

Evaluation of NCEP model Planetary Boundary Layer Mixing Processes and Impacts on Air Quality

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Operational air quality predictions for the United States (U. S.) are provided from NOAA by the National Air Quality Forecasting Capability (NAQFC). NAQFC provides nationwide operational predictions of ozone and particulate matter. Predictions are produced twice per day (at 06 and 12 UTC cycles) at 12 km resolution and 1 hour time intervals through 48 hours and distributed at <http://airquality.weather.gov>. The NOAA National Centers for Environmental Prediction (NCEP) operational North American Multi-scale (NAM) 12 km weather prediction is used to drive the Community Multiscale Air Quality (CMAQ) model. Recently, NCEP with other NOAA labs and research communities has developed the Next Generation Global Prediction System (NGGPS) based on the Finite Volume Cubed Sphere core FV3 model as it Unified Forecasting System (UFS). FV3GFS is run at similar resolutions (13 km) to the NAM while mainly using the standard NCEP global model physics. Simple aerosol chemistry is also being incorporated into FV3GFS and is designed to replace the NCEP operational NEMS Global Aerosol Capability that uses the Global Forecast System Spectral core and physics. The transition to FV3 should allow for unification of regional and global atmospheric composition predictions models. However, the transition and unification is only possible if the results of using FV3GFS to drive atmospheric composition models are favorable.

The boundary layer mixing schemes used by NAM and FV3GFS employ very different mechanisms (eg: local vs non-local vertical mixing) that could have important impacts on air quality prediction. This presentation will evaluate the ability of the FV3GFS for capturing boundary layer processes important for driving air quality prediction as compared to the operational NAM. The weather models will be evaluated for both summer and winter against standard and mesonet fields averaged for various regions with emphasis on the evaluation of meteorological fields important to prediction of ozone and fine particulate matter (eg: near surface winds, temperatures, moisture and boundary layer heights, cloud cover). Finally, a comparison of CMAQ model performance using NAM and FV3 meteorological predictions will be presented.