The Community Multiscale Air Quality (CMAQ) Model:
An Interdisciplinary Approach for Multipollutant Modeling Analysis (1.1)

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EPA and the states are responsible for implementing the National Ambient Air Quality Standards (NAAQS) for ozone and particulate matter (PM). New standards for 8-h average ozone and daily average $PM_{2.5}$ concentrations have recently been implemented. Air quality simulation models, such as the Community Multiscale Air Quality (CMAQ) model, are central components of the air quality management process at the national, state, and local levels. The CMAQ model, used for research and regulatory applications by the EPA, states, and others, must have up-to-date science in order to ensure the highest level of credibility for the regulatory decision-making process. The research goals under the CMAQ model development and evaluation program are (1) to develop, evaluate, and refine scientifically credible and computationally efficient process simulation and numerical methods for the CMAQ air quality modeling system; (2) to develop the CMAQ model for a variety of spatial (urban through continental) and temporal (days to years) scales and for a multipollutant regime (ozone, PM, air toxics, visibility, acid deposition); (3) to adapt and apply the CMAQ modeling system to particular air quality/deposition/climate-related problems of interest to EPA, and use the modeling system as a numerical laboratory to study the major science process or data sensitivities and uncertainties related to the problem; (4) to evaluate the CMAQ model using operational and diagnostic methods and to identify needed model improvements; (5) to use CMAQ to study the interrelationships between different chemical species as well as the influence of uncertainties in meteorological predictions and emission estimates on air quality predictions; (6) to collaborate with research partners to include up-to-date science process modules within the CMAQ model system; and (7) to pursue computational science advancements (e.g., parallel processing techniques) to maintain the efficiency of the CMAQ model.

The CMAQ model was initially released to the public by EPA in 1998. Annual updated releases to the user community and the creation of a Community Modeling and Analysis System (CMAS) center that provides user support for the CMAQ system and holds an annual CMAQ users conference have helped to create a dynamic and diverse CMAQ user community of over 1000 users throughout the world. CMAQ has been and continues to be extensively used by EPA and the states for air quality management analyses (SIPs; CAIR, CAMR, RFS-2 rulemakings), by the research community for studying relevant atmospheric processes, and by the international community in a diverse set of model applications. Future research directions include development of an integrated WRF-CMAQ model for two-way feedbacks between meteorological and chemical processes and models, and extension of the CMAQ system to hemispheric scales for global climate-air quality linkage applications and to the neighborhood scale for human exposure applications.