Emission Data Assimilation to Support NAQFC Real-Time $PM_{2.5}$ Forecasting: A New NOAA Service

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In November 2015, NOAA started to provide to the public real-time PM2.5 forecasting, a new service that have been long awaited by state/local environmental agencies. This work introduces the new development of the emission forecasting capability to support NOAA PM2.5 forecasting operation. Real-time air quality forecasting (AQF) imposes specific requirements on the emission data used to drive chemical transport models. Among others, AQF requires 1) effectively reducing time lag of anthropogenic emission updates and 2) accurately accounting for natural and intermittent emission sources. We report here the recent efforts made by our team to address these issues. Due to the cost and time needed to compile comprehensive national emission inventories (NEIs), even the latest NEIs are 3-5 years behind the forecast year. The time lag inherent in emission inventory updates is a bottleneck for forecasters to improve the accuracy of O_3 and $PM_{2.5}$ forecasts. To alleviate the effect of the time lag, NAQFC is developing an emission data assimilation algorithm for rapid refreshing of anthropogenic NOx emissions through assimilating fused ground and satellite NO_2 observations. To account for the contribution of natural sources, NAQFC is testing emission algorithms of several new sources, including dust, fire, and marine phytoplankton. A new windblown dust emission model, called FENGSHA, was implemented in the NAQFC system. This model calculates dust emissions based on a modified Owen's equation and the threshold friction velocity determined by wind tunnel experiments conducted over a variety land use types and soil texture types. We have also developed a marine isoprene emission algorithm based on the ocean color data retrieved from the VIIRS abroad Soumi-National Polar-orbiting Partnership (SNPP). The marine isoprene emission data have been compared against in-situ measurements collected at various open-sea and near-shore sites around the globe, showing that the retrieved emission flux is generally within the range of these measurements.