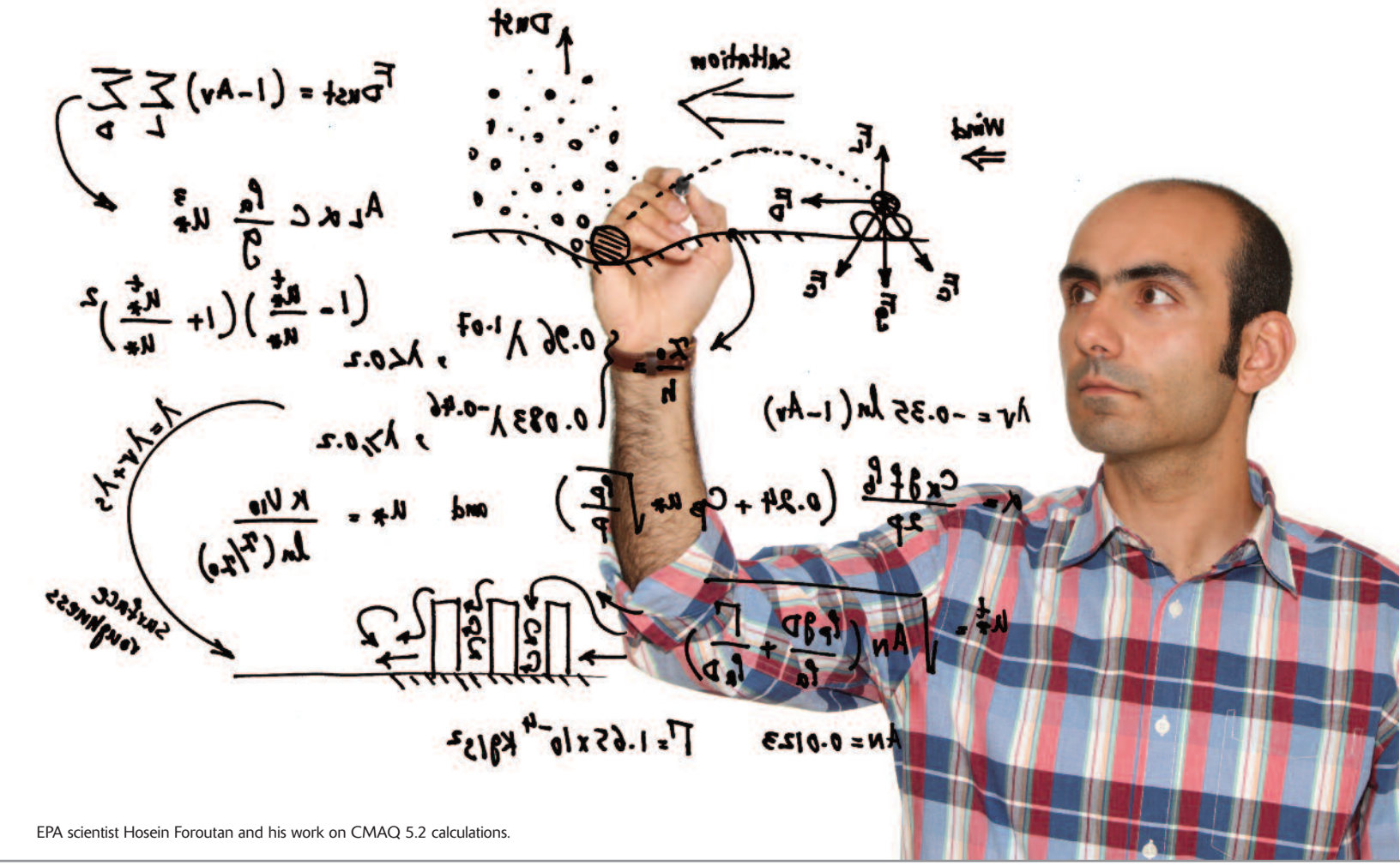

EPA scientist Hosein Foroutan and his work on CMAQ 5.2 calculations.

EPA Releases CMAQ 5.2

Giving states access to state-of-the-art tools for understanding air quality episodes and management

The U.S. Environmental Protection Agency (EPA) has released CMAQ 5.2, the newest version of its Community Multiscale Air Quality (CMAQ) Modeling System. CMAQ is a powerful computational tool that simultaneously model multiple air pollutants, including ozone, particulate matter, and a variety of air toxics, to help environmental managers determine the most effective strategies for improving air quality in their states and communities.

CMAQ 5.2 features numerous updates to modeled meteorological, physical, and chemical processes to better represent how complex mixtures of air pollutants are formed, transported, and eventually removed from the atmosphere. CMAQ is capable of simulating air quality on geographical scales ranging from local to hemispheric scales, which supports investigation into a broad range of air pollution scenarios.

Key Features

New features include:

- **A new windblown dust emission model,** increasing the accuracy of windblown dust emission components across regions;
- **A new gas-phase photochemistry mechanism,** providing users with more accurate models of chemistry in rural and remote environments;

- **Instrumented diagnostic capabilities,** which are additional tools that calculate and track contributions like sulfate production from sources and regions, providing decision-making support for air quality managers; and
- **New pathways to organic aerosol,** which incorporate semivolatile partitioning of primary organic aerosol; parameterized formation of secondary organic aerosol (SOA) from intermediate volatility organic vapors; explicit formation of terpene nitrates; and aqueous-phase formation of biogenic SOA from isoprene epoxide processing.

In addition to science updates, the 5.2 release includes many other improvements like faster model run times, new step-by-step tutorials for getting started with the model, improved error-checking for common model mistakes, and an update to the Atmospheric Model Evaluation Tool (AMET) for evaluating and visualizing model results.

Evolution of the Science

Developments to the CMAQ system are guided by emerging research, air attainment goals, and continual evaluation of model results against measurements from surface, aircraft, and remote-sensing platforms.

The updates in CMAQ 5.2 were designed to provide air quality managers with:

- Improved model simulation of contributions from natural sources, such as wind-blown dust, lightning nitrogen oxide, biogenic particulate matter precursor species, and stratospheric ozone. By identifying these non-controllable emissions, air quality managers can obtain a more robust examination of emission strategies from controllable sources;
- Improved representation of primary organic aerosol contribution to ambient particulate matter, enabling more accurate assessments of fine particulate matter exposure in urban areas; and
- Consistent representation of atmospheric processes from local to hemispheric scales enabling improved examination of U.S. air quality amidst the changing global atmosphere.

Dr. Dan Costa, EPA National Program Director for Air, Climate, and Energy Research, spoke about the ability to apply CMAQ 5.2 to assess the likelihood of localized stratospheric ozone as a contributor to background ozone levels: "Background ozone remains a conundrum in many state implementation plans to regulate this air pollutant and protect public health. These updates provide new insights into this complex phenomenon and help develop control strategies," Dr. Costa said.

Users and Case Studies

CMAQ is used by air quality managers, atmospheric research scientists, environmental and public health professionals, and others in private, academic, and government organizations. Many use CMAQ to more efficiently implement EPA's National Ambient Air Quality Standards that protect public health from unsafe levels of air pollutants.

In the United States, the Centers for Disease Control and Prevention uses CMAQ data in community-focused tools that allow the public easy access to county-specific air quality information on ozone and particulate matter. These tools promote awareness for individuals with asthma and other respiratory-related ailments by helping them protect their health. Additionally, the National Weather Service applies CMAQ to produce air quality forecasts twice daily to alert sensitive groups of high pollution days.

Impact

CMAQ has been enabling users to address complex air quality issues for almost two decades, helping states and communities solve challenges with meeting the National Air Quality Standards and determine which emissions control measures are needed to meet U.S. Clean Air Act requirements. CMAQ is also used to tackle long-range transport of pollution across nations and for predicting air toxics risks. Currently, 27 states use CMAQ and it is recognized worldwide as a premier modeling tool with users in more than 50 countries. With the transport of air pollutants across continents, this tool is helping to address worldwide air pollution.

In October 2016, EPA celebrated the 15th anniversary of its partnership with the Community Modeling and Analysis System (CMAS) Center (http://www.cmascenter.org) that has provided a variety of services to the user community. CMAS organizes a high-impact national conference annually, moderates user email exchanges, and provides training for users of the CMAQ modeling system.

The new source code for CMAQ 5.2 is available through a publically-accessible, version-controlled git repository on GitHub (http://www.github.com/usepa/cmaq), where interested parties may obtain the open-source software and contribute to enhancements of the model. Resources for new and experienced CMAQ 5.2 users, including scientific documentation, tutorials and test case data, are available on the CMAQ website (https://www.epa.gov/cmaq).

Future Enhancements

The CMAQ team is continuing work on making the modeling system more robust and cost effective for states, air quality managers and public health officials. One way researchers are focusing their efforts is toward using CMAQ to assess the impact of wildfires on states. Currently, scientists face a complex problem in characterizing the transport of wildfire smoke. Future CMAQ endeavors include studying the magnitude of wildfire smoke and how it is distributed vertically in the atmosphere. Visit the Ongoing Research and Development page (http://www.epa.gov/cmaq/ongoing-cmaq-research-and-development) of the CMAQ website to learn about more upcoming developments to the modeling system. **em**

More Information

Visit the CMAQ website (https://www.epa.gov/cmaq).

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