



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

**Monthly Progress Report
for January 2005**

Prepared by

University of California, Riverside (UCR)

ENVIRON International Corporation

University of North Carolina's Carolina Environmental Program (UNC-CEP)

Introduction

This is the January 2005 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). Mr. Ralph Morris (rmorris@environcorp.com) and Mr. Zac Adelman (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.

Responsibilities of the RMC include:

- Meteorological modeling
- 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

More details on the WRAP activities for project year 2004 (which has rolled over into January 2005) can be found in the WRAP RMC 2004 work plan, which is available on the WRAP RMC web site:

http://www.cert.ucr.edu/aqm/308/reports/RMC_2004_Workplan_Final_Version_03_01_04.pdf

The WRAP Technical Coordinator (Mr. 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 regular 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.

The WRAP RMC 2004 work effort, described next, has focused on developing the modeling analysis needed for preparing the §308 Regional Haze SIPs and TIPs due in 2007/2008.

Overview of WRAP RMC 2004 Work Effort

The WRAP RMC project year 2004 work has focused primarily on developing a 2002 annual air quality modeling database that can be used to simulate visibility impairment in the western United States. 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. In addition, the WRAP 2004 RMC activities include preliminary visibility modeling for Alaska, a WRAP state whose size and remoteness from the other states make it inefficient to include with the other states' modeling domain. The WRAP 2004 RMC work effort as laid out in the 2004 work plan is divided into 13 tasks, listed below. Note that Task 8 is not covered in this report because it did not receive funding for 2004. Also note that because the WRAP 2003 ammonia emissions modeling update activities were still gathering data at the end of 2003, the remaining funding in the 2003 budget was rolled over to 2004 and the work is presented as Task 0.5.

- Task 0.5: 2002 Ammonia Emissions Inventory for WRAP Region
- Task 1: Project Administration
- Task 2: Test, Improve, Quality Control, Obtain External Peer Review, and Finalize 36-km and 12-km MM5 Simulations for Eventual Use in CMAQ
- Task 3: 2002 Base Year Emissions Modeling, Processing, and Analysis
- Task 4: Air Quality Model Evaluation for 2002 Annual Simulation
- Task 5: Preparation and Reporting of Geographic Source Apportionment Results
- Task 6: Further Analysis of Model Performance in Regard to the Contribution of Natural Emissions to Visibility Impairment
- Task 7: Evaluation and Comparison of Alternative Models
- Task 8: Improvement of WRAP Spatial, Chemical Speciation, and Temporal Allocation Profiles (*not funded*)
- Task 9: Testing and Further Improvements to the Windblown Dust Emissions Modeling Methodology
- Task 10: Continued Improvement to Model Evaluation Software
- Task 11: Sensitivity Studies Designed to Evaluate Uncertainties in Fire Emissions
- Task 12: Preliminary Meteorological, Emissions, and Air Quality Modeling Activities for Alaska
- Task 13: Training Courses for the WRAP States and Tribes

Highlights for the January 2005 Reporting Period

- *Task 0.5—2002 Ammonia Emissions Inventory for WRAP Region:* No work was performed on this task during January. During February we will generate new ammonia emissions using the latest 36-km and 12-km 2002 MM5 data.
- *Task 1—Project Administration:* The primary activity in January was development of the work plan for 2005-06; three conference calls were held on this topic.
- *Task 2—Test, Improve, Quality Control, Obtain External Peer Review, and Finalize 36-km and 12-km MM5 Simulations for Eventual Use in CMAQ:* During January we began the final 2002 MM5 model evaluation and started making backup and distribution disks of the data. Some of the MMOUT files were found to be corrupted, however, so reruns of those days were initiated.
- *Task 3—2002 Base Year Emissions Modeling, Processing, and Analysis:* We finished the 36-km Pre02d emissions modeling and documentation, and corrected random errors in the modeling. We also started a one-month 12-km test simulation on the Pre02d emissions for January 2002.
- *Task 4—Air Quality Model Evaluation for 2002 Annual Simulation:* We completed the revised 2002 CMAQ base case simulation on the 36-km grid using the new MM5 meteorology and the pre02d emissions. We also completed the model performance evaluation for the IMPROVE sites.
- *Task 7—Evaluation and Comparison of Alternative Models:* In mid-January we received the February and July 2002 premerged emissions that will be used to perform the CAMx PM Source Apportionment Technology (PSAT) modeling. We began to process the MM5 and emissions data for input into CAMx/PSAT.
- *Task 9—Testing and Further Improvements to the Windblown Dust Emissions Modeling Methodology:* The draft of the final task report on the revised wind blown dust model was completed and submitted for review.
- *Task 12—Preliminary Meteorological, Emissions, and Air Quality Modeling Activities for Alaska:* We began processing the Alaska emissions for input into CALPUFF.

January 2005 RMC Status Report

Below we discuss our progress during this monthly reporting period (January 2005) and the expected activities during the next monthly reporting period (February 2005). We also describe any difficulties encountered and their resolutions.

Task 0.5: 2002 Ammonia Emissions Inventory for WRAP Region

Purpose:

To review current ammonia emissions generation techniques and develop a GIS-based ammonia emissions model.

Progress During This Reporting Period:

No additional work was performed during January. .

Expected Progress During the Next Reporting Period:

The ammonia model will be rerun using the new 2002 36-km and 12-km MM5 meteorology data. No comments have been received on the draft of the final task report prepared in August. The final task report will be revised to incorporate the final 2002 ammonia emissions and will be delivered in February along with the user's guide and final code for the WRAP ammonia emissions model.

Difficulties Encountered and Resolutions:

None.

Task 1: Project Administration

Purpose:

To manage the WRAP RMC activities, participate in WRAP conference calls, attend WRAP meetings, and prepare project status reports.

Progress During This Reporting Period:

General Activities:

UCR, ENVIRON, and UNC-CEP participated in various conference calls and administered the 2004 WRAP RMC work effort. Conference calls included the monthly WRAP Modeling Forum call, the WRAP RMC Project Management call, and three calls to discuss the 2005-06 work plan. Each contractor also contributed to the December monthly progress report and prepared invoices. We continued to work on finalizing subcontract modifications that have been delayed by several months because of staff changes in the UCR Office of Research Affairs.

Technology Transfer:

None.

Computer Systems Administration:

We are still having problems with the systems, and still trying to debug them. We experimented with a cluster management software, but it appears to be not very reliable, so we have resumed manual scheduling of jobs on the individual CPUs. We are still having problems with one of our servers, and we suspect that it might be a hardware problem. We are ordering a replacement server and will try to get the problematic server fixed or replaced after the new server is installed.

Expected Progress During the Next Reporting Period:

We will begin working on the 2004 WRAP RMC final report and continue work on the 2005-06 work plan.

Difficulties Encountered and Resolutions:

None.

Task 2: Test, Improve, Quality Control, Obtain External Peer Review, and Finalize 36-km and 12-km MM5 Simulations for Eventual Use in CMAQ

Purpose:

To perform MM5 modeling for 2002 on the 36-km Inter-RPO continental U.S. grid and a 12-km western U.S. WRAP grid.

Progress During This Reporting Period:

During January we began to evaluate the final 2002 36-km and 12-km MM5 simulations and make backup and distribution disks. Because some of the MM5 data have become corrupted, however, some segments of the run are having to be redone. This has slowed the evaluation and distribution of the data.

Expected Progress During the Next Reporting Period:

In February we will complete the 2002 MM5 evaluation and begin distributing the MM5 data. We will also prepare a separate report on the WRAP 2002 MM5 36-km and 12-km evaluation and comparison of performance with the VISTAS and CENRAP 2002 MM5 simulations.

Difficulties Encountered and Resolutions:

Some of the 1.5 terabytes of MM5 output has become corrupted, so some MM5 run segments are having to be redone.

Task 3. 2002 Base Year Emissions Modeling, Processing, and Analysis

Purpose:

To extend the work completed on the interim 2002 inventory by integrating the missing emissions sources into the modeling; to assimilate the results of applying the new analysis tools and QA plan for improving the emissions modeling process; and to integrate the final 2002 emissions inventories into a base 2002 emissions data set.

Progress During This Reporting Period:

Most of the work during January focused on generating a one-month test simulation for emissions case Pre02d on the 12-km modeling grid. We created emissions for all source categories for January 2002 except agricultural NH₃ sources and windblown dust. To utilize the ocean-going shipping emissions that we developed for the WRAP region, we created a set of 12-km shipping surrogates and integrated them with the rest of the 12-km surrogates. For the 36-km Pre02d simulation, we completed the QA and documentation of the emissions and gave them the final seal of approval for use by the RMC air quality modeling team. We corrected spurious

errors in the emissions by rerunning the merge step as the problems were encountered by the RMC air quality modelers.

Expected Progress During the Next Reporting Period:

We will work on completing the annual 12-km Pre02d simulation in February. As the CEP funding for 2004 is gone, however, our time on this work will have to be limited until additional funding is made available. We will also continue to work on the 2004 final report, although our effort will be limited.

Difficulties Encountered and Resolutions:

We periodically encountered simulation days that did not complete for the 36-km Pre02d simulation. As we became aware of these missing days, we reran SMOKE and created emissions files to complete the annual 36-km simulation. The first iteration of the shipping surrogates for the 12-km grid did not place the emissions in the correct rows and columns in the modeling grid. After reviewing the process that CEP employed to create these surrogates, we discovered that the rows and columns were switched in the surrogate file. After regenerating the emissions surrogates, we corrected the problem and continued with the 12-km test simulation.

Task 4: Air Quality Model Evaluation for 2002 Annual Simulation

Purpose:

To test the 2002 base year air quality modeling performed with CMAQ, including a preliminary simulation using the 2002 interim emissions inventory followed by several iterations with bug fixes or updates, and sensitivity experiments.

Progress During This Reporting Period:

We completed the revised 2002 CMAQ base case simulation on the 36-km grid using the new MM5 meteorology and the pre02d emissions. We also completed the model performance evaluation for the IMPROVE sites. The model performance evaluation results will be posted on the RMC web site and summarized in a PowerPoint file for discussion on the next Modeling Forum call.

Expected Progress During the Next Reporting Period:

We will complete the 2002 CMAQ 12-km base case simulation using the pre02d emissions and conduct a model performance evaluation.

Difficulties Encountered and Resolutions:

None.

Task 5: Preparation and Reporting of Geographic Source Apportionment Results

Purpose:

To implement, test, and apply Tagged Species Source Attribution (TSSA) particulate matter (PM) algorithms in CMAQ.

Progress During This Reporting Period:

We worked on implementing a new approach to creating stacked-bar time-series plots of contributions to beta extinction at each IMPROVE site. These plots will be compared with similar plots of monitoring data; we expect that this will be useful for assessing the model performance on best- and worst-visibility days.

Expected Progress During the Next Reporting Period:

We will finish development of the stacked-bar time-series plots.

Difficulties Encountered and Resolutions:

None.

Task 6: Further Analysis of Model Performance in Regard to the Contribution of Natural Emissions to Visibility Impairment

Purpose:

To perform modeling without anthropogenic emissions to help elucidate natural background visibility levels.

Progress During This Reporting Period:

We began work on the content for a task write-up for the 2004 WRAP RMC final report.

Expected Progress During the Next Reporting Period:

We will continue working to develop a plan to assess haze from natural emissions sources.

Difficulties Encountered and Resolutions:

None.

Task 7: Evaluation and Comparison of Alternative Models

Purpose:

To analyze alternative models to CMAQ for 2002 modeling.

Progress During This Reporting Period:

In mid-January we received the February and July 2002 premerged emissions that will be used to perform the CAMx PM Source Apportionment Technology (PSAT) modeling. We began to process the MM5 and emissions data for input into CAMx/PSAT.

Expected Progress During the Next Reporting Period:

The CAMx model will be applied using the Pre02d emissions inputs and the new February and July 2002 36-km MM5 data; the model performance will then be compared with CMAQ's. The CAMx PSAT and CMAQ TSSA PM source apportionment schemes will be applied for July 2002 and intercompared.

Difficulties Encountered and Resolutions:

The premerged emissions files used in the CMAQ TSSA source apportionment modeling were

deleted to generate additional disk space for other WRAP modeling activities, so there are delays in getting the premerged emission data for the CAMx PSAT modeling.

Task 9. Testing and Further Improvements to the Windblown Dust Emissions Modeling Methodology

Purpose:

To further refine and test the WRAP windblown dust model.

Progress During This Reporting Period:

The draft of the final task report on the revised wind blown dust model was completed and submitted for review.

Expected Progress During the Next Reporting Period:

An additional model run will be completed using the new MM5 data, updated agricultural data for the eastern U.S. states, and application of transport fractions. Any comments received on the draft of the final task report will be addressed as we prepare and submit the final task report.

Difficulties Encountered and Resolutions:

None.

Task 10. Continued Improvement to Model Evaluation Software

Purpose:

To continue the development of model evaluation software for meteorology, emissions, and air quality modeling. This includes expanding existing evaluation tools to include metrics on model bias and error, and creating visualizations for additional evaluation metrics.

Progress During This Reporting Period:

None.

Expected Progress During the Next Reporting Period:

None.

Difficulties Encountered and Resolutions:

None.

Task 11: Sensitivity Studies Designed to Evaluate Uncertainties in Fire Emissions

Purpose:

To perform fire sensitivity simulations as requested by the Fire Emissions Joint Forum (FEJF).

Progress During This Reporting Period:

None.

Expected Progress During the Next Reporting Period:

We will generate stacked-bar time-series plots showing the change in contribution to beta extinction resulting from each of the fire emissions sensitivity cases.

Difficulties Encountered and Resolutions:

None.

Task 12: Preliminary Meteorological, Emissions, and Air Quality Modeling Activities for Alaska

Purpose:

To perform MM5 modeling of Alaska and preliminary dispersion modeling using a Lagrangian puff model.

Progress During This Reporting Period:

During January we continued with the Alaska 2002 MM5 modeling and began processing the emissions for CALPUFF modeling.

Expected Progress During the Next Reporting Period:

We will complete the 2002 Alaska MM5 modeling and initiate CALPUFF modeling.

Difficulties Encountered and Resolutions:

The project started later than expected due to competing priorities with the WRAP continental U.S. 2002 MM5 modeling. Alaska modeling is proceeding quickly now, although the current scope of work will not be completed until after March 2005.

Task 13: Training Courses for the WRAP States and Tribes

Purpose:

To conduct training activities as needed to transfer datasets and technology to WRAP member tribes and states.

Progress During This Reporting Period:

None.

Expected Progress During the Next Reporting Period:

Additional one-day training classes will be held as requested by the WRAP. Also, the computer equipment page on the RMC web site will be updated to include recommended hardware configurations and a list of frequently asked questions (FAQs).

Difficulties Encountered and Resolutions:

None.