

Prediction of fine particulate matter (PM2.5) by the NAQFC



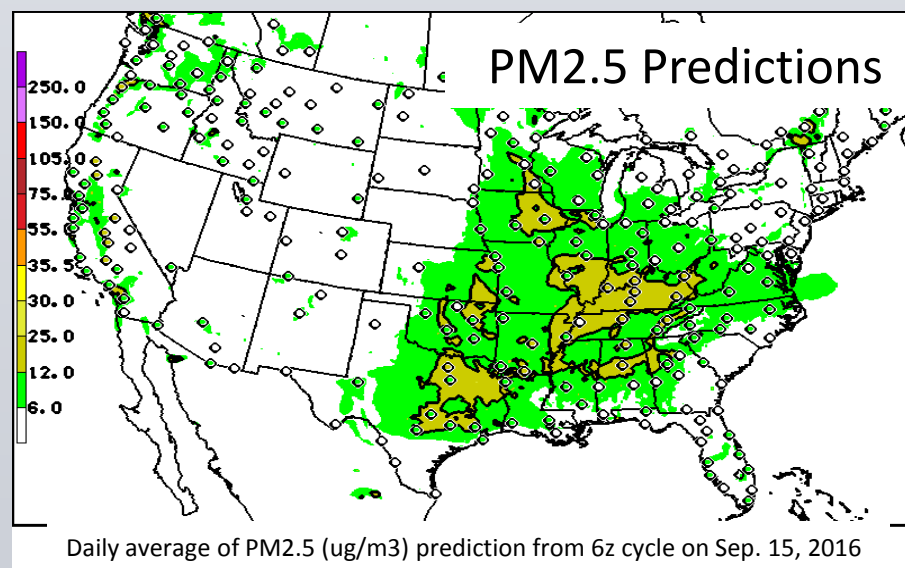
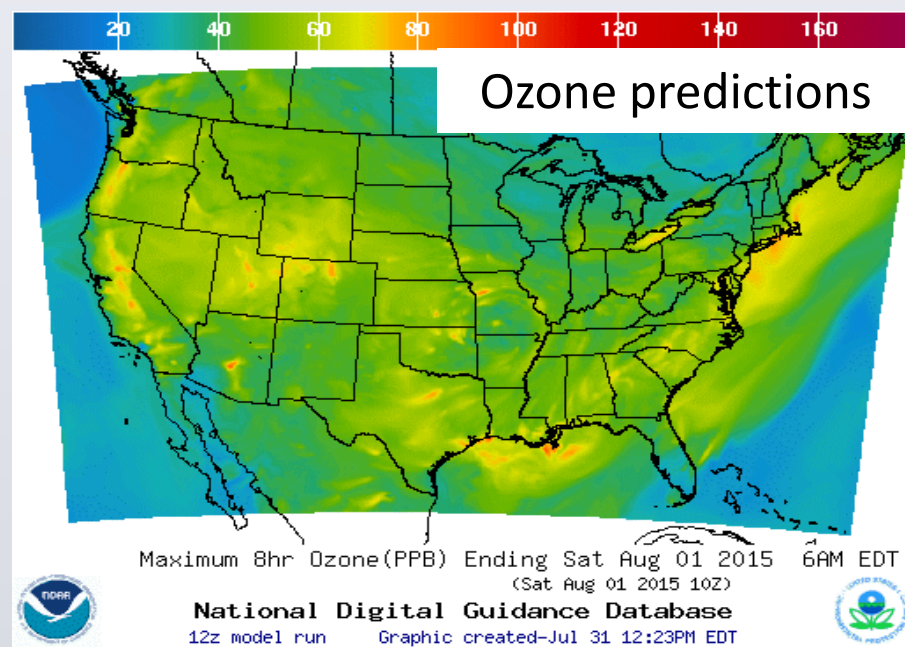
Ivanka Stajner¹, Jeff McQueen², Pius Lee³, Jianping Huang^{2,4}, Li Pan^{3,5}, Ho-Chun Huang^{2,4}, Daniel Tong^{3,5}, Ariel Stein³, Phil Dickerson⁶, Sikhya Upadhayay^{1,7}

¹ NOAA/NWS/STI, ² NOAA/NWS/NCEP, ³ NOAA ARL, ⁴IMSG, ⁵CICS, ⁶EPA and ⁷Syneren Technologies

National Air Quality Forecast Capability (NAQFC) operational predictions

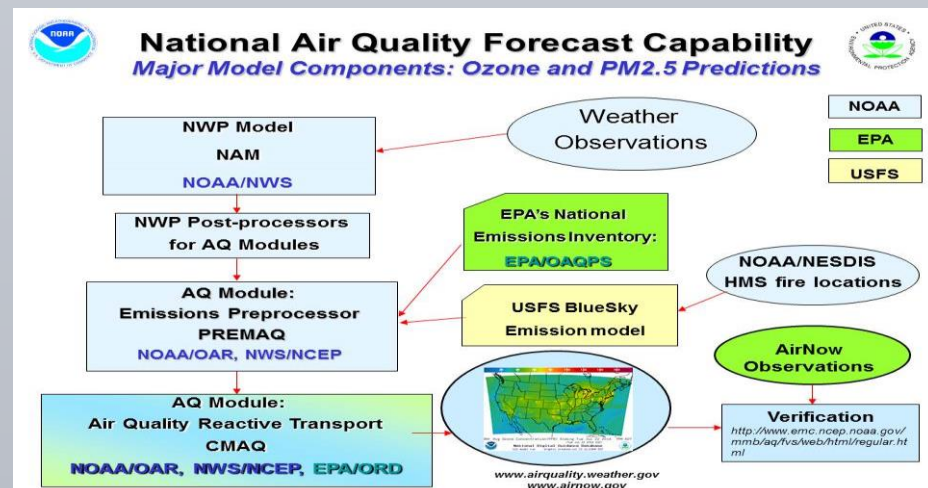
- PM2.5 - nationwide from CMAQ-NAM since February 2016
- Ozone - nationwide from CMAQ-NAM
- Smoke - nationwide from HYSPLIT-NAM
- Dust - for 48 states from HYSPLIT-NAM

Ozone, smoke and dust predictions are available at <http://airquality.weather.gov/>



Importance of Air Quality Predictions

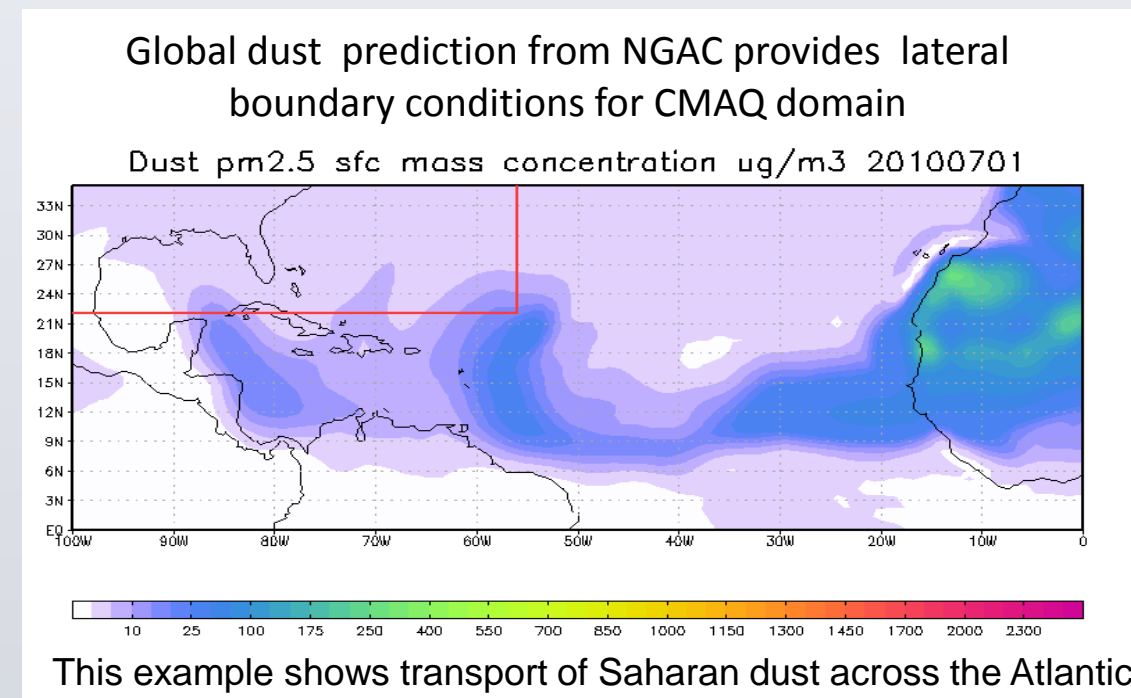
- Air Quality effect on health: 60,000 premature deaths annually in the US
- Air quality predictions provide advance information to help people limit their exposure to poor air quality, reduce respiratory and cardiovascular problems, and even save lives.



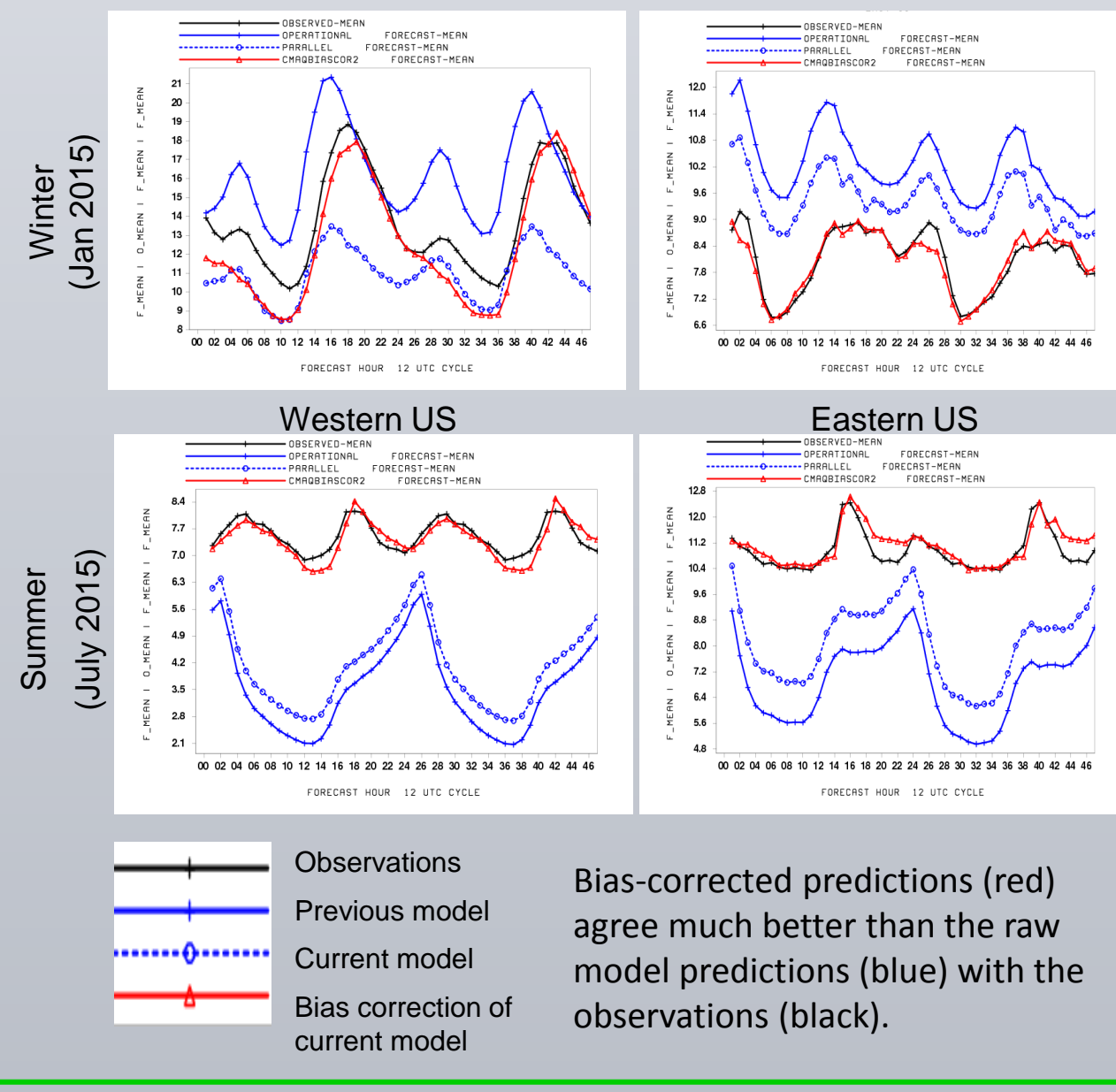
Ivanka Stajner (ivanka.stajner@noaa.gov)

CMAQ Model Upgrade in February 2016 - currently operational model

- First public release of raw model predictions and bias-corrected PM2.5 predictions from CMAQ based on v4.6
- Lateral boundary conditions from a global dust model and a GEOS-Chem climatology for gaseous species
- Increased vertical resolution from 22 to 35 levels
- Analog forecast technique for PM2.5 bias correction (Djalalova et. al. and Huang et. al.)

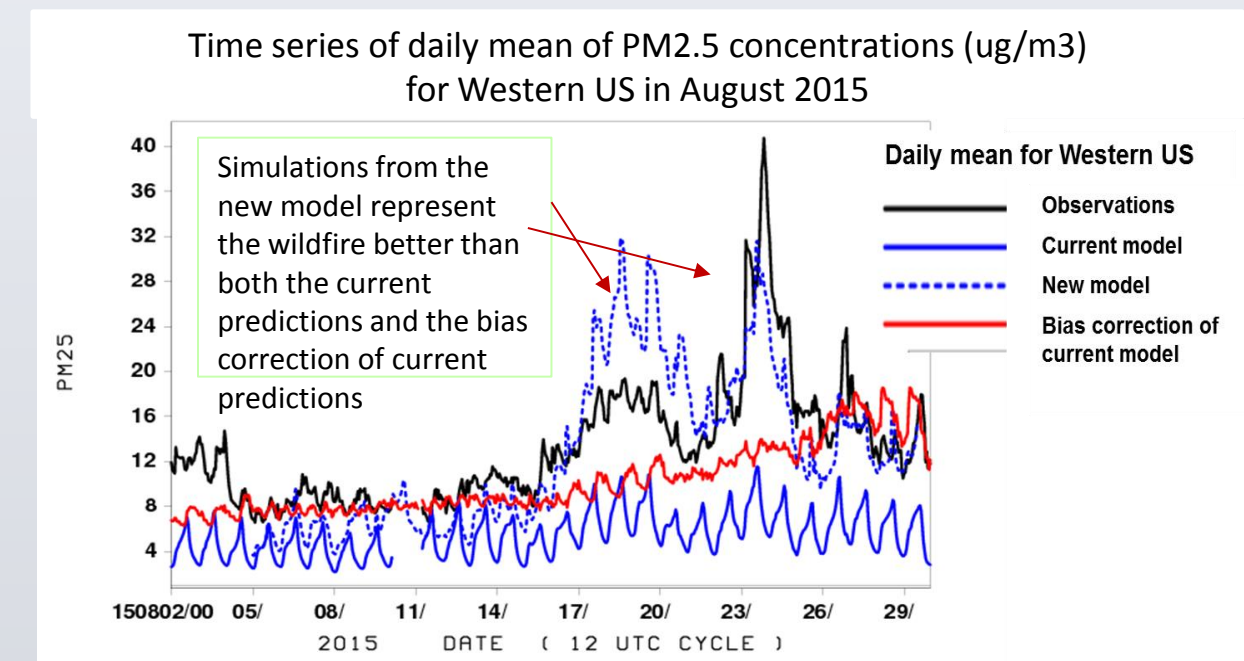


Regional mean of PM2.5 for each of the 48 prediction hours



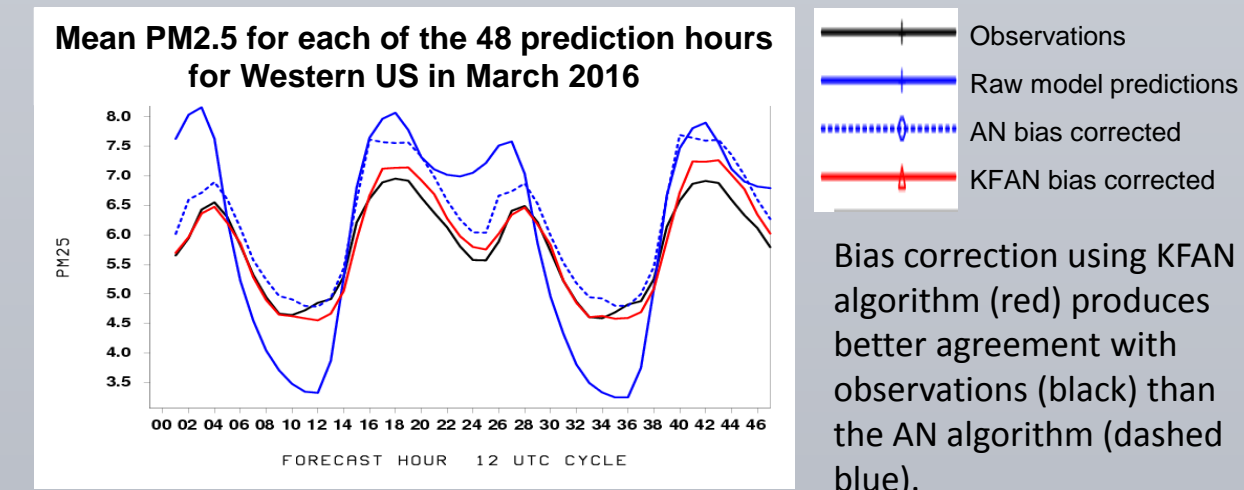
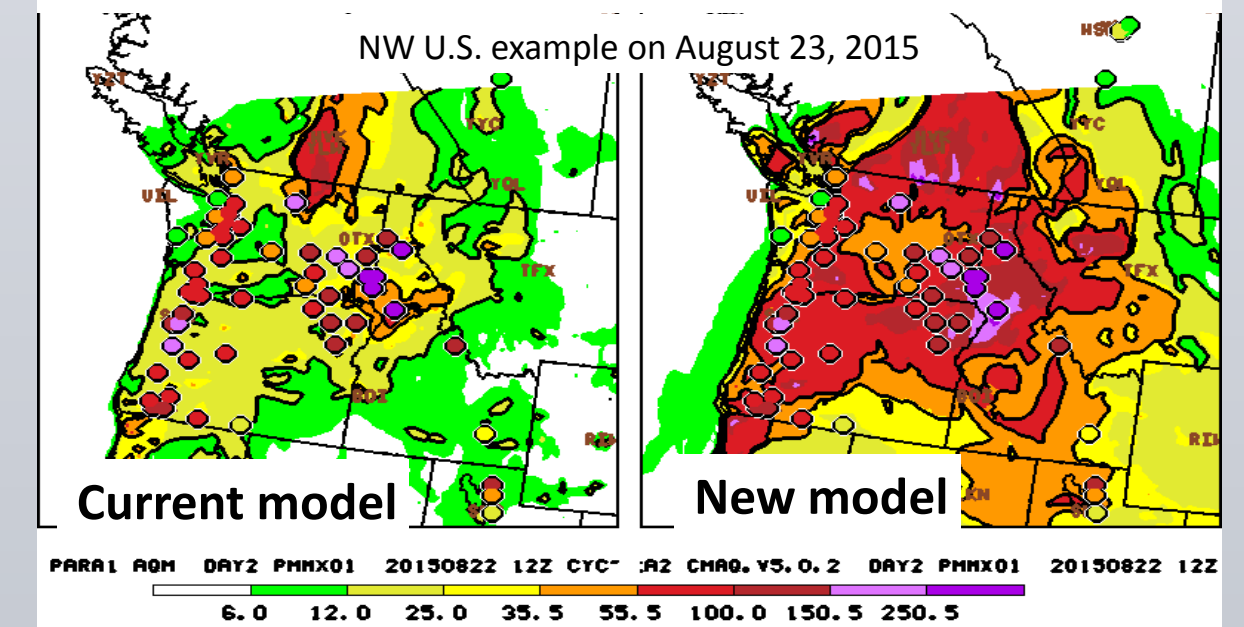
FY17 Plans - new model in testing

- Update to CMAQ v5.0.2
- Better representation of wildfire smoke emissions (updated BlueSky system and 24-hour "analysis cycle" to include emissions when they were observed)
- Updated mobile NOx emissions
- Update of bias correction method to KFAN (Kalman Filter Analog)
- Use updated NAMx meteorology



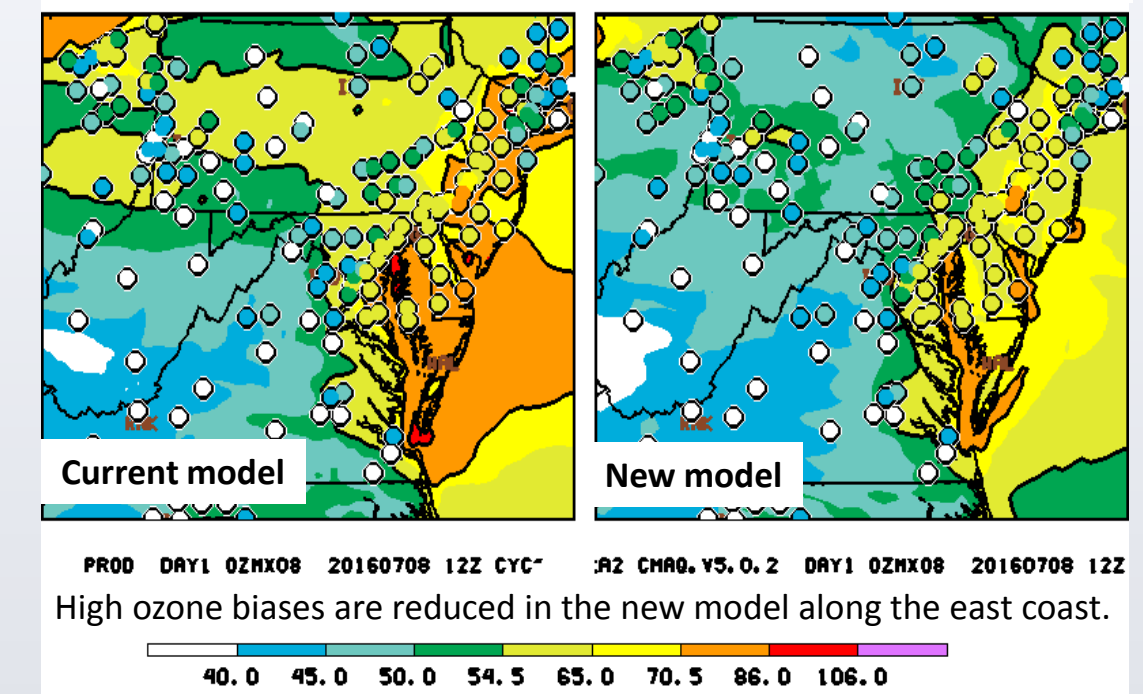
Predicted daily max of hourly average PM2.5

New model produces higher PM2.5 concentrations that agree with observed values (circles) much better than the current model.



Daily maximum of 8 hour average ozone concentrations

Example for Midatlantic region on July 8, 2016



Summary

- First public release of operational PM2.5 predictions
- Updated BlueSky and inclusion of wildfire emissions using 24-hour "analysis cycle" provide improved PM2.5 predictions especially near forest fires
- CMAQ 5.0.2 with updated NOx emissions reduces ozone overpredictions in the eastern U.S.
- Initial testing with KFAN bias correction method shows further improvements over the operational analog forecast technique

Plans

- Continued testing of CMAQ 5.0.2 for potential transition to operations
- Update display, dissemination and web presence
- Linkage with additional aerosols from global predictions
- Extend predictions to 72 hours
- Finer resolution of predictions (longer term)

References

- Lee et al. (2016): NAQFC developmental forecast guidance for PM2.5, Weather and Forecasting. <http://journals.ametsoc.org/doi/abs/10.1175/WAF-D-15-0163.1>
- Djalalova et. al. (2015): PM2.5 analog forecast and Kalman filter post-processing for CMAQ model, Atmospheric Environment, 108, 76-87.
- Tong et. al. (2015): Long-term NOx trends over large cities in the United States during the 2008 Recession, Atmospheric Environment, 107, 70-84.
- Huang et. al. (2016): Improving NOAA NAQFC PM2.5 predictions with a bias correction approach, manuscript submitted to Weather and Forecasting.
- Lu et. al. (2016): The implementation of NEMS GFS Aerosol Component (NGAC) Version 1.0 for global dust forecasting at NOAA/NCEP, Geosci. Model Dev., 9, 1905-1919.

For more information please visit http://www.weather.gov/sti/stimodeling_airquality