The National Air Quality Forecasting Capability

Jeff McQueen
Environmental Modeling Center
NCEP/NWS/NOAA/DOC
College Park, MD 20740
e-mail: Jeff.mcqueen@noaa.gov

The United States National Weather Service National Air Quality Forecasting Capability (NAQFC) system is an off-line coupled atmospheric chemical concentration forecasting modeling system using the National Centers for Environmental Predictions (NCEP) North American Meso-scale non-hydrostatic Model (NAM/NMMB) to drive the Environmental Protection Agency (EPA) Community Multi-scale AQ model (CMAQ) with the CB05 gaseous and AERO4 aerosol chemistry options -- run at 12 km horizontal resolution to 48 hours twice per day. CMAQ solves the material continuity equation for the chemical constituents in the troposphere. In so doing it provides forecasts for surface ozone (O3) and fine particulate matter (PM) concentrations for the nation. Chemical lateral boundary conditions for inflow are adopted from a species mapping methodology (Tang et al., 2009), matching constituents between the CMAQ with those from a global Harvard University GEOS-Chem model climatology. Tests incorporating the NWS NGAC predicted aerosols at the CMAQ lateral boundary conditions are on-going with operational implementation expected later in 2015.

The emission dataset is built on top of the 2011 National Air Quality Forecasting Capability (NAQFC) 2011 baseline data, but with four major updates: (a) new point source emissions with updated emission measurements and energy projections; (b) new mobile source emissions updated to 2012 based on a trends from the U.S. EPA surface monitoring network corroborated with satellite trends for the same constituents (Tong et al., 2015); (c) new off-road emissions projected to 2012; and (d) updated Canadian emission sectors from Environment Canada (EC) 2012 emission inventories and the Mexican 2010 National Inventory for Mexico. The NOAA Hazard Mapping System (HMS) is used to detect wild fires over the Nation. The HMS product is then used to drive the U.S. Forest Service BlueSky wild fire emissions system. Other intermittent sources are also included. Finally, A Kalman filter based bias correction scheme (Djalalova, et al. 2015) has provided improved PM prediction skill that should result in improved guidance for State environmental agencies responsible for air quality alerts.

References

Djalalova, I., L. Delle Monache., J. Wilczak (2015): PM2.5 analog forecast and Kalman filter post-processing for the Community Multiscale Air Quality (CMAQ) model, Atmospheric Environment, 108,

76-87, doi:10.1016/j.atmosenv.2015.02.021.

Tang, Y., P. Lee, M. Tsidulko, H.-C. Huang, J. T. McQueen, G. J. DiMego, L. K. Emmons, R. B.Pierce, H.-M. Lin, D. Kang, D. Tong, S. Yu, R. Mathur, J. E. Pleim, T. L. Otte, G. Pouliot, J. O. Young, K. L. Schere, P. M. Davidson, I. Stajner (2009): The Impact of Chemical Lateral Boundary Conditions on CMAQ Predictions of Tropospheric Ozone over the Continental United States, Environmental Fluid Mechanics, 9 (1), 43-58, doi:10.1007/s10652-008-9092-5.

Tong, D.Q , L. Lamsal, L. Pan, C. Ding, H-C. Kim, P. Lee, T. Chai, K. E. Pickering, I. Stajner (2015): Long-term NOx trends over large cities in the United States during the Great Recession Comparison of satellite retrievals, ground observations, and emission inventories Atmospheric Environment 01/2015; 109. DOI:10.1016/j.atmosenv.2015.01.035