

## NOAA's National Air Quality Forecast Capability for Ozone and Fine Particulate Matter

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The NOAA National Air Quality Forecast Capability, NAQFC, provides two day model forecasts of ozone and fine particulate matter surface concentrations twice per day at the 06 and 12 UTC cycles. The NAQFC operational forecast for ozone (O<sub>3</sub>) for the nation was implemented in September 2007 and for fine particulate matter (PM<sub>2.5</sub>) in January 2015 (Lee, et al., 2017). The NAQFC is made up of the North American Non-Hydrostatic Multiscale Model (NAM-NMMB) 12 km numerical weather prediction model and the EPA Community Model for Air Quality (CMAQ) using Carbon Bond-V (CB-V) gas phase chemistry and AERO-VI particulate matter processing (Fig. 1). Predictions are available in real-time for the continental U.S., Alaska and Hawaii.

Offline coupling between NAM and CMAQ is achieved at hourly intervals by interpolation from the NAM to the CMAQ horizontal and vertical grids. Anthropogenic emissions are updated monthly from the EPA National Emission Inventory for the base year 2014V2. Wild fire smoke emissions were included in 2015 and are based on the U.S. Forest Service BlueSky smoke emission system and the NESDIS Hazardous Mapping System (HMS) fire locations which are updated daily. Dust emissions were also included in 2015 using a friction velocity- and soil moisture criteria-based approach. Dust lateral boundary conditions are provided by the NCEP NEMS Global Aerosol Capability (NGAC) V2 with climatological values from NASA GEOS-Chem for other species (Lu, et al., 2016; Wang, et al., 2018). The number of vertical levels was increased to 35 and an analog bias correction for PM<sub>2.5</sub> was implemented in 2016, with upgrades to CMAQ (to V5.0.2), emissions and PM<sub>2.5</sub> bias correction (Huang, et al., 2017) implemented in 2017 and inclusion of ozone bias correction in 2018. Predictions are available to U.S. state air quality forecasters and the public from the NWS National Digital Guidance Database (NDGD): <http://airquality.weather.gov/> with experimental model predictions at <http://www.emc.ncep.noaa.gov/mmb/aq/>.

In 2018, a Kalman Filter Analog bias correction was improved to capture rare events and extended to both ozone and PM<sub>2.5</sub>. Oil and gas sector emissions were also updated. Tests with a Unified Forecast System (UFS) based on global Finite Volume (FV3) model predictions were begun. In 2019, smoke emissions from the NOAA/NESDIS Global Biomass Burning Emissions Product (GBBEPx) with fire radiative power (for plume rise) will be coupled to NAM-CMAQ as well as NGAC V3. NGACV3 is based on FV3GFS dynamic core inline aerosol global model at ~ 25 km out to 5 days with expected implementation in 2020. These changes to NAM-CMAQ along with updates to anthropogenic emissions and the extension of regional forecasts to 72 hours are also expected to be implemented in 2020.

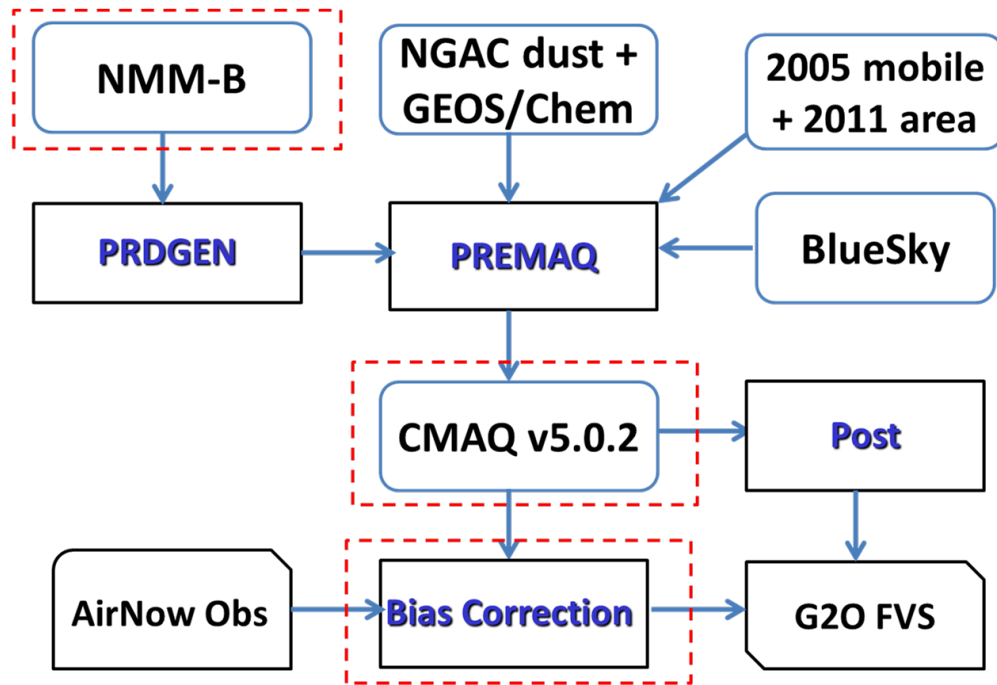


Figure 1. Overview of NAQFC NAM/NMMB-CMAQ system. CMAQ was upgraded to V5.0.2 and bias correction was improved to a Kalman Filter Analog (KFAN) technique in 2017 and 2018.

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