Emission Modeling: Fires, Biogenics, and Sea Salt (1.4)

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The NARSTO 2005 assessment report stressed that emissions are at the cornerstone of air quality management decision-making. While OAQPS bears the responsibility for maintaining the National Emissions Inventory (NEI) for traditional anthropogenic sources (e.g., electrical generating units and mobile sources), many nontraditional emission categories (e.g., fires and biogenics) remain poorly characterized. During the 1980s, AMAD began to identify these categories and started to work with outside groups (e.g., NCAR, NASA, and the U.S. Forest Service) to build new and improved emission estimation tools. This poster highlights AMAD's work on fire, biogenics, and sea salt. Not shown because of space limitations is research on speciation, fugitive dust, lightning NO_x, and ammonia emissions from natural landscapes and agricultural activities. The goal of this research is to improve the characterization of emissions that will reduce the uncertainty in air quality model simulations, such as with the CMAQ model.

Until OAQPS and several Regional Planning Organizations spent nearly a million dollars building a 2002 biomass burning inventory for event-specific emissions, fire emissions were resolved only by month and by county. We used the 2002 inventory as a baseline for developing a combined satellite/ground-based inventory that can be constructed at a fraction of the cost. Our methodology has been incorporated into the NEI and has been used to estimate biomass burning emissions (on a daily basis) for the years 2003-2006.

AMAD was a pioneer in developing the Biogenic Emissions Inventory System (BEIS) for estimating biogenic volatile organic compounds from vegetation and NO from soil. We are now collaborating with NCAR to develop and evaluate the Model of Emissions of Gases and Aerosols from Nature (MEGAN), which represents an evolution of the BEIS system, but was only recently converted into Fortran computer code that is compatible with CMAQ. While BEISv3.14 is the latest operational biogenic emissions processor in the CMAQ system, the Division is performing rigorous tests with MEGAN and is seeking to integrate the National Land Cover Database (NLCD) into its structure.

Until recently, the characterization of sea-salt emissions did not exist in regional air quality simulation models. To meet this need, we have constructed a saltwater and shoreline geographical coverage file to drive emissions from open water and breaking waves using available flux equations that vary as a function of wind speed.

Simulations with the CMAQ modeling system suggest that model performance has improved with the addition of these more scientifically defensible emission algorithms. In addition, the underlying data and modeling systems have been distributed to the scientific community and are widely used by other modeling groups around the world. Over the next few years, we plan to continue work to integrate the MEGAN system, to incorporate NO production from lightning, and to explore the feasibility of a windblown dust algorithm.