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Preface

Special issue on model evaluation: Evaluation of urban and regional Eulerian air quality models

This special issue of *Atmospheric Environment* presents research on the evaluation of urban and regional Eulerian air quality models. The set of papers published here is based on presentations given during the Third Annual Community Modeling and Analysis System (CMAS) Users' Conference held in Chapel Hill, North Carolina, on October 18–20, 2004. Each fall the CMAS Center hosts an air quality model users' conference. The goal is to bring together members of the air quality community to present, discuss, and learn about recent advances in the field. More than 180 scientists participated in the third annual conference, including 25 scientists from South Korea, Spain, Germany, China, Australia, Taiwan, and Canada. To excite and educate the upcoming generation of air quality modeling professionals, CMAS encourages students to attend the conferences; 27 participated in 2004. There were seven topical sessions, with the largest one addressing model evaluation topics. Authors of papers in that session were invited to prepare journal manuscripts to be considered for publication in this special issue. These papers were then subjected to a rigorous peer review process.

The CMAS Center was established in cooperation with the US Environmental Protection Agency (EPA) in 2001 to leverage the air quality community's expertise in modeling and analysis to support policies on air pollution control and regulation. The Center initially focused on EPA's Community Multiscale Air Quality (CMAQ) model. Today, the Center participates in the development, maintenance, and support of multiple publicly available and scientifically sound air quality modeling systems, as tools for decision support that are flexible and user-friendly. Building upon the "one atmosphere" concept, the modeling systems are inherently multiscale and multipollutant, and include detailed descriptions of the relevant atmospheric processes.

An air quality modeling system is usually composed of several models: an emissions model, a meteorology model, and a chemistry-transport model (CTM); the first two are used to prepare inputs to the third. In the Eulerian modeling framework, the CTM is used to predict species concentrations (gases and particulate matter) in a fixed grid system accounting for transport and transformation. The complexity of air quality modeling systems requires careful examination and evaluation of each of their components. Because the inputs to a CTM include data derived from meteorological and emission models, it is important to evaluate the accuracy of these input models. The CTM includes interactions among processes such as chemical reactions, transport, dispersion, and cloud and aqueous chemistry. Consequently, conducting a credible evaluation requires examining not only how well the model predicts the species concentrations of interest, but also whether the modeled processes are correctly simulated. The latter ensures that correct results from the model are obtained for valid reasons rather than, for example, by two types of errors canceling each other out.

The papers presented in this issue address air quality model evaluations in terms of operational evaluation, diagnostic evaluation, model intercomparisons, and sensitivity analyses.

- Operational evaluations compare model results with measurements of species concentrations for a specific time period.
- Diagnostic evaluations assess the performance of specific processes within the air quality modeling system.

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- Model intercomparison studies can be performed with models that have general similarities in their theoretical formulations, but differ in modeling certain dynamical processes and the utilization of spatial and temporal grid discretization.
- Assessing the sensitivity of a model to changes in its input parameters helps to evaluate the influences of different inputs on simulated concentrations.

We hope that the papers in this issue will stimulate further development and confidence building for Eulerian air quality models. We also intend to have this issue be one in a series of major CMAS contributions to state-of-the-art air quality modeling around the world.

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Disclaimer

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