Air Quality Models for PM: A Discussion on Model Evaluation, Diagnostics and Application Guidance

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Brief Description:

Air quality models (AQMs) have been used with varying degrees of success to simulate ozone and other gas phase pollutants since the 1980s. In recent years AQMs have also been developed to simulate particulate matter (PM); however, these models are not yet able to provide consistent predictions of PM in agreement with ambient observations. Moreover, more complex models do not necessarily perform better than simpler counterparts and the response of one model to changes in emissions may be quite different from the response exhibited by other models. As a crucial step in the continued implementation of PM models, this study evaluates four models that could be used in a regulatory framework and aims to understand the causes for varying model performance. The air quality models evaluated are REMSAD, CAMx, CMAQ, CMAQ-MADRID. Results are presented for an evaluation of the models simulating a July 1-10, 1999 episode in the southeastern U.S.

The four models use consistent input data bases (emissions, meteorology, and air quality) so that differences among the models represent the effects of the different approaches used to implement science algorithms in each model. Insight on these discrepancies is needed to enhance our conceptual models of atmospheric processes and improve algorithms that represent a myriad of physical and chemical processes. A performance evaluation is presented by comparing model predictions to ambient data. A diagnostic evaluation is also performed in order to elucidate key mechanisms influencing model behavior and understanding differences across models. Diagnostic sensitivity simulations and process analysis calculations are conducted as well in order to understand the response of the models to changes in emissions. This presentation concludes by discussing issues that arise from the current lack of standardized guidance for AQM evaluation and for AQM application.