

Progress Report

May, 2003

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General:

The project continues with good progress. Most of the subcontracts are now in place.

Emissions (Tasks 1, 2 & 8):

UNC-CEP has completed an updated version of the ICAP gridded emissions for CMAQ modeling that we will use for the April 1-10 case. The updated emissions include the following:

- Joshua Fu's Asian emissions received May 6, 2003,
- Put power, industry and biomass burning emissions in CMAQ layer 2,
- Used 14-layer MCIP meteorological data for biogenics and point sources (vertical allocation),
- Implemented more realistic temporal profile for biogenic OVOC and terpene emissions for Asian grid cells,
- Corrected bad surrogates that were used in Canada (area and mobile src emissions were being dropped) ,
- Added 14 continually erupting volcanoes to the point source gridded inventory,
- Used Asian biomass burning inventory for April in this case.

ANL started two main tasks in May. First, ANL began to expand the data for forecasting emissions to include the whole world, rather than just the Pacific/Atlantic regions, in accordance with the requests of Daniel Jacob and Mark Jacobson for data to run the global models. This required downloading and processing a new batch of IPCC data. As of the end of May ANL had completed a prototype, whole-world forecast for SO₂, which is presently being reviewed. ANL will probably circulate the SO₂ forecast early in June, so that the emissions sub-group and the global modelers can decide on the best way to use these forecasts to prepare 2030 model cases. Second, ANL have been working on setting up the particulate model to forecast BC, OC and possibly other particulate species. At the end of May ANL had prepared a 1996 base case model, incorporating 112 fuel/technology combinations and 17 IPCC world regions. This model was successfully calibrated against the country-level model, as documented in Tami Bond's JGR paper. ANL have also mapped IPCC fuel/technology combinations against our PM model. So ANL are now ready to begin in June to prepare 2000 and 2030 emissions cases, from which ANL can derive the needed growth factors in particulate emissions.

Meteorology and Chemistry transport (Tasks 1,2 , 5& 8):

UNC-CEP completed the MM5 version 3.6 simulations (PX scheme) for the months of January, March, and April 2001. UNC-CEP has prepared the inputs for a test case study to examine the performance of the chemistry transport model, CMAQ, during the 10 days of the January and April 10 days test episodes. MCIP input as well as the revised SMOKE emissions as described above have been prepared for the trans-Pacific region for the test episodes. UNC-CEP completed the CMAQ test case analysis using 14 vertical layers only using the MCIP layer collapsing scheme. A comparison and evaluation of the CMAQ 23-layers versus 14 layers will be conducted. For the operational year 2001 simulations, a new MCIP that will be released by EPA shortly will be used.

UNC-CEP has also completed the MM5 China domain test run for April 2001 (Task 8)

UNC-CEP will start the operational MM5 runs for the Trans-Atlantic domain in June.

UNC-CEP has completed the design of the ICAP web site as proposed under task 9. The web site at

<http://www.cep.unc.edu/empd/projects/ICAP/index.shtml>

Task 3:

TASKS 3.7, 3.8, 3.9

Harvard University has completed a fully coupled aerosol-chemistry GEOS-CHEM simulation for year 2001 to interface with the CMAQ ICAP simulation, and also conducted several sensitivity simulations to investigate issues of trans-boundary and transpacific transport of pollutants. They include simulations with anthropogenic sources turned off in (1) the United States, (2) North America (2), (3) Asia, (4) the entire world. Analysis of results is underway.

Harvard is also working with Daewon Byun at U. Houston on the development of an interface between GEOS-CHEM and CMAQ. The interface module for oxidant chemistry has been fully developed and tested in a simulation of ozone and its precursors for TEXAQS 2000. Harvard is developing a similar interface module for aerosol. Particular interest relates to the effect of trans-boundary transport of biomass burning aerosols from fires in Mexico and Central America. Harvard has conducted a 1-year GEOS-CHEM simulation of carbon aerosols for the year 2000, with biomass burning emissions constrained by satellite observations of fires. Results will be used for initial development of the aerosol interface between CMAQ and GEOS-CHEM.

Harvard is also working on improving the mercury simulation in GEOS-CHEM by adding a more detailed representation of redox processes (coupled to our oxidant chemistry simulation) and improved representations of sources. Harvard plans to conduct a thorough evaluation of the mercury simulation with data from NADP/MDM network in the United States.

Task 4:

During May, Stanford University performed the following work as part of the Intercontinental Transport and Climatic Effects of Air Pollutants project.

1) Stanford setup the GATOR-GCMOM model to simulate a regional USA grid nested within a global grid and multiple fine urban grids (Los Angeles and Atlanta are being used as test cases) nested within the USA grid. Test simulations are currently running that include gases and size resolved aerosols on all four grids.

2) Completed development of a code to read U.S. EPA NEI99V2 emissions for any U.S. grid. The last step in the process was to distribute county mobile and area emissions using spatial surrogates based on population, households, roads, etc. This was completed. The inventory was then used to generate emission inventories for item 1, above.

3) Received BC and OM emission data for fossil fuels (ff), biofuels (bf), and biomass burning (bb) from Tami Bond and Dave Streets. We started global simulations (nonnested) to examine the climate response of controlling (a) ff BC+OM, (b) bf BC+OM, (c) ff+bf BC+OM, (d) bb BC+OM.

4) Started non-nested global simulations to examine the climate response of (a) NO_x+VOCs+CO, (b) NH₃, (c) SO₂, and (d) CH₄.

5) Completed a paper examining the effect on photochemical smog of switching from a fleet of gasoline vehicles to a fleet of modern diesel vehicles in the U.S. This paper has been submitted for publication.

Task 6:

CAPITA has processed SeaWiFS aerosol data imageries for 2001s for the US and adjacent ocean. SeaWiFS provides aerosol data retrieval of aerosol for land and ocean (daily). The aerosol optical depth is available from this data (the sensor is on km). This data distinguishes between dust and smoke. In addition CAPITA is working on the analysis of IMPROVE data (the chemical data) and also will provide back trajectory quasi source analysis using clustering techniques.

Task 7:

Harvard U. has implemented two simple chemical tracers, anthropogenic CO and black carbon, in the GISS GCM 2' model. Harvard included present-day emission inventories for both tracers, an OH sink for CO (using archived OH fields from a present-day simulation), and wet and dry deposition for black carbon. Harvard calculated the ocean heat transport fluxes which will be held fixed for the entire simulation. Initializing the model with 1950s sea surface temperatures, Harvard has begun the 100-year simulation from 1950 to 2050. Each model month, the concentrations of the well-mixed greenhouse gases are updated, following observations for 1950 to 2050 and the IPCC scenario A1B for 2000 to 2050. Harvard has now completed the 50-year spinup required to equilibrate the sea surface temperatures with the changing greenhouse gas forcing, and have reached year 2020 of the simulation. The calculated, globally averaged surface temperature over the first 50 years increased about 0.8°C, consistent with results from Hansen et al., 2002. Harvard has now begun analysis of the model output to diagnose changes in the meteorological variables that influence ozone and PM air quality, including frequency of stagnation events, boundary layer heights, mean temperatures, temperature extremes, cloud cover, relative humidity and lightning.

This spring Harvard used the GISS GCM to generate a test file of meteorological boundary conditions to be implemented in the MM5 regional model. The test file was sent in May to Ruby Leung of Pacific National Labs for evaluation. Harvard's plan is to provide files of meteorological boundary conditions from the GCM for the five-year intervals of 1998-2003, 2023-2027, and 2048-2052. Harvard will also calculate the chemical boundary conditions for the same time intervals, using the GCM with full chemistry capability. Dr. Leung will apply the GCM meteorological boundary conditions into MM5. Alice Gilliland, in turn, will apply the meteorology calculated by MM5 together with the GCM chemical boundary conditions into CMAQ, for simulations to be performed later this year.

Schedule:

June-July 2003: Complete 100-y simulation, begin analysis of results

June-August 2003: Generate files of meteorological and chemical boundary conditions for use in MM5 and CMAQ.

August-December 2003: Finish analysis of results, develop final report, and prepare paper for publication.

Task 8:

UT continues to work on emissions and meteorological modeling concepts of the China domain in collaboration with ANL and UNC-CEP.

Task 9:

UNC-CEP completed the design of the ICAP web site

Management and project coordination:

Conference calls have been conducted between members of the emissions specialty group and also between the over all ICAP principal investigators and the EPA project officers.

Conf call 5/6/03 ICAP PIs

- Provide the Global Emissions Forecasts
- Discussion of the Mercury issue (unfunded task)
- Team members to provide work statement and schedule.

Conf call 5/16: Emissions Group

- Need to check the Canadian Inventory
- Put a place holder in SMOKE for three Mercury Species (2 gas, one PM)
- Trans-Atlantic European emissions from EMEP will be provided to UNC-CEP

Schedule:

We include for consistency the schedule for all tasks.

Table: Schedule of operations

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept	Oct.	Nov.	Dec
Task 1 Trans-Pacific												
Task 1.1 Model domain												
Task 1.2 Meteorology												
Linux Testing												
MM5 version 3.5 or 3.6												
Examine layer 14 vs. 23												
Prepare 10-day (Jan, April, July) test cases												
Evaluate and recommend MM5 configuration												
MM5 2001 Meteorology (preprocess and run model)			Jan-July	Feb Aug.	Mar. Sept	Apr. Oct.	May Nov.	June Dec.				
MCIP 2001												
Task 1.3 Emissions												
Provide Asian EI gridded												
SMOKE issues												
Complete Gridded Surrogates for N America												
Provide SMOKE emission data to test CMAQ intercontinental												
Run and evaluate CMAQ test case												
SMOKE/Emissions 2001												
Task 1.4 Future emissions (2030)												
Task 1.5 Task 1 report												
Task 2. Trans-												

Atlantic												
Domain identification												
Seasonal Evaluation												
Meteorology 2001												
Emissions 2001												
Task 3.0												

interface with MM5 and CMAQ												
Task 8												
Task 9												

* The green shade identifies completion of subtask