

## **Seasonal NH<sub>3</sub> Emissions for an Annual 2001 CMAQ Simulation: Inverse Model Estimation and Evaluation**

Alice Gilliland, Shawn Roselle, Rob Pinder, and Robin Dennis; (1) USEPA ORD NERL Atmospheric Modeling Division and (2) Carnegie Mellon University Department of Engineering and Public Policy, Department of Civil and Environmental Engineering

### **Brief Description:**

The formation of ammonium nitrate aerosols is often limited by ammonia (NH<sub>3</sub>), and sulfate aerosols are predominantly in the form of ammonium sulfate. While NH<sub>3</sub> plays a central role in the prediction of nitrate and sulfate aerosols, inherent uncertainty exists in NH<sub>3</sub> emissions because of the predominant sources, animal husbandry and fertilizer application. The temporal variability in fertilizer application and the meteorological dependence of NH<sub>3</sub> volatilization from animal waste suggest that a strong seasonal variability should be expected in the emissions. Current work by Pinder et al. [2004] provides the first farm-level model for NH<sub>3</sub> emissions from dairy cattle, and Goebes et al. [2003] provides a seasonally varying fertilizer inventory for NH<sub>3</sub>. Top-down estimates of NH<sub>3</sub> seasonally varying emissions for all combined source types have been developed by Gilliland et al. [2003] using an inverse modeling method. Currently, these studies provide the most comprehensive information available for seasonally distributing NH<sub>3</sub> emissions for air quality modeling. Combining this information, we have constructed a best prior estimate of seasonal scaling factors for NH<sub>3</sub> emissions. These emissions were then used in an annual 2001 simulation using the USEPA Community Multiscale Air Quality (CMAQ) model for a contiguous United States domain. The objective of this study is to evaluate the reasonableness of these prior NH<sub>3</sub> emission scaling factors and then test the inverse modeling method used in Gilliland et al. [2004] to produce revised top-down seasonal scaling factors for the eastern and western portions of the modeling domain. First, we will describe the approach used to generate our best prior estimate of NH<sub>3</sub> seasonal scaling factors. Evaluation results against the National Atmospheric Deposition Program (NADP) precipitation chemistry network and several speciated aerosol networks will then be presented with a primary focus on monthly and seasonal time scales. Posterior inverse modeling emission estimates will be presented to conclude the analyses.