THE U.S. EPA CMAQ MODELING SYSTEM – FUTURE DEVELOPMENT PLANS

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Spatial Scales

- Urban/Regional
  - Has been and continues to be primary focus
- Fine/Neighborhood Scale
  - ~1 km grids, or finer
  - Pilot programs now; may grow into larger program
  - Emphasis on air toxics and human exposure applications; homeland security
  - Exploring stochastic approaches within grid modeling context
    - PDFs; sub-grid variability

- Hemispheric/Global Scale
  - New project in conjunction with EPA/NCEA's assessment of impacts of potential climate change on regional/urban air quality
  - Purpose: Perform AQ simulations under current and future climate scenarios to study the sensitivity of air quality predictions (O_3, PM) to climate change. Model simulations developed to support the USEPA Global Change Research Program (GCRP) national air quality assessment (2007, 2010 reports).

– Modeling Tools

- USEPA Community Multiscale Air Quality (CMAQ) model for national-scale simulations
- MM5 regional climate simulations performed by Ruby Leung (PNNL)
- Global Climate and Chemical Transport Modeling fields provided by STAR grantees (Harvard, CMU)
- Future Emission Scenarios requires collaboration with NRMRL for future technology scenarios, OAQPS, OTAQ, FY03 and FY04 STAR grantees

- Planned Products from the CIRAQ model study
  - 5-yr current and future CMAQ simulations: Test sensitivity of AQ simulations to climate forcing (IPCC A1B scenario)
  - Analysis of CMAQ results for (1) climate sensitivity
  - Results and analyses from CMAQ simulations will be provided for the USEPA GCRP 2007 national assessment report
  - Future CMAQ simulations (2) climate + emissions, schedule depends on…
    - Future AQ emission developments
    - Steps needed to integrate these developments into “model-ready” emissions
    - Plan to complete these simulations to contribute to the USEPA GCRP 2010 national air quality assessment report.

Other New Dimensions

- Annual simulations
  - Most of the new applications require longer-term model simulations of seasons to years
- New chemical species
  - Air toxics, metals, Hg, PBTs, POPs, etc.
- Links with other models
  - Water quality (through deposition)
  - Ecological and human exposure
  - Global climate, general circulation, global chemistry

- New applications
  - AQ Forecasting
    - Air quality climatological model database and analyses
    - Links with regulatory process through long-term model data archive
    - Collaborations with CDC on links with health data

Meteorology

- Transition from MM5 to Weather Research and Forecast (WRF) Model
  - Add data assimilation (nudging) to WRF
  - Add PX Land surface model to WRF
- WRF physics options
  - Sensitivity tests for AQ applications
  - Linkage with CMAQ
  - Dynamic cores
    - Mass
    - NMM
    - Ensembles

Emissions

- Biogenics
- Fire emissions
- Blowing dust
- Mobile sources
  - New modal mobile models
- Bi-directional fluxes
  - e.g., NH_3

Chemical Transport Model

- Aerosol research and integration
  - Source apportionment
  - Fine/coarse interactions
  - External mixtures
- Chemistry
  - Mechanisms; morphecules
- Efficiencies
  - Creation of engineering model (?)
- PBL and land-surface processes
- Clouds (physics and chemistry)
- Data assimilation/ satellite data

- WRF-Chem
  - Integrated model
  - Two-way; feedbacks
    - Radiation
    - Cloud microphysics