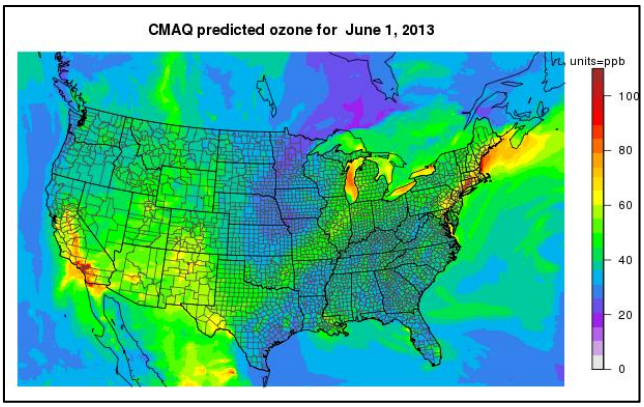
Community Multiscale Air Quality (CMAQ) Model Impact Statement

www.epa.gov/cmaq

Mission Statement: *The CMAQ development team's mission is to protect human health and the environment by providing communities, states and countries with robust tools to characterize and predict the atmospheric fate of air pollutants under varying conditions. To achieve this, we continually refine and update the CMAQ software as new relevant scientific discoveries emerge or user feedback identifies unmet needs.*



Background: Choosing the most effective policies for improving the quality of the air we breathe requires an understanding of the complex physical and chemical processes that determine how air pollutants from thousands of sources interact and move around the world. The Community Multiscale Air Quality (CMAQ) model is a comprehensive computer software package that provides state-of-the-art representation of the processes that affect the fate of airborne pollutants. More than three decades of air pollution research have led to CMAQ, and it continues to evolve scientifically in order to address increasingly complex environmental problems such as those that involve multiple chemicals; can build up over time; and can cross county, state, and national borders.

Why do we need CMAQ? The natural, societal and economic pressures that impact air quality in the U.S. are changing rapidly. Accurate and timely risk assessments are needed to ensure that public health is protected from dangers like smog, air toxics, and smoke from prescribed fires and wildfires. Without a clear and proven understanding of atmospheric processes, efforts to manage air quality will likely be costlier and less effective. Using CMAQ is a reliable and cost-effective way to calculate the potential benefits of air pollution reduction strategies and assess the impact of human influences on the future state of our environment.

Partners: CMAQ is developed and maintained by scientists in EPA's Office of Research and Development, and new versions of the software are made publicly available through regular public releases. This has fostered a vibrant global user community and enabled collaborations with State, Federal, industrial, and academic institutions in the U.S. and around the world to investigate and solve a myriad of air pollution problems. As Ben Grumbles, Maryland Department of the Environment Secretary, said, *"Maryland has made dramatic progress over the*

past 10 years in reducing ozone and fine particle pollution. . . . The CMAQ model has been the key tool we have used to design and refine control strategies. It has helped us find least-cost solutions to reduce ozone and fine particle pollution."

Programs and Activities: CMAQ is used for many purposes including:

- supporting the Clean Air Act and the development of the National Ambient Air Quality Standards (NAAQS) by EPA;
- providing guidance on implementation of the NAAQS to State environmental agencies and EPA Regional Offices;
- providing air quality forecasts to the National Weather Service that are then used to inform public health advisories;
- assessing impacts of changing air pollution levels on human health by EPA and Centers for Disease Control and Prevention (CDC); and
- assessing impacts of polluted rainfall to sensitive ecosystems such as the Chesapeake Bay.

For more examples, please visit www.epa.gov/cmaq/browse-cmaq-applications.

Assurance of Scientific Integrity: Software and scientific publications produced by EPA's Office of Research and Development undergo several levels of internal peer review and quality assurance before release to the public. Once CMAQ software is released, it is publicly available and open source to ensure transparency and reproducibility of results. This is essential for a tool that is used to guide analysis of regulatory decisions. In addition, panels of U.S. and international experts in atmospheric science are convened to peer review new CMAQ versions and the panel's findings are released to the public along with the software to promote the software's sound scientific use. In a typical year, EPA developers and the broad user community will release several hundred publications that also document the software's performance and help guide future research, much of which will be used to improve CMAQ even further.

Resource Requirements: Because CMAQ captures a multitude of complex processes, evolves rapidly with emerging science, is publicly available and is widely-used, its maintenance and continued scientific development require sustaining both 1) a research staff with high levels of atmospheric science experience and 2) access to state-of-the-art and well-maintained high performance computing technology. The loss or stagnation of this tool would jeopardize protection of public health and adequate assessment of Clean Air Act compliance.

Future Vision: The environmental problems emerging today involve complex interactions and inter-dependencies that require powerful tools to ensure that well-meaning actions do not lead to unintended consequences. Currently, CMAQ developers are broadening its scope to take into account atmospheric phenomena from the global-to-continental-to-regional-to-city-to-neighborhood scale. This is important for understanding the impacts of human activities and intervention strategies at all levels. Finally, because environmental pollutants can affect land, water, and air, connections are being developed with other models within and outside of EPA so that the real cumulative effects of pollutants are represented accurately.