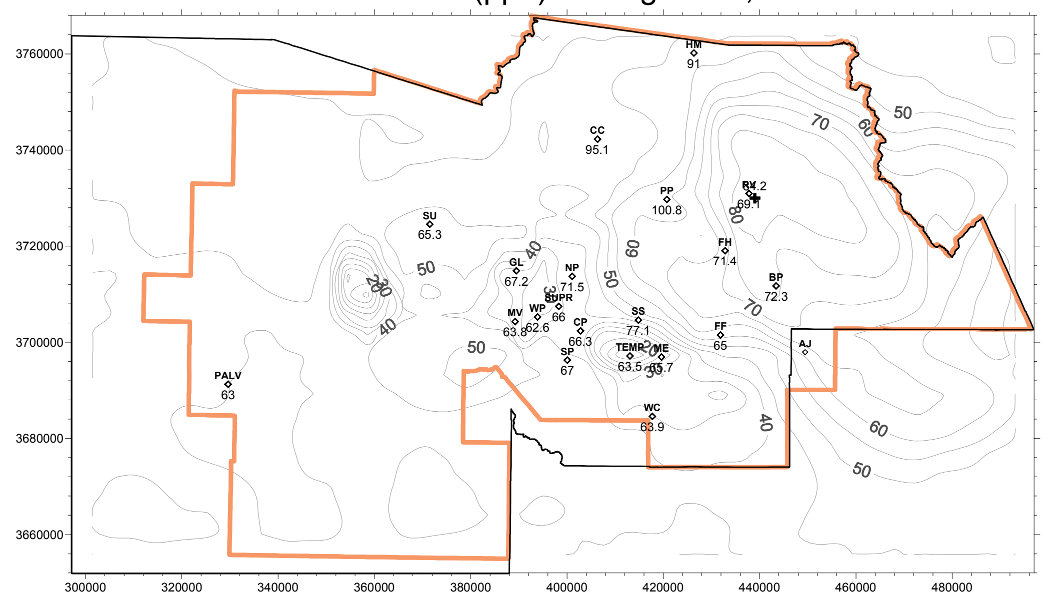
Surface 1-hour ozone concentration (ppb) on August 10, 2005 17:00-18:00 LST



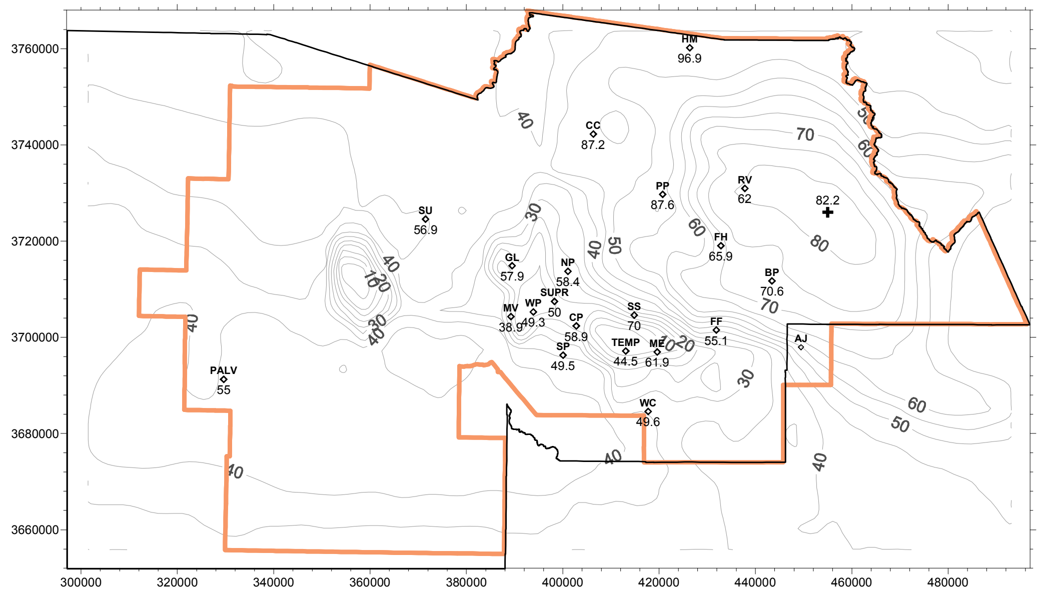
Surface 1-hour ozone concentration (ppb) on August 10, 2005 18:00-19:00 LST



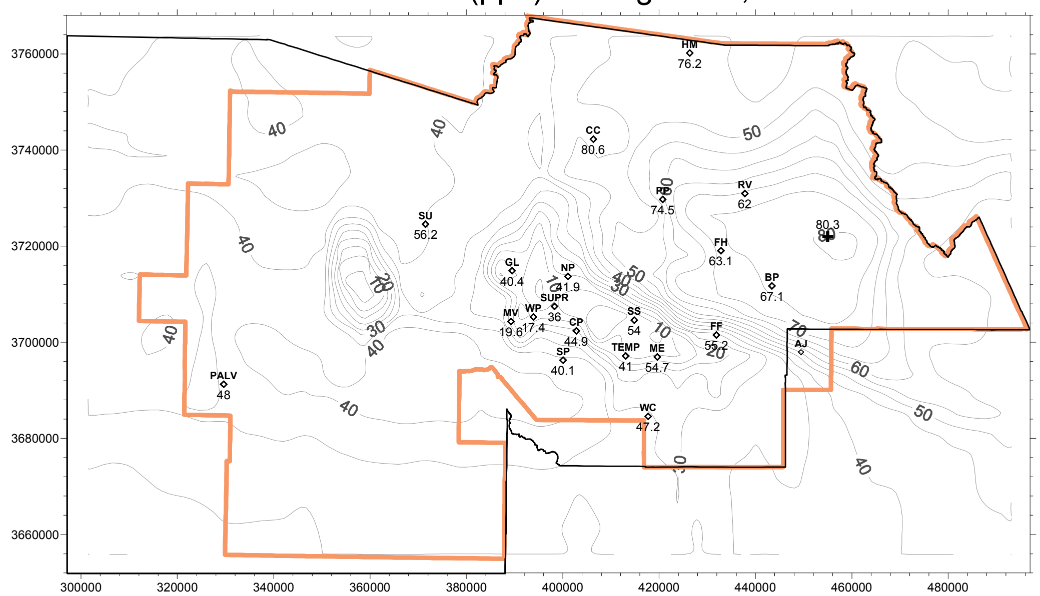
Surface 1-hour ozone concentration (ppb) on August 10, 2005 19:00-20:00 LST



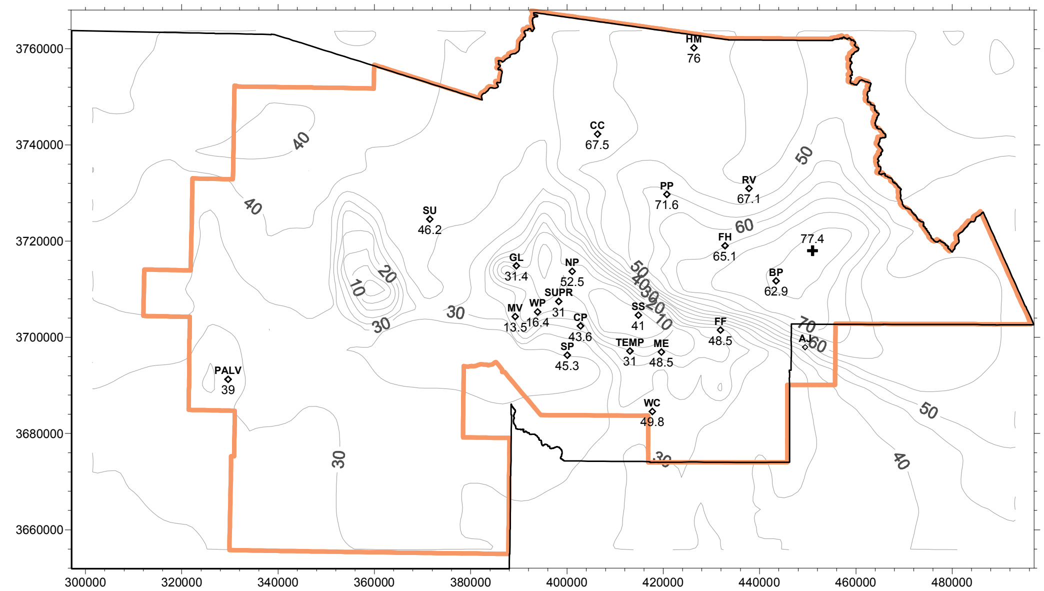
Surface 1-hour ozone concentration (ppb) on August 10, 2005 20:00-21:00 LST



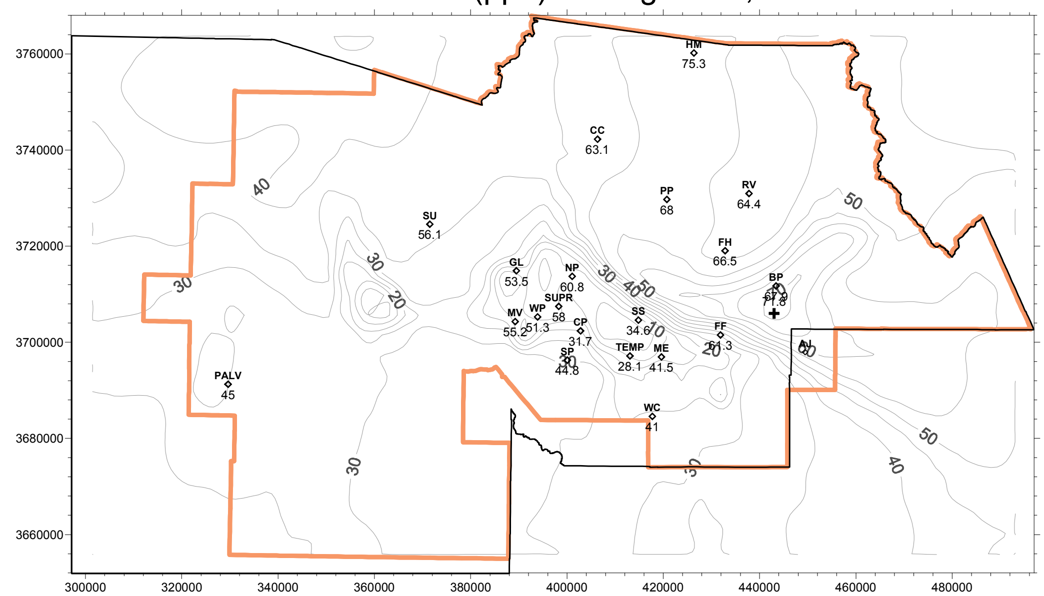
Surface 1-hour ozone concentration (ppb) on August 10, 2005 21:00-22:00 LST



Surface 1-hour ozone concentration (ppb) on August 10, 2005 22:00-23:00 LST



Surface 1-hour ozone concentration (ppb) on August 10, 2005 23:00-24:00 LST

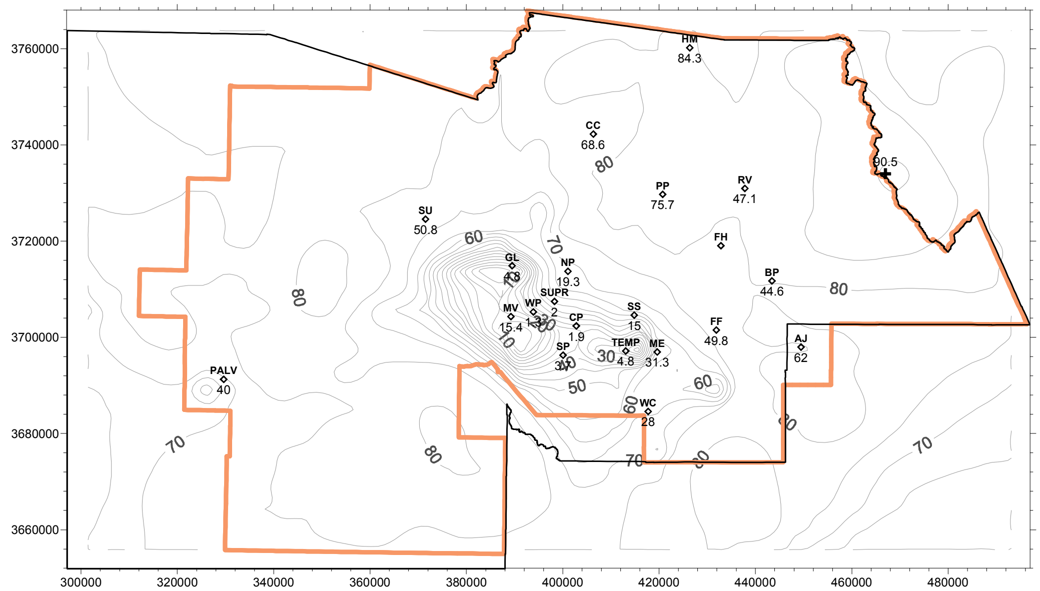


Appendix IV-xiii

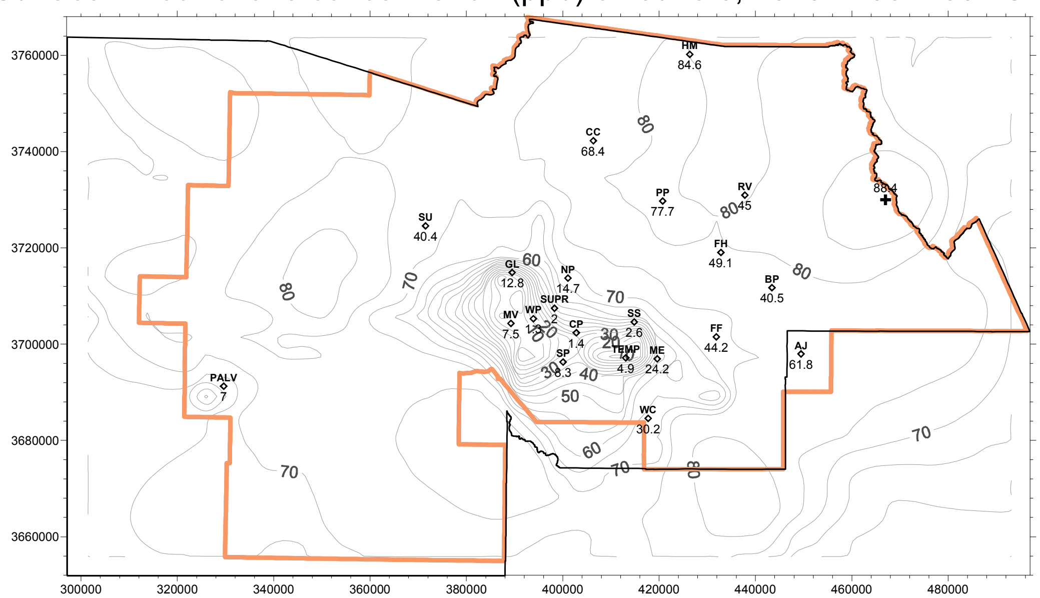
Modeled 1-Hour Ozone for the June 2025 Episode

The plots shown here are the simulated 1-hour ozone for the future year. These hourly ozone concentrations are from 0:00 to 24:00 LST on June 6, 2025.

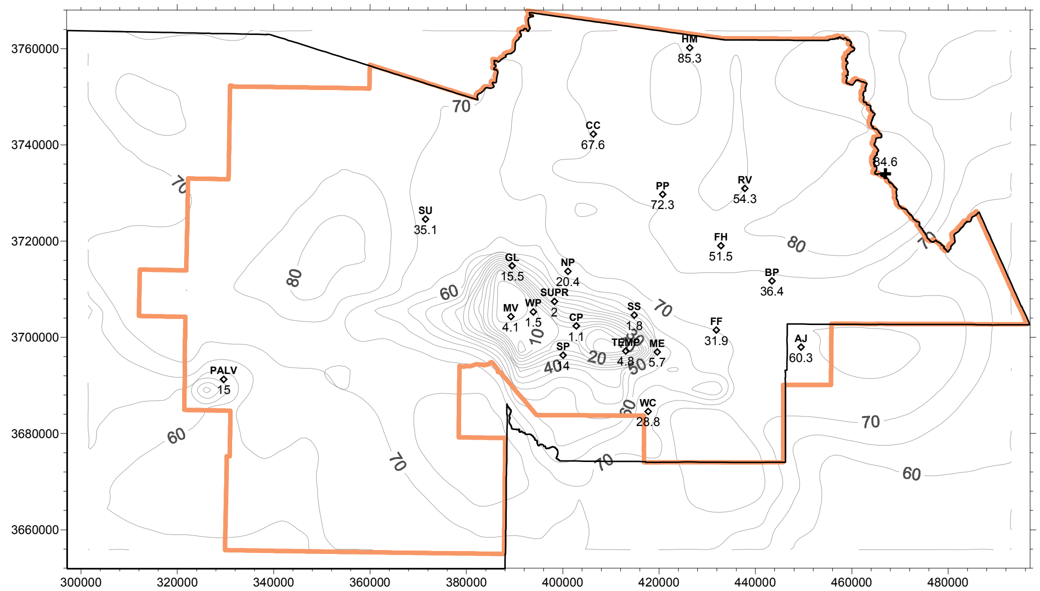
Surface 1-hour ozone concentration (ppb) on June 6, 2025 0:00-1:00 LST



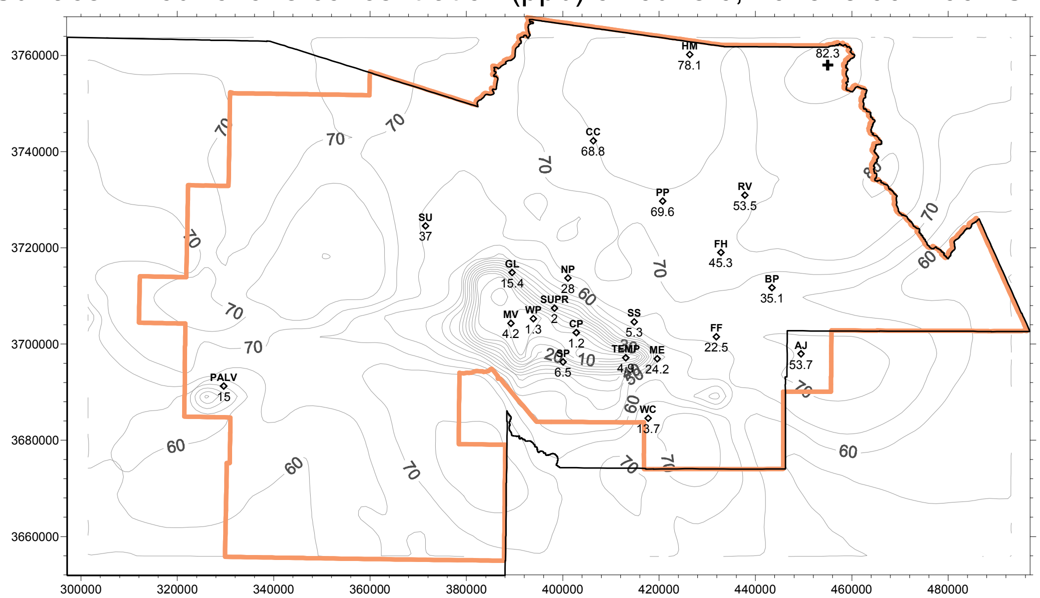
Surface 1-hour ozone concentration (ppb) on June 6, 2025 1:00-2:00 LST



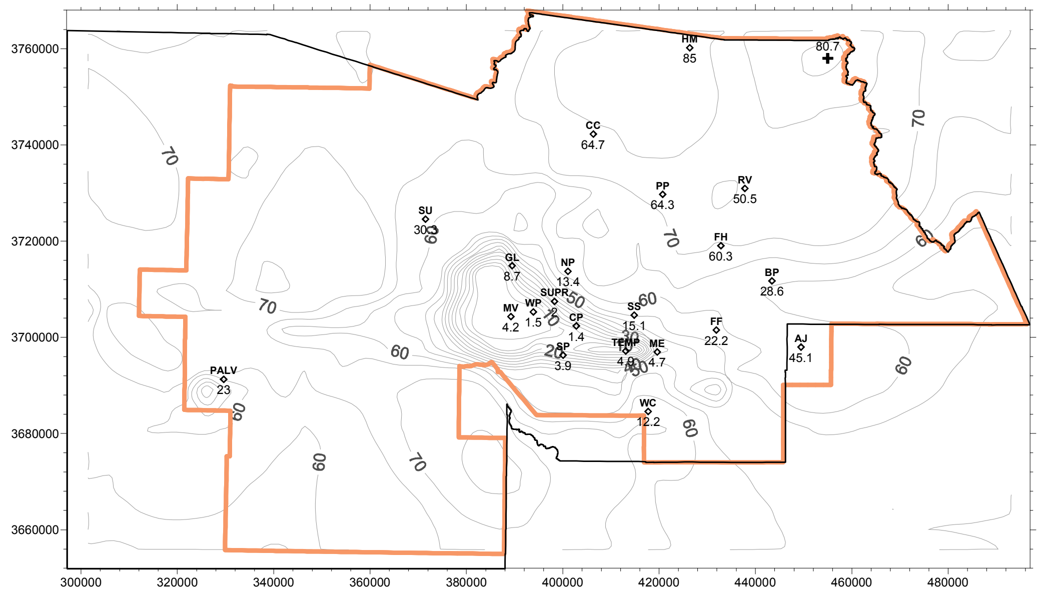
Surface 1-hour ozone concentration (ppb) on June 6, 2025 2:00-300 LST



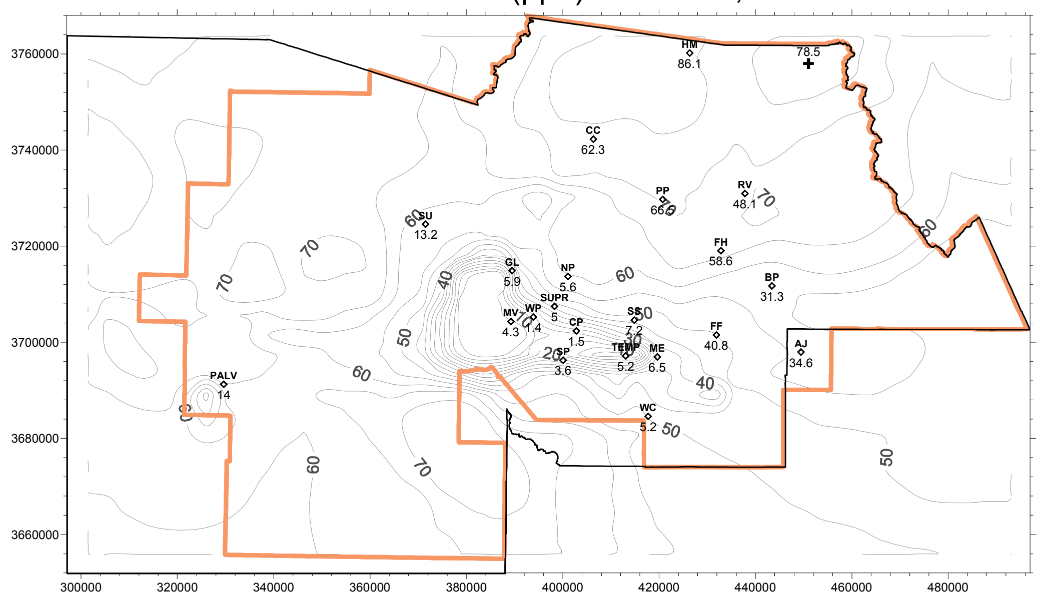
Surface 1-hour ozone concentration (ppb) on June 6, 2025 3:00-4:00 LST



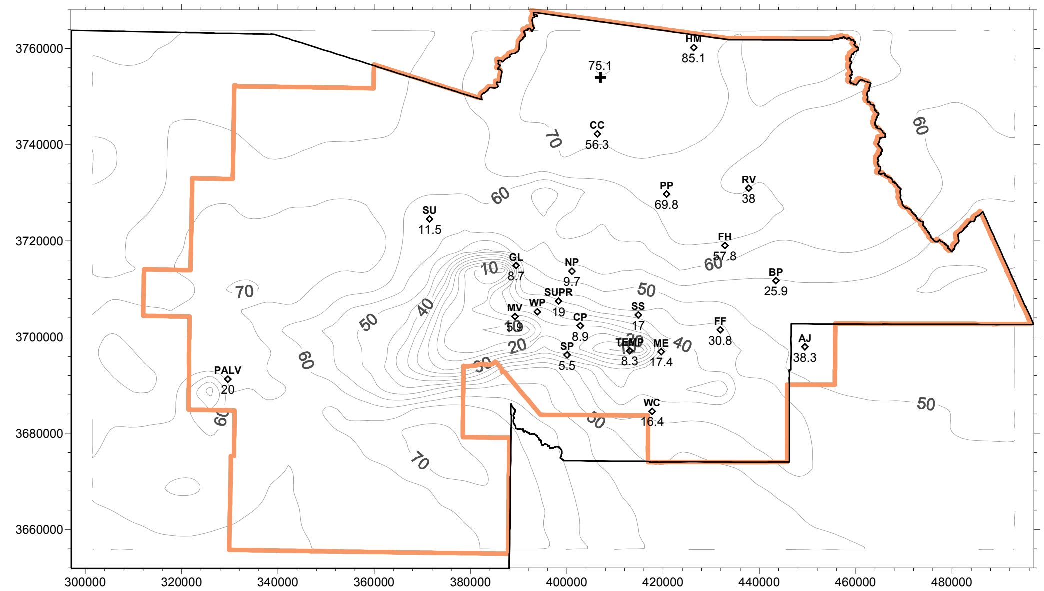
Surface 1-hour ozone concentration (ppb) on June 6, 2025 4:00-5:00 LST



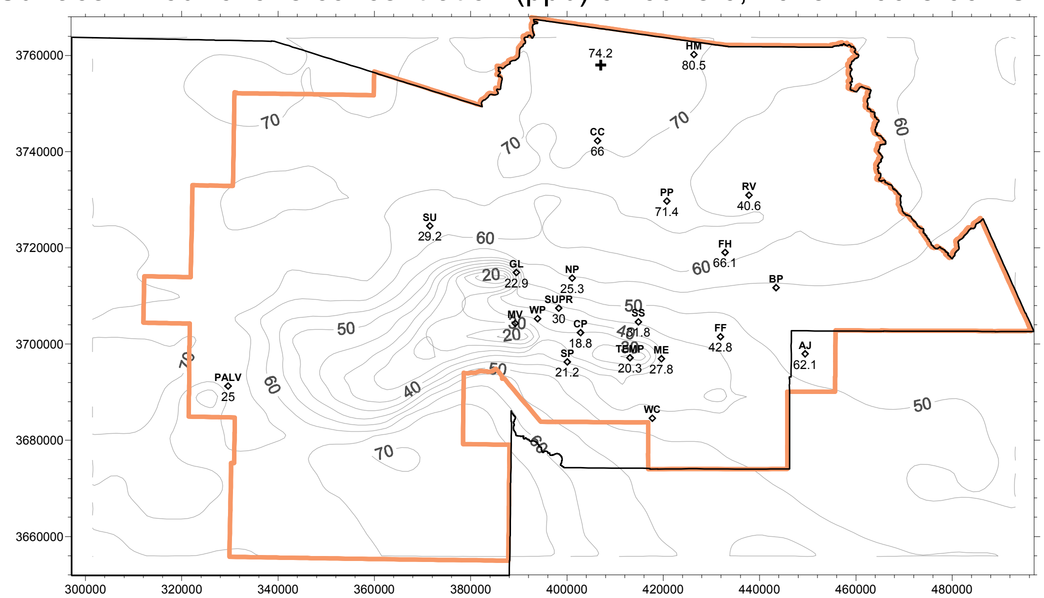
Surface 1-hour ozone concentration (ppb) on June 6, 2025 5:00-6:00 LST



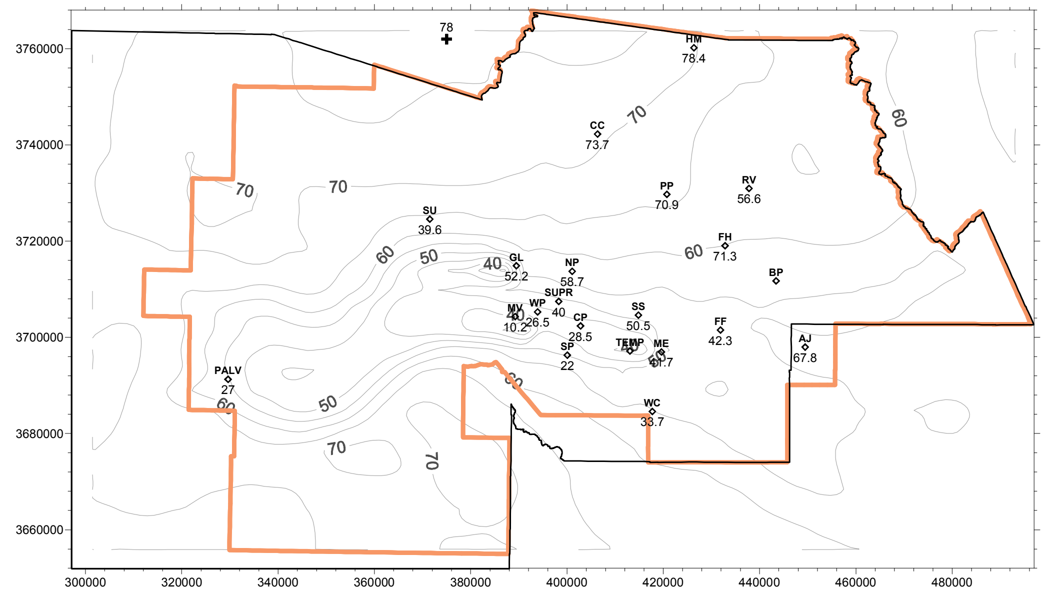
Surface 1-hour ozone concentration (ppb) on June 6, 2025 6:00-7:00 LST



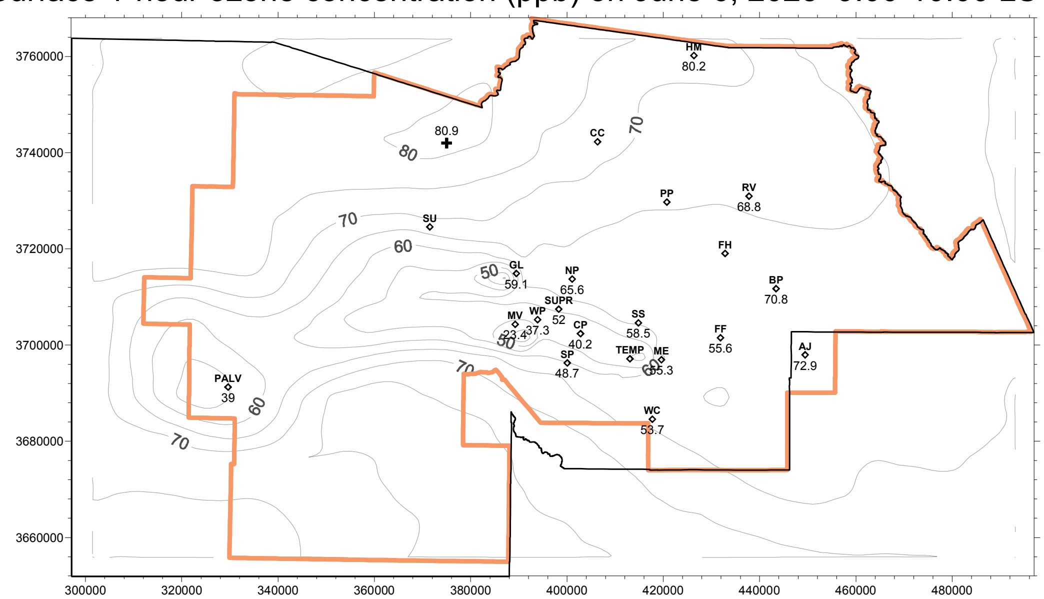
Surface 1-hour ozone concentration (ppb) on June 6, 2025 7:00-8:00 LST



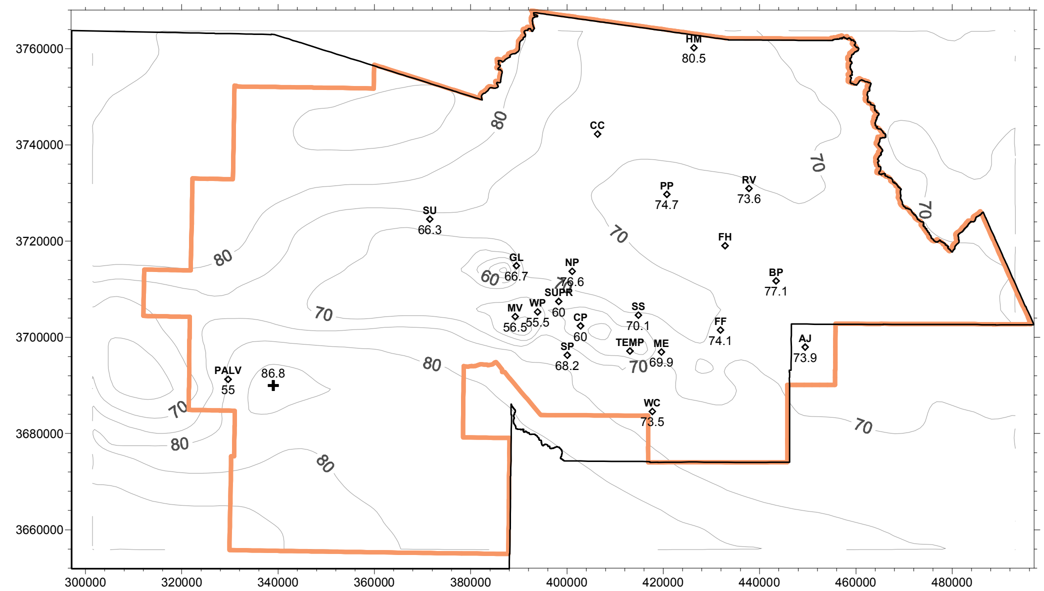
Surface 1-hour ozone concentration (ppb) on June 6, 2025 8:00-9:00 LST



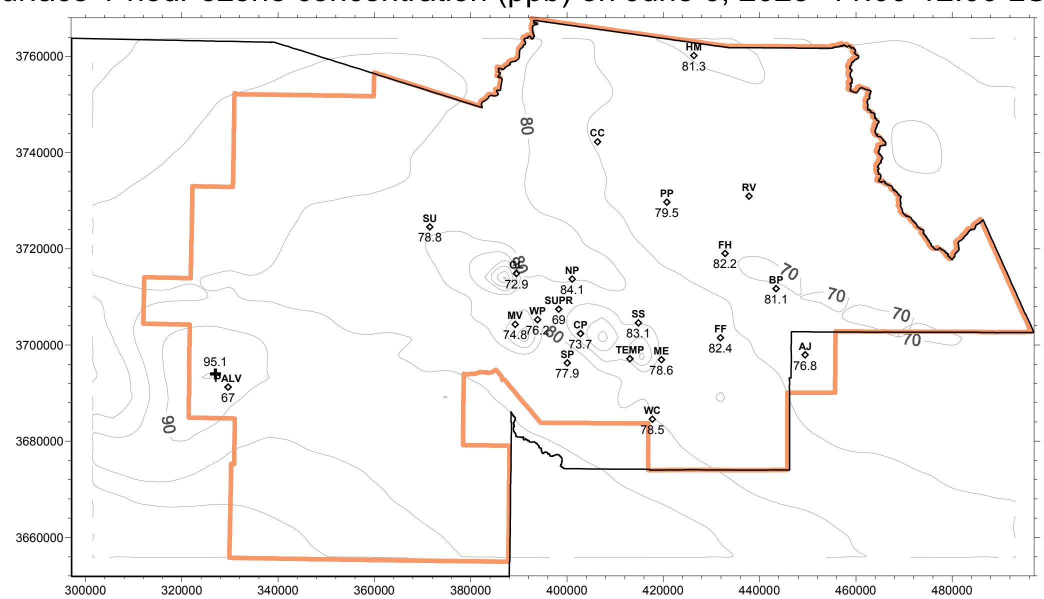
Surface 1-hour ozone concentration (ppb) on June 6, 2025 9:00-10:00 LST



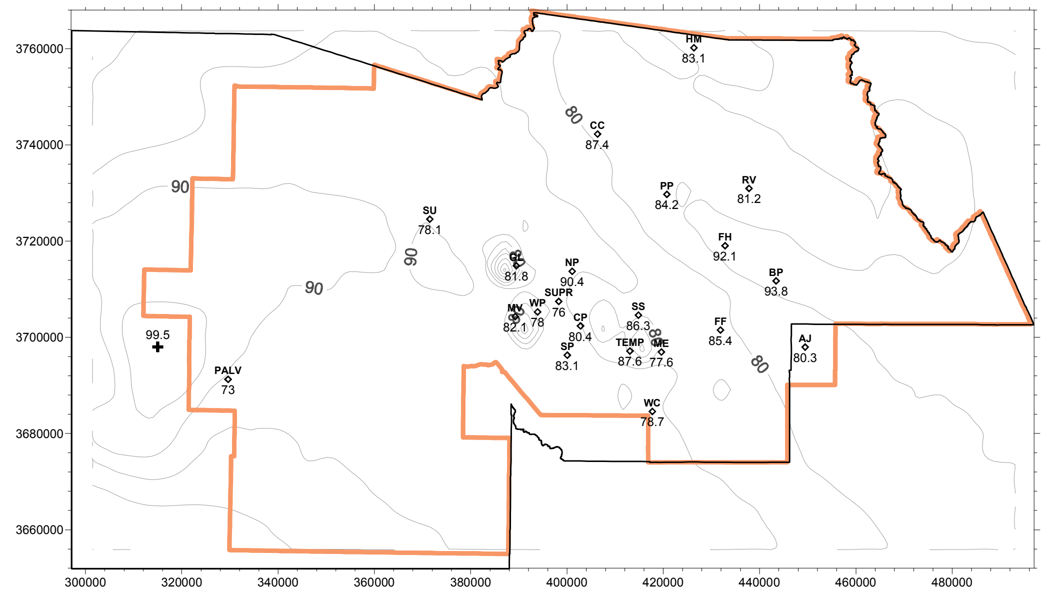
Surface 1-hour ozone concentration (ppb) on June 6, 2025 10:00-11:00 LST



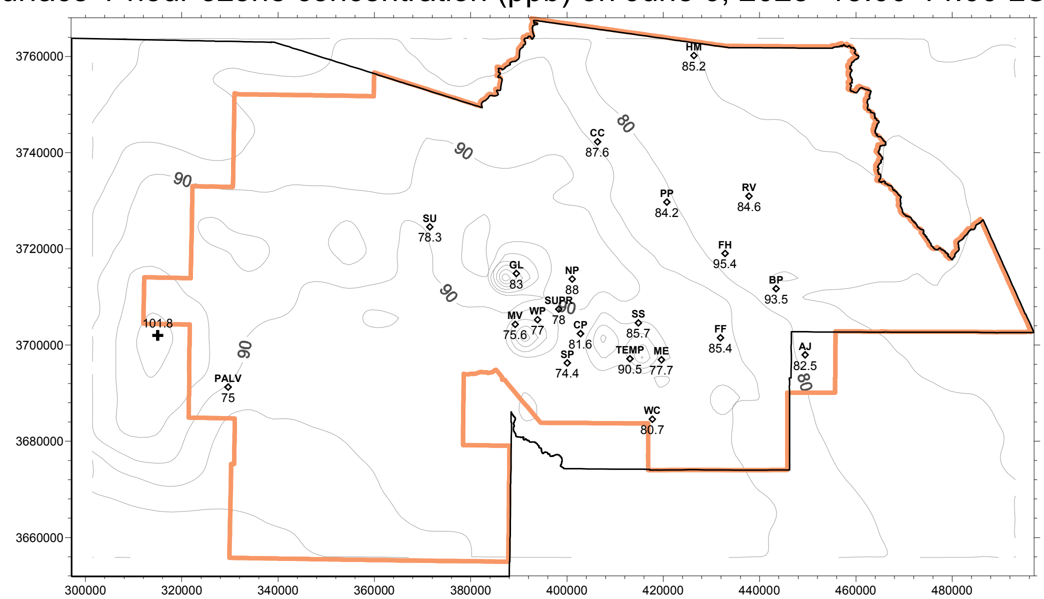
Surface 1-hour ozone concentration (ppb) on June 6, 2025 11:00-12:00 LST



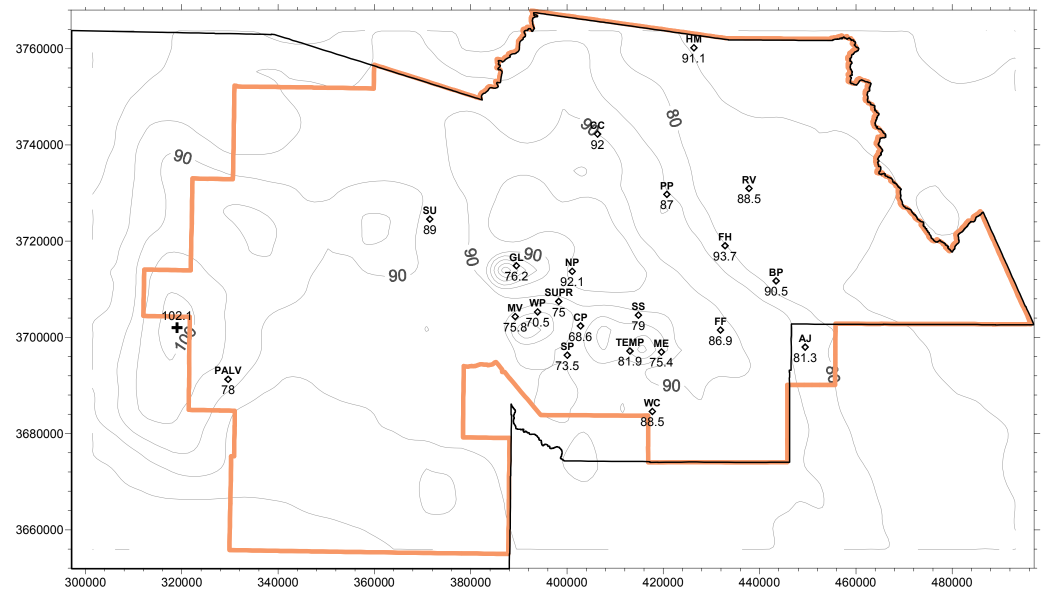
Surface 1-hour ozone concentration (ppb) on June 6, 2025 12:00-13:00 LST



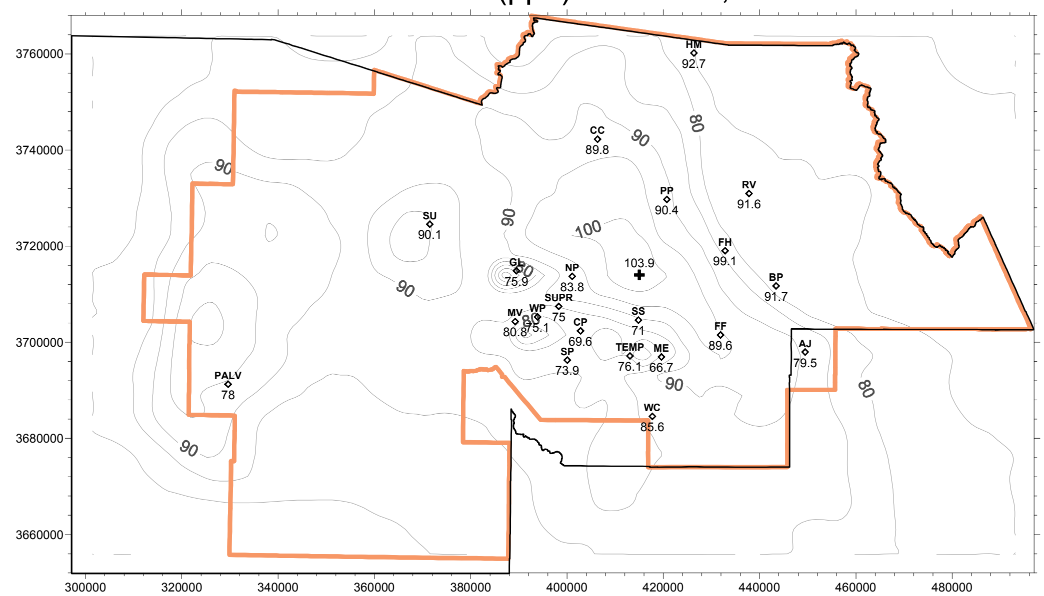
Surface 1-hour ozone concentration (ppb) on June 6, 2025 13:00-14:00 LST



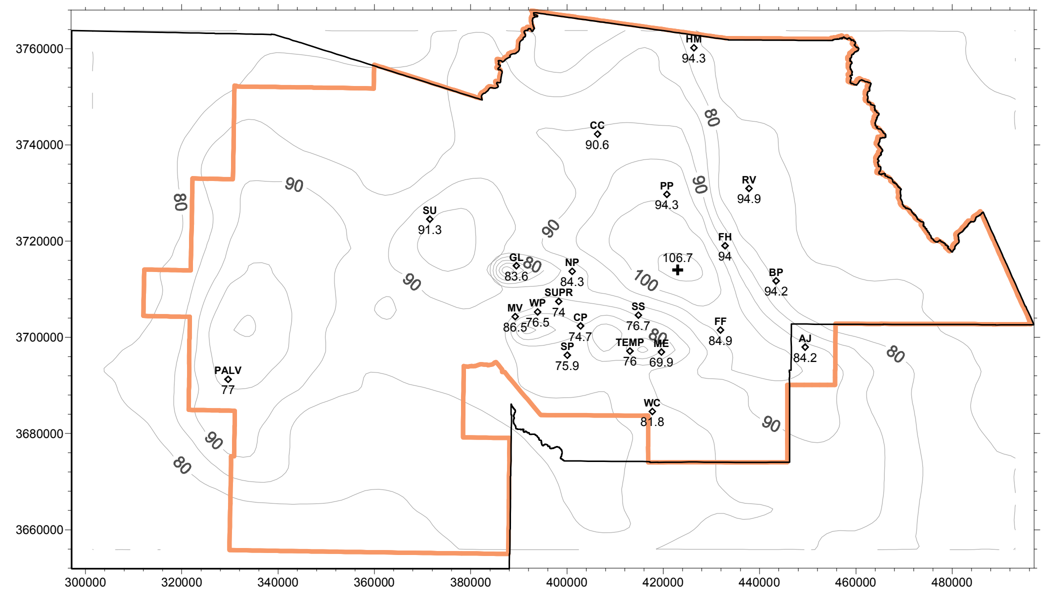
Surface 1-hour ozone concentration (ppb) on June 6, 2025 14:00-15:00 LST



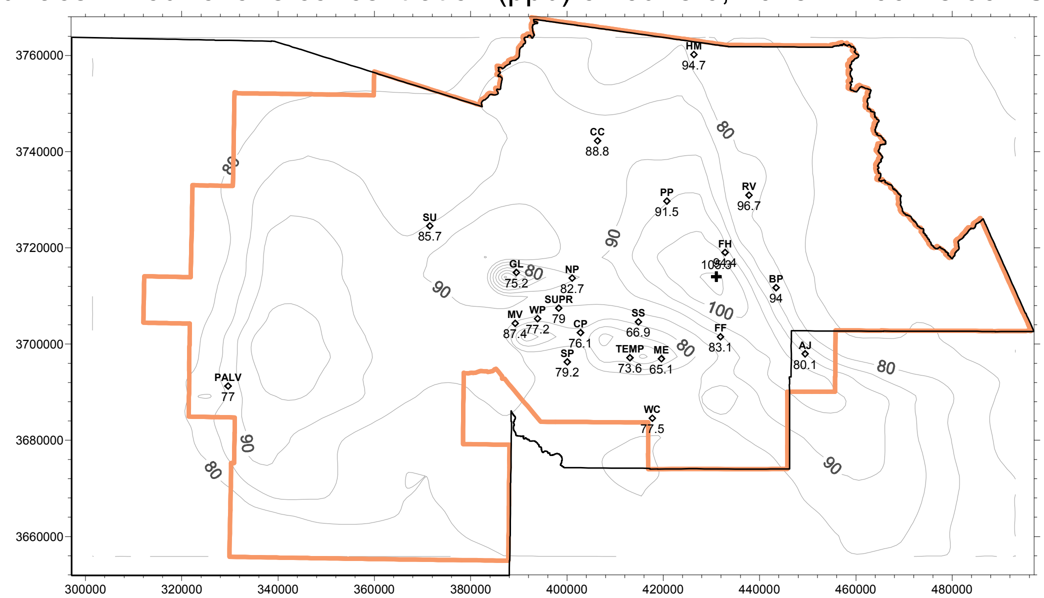
Surface 1-hour ozone concentration (ppb) on June 6, 2025 15:00-16:00 LST



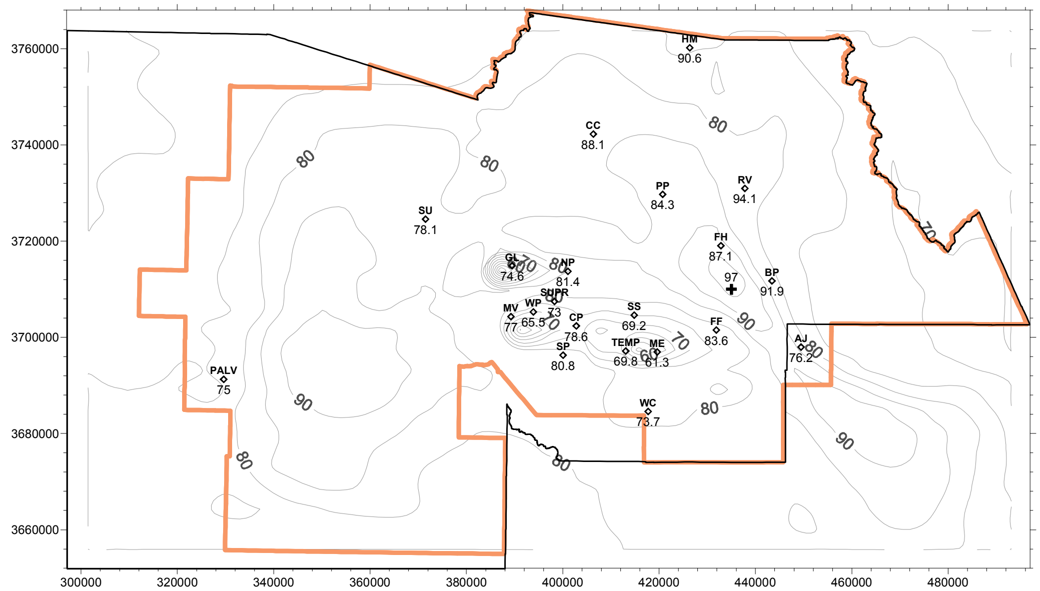
Surface 1-hour ozone concentration (ppb) on June 6, 2025 16:00-17:00 LST



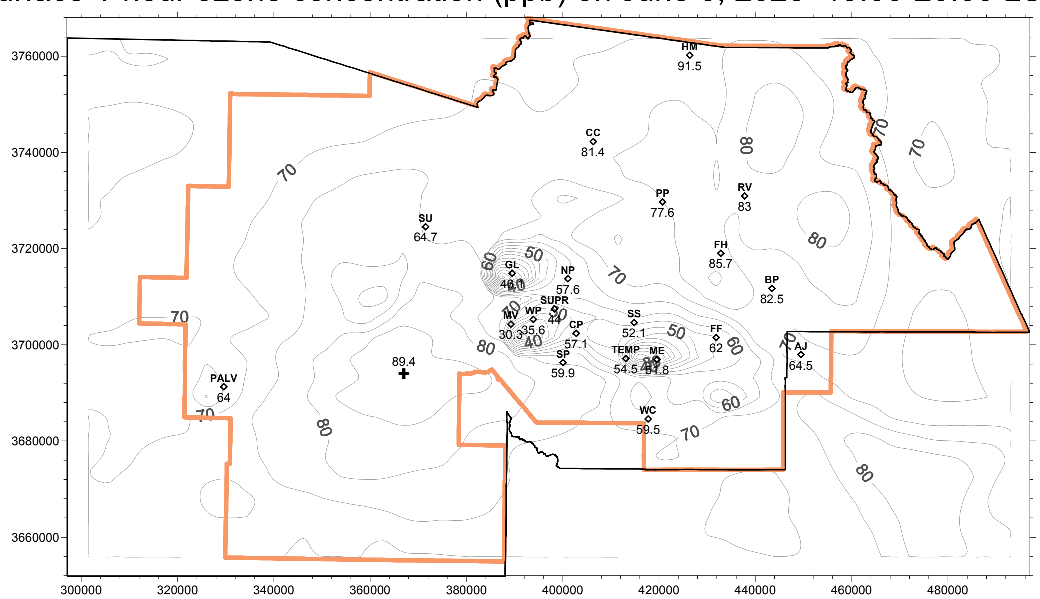
Surface 1-hour ozone concentration (ppb) on June 6, 2025 17:00-18:00 LST



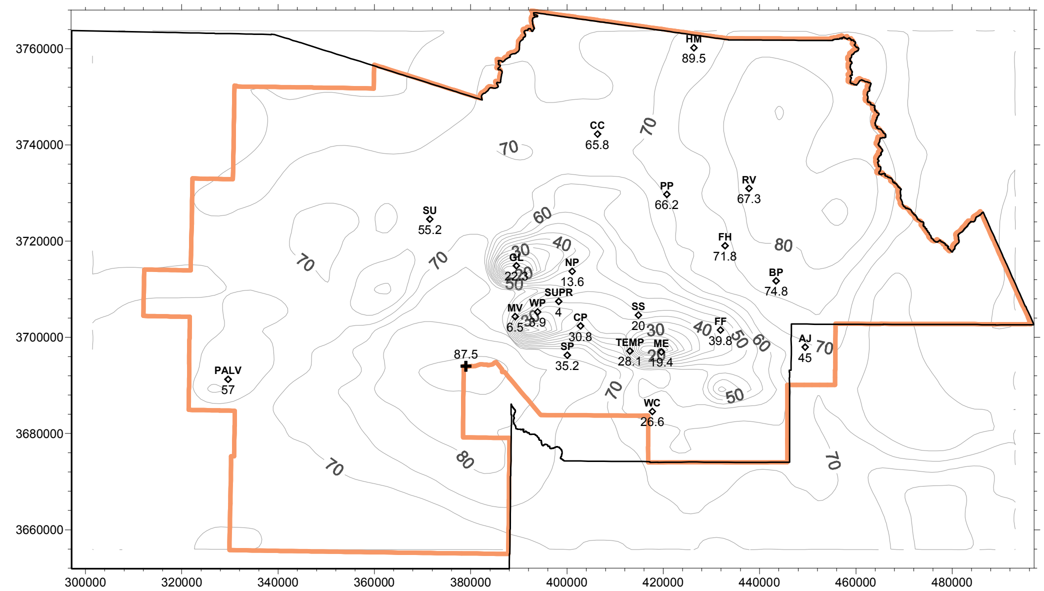
Surface 1-hour ozone concentration (ppb) on June 6, 2025 18:00-19:00 LST



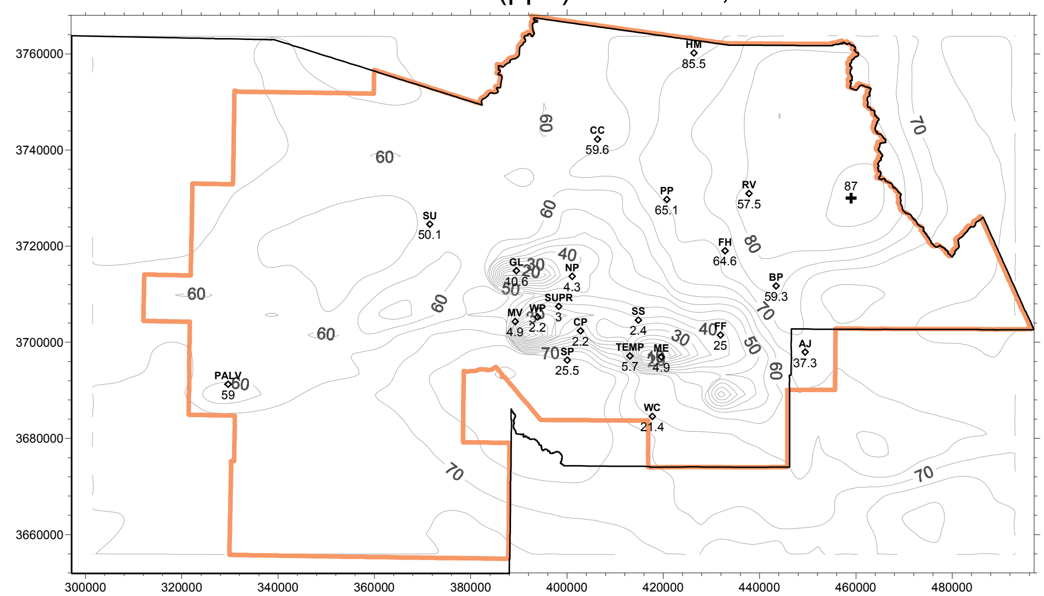
Surface 1-hour ozone concentration (ppb) on June 6, 2025 19:00-20:00 LST



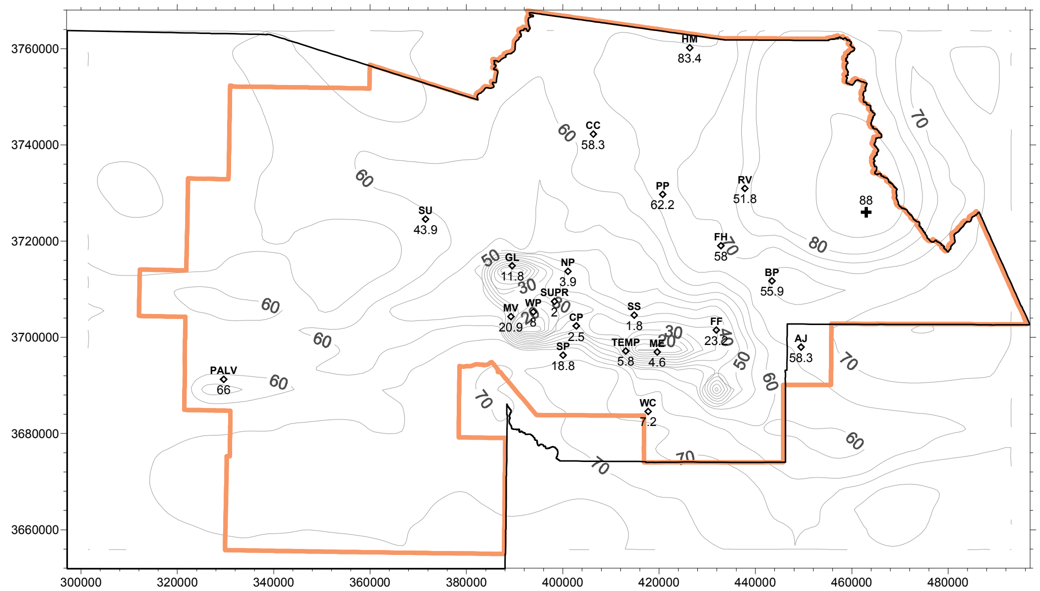
Surface 1-hour ozone concentration (ppb) on June 6, 2025 20:00-21:00 LST



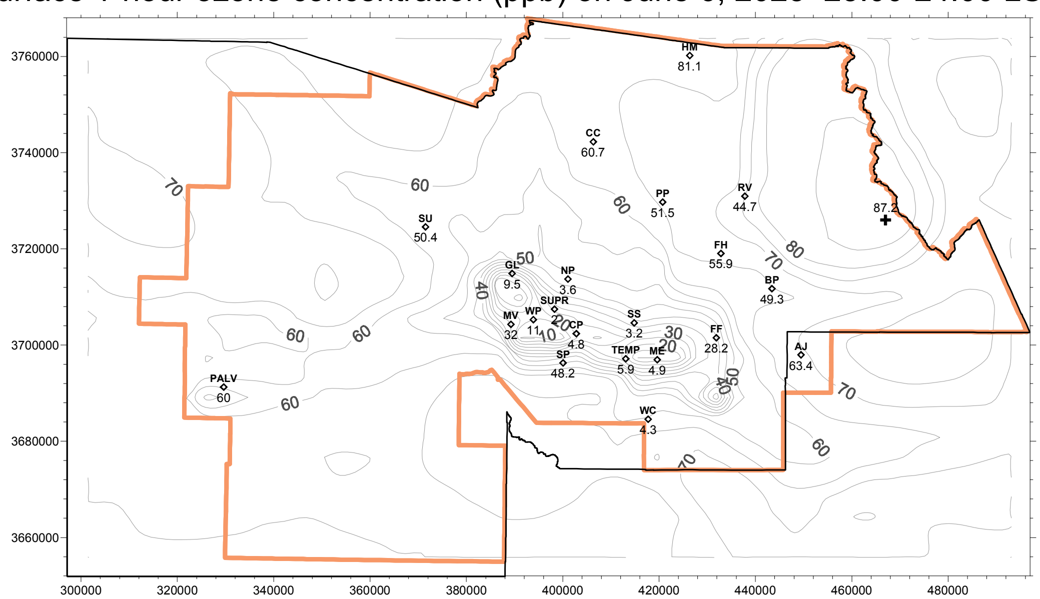
Surface 1-hour ozone concentration (ppb) on June 6, 2025 21:00-22:00 LST



Surface 1-hour ozone concentration (ppb) on June 6, 2025 22:00-23:00 LST



Surface 1-hour ozone concentration (ppb) on June 6, 2025 23:00-24:00 LST

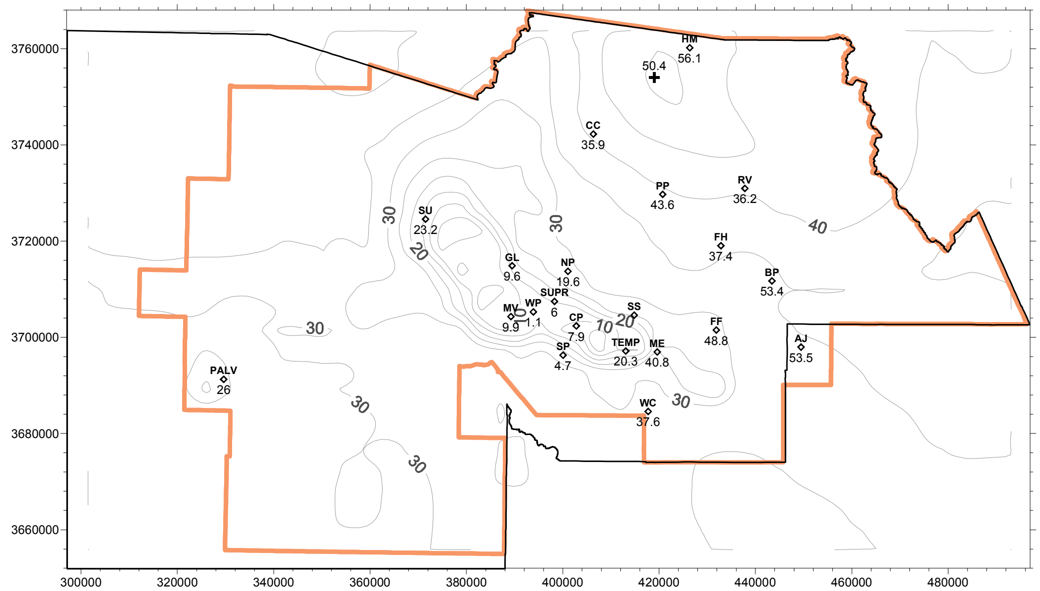


Appendix IV-xiv

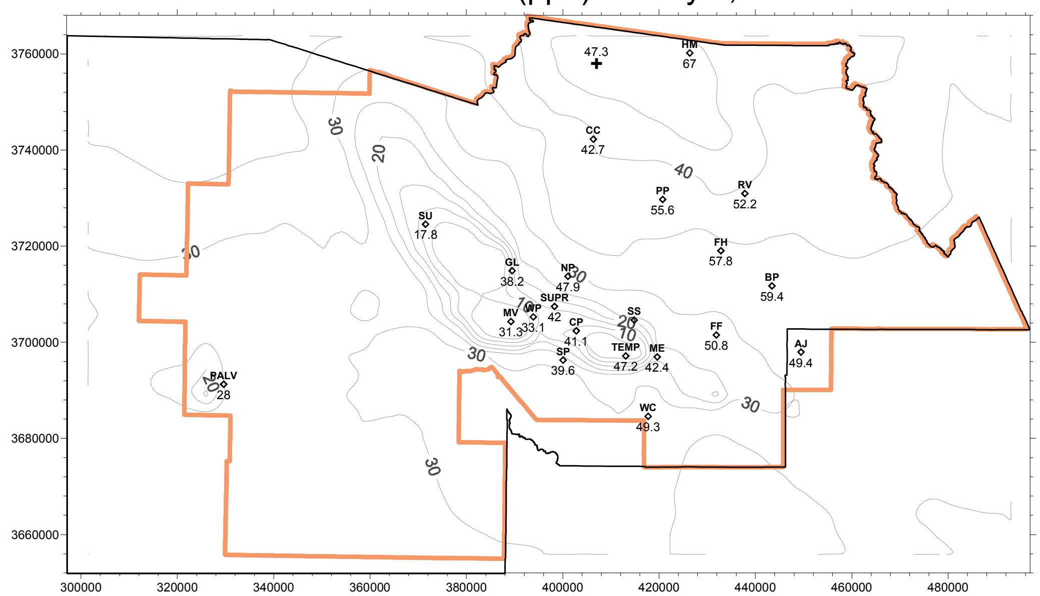
Modeled 1-Hour Ozone for the July 2025 Episode

The plots shown here are the simulated 1-hour ozone for the future year. These hourly ozone concentrations are from 0:00 to 24:00 LST on July 9, 2025.

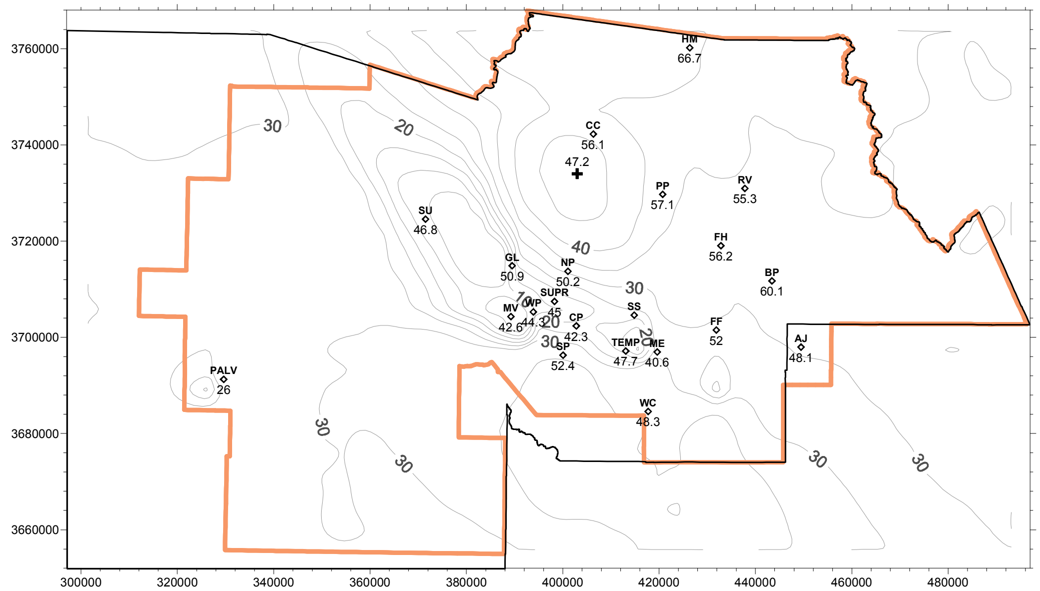
Surface 1-hour ozone concentration (ppb) on July 9, 2025 0:00-1:00 LST



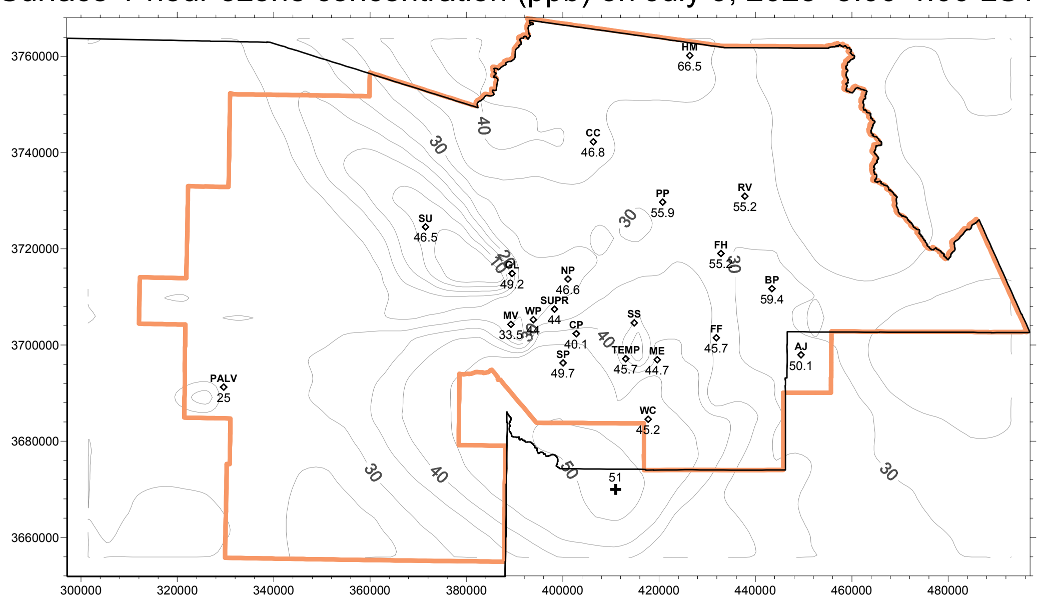
Surface 1-hour ozone concentration (ppb) on July 9, 2025 1:00-2:00 LST



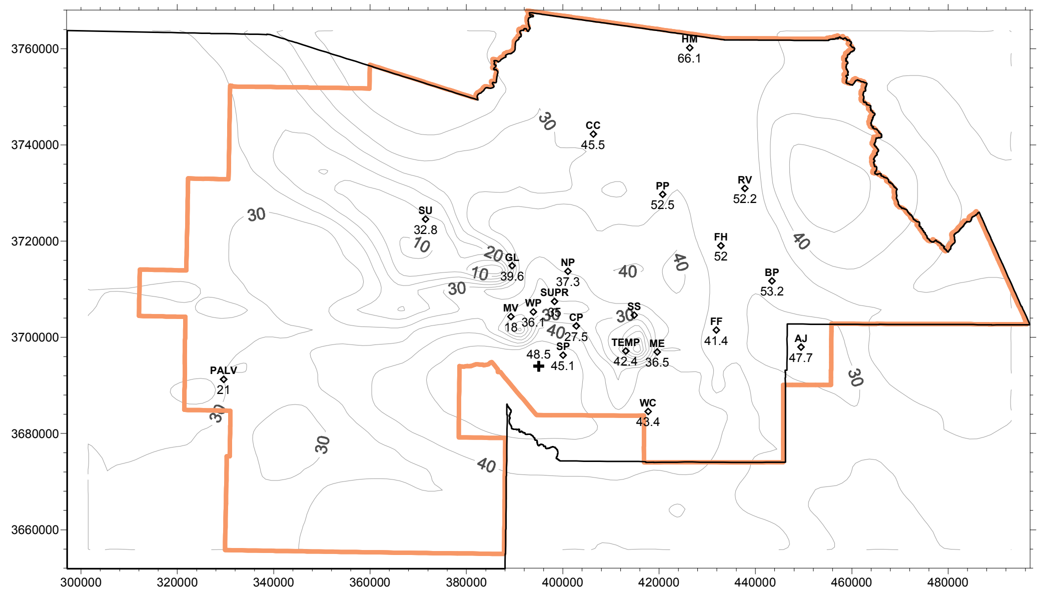
Surface 1-hour ozone concentration (ppb) on July 9, 2025 2:00-300 LST



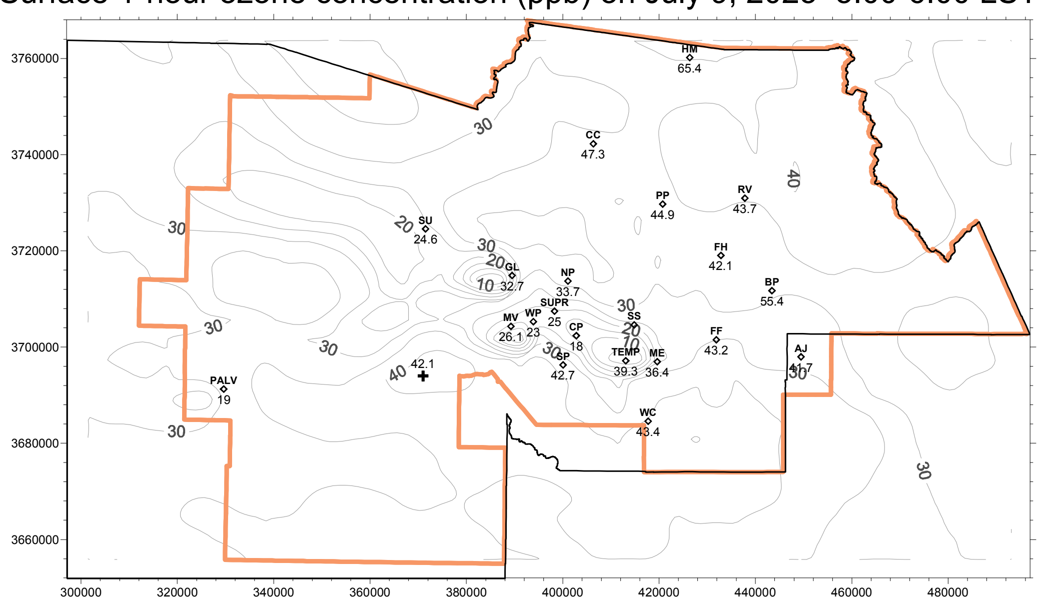
Surface 1-hour ozone concentration (ppb) on July 9, 2025 3:00-4:00 LST



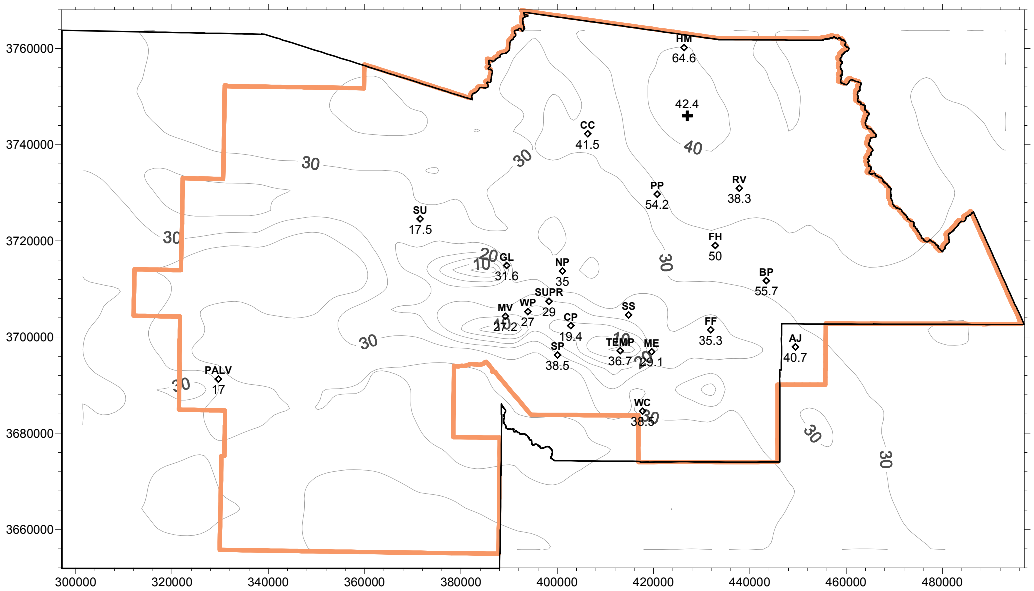
Surface 1-hour ozone concentration (ppb) on July 9, 2025 4:00-5:00 LST



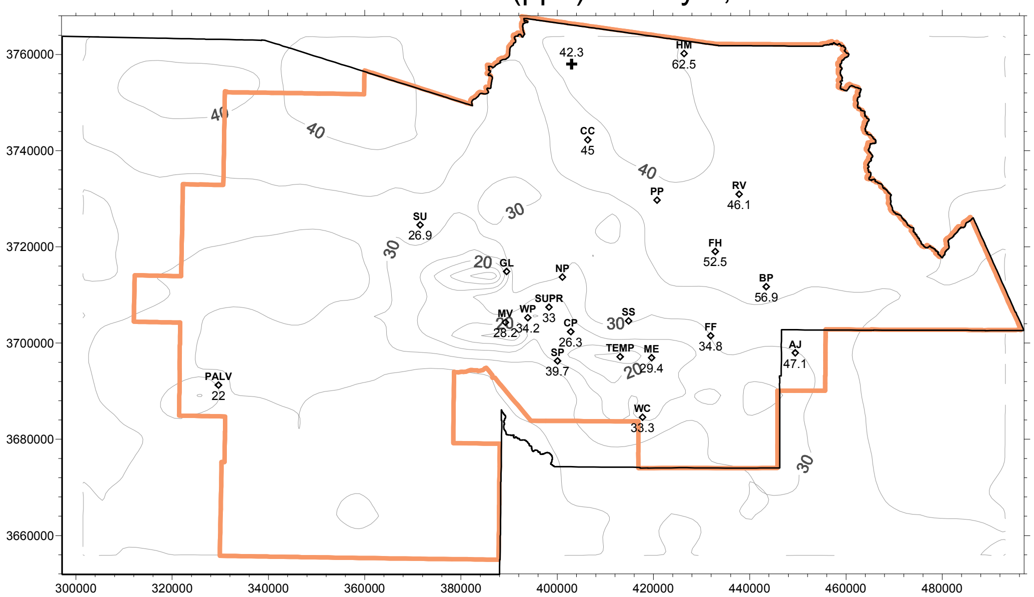
Surface 1-hour ozone concentration (ppb) on July 9, 2025 5:00-6:00 LST



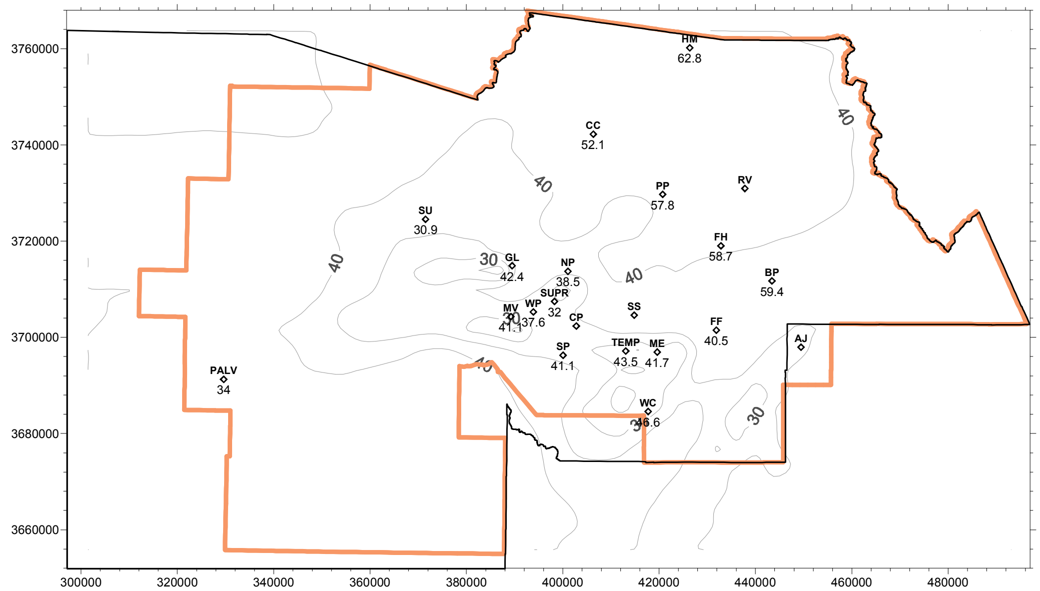
Surface 1-hour ozone concentration (ppb) on July 9, 2025 6:00-7:00 LST



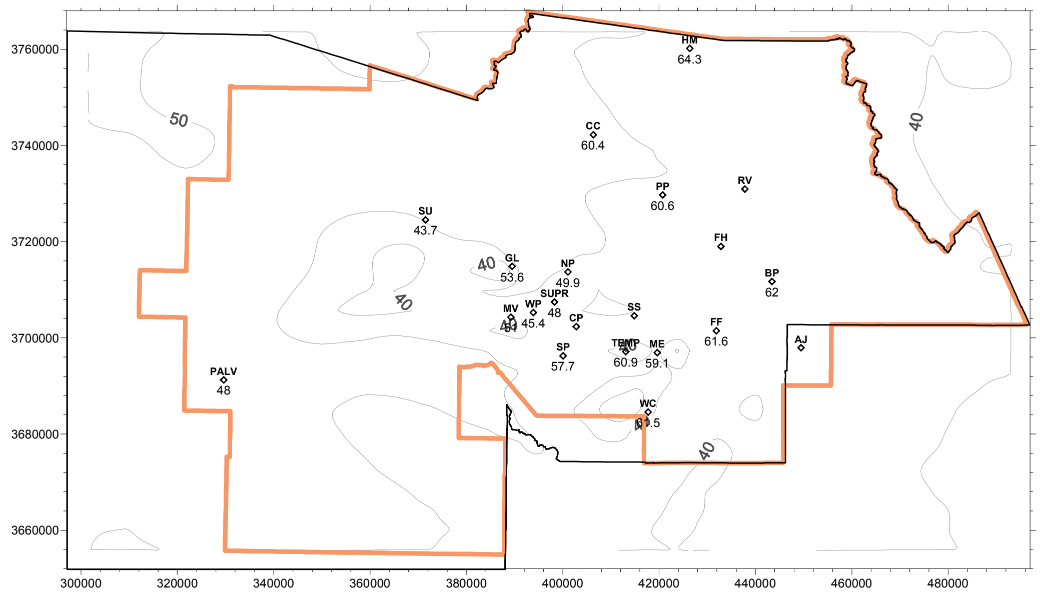
Surface 1-hour ozone concentration (ppb) on July 9, 2025 7:00-8:00 LST



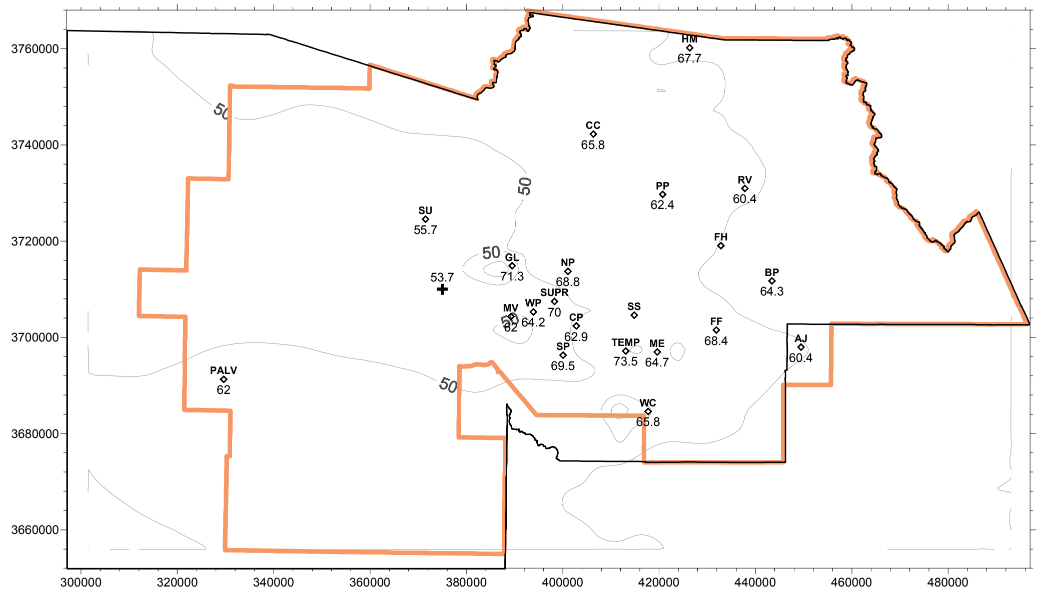
Surface 1-hour ozone concentration (ppb) on July 9, 2025 8:00-9:00 LST



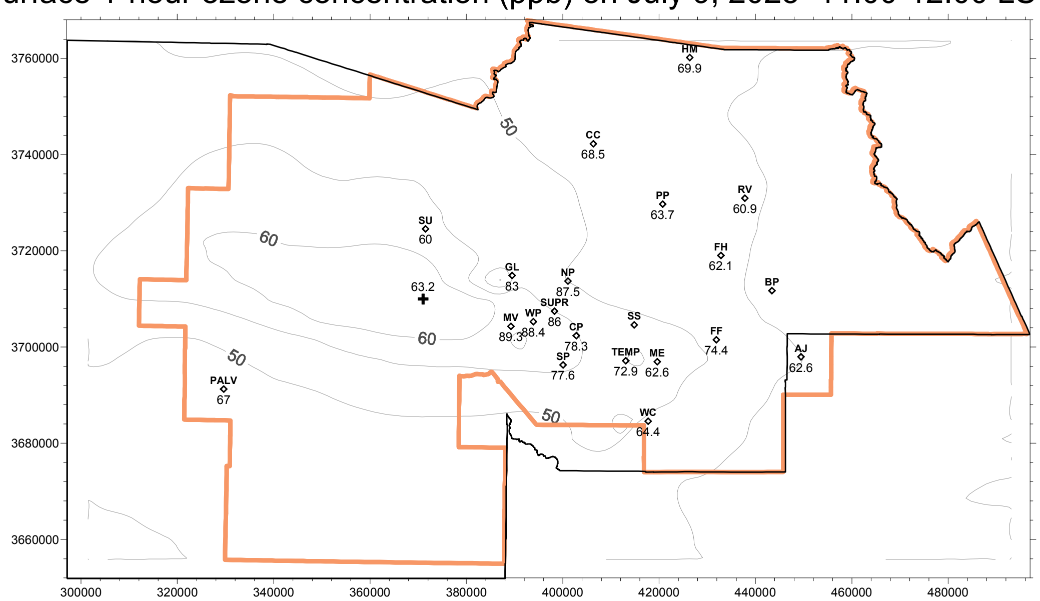
Surface 1-hour ozone concentration (ppb) on July 9, 2025 9:00-10:00 LST



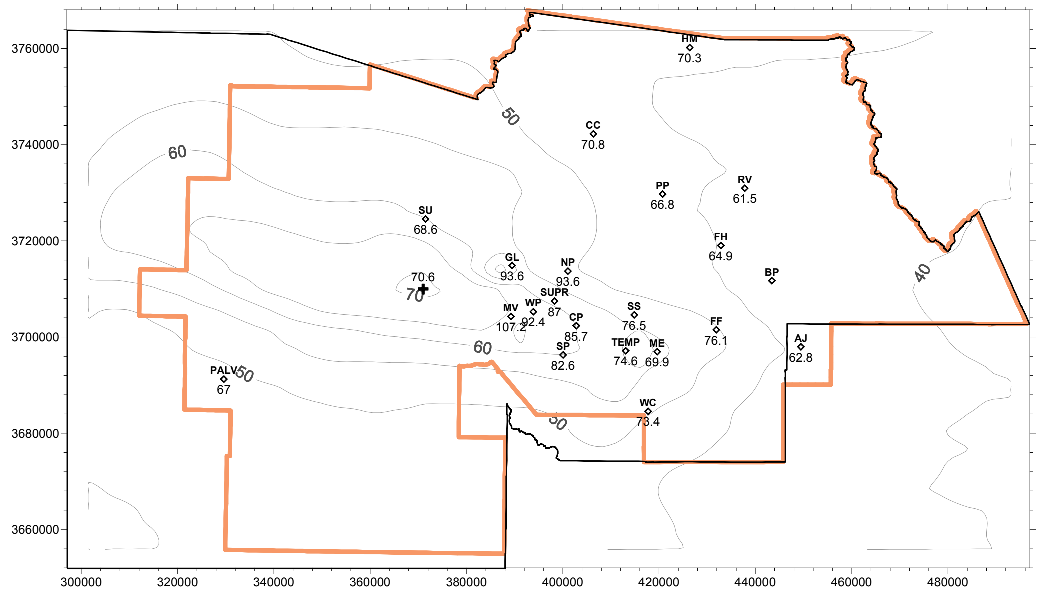
Surface 1-hour ozone concentration (ppb) on July 9, 2025 10:00-11:00 LST



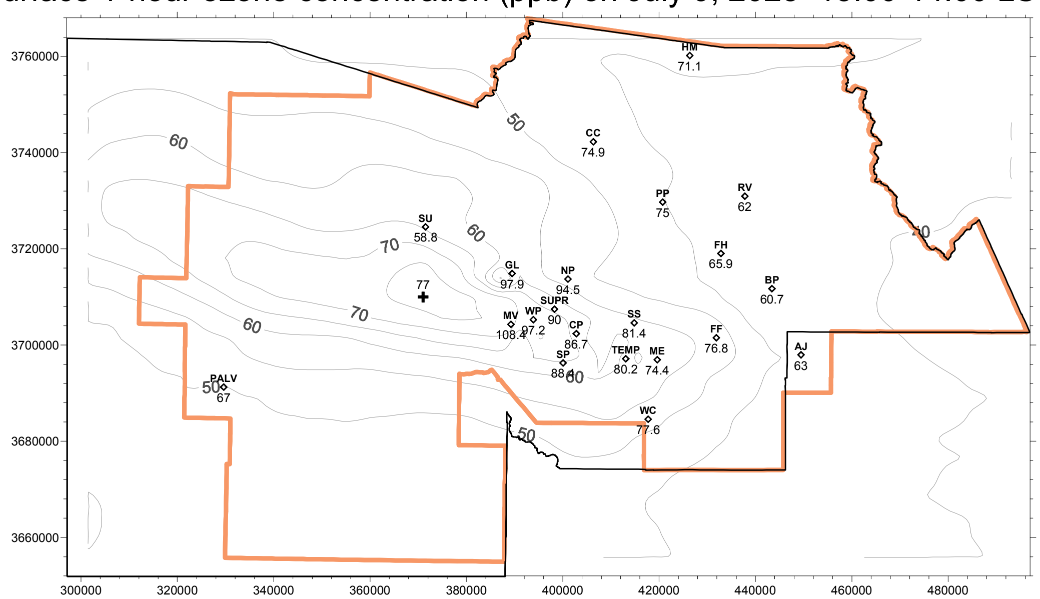
Surface 1-hour ozone concentration (ppb) on July 9, 2025 11:00-12:00 LST



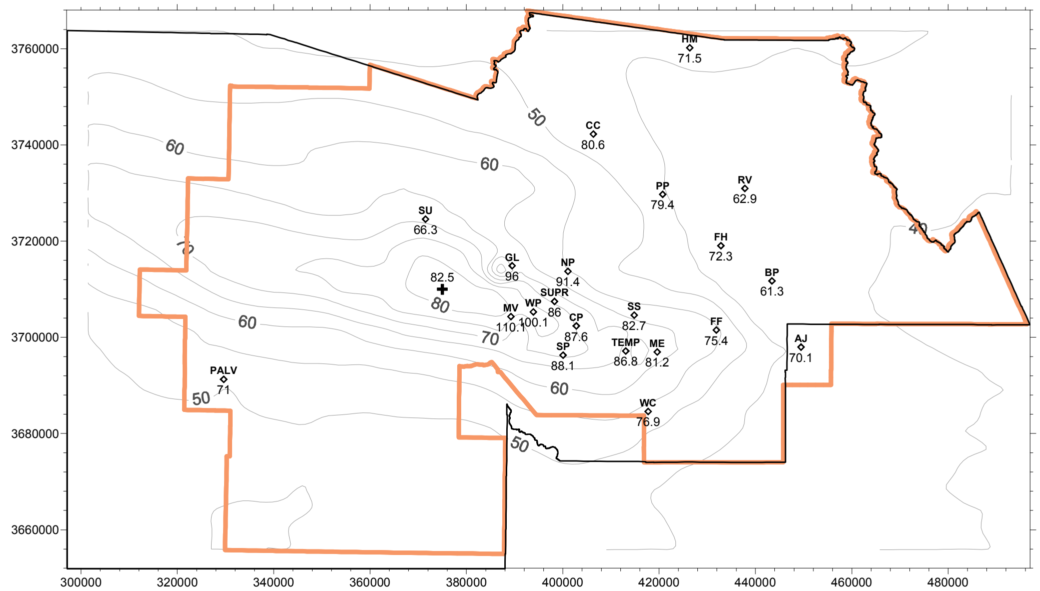
Surface 1-hour ozone concentration (ppb) on July 9, 2025 12:00-13:00 LST



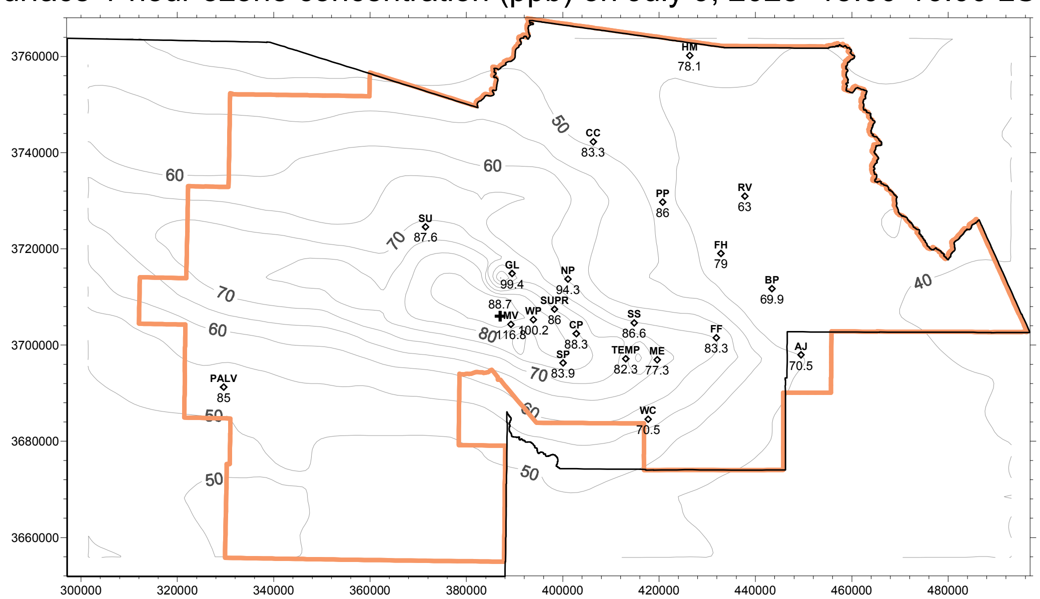
Surface 1-hour ozone concentration (ppb) on July 9, 2025 13:00-14:00 LST



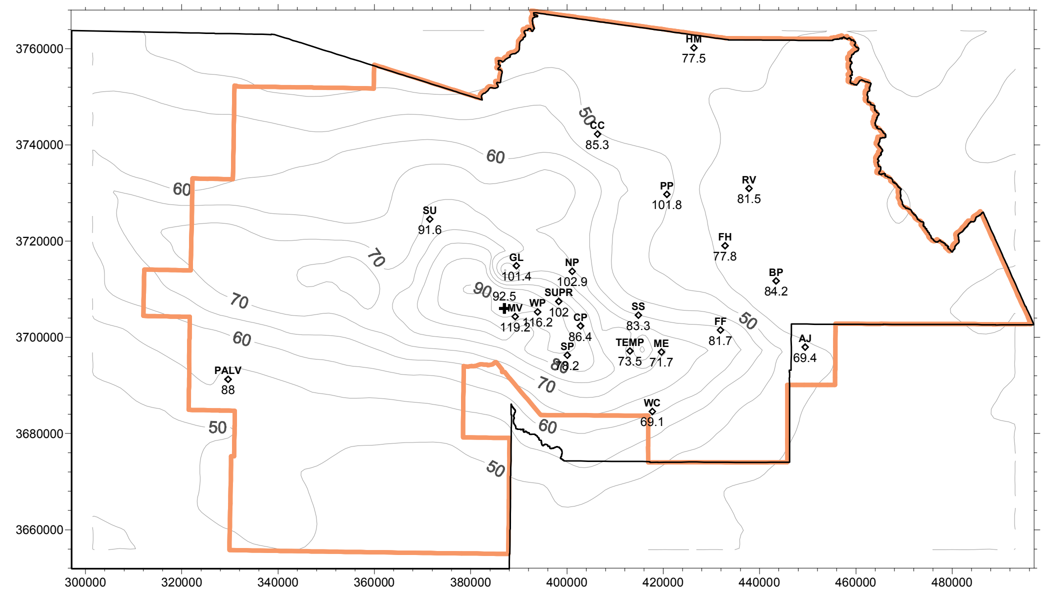
Surface 1-hour ozone concentration (ppb) on July 9, 2025 14:00-15:00 LST



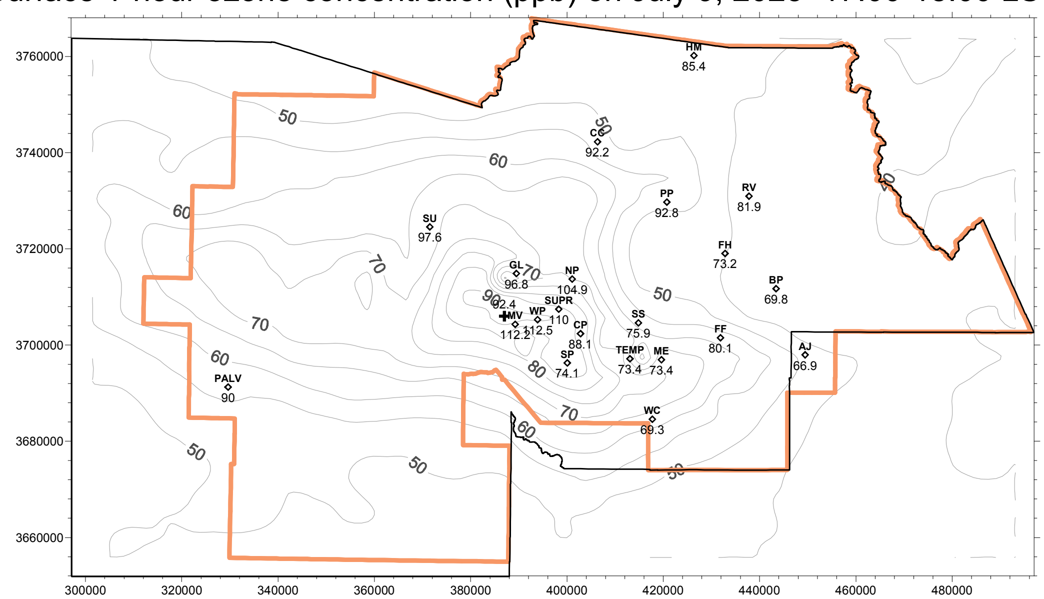
Surface 1-hour ozone concentration (ppb) on July 9, 2025 15:00-16:00 LST



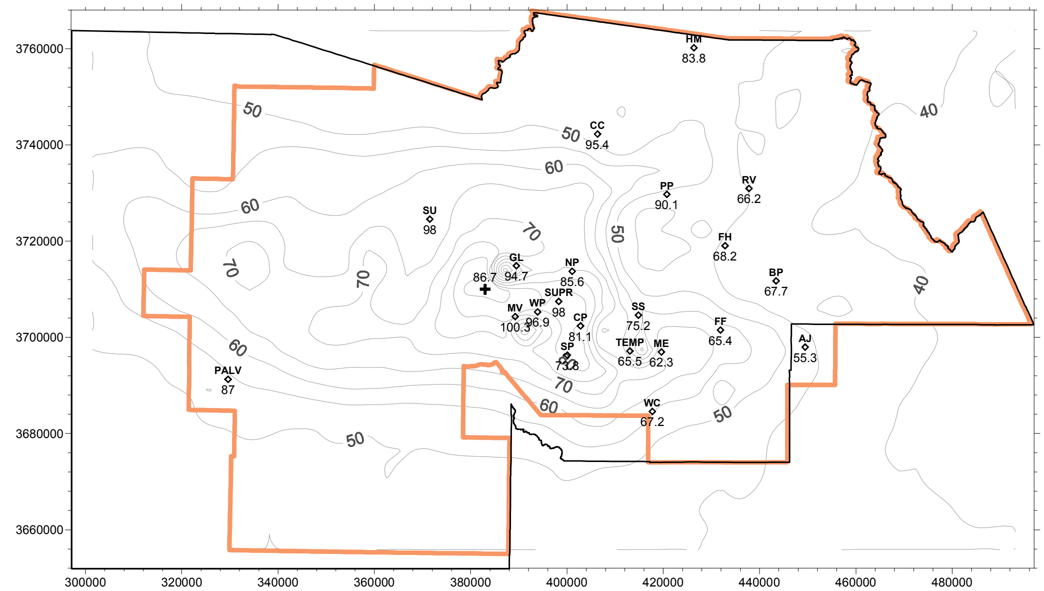
Surface 1-hour ozone concentration (ppb) on July 9, 2025 16:00-17:00 LST



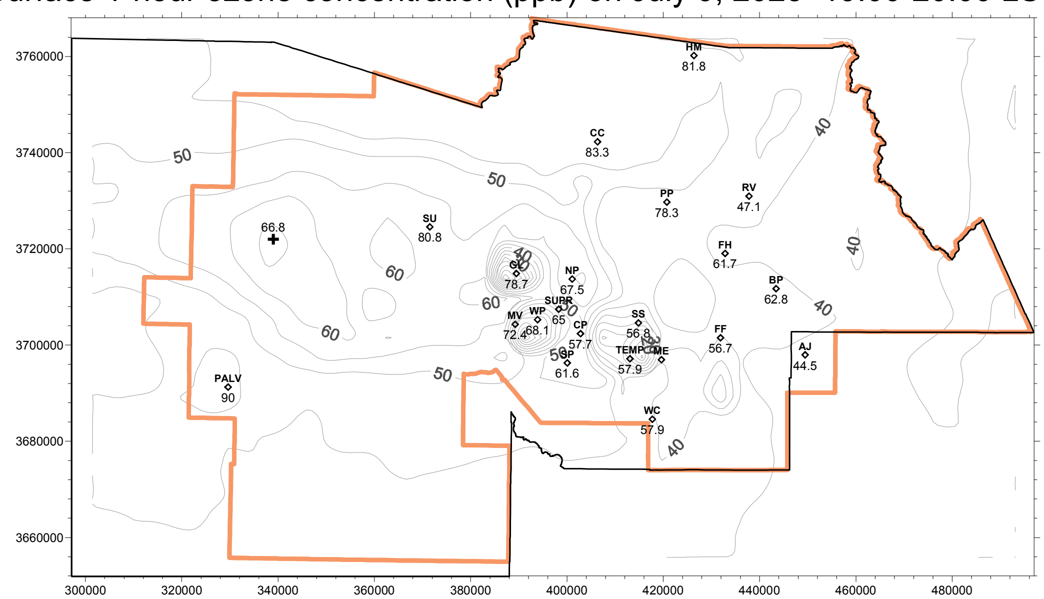
Surface 1-hour ozone concentration (ppb) on July 9, 2025 17:00-18:00 LST



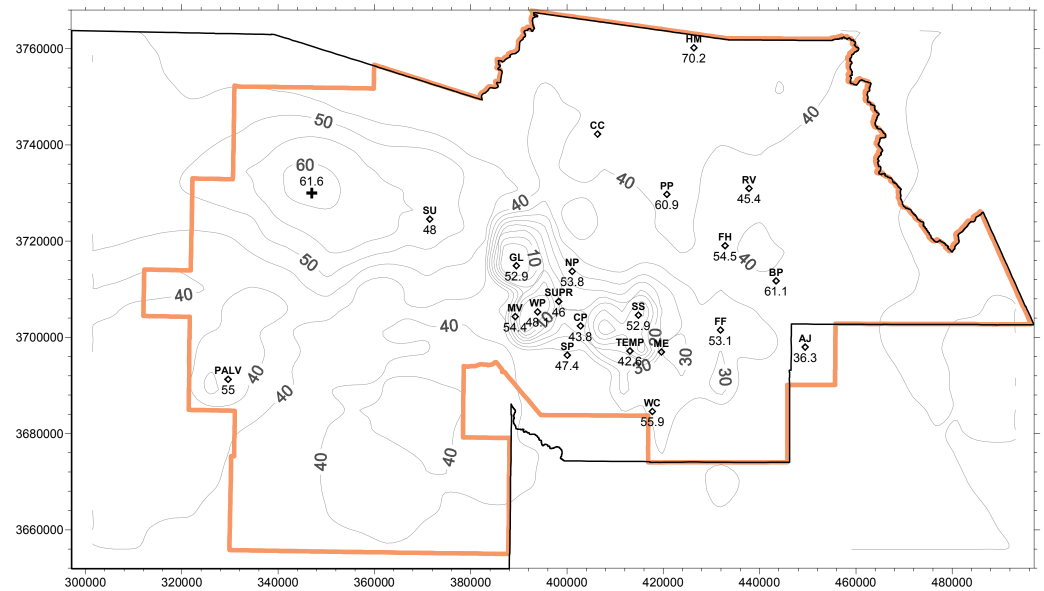
Surface 1-hour ozone concentration (ppb) on July 9, 2025 18:00-19:00 LST



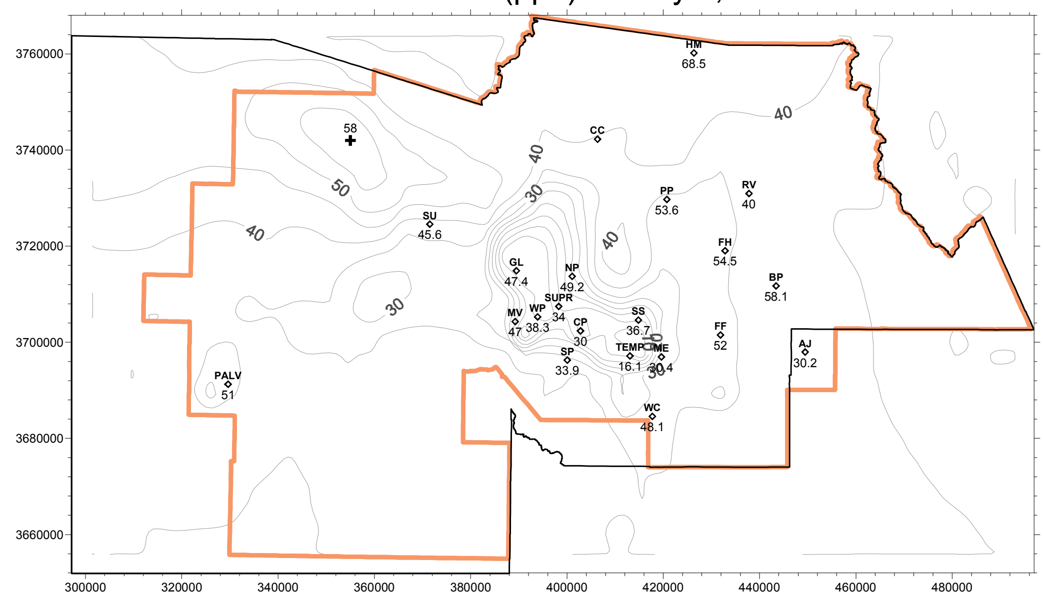
Surface 1-hour ozone concentration (ppb) on July 9, 2025 19:00-20:00 LST



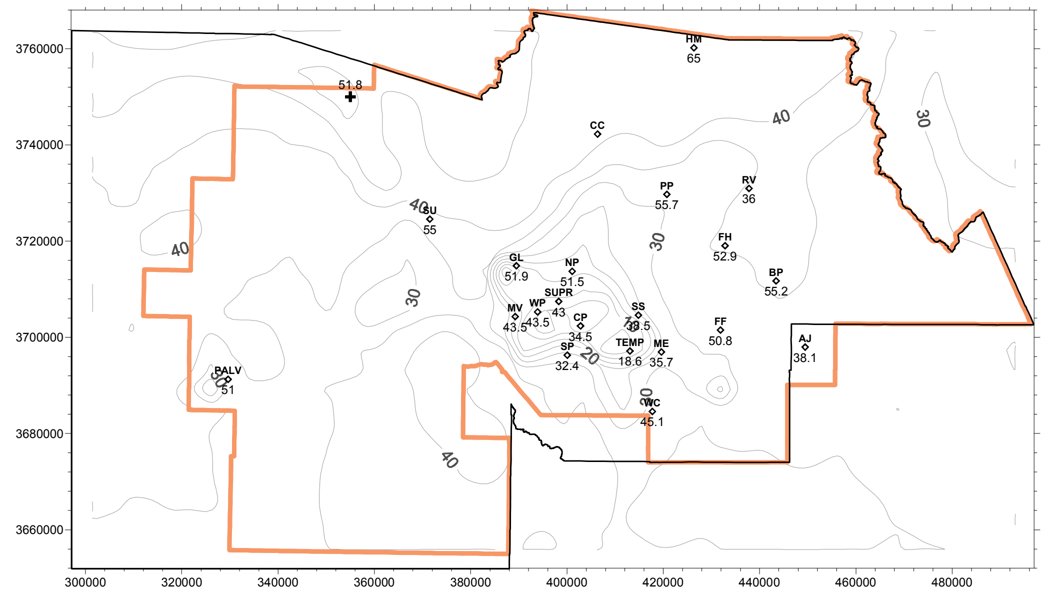
Surface 1-hour ozone concentration (ppb) on July 9, 2025 20:00-21:00 LST



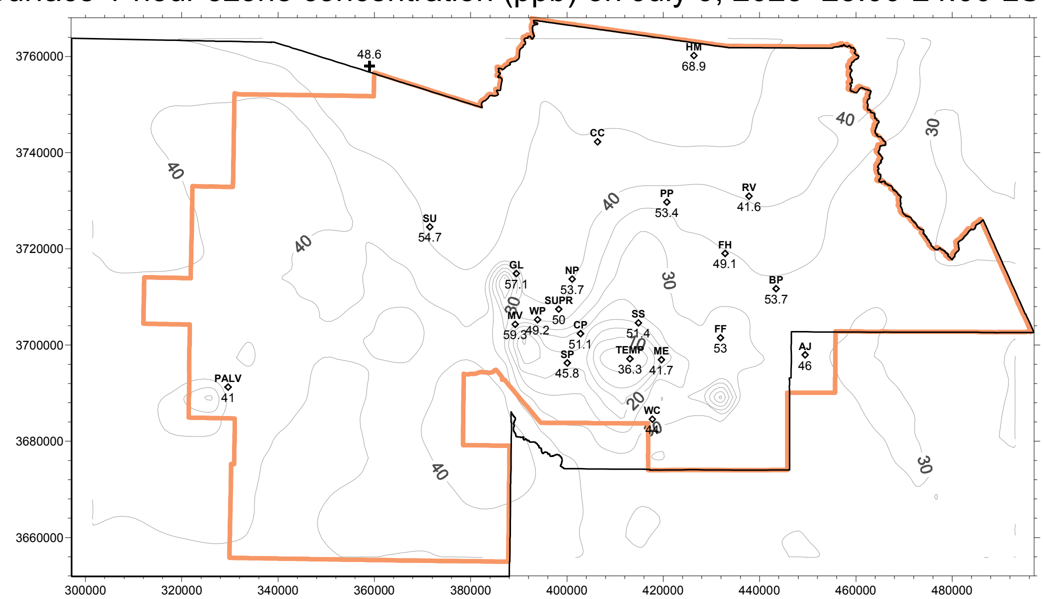
Surface 1-hour ozone concentration (ppb) on July 9, 2025 21:00-22:00 LST



Surface 1-hour ozone concentration (ppb) on July 9, 2025 22:00-23:00 LST



Surface 1-hour ozone concentration (ppb) on July 9, 2025 23:00-24:00 LST

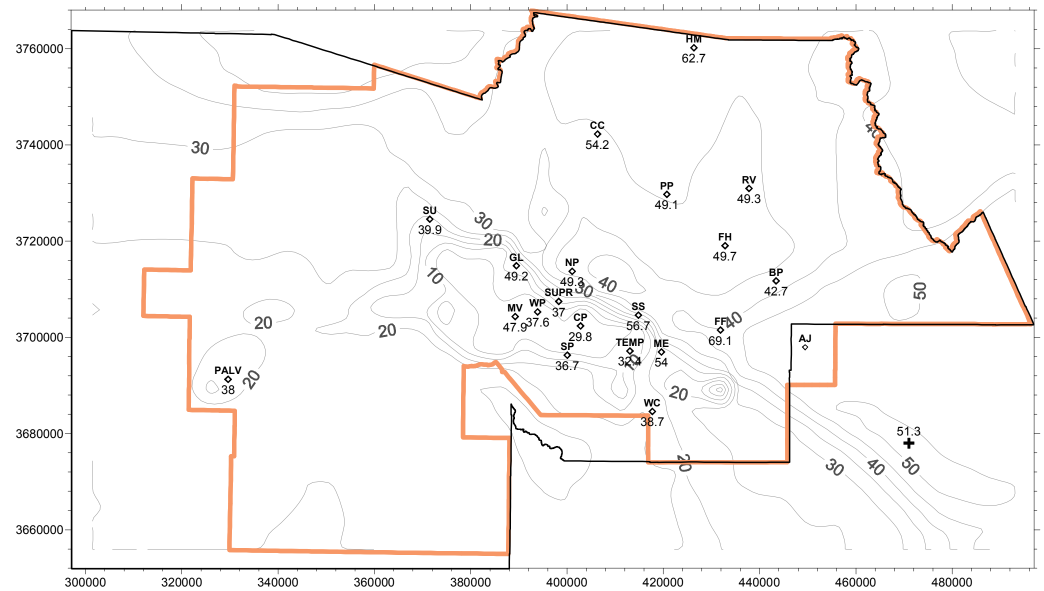


Appendix IV-xv

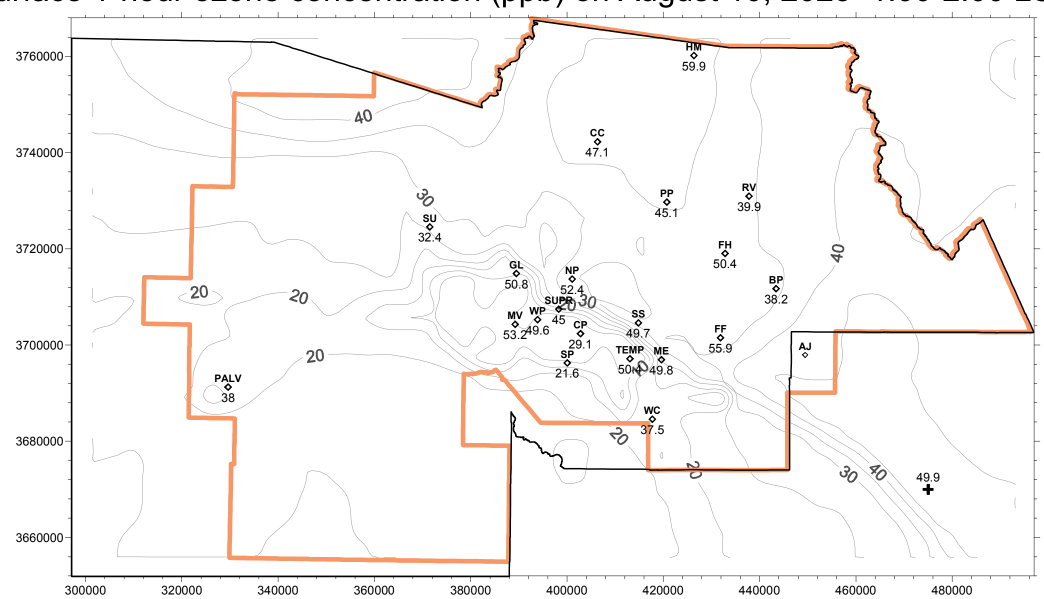
Modeled 1-Hour Ozone for the August 2025 Episode

The plots shown here are the simulated 1-hour ozone for the future year. These hourly ozone concentrations are from 0:00 to 24:00 LST on August 10, 2025.

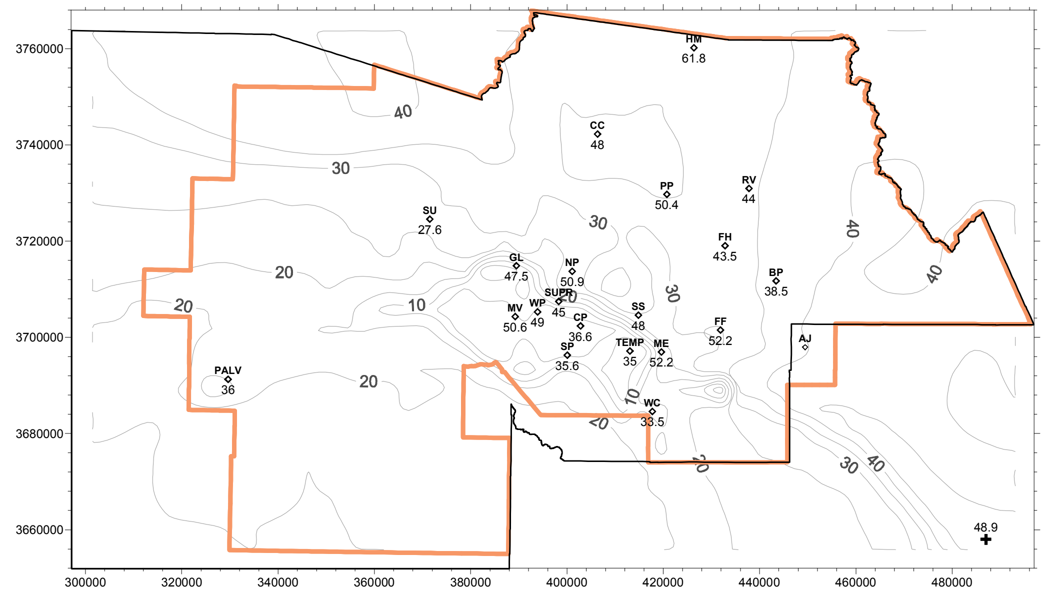
Surface 1-hour ozone concentration (ppb) on August 10, 2025 0:00-1:00 LST



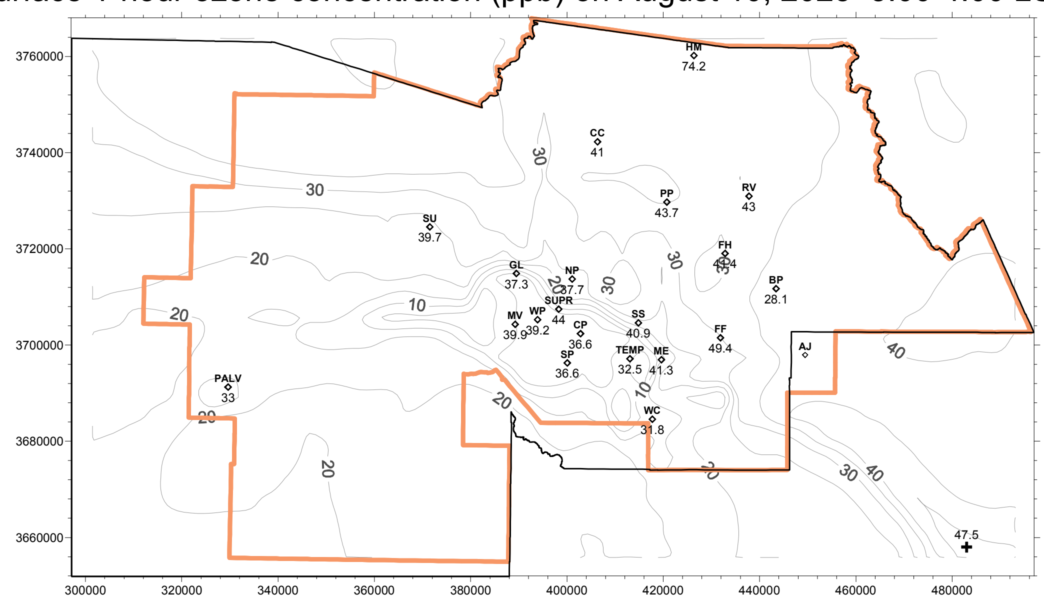
Surface 1-hour ozone concentration (ppb) on August 10, 2025 1:00-2:00 LST



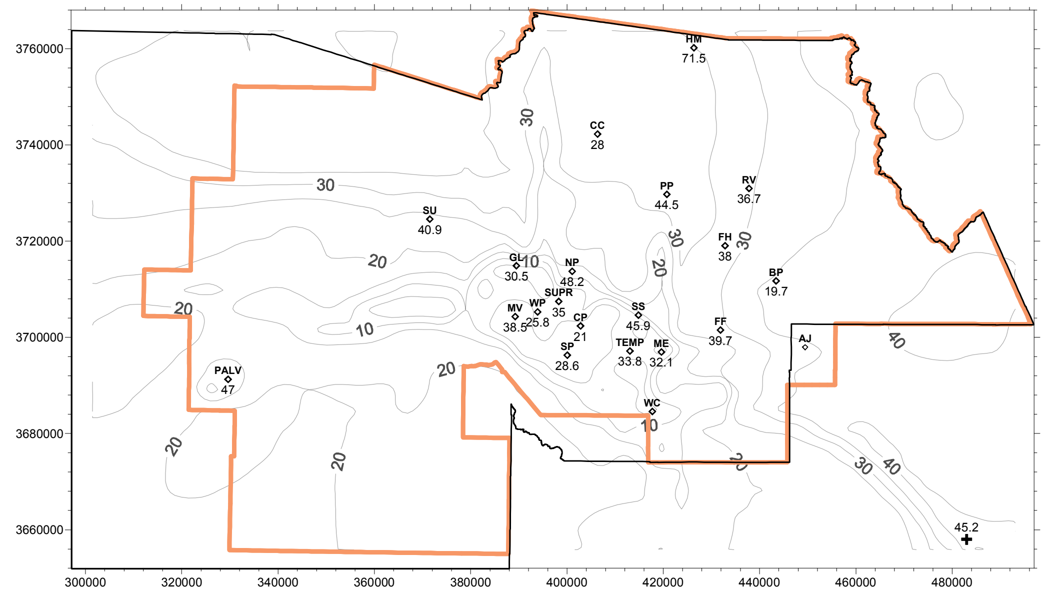
Surface 1-hour ozone concentration (ppb) on August 10, 2025 2:00-300 LST



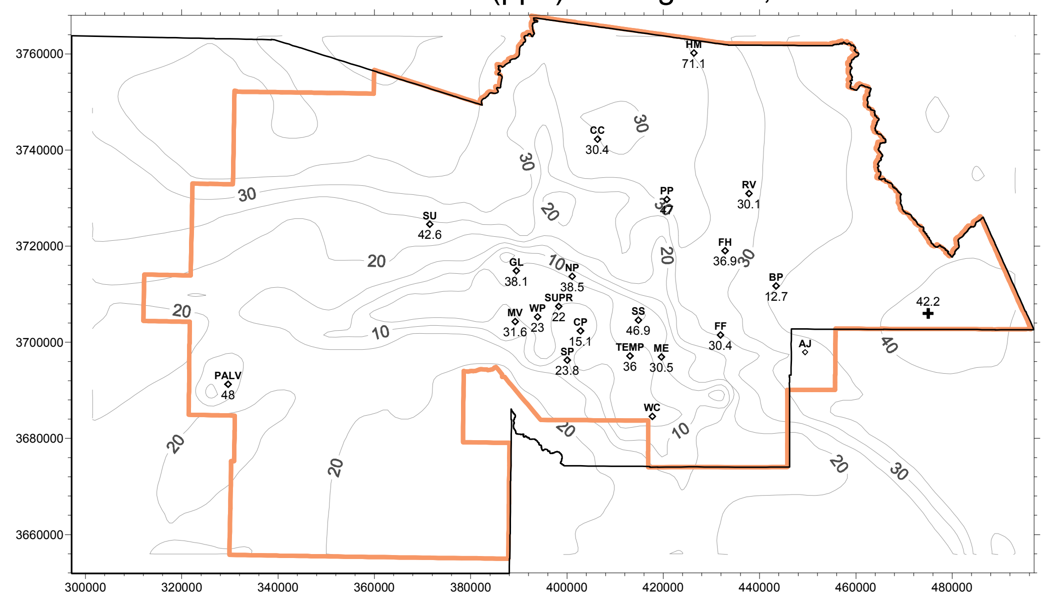
Surface 1-hour ozone concentration (ppb) on August 10, 2025 3:00-4:00 LST



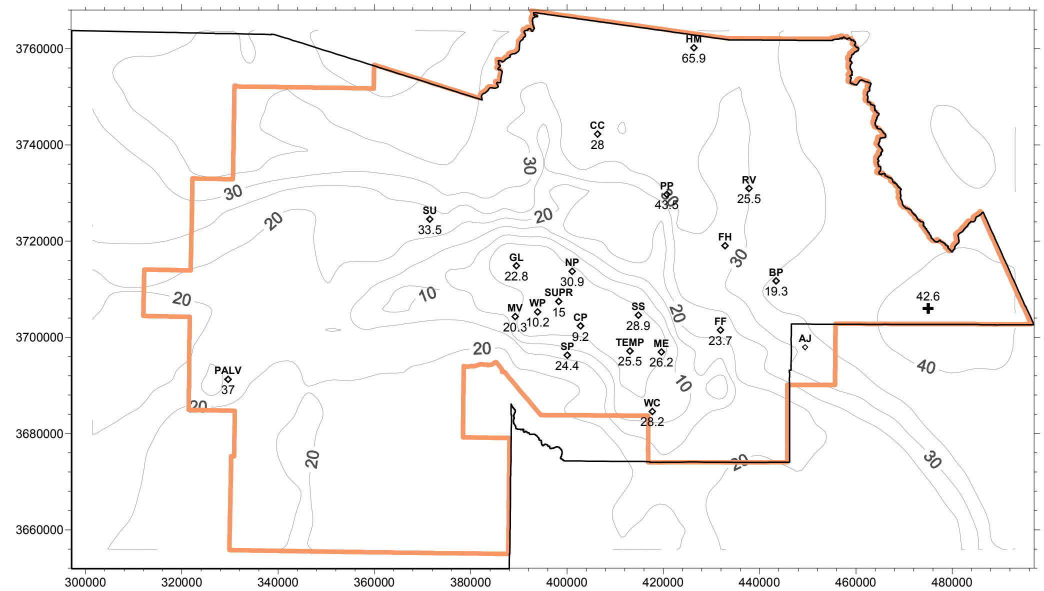
Surface 1-hour ozone concentration (ppb) on August 10, 2025 4:00-5:00 LST



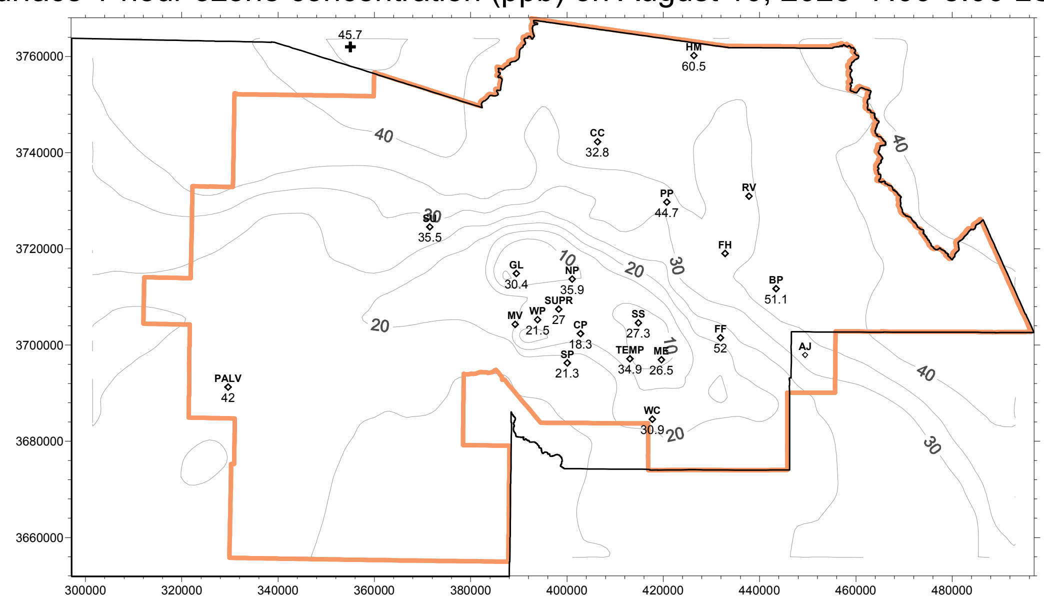
Surface 1-hour ozone concentration (ppb) on August 10, 2025 5:00-6:00 LST



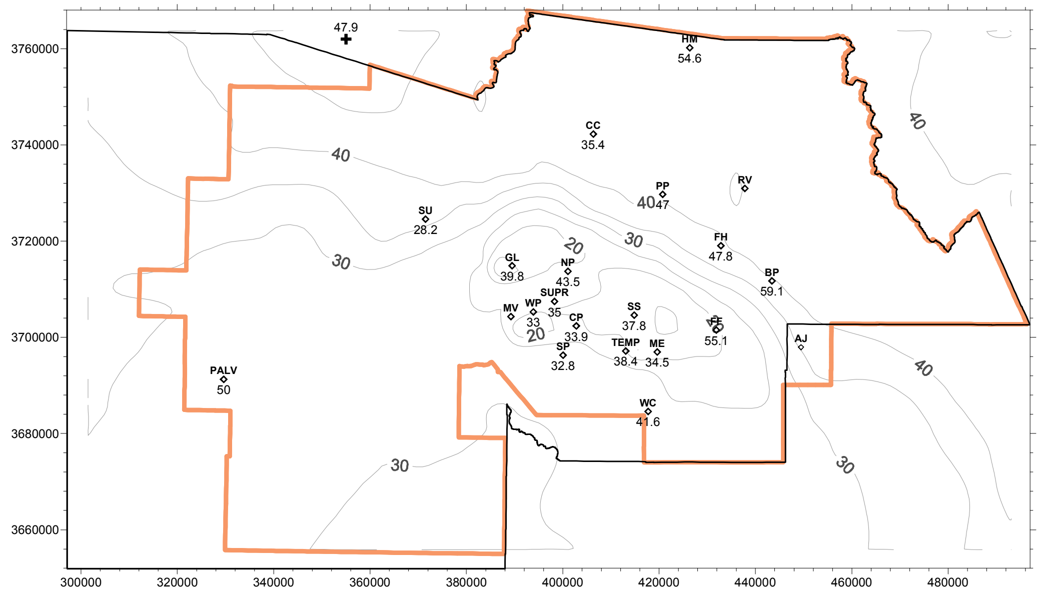
Surface 1-hour ozone concentration (ppb) on August 10, 2025 6:00-7:00 LST



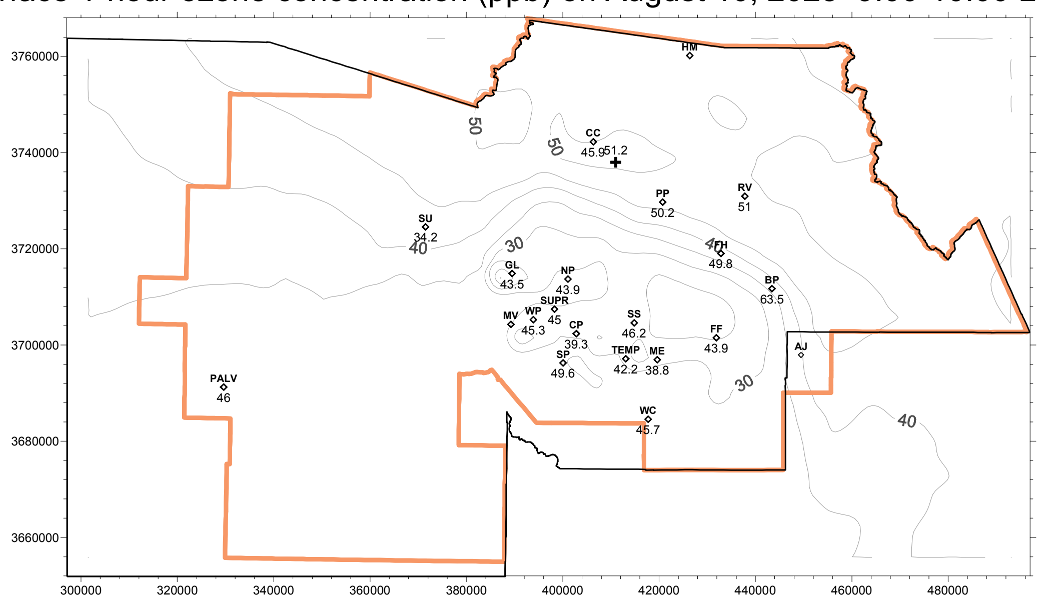
Surface 1-hour ozone concentration (ppb) on August 10, 2025 7:00-8:00 LST



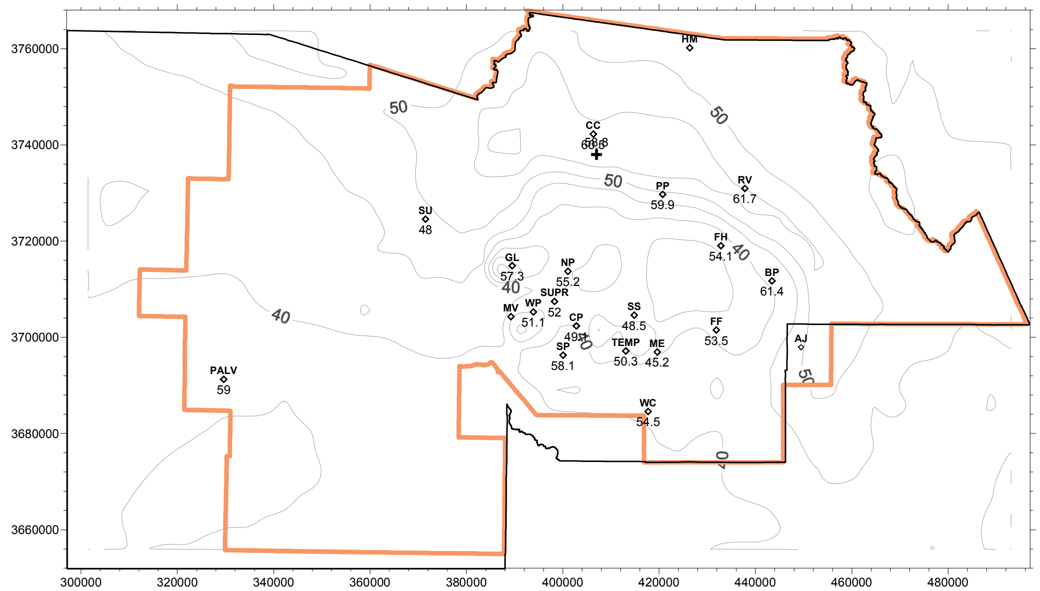
Surface 1-hour ozone concentration (ppb) on August 10, 2025 8:00-9:00 LST



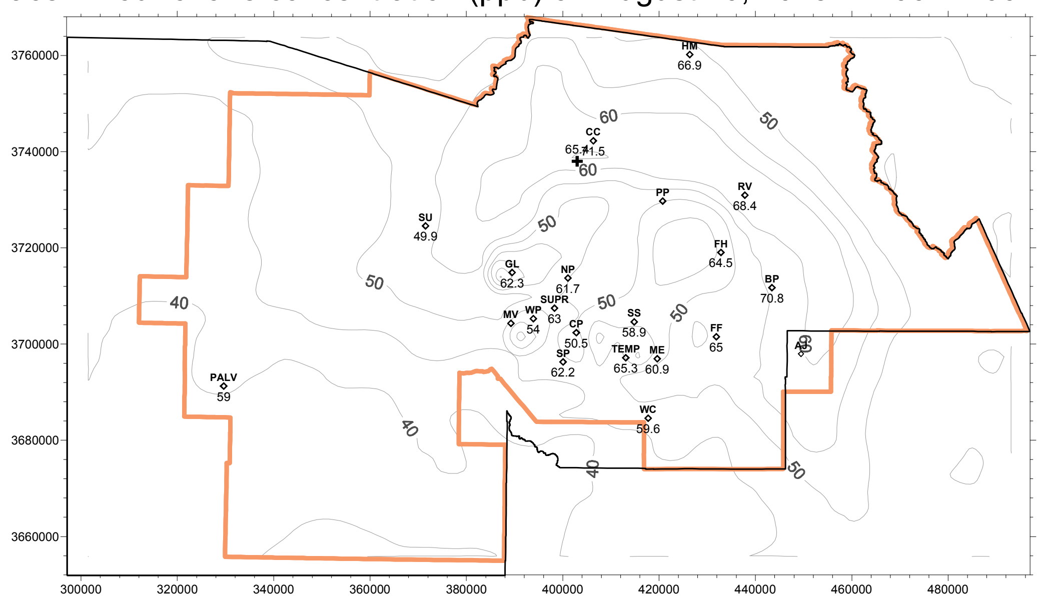
Surface 1-hour ozone concentration (ppb) on August 10, 2025 9:00-10:00 LST



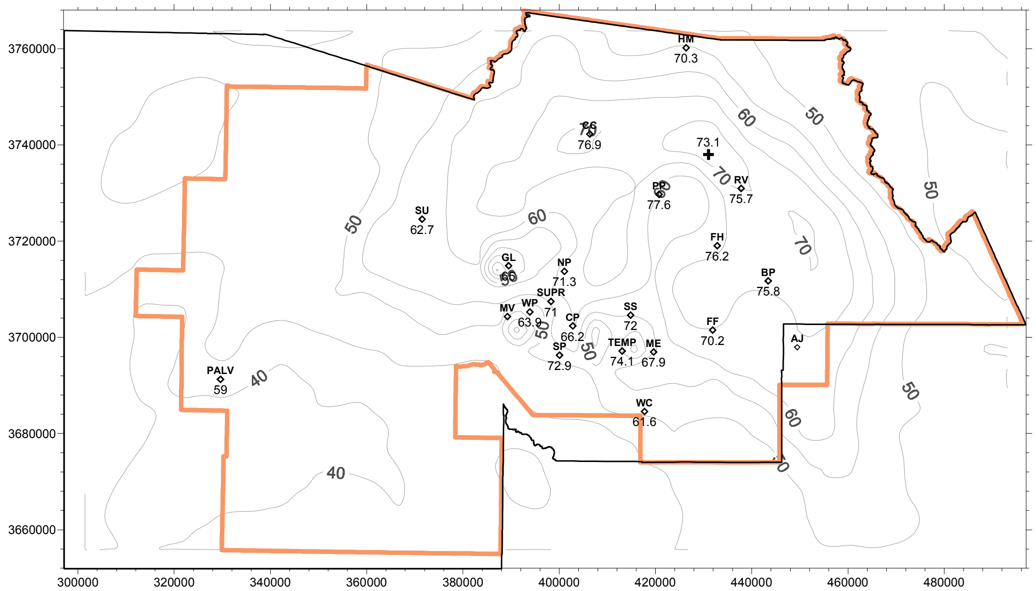
Surface 1-hour ozone concentration (ppb) on August 10, 2025 10:00-11:00 LST



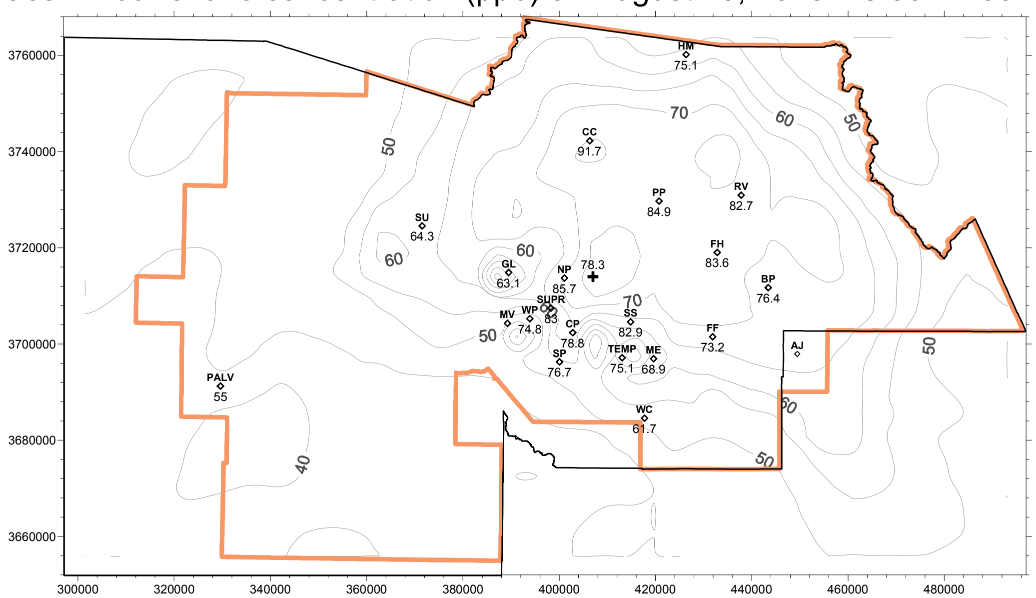
Surface 1-hour ozone concentration (ppb) on August 10, 2025 11:00-12:00 LST



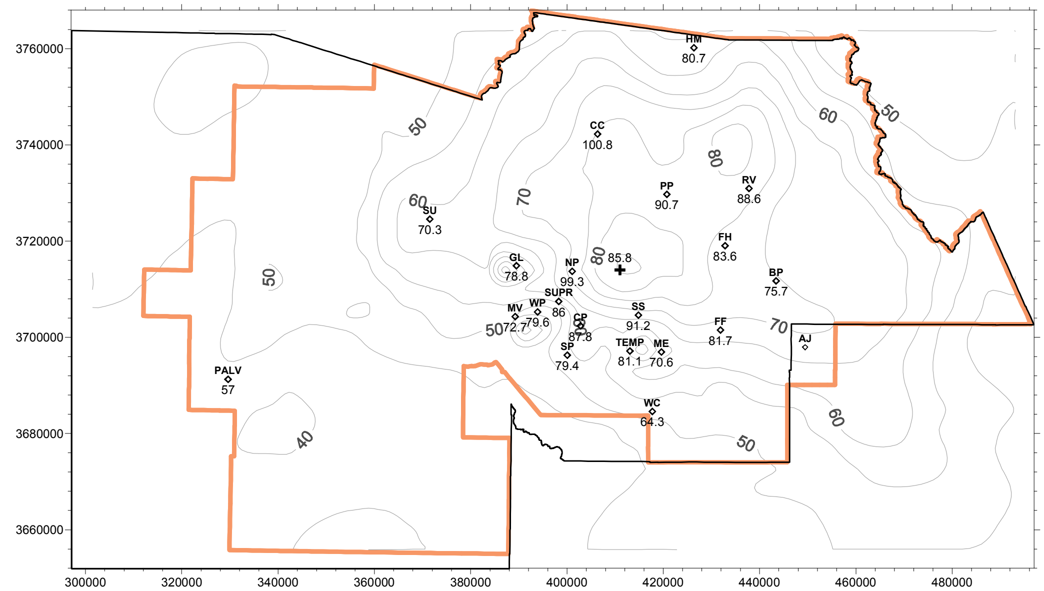
Surface 1-hour ozone concentration (ppb) on August 10, 2025 12:00-13:00 LST



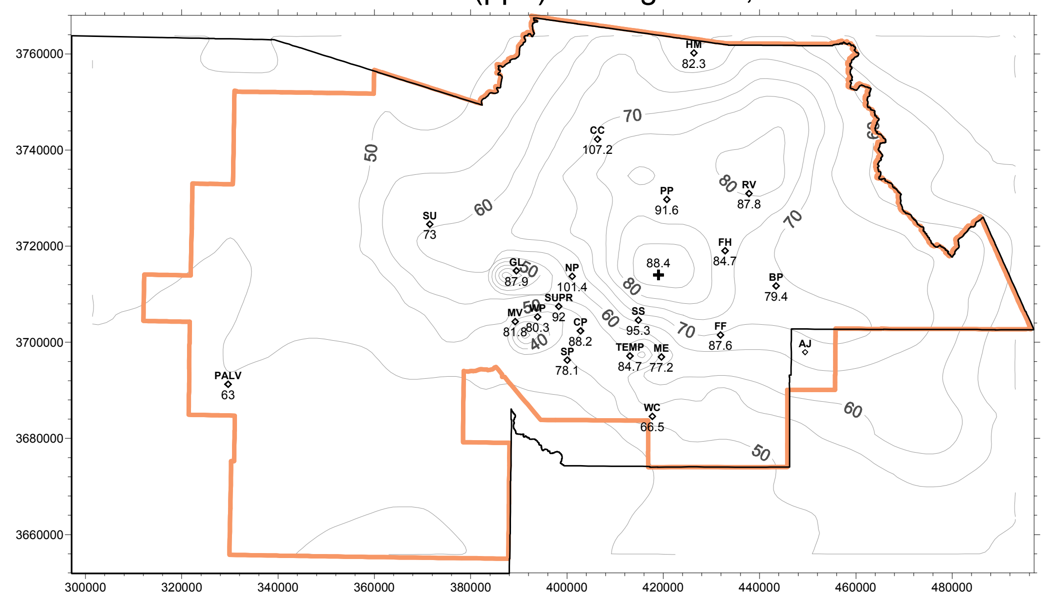
Surface 1-hour ozone concentration (ppb) on August 10, 2025 13:00-14:00 LST



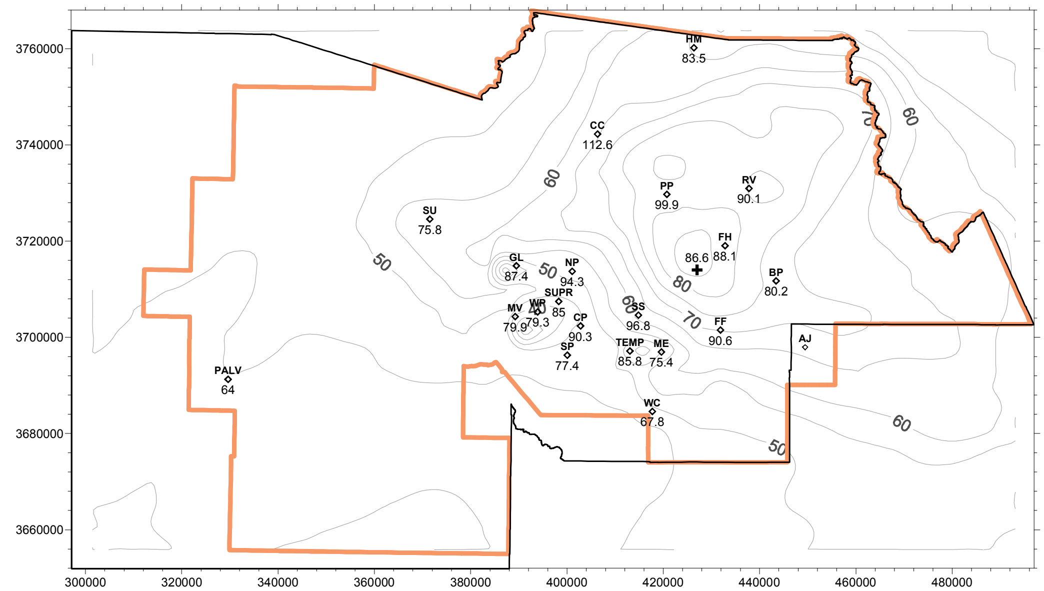
Surface 1-hour ozone concentration (ppb) on August 10, 2025 14:00-15:00 LST



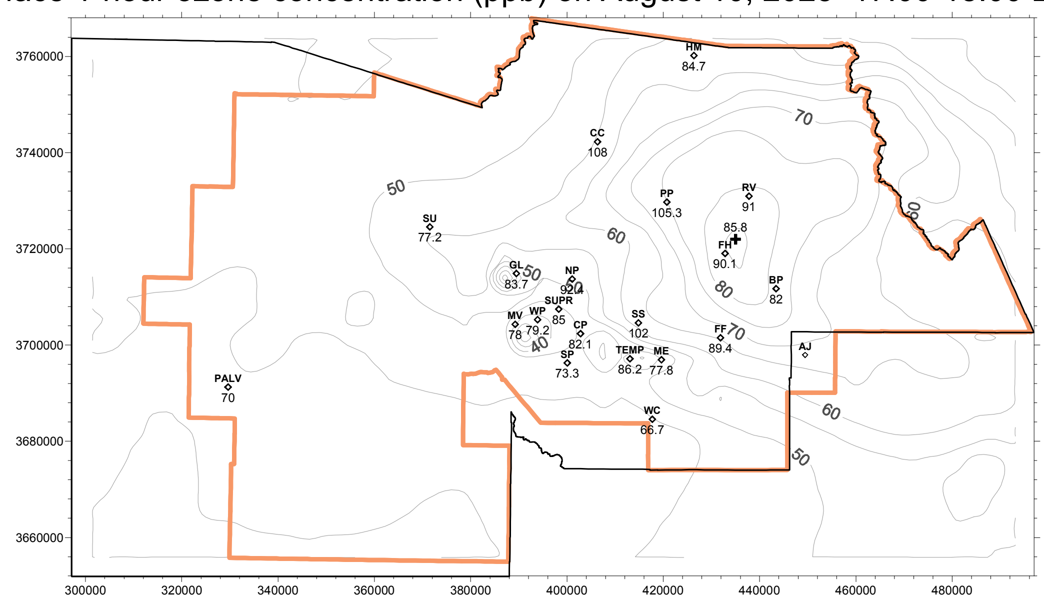
Surface 1-hour ozone concentration (ppb) on August 10, 2025 15:00-16:00 LST



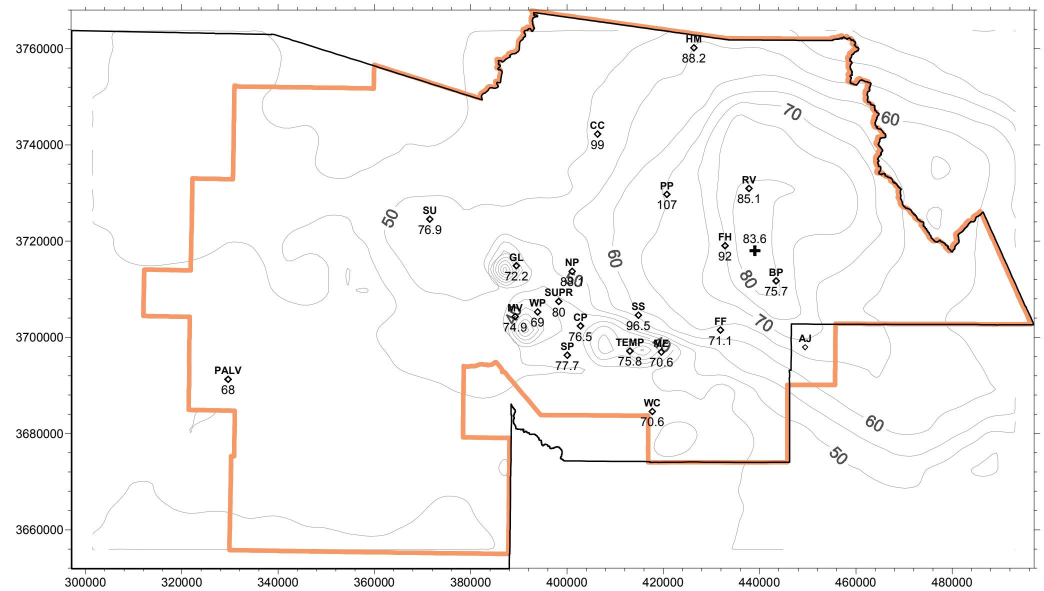
Surface 1-hour ozone concentration (ppb) on August 10, 2025 16:00-17:00 LST



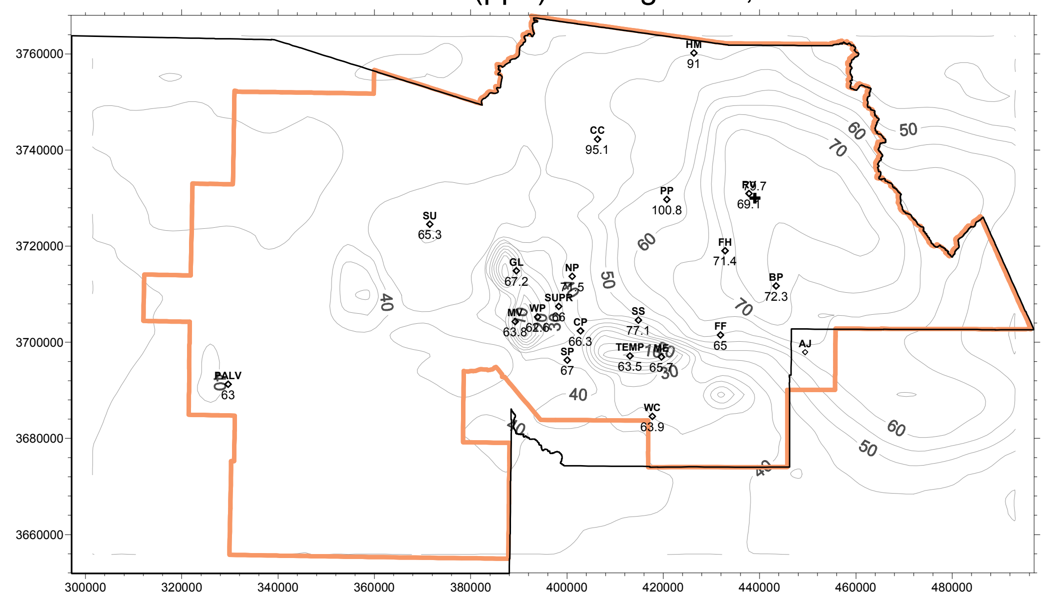
Surface 1-hour ozone concentration (ppb) on August 10, 2025 17:00-18:00 LST



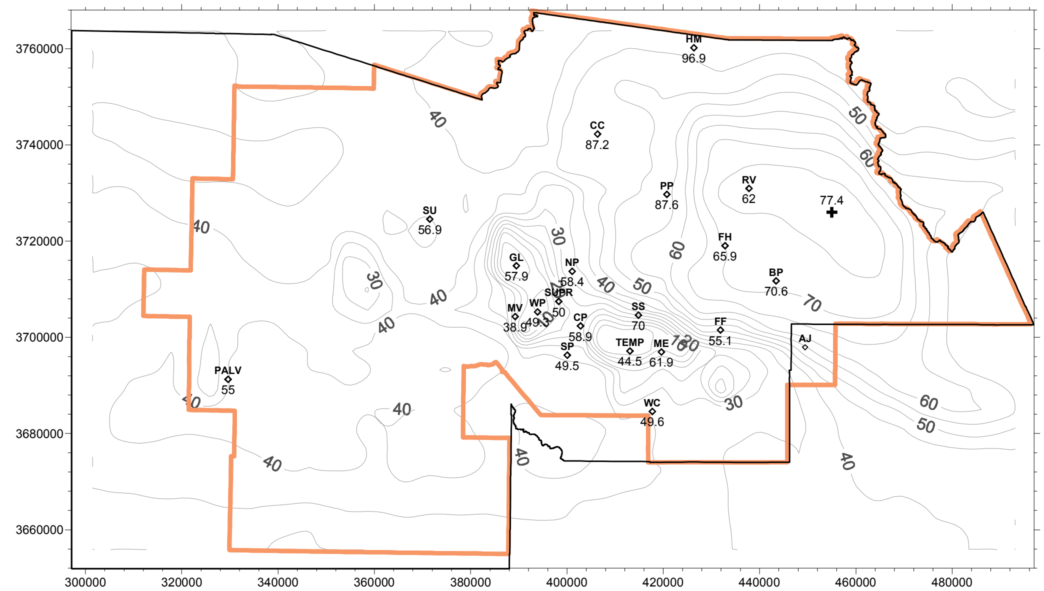
Surface 1-hour ozone concentration (ppb) on August 10, 2025 18:00-19:00 LST



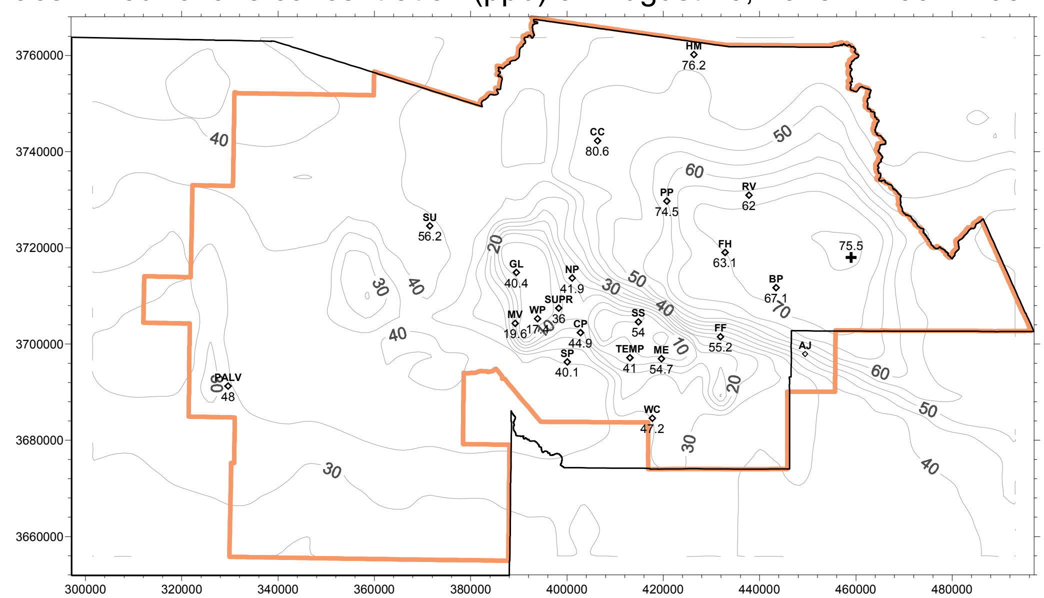
Surface 1-hour ozone concentration (ppb) on August 10, 2025 19:00-20:00 LST



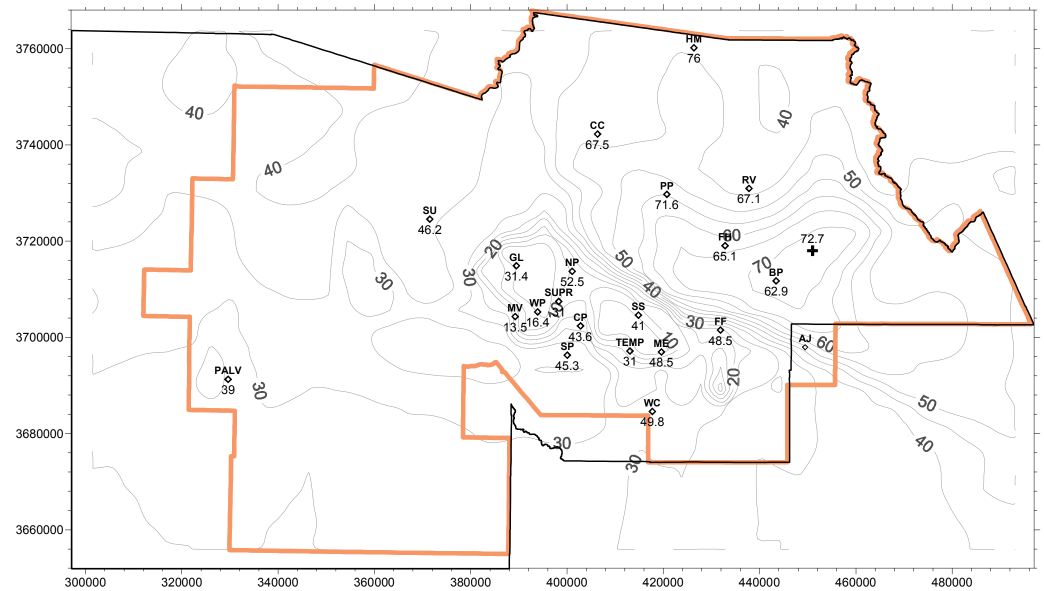
Surface 1-hour ozone concentration (ppb) on August 10, 2025 20:00-21:00 LST



Surface 1-hour ozone concentration (ppb) on August 10, 2025 21:00-22:00 LST



Surface 1-hour ozone concentration (ppb) on August 10, 2025 22:00-23:00 LST



Surface 1-hour ozone concentration (ppb) on August 10, 2025 23:00-24:00 LST