



**Western Regional Air Partnership (WRAP)  
Regional Modeling Center (RMC)**

**Monthly Progress Report  
for June 2006**

Prepared by

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## Introduction

This is the June 2006 Monthly Progress Report that covers the activities of the Western Regional Air Partnership (WRAP) Regional Modeling Center (RMC).

## Background

The WRAP RMC is composed of staff from the University of California, Riverside (UCR), ENVIRON International Corporation, and the University of North Carolina's Carolina Environmental Program (UNC-CEP). The Principal Investigator and Project Manager for the RMC is Dr. Gail Tonnesen of UCR ([tonnesen@cert.ucr.edu](mailto:tonnesen@cert.ucr.edu)). Mr. Ralph Morris ([rmorris@environcorp.com](mailto:rmorris@environcorp.com)) and Mr. Zac Adelman ([zac@unc.edu](mailto:zac@unc.edu)) lead the RMC efforts at ENVIRON and UNC-CEP, respectively. The RMC is the contractor for meteorological, emissions, and air quality modeling and analysis performed for the WRAP region's states and tribes to provide the analytical results needed to address the requirements of the EPA Regional Haze Rule.

Current responsibilities of the RMC include:

- Emissions processing and modeling
- Air quality and visibility modeling simulations
- Analysis, display, and reporting of modeling results
- Storage and quality assurance of the modeling input and output files

The tasks and deliverables discussed in this report are based on the WRAP RMC 2005-06 work plan, which is available on the WRAP RMC web site:

<http://pah.cert.ucr.edu/aqm/308/docs.shtml>

The tasks are linked to and based on the WRAP Strategic Plan and the WRAP 2005 Work Plan, found at:

[http://wrapair.org/WRAP/meetings/031014board/Tab\\_4\\_Strategic\\_Plan\\_Final.pdf](http://wrapair.org/WRAP/meetings/031014board/Tab_4_Strategic_Plan_Final.pdf)

[http://wrapair.org/WRAP/documents/041207WRAP\\_CY05\\_Final\\_Workplan.pdf](http://wrapair.org/WRAP/documents/041207WRAP_CY05_Final_Workplan.pdf)

The WRAP Technical Coordinator (Tom Moore) and the cochairs of the WRAP Modeling Forum (John Vimont of the National Park Service, Mary Uhl of the New Mexico Environment Department, and Kevin Briggs of the Colorado Department of Public Health and Environment) provide day-to-day oversight of RMC activities, and the Modeling Forum oversees the activities of the RMC through monthly conference calls, topical conference calls, and periodic in-person meetings and workshops.

The WRAP is one of five Regional Planning Organizations (RPOs) consisting of states, tribes, federal and local agencies, and stakeholders charged with the responsibility for conducting technical analyses and assisting in the development of State Implementation Plans (SIPs) and Tribal Implementation Plans (TIPs) for regional haze in different areas of the United States.

## Overview of WRAP RMC 2005-06 Work Effort

The WRAP RMC 2005-06 work effort is focused on the following activities:

- 1) Finalize the 2002 base case input data and the selection of models to be used for future-year 2018 modeling.
- 2) Implement final performance metrics, displays, and methods to project future-year model results.
- 3) Complete and analyze a 2018 base case modeling scenario.
- 4) Complete and analyze several emissions reduction and emissions sensitivity scenarios.
- 5) Perform additional source apportionment model simulations.
- 6) Complete the visibility modeling effort for Alaska.

The 2005-06 work plan provides additional background information on these activities, and the revisions made to it in April 2006 provide specifics on the tasks being completed during 2006. The revisions are available at <http://pah.cert.ucr.edu/aqm/308/docs.shtml>.

The overall objective of the 2005-06 work plan is to complete all modeling studies and documentation needed for development of §308 SIPs and TIPs for regional haze. The WRAP visibility modeling system comprises the Sparse Matrix Operator Kernel Emissions (SMOKE) emissions model, the Fifth-Generation Mesoscale Model (MM5) meteorological model, and the Community Multiscale Air Quality (CMAQ) model. The WRAP modeling domain consists of a continental U.S. 36-km domain and a western U.S. 12-km domain. The WRAP RMC modeling efforts also include analysis of specific topics to support the other WRAP forums. The RMC's 2005-06 work effort as laid out in the work plan is divided into 12 tasks, listed below. Note that Task 3 below is not covered in this report because it was essentially completed by the end of project year 2004.

- Task 1: Project Administration, Major Project Reports, and Computer Hardware and Systems Administration
- Task 2: Emissions Modeling, Processing, and Analysis
- Task 3: Test, Improve, Quality Control, Obtain External Peer Review, and Finalize 36-km and 12-km MM5 Simulations for Eventual Use in CMAQ (*completed in project year 2004*)
- Task 4: Air Quality Model Evaluation for 2002 Annual Simulation
- Task 5: Testing of and Further Improvements to the Windblown Dust Emissions Modeling Methodology

- Task 6: BART Source Sensitivity Screening Using CALPUFF
- Task 7: Sensitivity Studies Designed to Evaluate Uncertainties in Fire Emissions
- Task 8: Preliminary Meteorological, Emissions, and Air Quality Modeling Activities for Alaska
- Task 9: Further Analysis of Model Performance in Regard to the Contribution of Natural Emissions to Visibility Impairment
- Task 10: Preparation and Reporting of Geographic Source Apportionment Results
- Task 11: Technology Transfer
- Task 12: Computer Hardware

The list above was revised in April 2006 when the work plan was updated, based on revised priorities and funding. The changes are reflected in the rest of this report. The original Task 6 was renumbered to become Task 3, and Tasks 8 through 10 were deleted. Also, the focuses of some of the remaining tasks were changed. In May 2006, Task 5 was deleted from the list below because all work on it was completed.

## Highlights for the June 2006 Reporting Period

- *Task 1—Project Administration, Major Reports, and Computer Systems Administration:* We completed project management and Modeling Forum conference calls and additional conference calls on specific topics.
- *Task 2—Emissions Modeling, Processing, and Analysis:* We completed emissions simulation Plan02c, which consisted of a fix to non-Federal rangeland fire speciation and temporal profiles to maintain consistency with the Base2018b emissions. We also completed another draft of the BART source selection worksheets and circulated these to the WRAP Modeling Forum cochairs for comment.
- *Task 3—BART Source Sensitivity Screening Using CALPUFF:* A revised draft WRAP RMC CALPUFF BART modeling protocol dated June 16, 2006, was prepared and distributed to states for review.
- *Task 4—Air Quality Modeling:* We completed a new 2002 Plan C simulation that used updated fire speciation profiles for non-Federal rangeland fires, for consistency with the new profiles used in the 2018 Base Case. This had very small effects on OC and PM<sub>2.5</sub> concentrations in comparison to the 2018 Plan B case. We continued work on the CAMx/PSAT 2002 and 2018 simulations; we expect these to be completed in August. We will process partial results (i.e., monthly averages for several months) to present at the July 27-28 Attribution of Haze meeting.
- *Task 7—Fire Sensitivity, Phase 2: Regional and Mesoscale:* No new activities this month.

- *Task 11—Technology Transfer and Data Distribution:* We replied to several requests for data and information about the visibility modeling.
- *Task 12—Computer Hardware:* We removed RAM memory from two older, dead compute nodes to increase the amount of RAM in one Opteron machine that is being used for the PSAT simulations. We also purchased additional hard disks for archiving and data transfer.

## **June 2006 RMC Status Report**

Below we discuss our progress during this monthly reporting period (June 2006) and expected activities during the next reporting period (July 2006). We also describe any difficulties encountered and their resolutions.

### ***Task 1: Project Administration, Major Reports, and Computer Systems Administration***

#### Purpose:

Within Task 1, the project administration subtask includes deliverables tracking and display, coordination with modeling efforts supported by other RPOs, attending meetings, participating in conference calls, and general project management. The major reports subtask covers preparation of several reports, including an RMC 2005-06 project final report. The computer systems administration subtask includes maintenance, updates, expansion, and optimization of the computing systems (software and hardware updates, maintenance of the project web site and listservs, and data backups and archiving).

#### Progress During This Reporting Period:

##### *Project Administration:*

UCR, ENVIRON, and UNC-CEP participated in monthly project administration and WRAP Modeling Forum conference calls. Each contractor also contributed to the monthly progress report and prepared invoices.

##### *Preparation of the 2006 Midyear Report and 2005-06 Project Report:*

None.

#### Expected Progress During the Next Reporting Period:

We will conduct conference calls and prepare monthly progress reports.

#### Difficulties Encountered and Resolutions:

None.

## **Task 2: Emissions Modeling, Processing, and Analysis**

### Purpose:

To develop final emissions inventories for the 2002 model performance evaluation case, a typical 2002 case, a 2018 base case, and several 2018 emissions control strategy cases.

### Progress During This Reporting Period:

#### *Technical Activities:*

Our primary focus in June was to fix an inconsistency in the Planning 2002 emissions relative to the Base 2018 version B (Base18b) simulation. We discovered that we incorrectly applied PM speciation and temporal profiles to non-Federal rangeland fires in the WRAP states in the Planning 2002 version B (Plan02b) simulation. In fixing these errors in Base18b, we inserted an inconsistency between these two simulations that produced unacceptable differences in the results of the air quality modeling simulations that used these emissions. We are creating a Planning 2002 version C (Plan02c) simulation to normalize the fire emissions between the Base18b and Planning inventories.

Also in June, we released a new version of the BART source selection worksheets. We included in each worksheet detailed instructions for the states that will use these worksheets to confirm those point sources to be modeled in BART sensitivity simulations. We have begun to receive comments on these final draft worksheets and will release final worksheets to the states in July.

#### *Preparation of the 2006 Midyear Report and 2005-06 Project Report:*

We documented the changes to simulation Plan02c relative to Plan02b. We will include the documentation of these changes in the 2006 midyear report.

### Expected Progress During the Next Reporting Period:

We plan to complete work on the BART source selection, and distribute the state and tribal worksheets to finalize those sources that we will include in our BART sensitivity modeling.

### Difficulties Encountered and Resolutions:

During June we addressed some questions about emissions issues, as explained below.

- Unexpected PM differences between the Base2018b and Plan02b simulations led us to conclude that seemingly minor differences in the non-Federal rangeland fire emissions between these two simulations actually resulted in significant differences on certain days in the air quality modeling results. We fixed the incorrect application of the speciation and temporal profiles in the Plan02b simulation, normalizing the emission from this component of the inventory between the Plan02c and Base2018b simulations.

## **Task 3: BART Source Sensitivity Screening Using CALPUFF**

### Purpose:

To assist states in addressing the modeling requirements of the Best Available Retrofit Technology (BART) component of the Regional Haze Rule (RHR).

Progress During This Reporting Period:

*Technical Activities:*

We prepared a revised draft WRAP RMC BART CALPUFF modeling protocol dated June 16, 2006, that addressed comments from the states. The CALMET modeling for the South Dakota domain and 2003 was completed. Based on comments, WRAP may wish to include meteorological observations in the CALMET modeling. However, the budget available is not sufficient to accomplish this task. Thus, the WRAP BART CALMET/CALPUFF modeling has been put on hold while this issue is resolved, except for performing the 2003 South Dakota BART modeling so that the software and procedures for postprocessing the output can be developed and tested.

*Preparation of the 2006 Midyear Report and 2005-06 Project Report:*

None.

Expected Progress During the Next Reporting Period:

Progress during July will depend on whether WRAP elects to proceed with the CALMET/CALPUFF modeling without meteorological observations (NOOBS). If WRAP elects to continue with the NOOBS approach, then the BART CALPUFF screening modeling for several states will likely be completed. However, if meteorological observations are desired, then the BART screening modeling will be delayed.

Difficulties Encountered and Resolutions:

The WRAP BART screening modeling has assumed for months that no meteorological observations would be used. A recent request that observations be used would adversely affect schedule and budget.

***Task 4: Air Quality Modeling***

Purpose:

To complete the 2002 base-year air quality modeling performed with CMAQ and CAMx, 2000-2004 typical-year modeling, 2018 base case modeling, and a series of 2018 control strategy modeling runs. Also, to perform model bug fixes, model version updates, sensitivity experiments, and source apportionment modeling.

Progress During This Reporting Period:

*Technical Activities:*

We found a relatively small error in the emissions input data for the 2002 Planning case version B (Plan02b). Initially the old, default fire speciation profiles were used in Plan02b for non-Federal rangeland fires (NFR). With the default profiles, VOC was speciated into all eight CB4 species, and all PM<sub>2.5</sub> was speciated as PMFINE. In the new fire speciation profiles, the VOC is speciated into four CB4 species and the PM<sub>2.5</sub> is speciated into other PM species (PEC, POA, etc.). In addition, the default diurnal profile is uniform and the fire diurnal profile places the fires between 8:00 AM and 8:00 AM local time, with peak emissions at 4:00-5:00 pm. The error was detected because on some days there were very small increases in PM<sub>2.5</sub> emissions in the 2018 base case compared to Plan02b. We corrected the NFR emissions to use the new fire

speciation profiles in a new CMAQ case named Plan02c. This caused very small increases of 0.6-0.7% in the annual emissions of the NFR and 0.06-0.08% of overall annual emissions. The change in speciation resulted in very small increases in OC and very small reductions in primary PM<sub>2.5</sub> in Plan02c compared to Plan02b. Spatial plots of these results are on the Web site at [http://pah.cert.ucr.edu/aqm/308/cmaq.shtml#plan02c\\_vs\\_plan02b](http://pah.cert.ucr.edu/aqm/308/cmaq.shtml#plan02c_vs_plan02b). We redid the visibility projections using the Plan02c and Base 2018 model results, and as expected we found that this small change had negligible impact on progress toward achieving 2018 visibility goals. However, it did eliminate the artifact of very small increases in PM<sub>2.5</sub> in the 2018 modeling that were caused by the use of the old, default speciation profiles for NFR emissions in the Plan02b case.

We continued the CAMx/PSAT 2002 Planning version B annual and the CAMx/PSAT 2018 simulations, and carried out additional QA on the PSAT model results. We found an error in the emissions, made corrections, and restarted the CAMx/PSAT simulation. We developed some prototype software using Mapview for spatially displaying the impacts of particular PSAT source groups on receptor sites. A sample plot is shown in Figure 1; pie charts and the color within each state show each state's contribution to PM at a particular receptor site. However, we determined that these spatial plots did not provide any additional useful information above what can be obtained using our existing analysis products. We expect to complete the CAMx/PSAT simulations in August 2006.

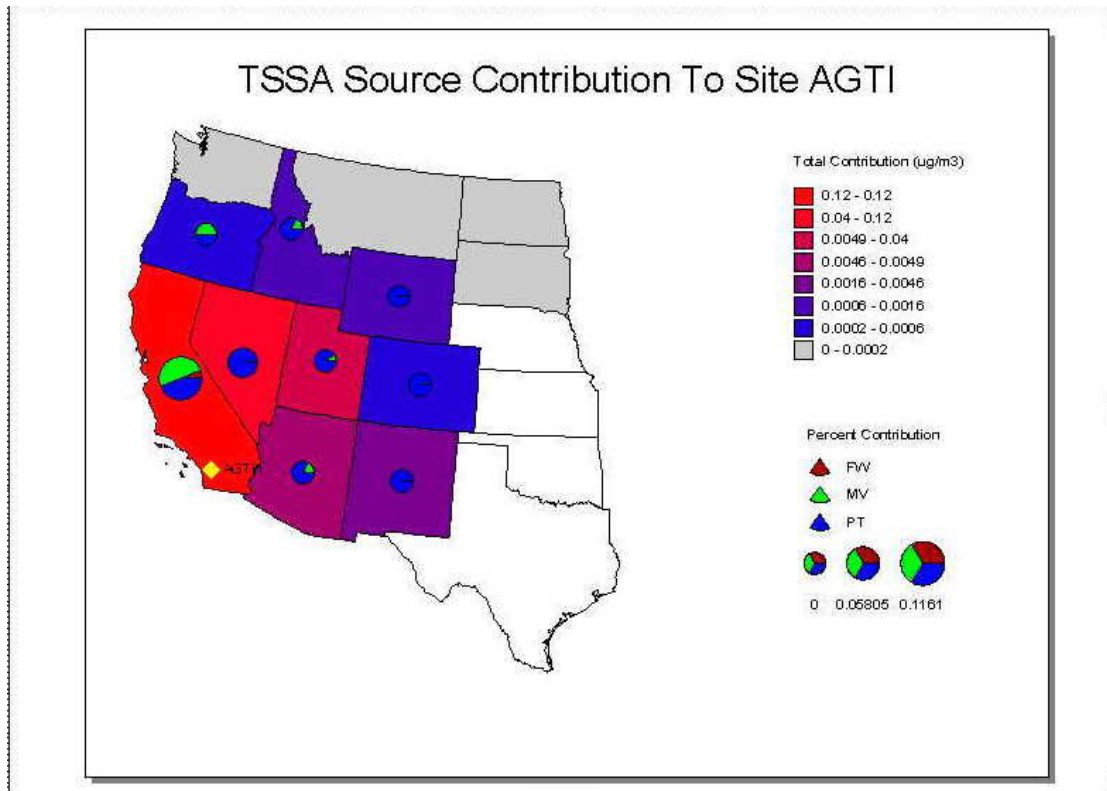


Figure 1. Prototype of new spatial plots developed using Mapview software to show spatial impacts of particular emissions source groups on receptor sites.

*Preparation of the 2006 Midyear Report and 2005-06 Project Report:*  
None.

Expected Progress During the Next Reporting Period:

We will produce analysis products from the PSAT simulations using partial PSAT results. These will include spatial plots and bar plots showing contributions of source groups to receptor sites using the monthly average of the PSAT results for several months for which the simulations are completed by July 21.

Difficulties Encountered and Resolutions:

None.

***Task 7: Fire Sensitivity, Phase 2: Regional and Mesoscale***

Purpose:

To perform additional modeling studies to evaluate sensitivity to uncertainty in the fire emissions inventory. Major uncertainties include the effect of the plume rise height for fire emissions, and the effects of small fires in or near Class I areas.

Progress During This Reporting Period:

*Technical Activities:*

None.

*Preparation of the 2006 Midyear Report and 2005-06 Project Report:*  
None.

Expected Progress During the Next Reporting Period:

We will document the results of the Clear Skies plume rise formula for the several fires that we previously selected, and compare those results to the default FEJF fire plume rise approach.

Difficulties Encountered and Resolutions:

None.

***Task 11: Technology Transfer and Data Distribution***

Purpose:

To transfer the models, model evaluation tools, and data sets to the states and tribes so that they can perform additional studies of emissions reduction strategies, including supporting these groups in model setup and operation.

Progress During This Reporting Period:

*Technical Activities:*

We replied to several requests for data and information about the visibility modeling. The Web page for tracking data requests is [http://pah.cert.ucr.edu/aqm/308/data\\_transfer.shtml](http://pah.cert.ucr.edu/aqm/308/data_transfer.shtml). Table 1 shows the current status on specific data requests.

**Table 1. Status on transfer of datasets to States and Tribes.**

Agency Name	Request Date	Contact Info	Data Requested	Expected Delivery Date	Deliverable			
					Status	Compatible OS	Transfer Media	Total File Size
Utah	4/20/06	<a href="#">Patrick Barickman</a>	12km cmaq acon; 12km emis by sector, 12km oil&gas emis input data	4/30/06	Shipped	Linux	disk/firewire cage	
Idaho	4/20/06	<a href="#">Rick Hardy</a>	MCIP and CMAQ 12 km outputs (5 months of 2002)	5/30/06	Shipped	Windows	LaCie 1TB drive (PCI-X)	~660G
Idaho	4/20/06	<a href="#">Rick Hardy</a>	Data/scripts for running CMAQ with nested grids	5/30/06	Shipped			
Idaho	5/31/06	<a href="#">Rick Hardy</a>	MM5 36km/12km					
Nevada	4/20/06	<a href="#">Frank Forsgren</a>	CALPUFF datasets for UT/NV domain, 2001-2003	test data by May 15	in progress		ftp transfer for test data	Test data: 7.4G
Montana	4/20/06	<a href="#">Diane Lorenzen</a>	CALMM5 Data sets for MT subregion, 2001-2003	test data by May 15	Shipped	Windows	Firewire	20 G
Confederated Salish & Kootenai Tribes	5/03/06	<a href="#">Randy Ashley</a>	CALMET data sets for MT subregion, 2001-2003	early June	in progress			
Arizona DEQ	5/18/06	<a href="#">Jie Yang</a>	MM5 36km and emissions data	6/8/06	Shipped	Linux	disk/firewire cage	700 G
University of Maryland		<a href="#">Jeff Stehr</a>	MM5 and NH3 emissions data		not scheduled			

*Preparation of information on the availability of data and tools, to be included in the 2006 Midyear Report and 2005-06 Project Report:*

None.

Expected Progress During the Next Reporting Period:

We will perform routine updates to the Web site, and respond to data requests from WRAP member states and tribes, as needed.

Difficulties Encountered and Resolutions:

None.

**Task 12: Computer Hardware**

Purpose:

To acquire new/additional equipment to support the RMC's work on the above tasks.

Progress During This Reporting Period:

We conducted routine maintenance and repair of computers and data storage systems. We removed RAM memory from two older, dead compute nodes to increase the amount of RAM in one Opteron machine that is being used for the PSAT simulations. We purchased additional hard disks for archiving and data transfer.

Expected Progress During the Next Reporting Period:

None.

Difficulties Encountered and Resolutions:

None.