Recent Updates to the SMOKE Modeling System

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Background

- Sparse Matrix Operator Kernel Emissions (SMOKE) Modeling System
- Processes emissions for input into various air quality models
- Handles area, mobile, point, and biogenic emissions
- Developed at MCNC, now under active development at CEP

Core Functions

- Spatial allocation (gridding)
- Speciation
- Temporal allocation
- Optional processing
  - Plume rise calculations
  - Growth and controls of emissions
  - Reporting at each step of the process
  - Compute mobile emissions using MOBILE6

Release Schedule

- Usually aim for two releases per year
- SMOKE v1.5 released in early 2003 with patches over the summer
- SMOKE v2.0 released in fall 2003
- Planning to release SMOKE v2.1 at the end of June
- SMOKE v2.2 probably at the end of 2004

SMOKE v2.0 Features

- Support for all toxic source categories
  - SMOKE v1.5 supported nonroad and onroad mobile sources
  - SMOKE v2.0 added support for nonpoint and point sources
  - Uses additional fields from the NIF (MACT, NAICS, source type code, CAS number, and SIC for nonpoint sources)
  - Uses INVTABLE file to combine emissions into pollutants based on CAS numbers

Toxics Support

- New inventory format (ORL) for toxics data
- Handles 8- and 10-digit SCCs within the same source category (nonpoint, nonroad, and point)
- Can apply controls by SIC and MACT code
- Can assign speciation profiles by SIC and MACT code
- Special processing to avoid double counting of hydrocarbon emissions

More on SMOKE v2.0

- Updates to SMOKE/MOBILE6 integration
  - Supports hourly speed data
  - Accounts for travel on freeway ramps; uses environmental variables ADJUST_INV_SPEED, ADJUST_HR_SPEED
- Revised plume rise calculations
  - Contributed by James Godowich, U.S. EPA NERL Atmospheric Modeling Division

Reporting Options

- ARRANGE instruction
  - Can split reports into several files
  - New database format to write reports one variable at a time
- ASCIIELEV instruction
  - Reports emissions from the elevated ASCII emissions files (ELEVTS_L, ELEVTS_S)

SMOKE v2.1 Highlights

- Reporting by SIC
  - Contributed by Marc Houyoux, U.S. EPA OAQPS Emission Factors and Inventory Group
  - New REPCONFIG instruction: BY_SIC
  - Uses new file SICDESC to provide text descriptions of each SIC

SMOKE/MOBILE6

- Humidity updates
  - Reads hourly absolute humidity and barometric pressure data from gridded meteorology files
  - Calculates hourly relative humidity as input to MOBILE6
  - New utility program Metcombine creates custom meteorology files
    - Combines 2-D files with 1st layer of 3-D files

SMOKE/MOBILE6 (2)

- New options to treat rural and urban local roads separately
- New environment variable M6_FLAT_VMT to use uniform hourly VMT in MOBILE6
- Updated default temporal profiles for exhaust start and hot soak emission processes

More SMOKE Goodies

- Updated utility Mrggrid
  - Able to merge files with different start dates
- Updated to version 2.2 of I/O API library
  - Able to specify spheroid for modeling shape of the earth using IOAPI_ISPH env. variable
- Supports polar stereographic grids
  - Contributed by Éric Giroux, National Research Council Canada

Current Work

- Support for variable grids
  - Grid has constant number of rows and columns, but variable cell sizes
  - Ongoing work by Dr. Kiran Alapaty at CEP
  - Already have modified version of MAQSIP
  - Avoids multiple domain requirements when using nested grids

Current Work (2)

- Updates to process aircraft emissions
  - Project headed by Dr. Frank Binkowski at CEP
  - Have annual emissions data at specific latitudes, longitudes, and altitudes
  - Determine how to handle in SMOKE and how to temporally allocate the emissions

Other Plans

- Support additional Linux compilers
  - Currently use Intel Fortran Compiler v7.1
  - IFC v8.0 available
  - Portland Group Fortran compiler
- Anonymously accessible CVS server
  - Allow access to latest bug fixes between official releases
  - Better interaction with community

Availability

- Download executables, scripts, source code, and data through the CMAS website

  http://www.cmascenter.org/html/models.html

- Problems and questions can be submitted through the CMAS help desk

  http://www.cmascenter.org/html/help.html