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ABSTRACT TITLE: ON THE ASSIMILATION OF SATELLITE RETRIEVALS OF AEROSOL OPTICAL DEPTH TO IMPROVE 0-48 H AIR QUALITY PREDICTIONS OVER THE U.S.

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Abstract. The National Oceanic and Atmospheric Administration (NOAA) / National Centers for Environmental Prediction (NCEP) operational National Air Quality Forecasting Capability (NAQFC) is one of the key tools used by decision makers across the U.S. to protect the public from adverse air pollution-related health effects by dispensing timely information about air pollution episodes. This project funded by the National Aeronautics and Space Administration (NASA) aims to enhance the decision-making activity by improving the accuracy of NAQFC 0-48 h predictions of ground-level ozone and particulate matter less than 2.5 µm in diameter (PM2.5) and to provide reliable quantification of their uncertainty. We will present results on improving the initialization of the NOAA/NCEP operational air quality prediction system, which is based on the Community Multiscale Air Quality (CMAQ) model. Chemical data assimilation of retrievals of aerosol optical depth from the NASA Aqua/Terra Moderate Resolution Imaging Spectroradiometer (MODIS) is performed within the Community Gridpoint Statistical Interpolation (GSI) system.

We have developed capabilities within GSI to read/write CMAQ data, a forward operator that calculates aerosol optical depth at 550 nm from CMAQ aerosol chemical composition, and an adjoint of the forward operator that calculates the sensitivity of AOD to the aerosol chemical composition. The generalized background error covariance GEN_BE program has been extended to calculate the background error covariance using CMAQ output. Also, we have designed a procedure to explore the uncertainty of emission fields used as input to CMAQ, to improve the vertical distribution of GSI increments, particularly in the surface proximity. Results will be shown for experiments over the continental U.S. during 15 July to 14 Aug 2014, which is also the period when the Front Range Air Pollution and Photochemistry Éxperiment (FRAPPÉ) was held. FRAPPÉ provides additional independent data for evaluating the new GSI/CMAQ system.