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Operational air quality forecast guidance for the United States

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NOAA provides operational air quality predictions for ozone and wildfire smoke over the United States (U.S.) and predictions of airborne dust over the contiguous 48 states at http://airquality.weather.gov. These predictions are produced using U.S. Environmental Protection Agency (EPA) Community Model for Air Quality (CMAQ) and NOAA's HYSPLIT model (Stein et al., 2015) with meteorological inputs from the North American Mesoscale Forecast System (NAM). The current efforts focus on improving test predictions of fine particulate matter (PM2.5) from CMAQ. Emission inputs for ozone and PM2.5 predictions include inventory information from the U.S. EPA and recently added contributions of particulate matter from intermittent wildfires and windblown dust that rely on near real-time information. Current testing includes refinement of the vertical grid structure in CMAQ and inclusion of contributions of dust transport from global sources into the U.S. domain using the NEMS Global Aerosol Capability (NGAC). The addition of wildfire smoke and dust contributions in CMAQ reduced model underestimation of PM2.5 in summertime. Wintertime overestimation of PM2.5 was reduced by suppressing emissions of soil particles when the terrain is covered by snow or ice. Nevertheless, seasonal biases and biases in the diurnal cycle of PM2.5 are still substantial. Therefore, a new bias correction procedure based on an analog ensemble approach was introduced (Djalalova et al., 2015). It virtually eliminates biases in monthly means or in the diurnal cycle, but it also reduces day-to-day variability in PM2.5 predictions. Refinements to the bias correction procedure are being developed. Upgrades for the representation of wildfire smoke emissions within the domain and from global sources are in testing. Another area of active development includes approaches to scale emission inventories for nitrogen oxides in order to reproduce recent changes observed by the AirNow surface monitoring network and by satellite instruments (Tong et al., 2015) and to use these updated emissions to improve ozone predictions (Pan et al., 2015). An overview of the impacts of these recent and ongoing efforts to improve predictions of ozone, smoke and PM2.5 will be presented.

Djalalova, I. et al., 2015: PM2.5 analog forecast and Kalman filter post-processing for the Community Multiscale Air Quality (CMAQ) model. Atmospheric Environment, doi:10.1016/j.atmosenv.2015.05.057.

Pan L. et al., 2014: Assessment of NO_x and O_3 forecasting performances in the U.S. National Air Quality Forecasting Capability before and after the 2012 major emissions updates. Atmospheric Environment, doi: 10.1016/j.atmosenv.2014.06.020.

Stein, A. et al., 2015: NOAA's HYSPLIT atmospheric transport and dispersion modeling system. Bull. Amer. Meteor. Soc., doi:10.1175/BAMS-D-14-00110.1.

Tong, D.Q. et al., 2015: Long-term NO_x trends over large cities in the United States during the great recession: Comparison of satellite retrievals, ground observations, and emission inventories. Atmospheric Environment, doi:10.1016/j.atmosenv.2015.01.035.