

CS13

January 22, 1995

LAKE MICHIGAN AIR DIRECTORS CONSORTIUM

BOUNDARY CONDITIONS IN THE LAKE MICHIGAN AREA

Regional-Scale Application of UAM-V

The Lake Michigan Air Directors Consortium has adopted a policy for dealing with future year boundary conditions in the attainment demonstrations for the Lake Michigan region. According to this policy, a boundary condition of 60 ppb for ozone (and correspondingly lower concentrations for ozone precursors) will be assumed for now to allow the States to move forward with the development of revised State Implementation Plans (SIPs). The policy also encourages USEPA to improve the characterization of future year boundary conditions through a cooperative Federal-State research effort. It is expected that this new technical information will lead to a National control strategy to address the ozone transport problem in the eastern United States.

The purpose of this paper is to outline a 3-step approach for applying the UAM-V photochemical grid model on a regional scale to generate base year (1991) and future year (2007) boundary conditions for the LMOS modeling domain. This modeling represents LADCO's contribution to the Federal-State research effort. (It is not clear whether satisfactory modeling results will be available in time for use in the current round of SIP development.) To enhance its application, the modeling will be coordinated with other the regional-scale modeling studies (e.g., USEPA's ROM modeling and the northeast Modeling Ozone Cooperative (MOCA) UAM-V's modeling).

STEP 1: Model Set-Up

MODEL

UAM-V (same version as MOCA - i.e., Fast Version 1.22a)

PHYSICAL CONFIGURATION

DOMAIN: SUPROXA domain (see attached figure)

COORDINATE SYSTEM: latitude/longitude

HOZ RESOLUTION: fixed 20 km grid (no nested grids)

VERT RESOLUTION: 6 vertical layers/3 km top/100 m lowest layer depth

PIG TREATMENT: Applied to largest NO_x point sources in the "Midwest" sub-domain, with "wdump" parameter set to 1.0

DEPOSITION: standard option

CHEMISTRY: CB-IV, updated version 6.3

PHOTOLYSIS RATES: UAM-V rates ('calcj' program)

CLOUDS: New, simplified UAM-V treatment

EPISODES

Episode 1 - June 22 - 28 (7 days; Saturday-Friday)

Episode 2 - July 13 - 21 (9 days; Saturday-Sunday)

Episode 3 - Aug 20 - 26 (7 days; Tuesday-Monday)

Episode 4 - June 16 - 21 (6 days; Sunday-Friday)

MODEL INPUTS**Emissions (Base Year - 1991):**

- (1) Upgrade Midwest sub-domain portion of 1990 Interim Regional Inventory (i.e., review and revise, if necessary, the NOx emission rates for major point sources; and obtain and incorporate SIP inventories for nonattainment areas);
- (2) Prepare EMS-95 input files based on revised 1990 Interim Regional Inventory (with LADCO, OTC, TVA, and EPA "fixes"); and
- (3) EMS-95 base year runs.

Emissions (Future Year - 2007):

- (1) Review and revise, if necessary, growth and control factors; and
- (2) EMS-95 future year runs.

Meteorology: RAMS3a prognostic meteorological model will be run to create the necessary UAM-V meteorological input files

DOMAIN: Continental United States

COORDINATE SYSTEM: latitude/longitude

HOZ RESOLUTION: fixed 80 km grid, with nested 20 km grid over SUPROXA domain

VERT RESOLUTION: 15 vertical layers/7 km top/100 m lowest layer

4DDA: will be used

VERTICAL DIFFUSIVITIES: derived using KRAMS

Initial/Boundary Concentrations: ROM inputs will be used (i.e., "clean" values for initial concentrations, "clean values for precursor and top ozone boundary concentrations, and surface AIRS data for perimeter ozone boundary concentrations)

Other Inputs: Other inputs parameters, such as topography and land use/land cover, should be available from SAI (i.e., they were generated as part of SAI's previous regional modeling for LADCO). Cloud data may also be needed.

STEP 2: UAM-V Modeling, Phase 1 (Performance Evaluation)**LMOS BOUNDARY TEST (SURFACE)**

Compare UAM-V predictions to ground-level ozone and ozone precursor monitoring data in the four subregions near the upwind boundary of the Lake Michigan sub-domain. Statistical and graphical performance measures will be similar to those used by MOCA.

LMOS BOUNDARY TEST (ALOFT - EPISODES 1 AND 2)

Compare UAM-V predictions to aircraft ozone and ozone precursor monitoring data near the upwind boundary of the Lake Michigan sub-domain. Statistical and graphical performance measures will be similar to those used by MOCA.

REGIONAL TEST (SURFACE)

A limited evaluation over the eastern U.S. will be performed similar to that performed by MOCA.

STEP 3: UAM-V Modeling, Phase 2 (Strategy Simulations)

Several control strategies will be modeled. Resources are being budgeted for as many as 12 strategies. Examples of such strategies are as follows:

Eastern U.S. Strategies

Clean Air Act Mandatory Measures

Motor Vehicle 1 (OTC LEV)

Motor Vehicle 2 (Fed LEV)

Point Source 1 (0.15 lb NO_x/MMBTU)

Point Source 2 (0.30 lb NO_x/MMBTU)

Combined MV/Pt 1 (OTC LEV, 0.15 lb NO_x/MMBTU)

Combined MV/Pt 2 (Fed LEV, 0.15 lb NO_x/MMBTU)

"Downstate" Illinois and Indiana Strategies

Point Source 1 (0.15 lb NO_x/MMBTU MMBTU/hr)

Point Source 2 (0.30 lb NO_x/MMBTU MMBTU/hr)

Point Source 3 (0.45 lb NO_x/MMBTU MMBTU/hr)

Combined MV/Pt 1 (OTC LEV, 0.15 lb NO_x/MMBTU)

Combined MV/Pt 2 (OTC LEV, 0.45 lb NO_x/MMBTU)

