



Ozone and PM_{2.5} Forecasting Research

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Air Resources Laboratory

ARL Laboratory Review
May 3-5, 2011



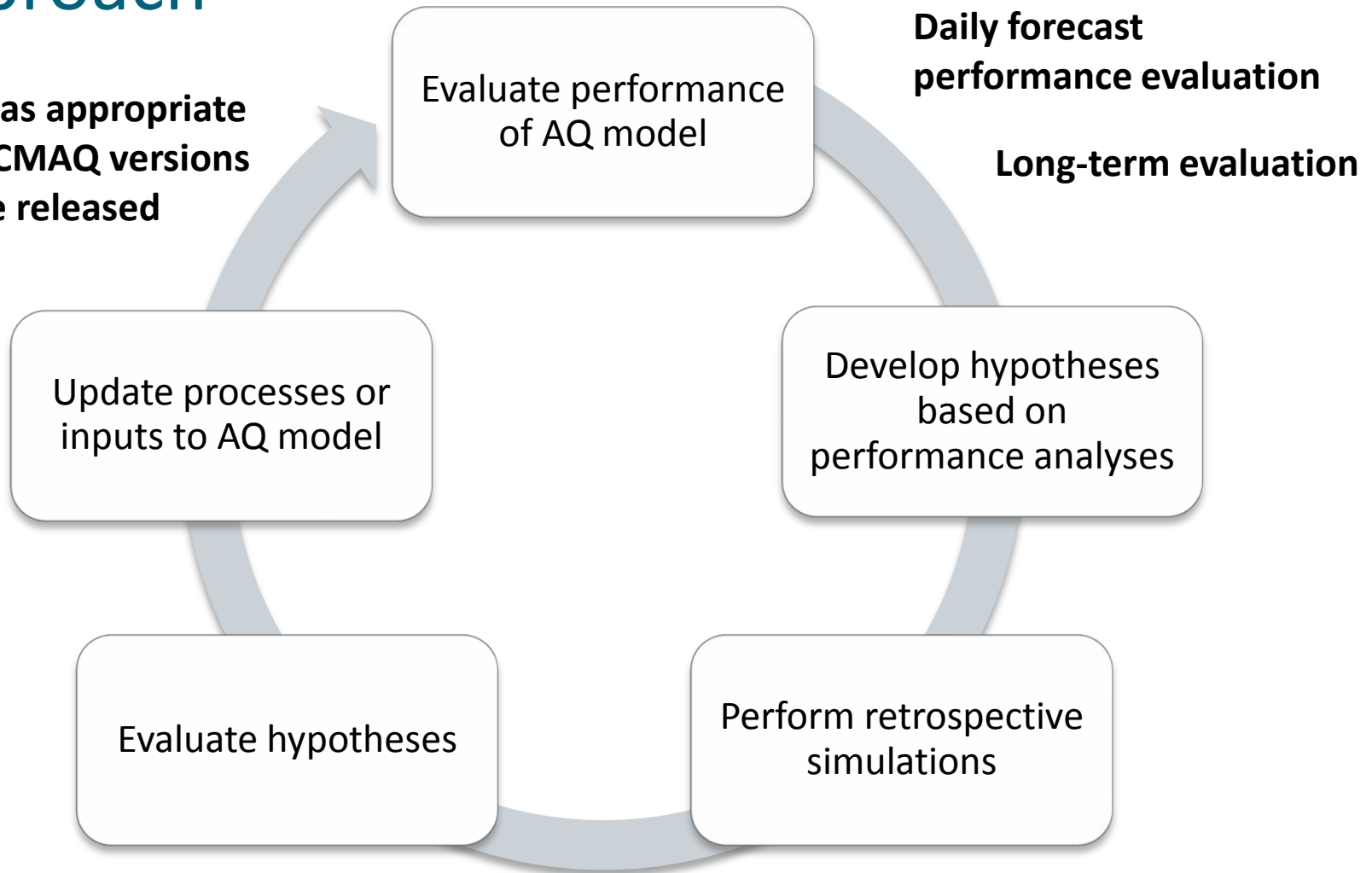
Goal

- Improve the ozone (O_3) and fine particulate matter ($PM_{2.5}$) forecasting capabilities of air quality models through scientifically sound improvements in model processes and model inputs.



Approach

**Update as appropriate
as new CMAQ versions
are released**



Daily Forecast Discussion

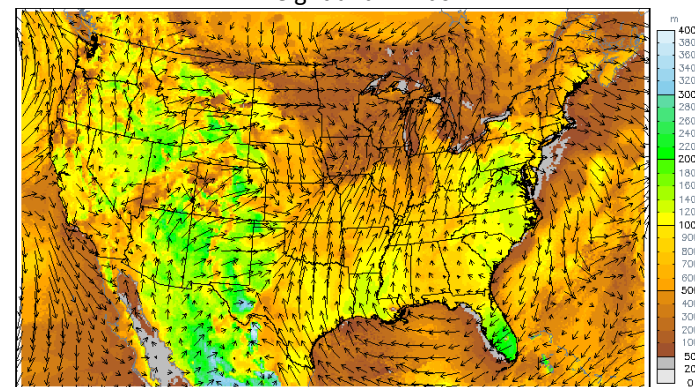
NO Emissions



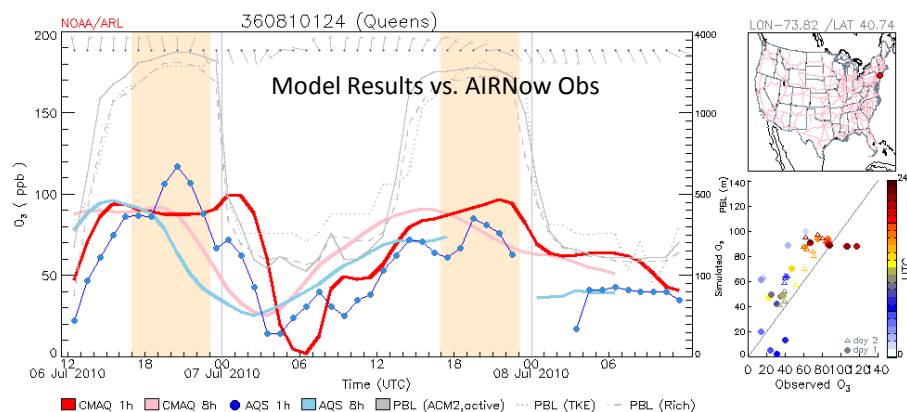
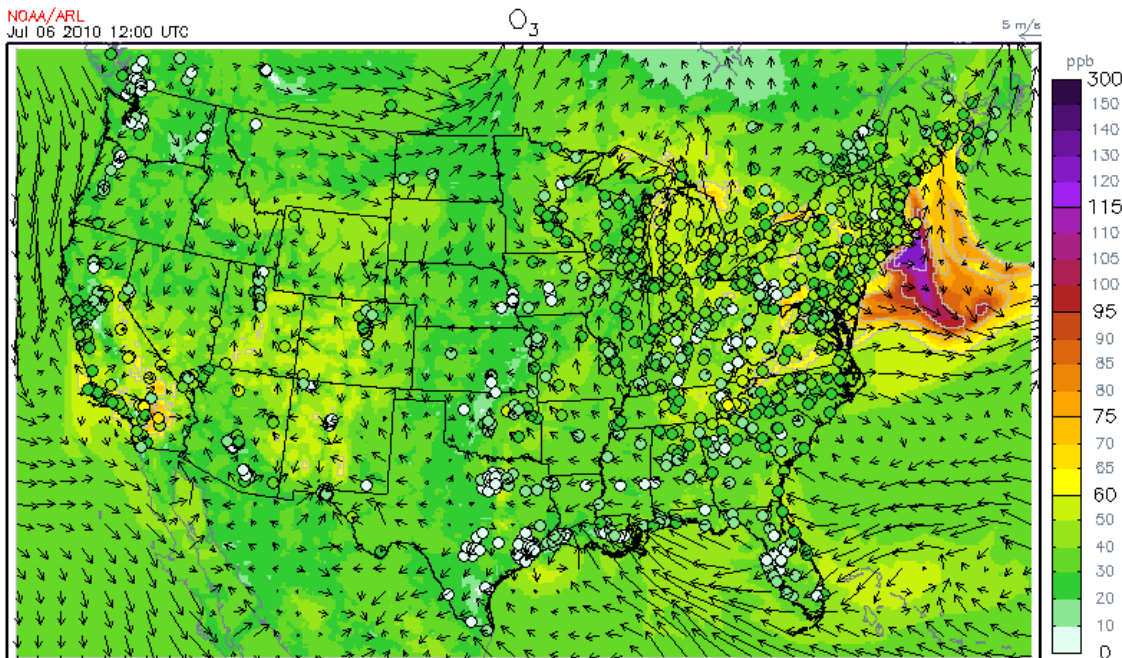
Isoprene Emissions



PBL Height and Winds

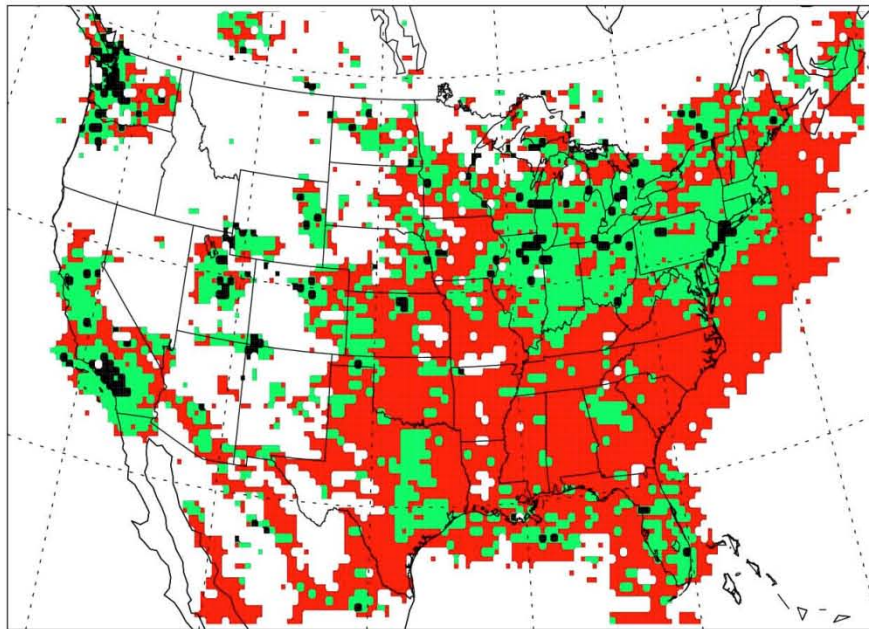


NOAA/ARL
Jul 06 2010 12:00 UTC

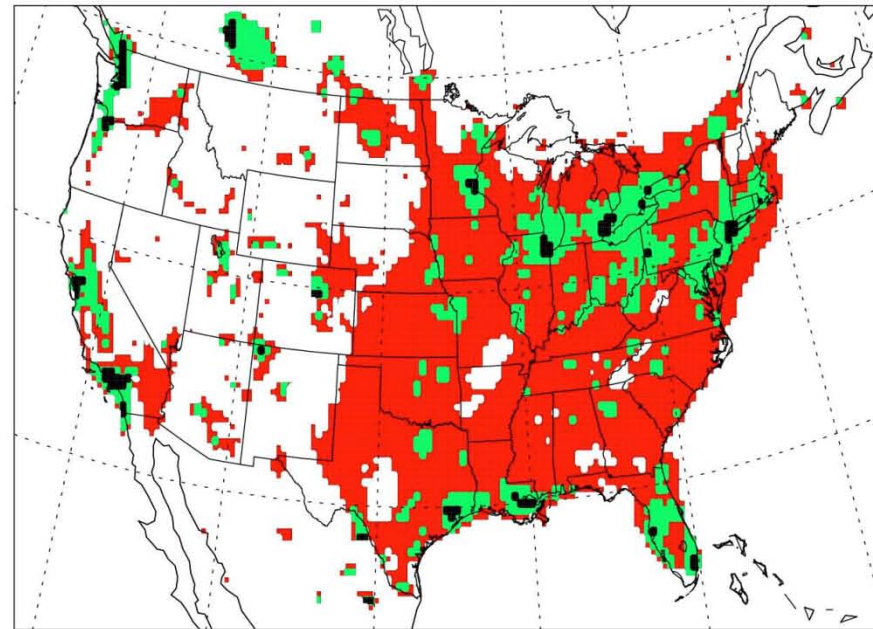


HCHO/NO₂ - August 2009

GOME-2 Satellite Data

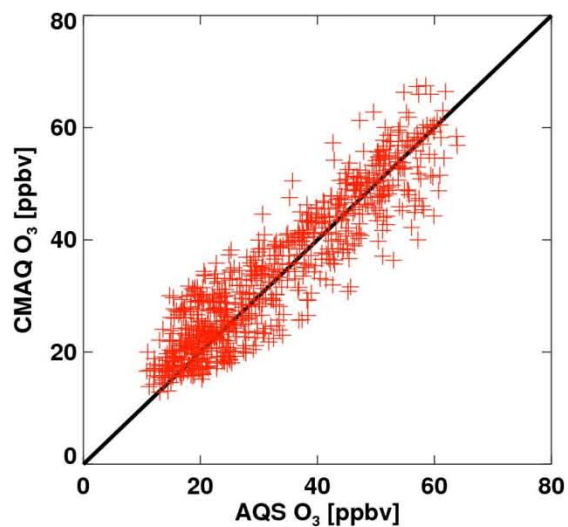


CMAQ 4.7.1

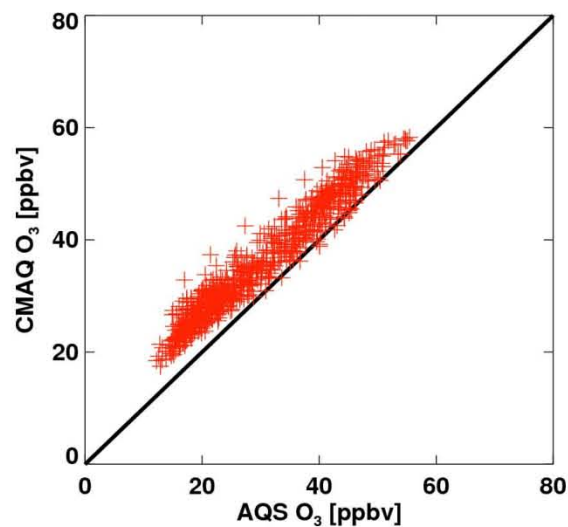


Ozone Biases by Chemical Regime

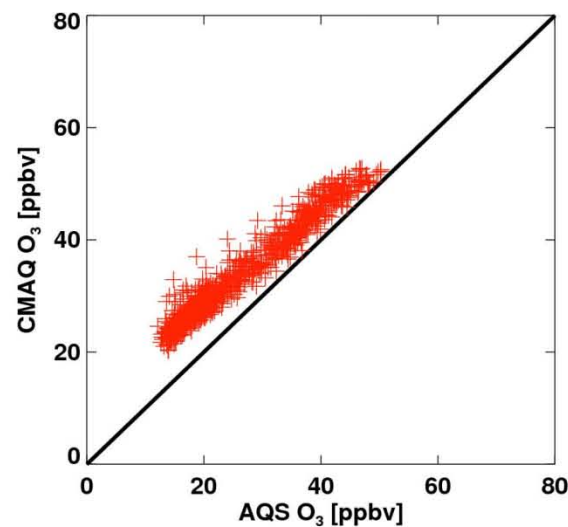
NO_x -saturated



mixed



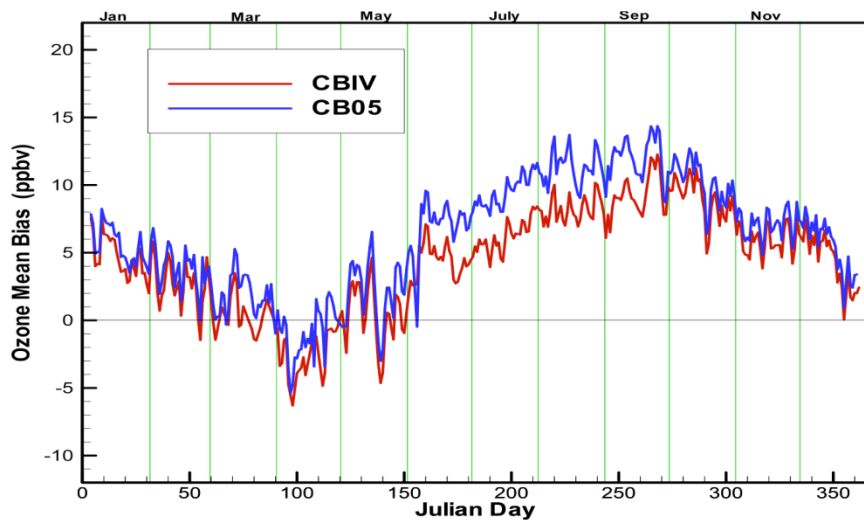
NO_x -sensitive



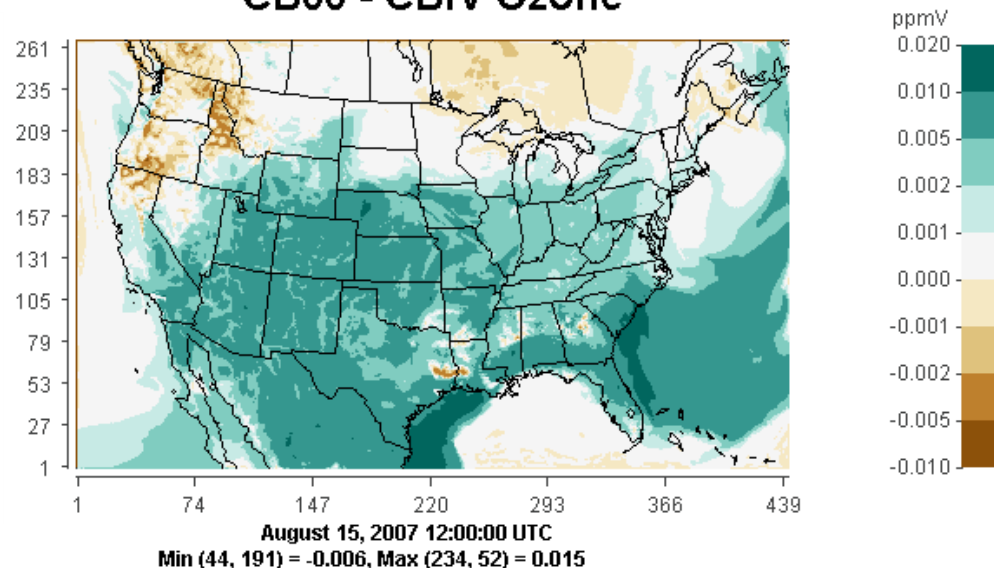
Possible causes?

- Emissions
- Deposition
- Transport
- Chemistry

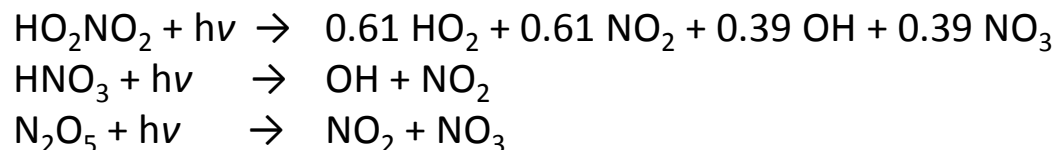
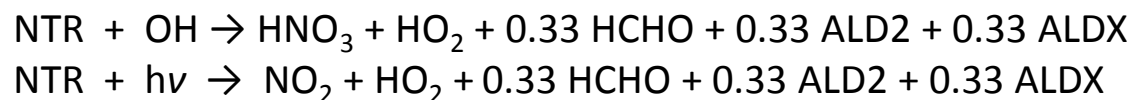
Choi et al. poster



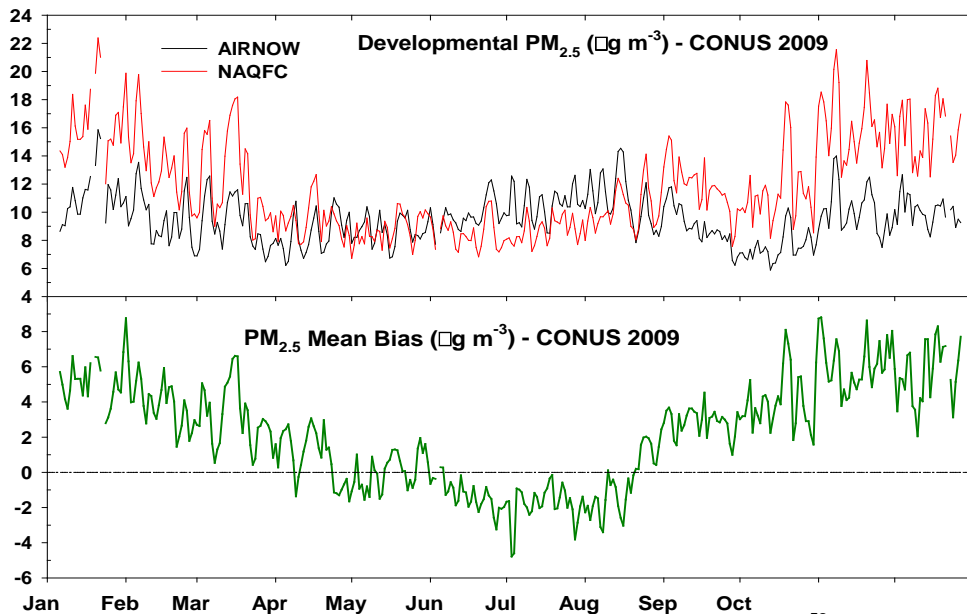
CB05 - CBIV Ozone



Additional NO_x
Recycling
Reactions of CB05
Produce Higher
Ozone than CBMIV



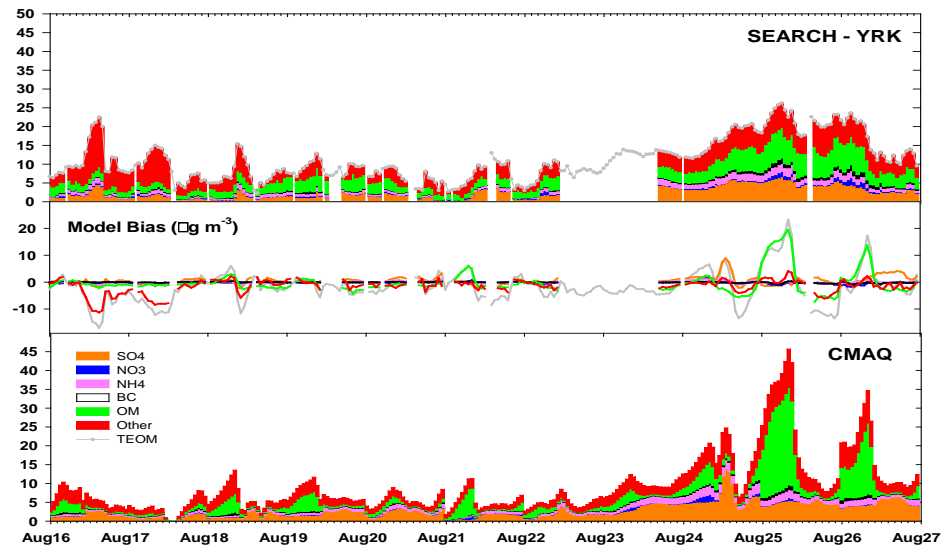
Saylor et al.
 O_3 poster



Seasonal Biases of NAQFC PM_{2.5} Forecasts

Saylor et al.
PM_{2.5} poster

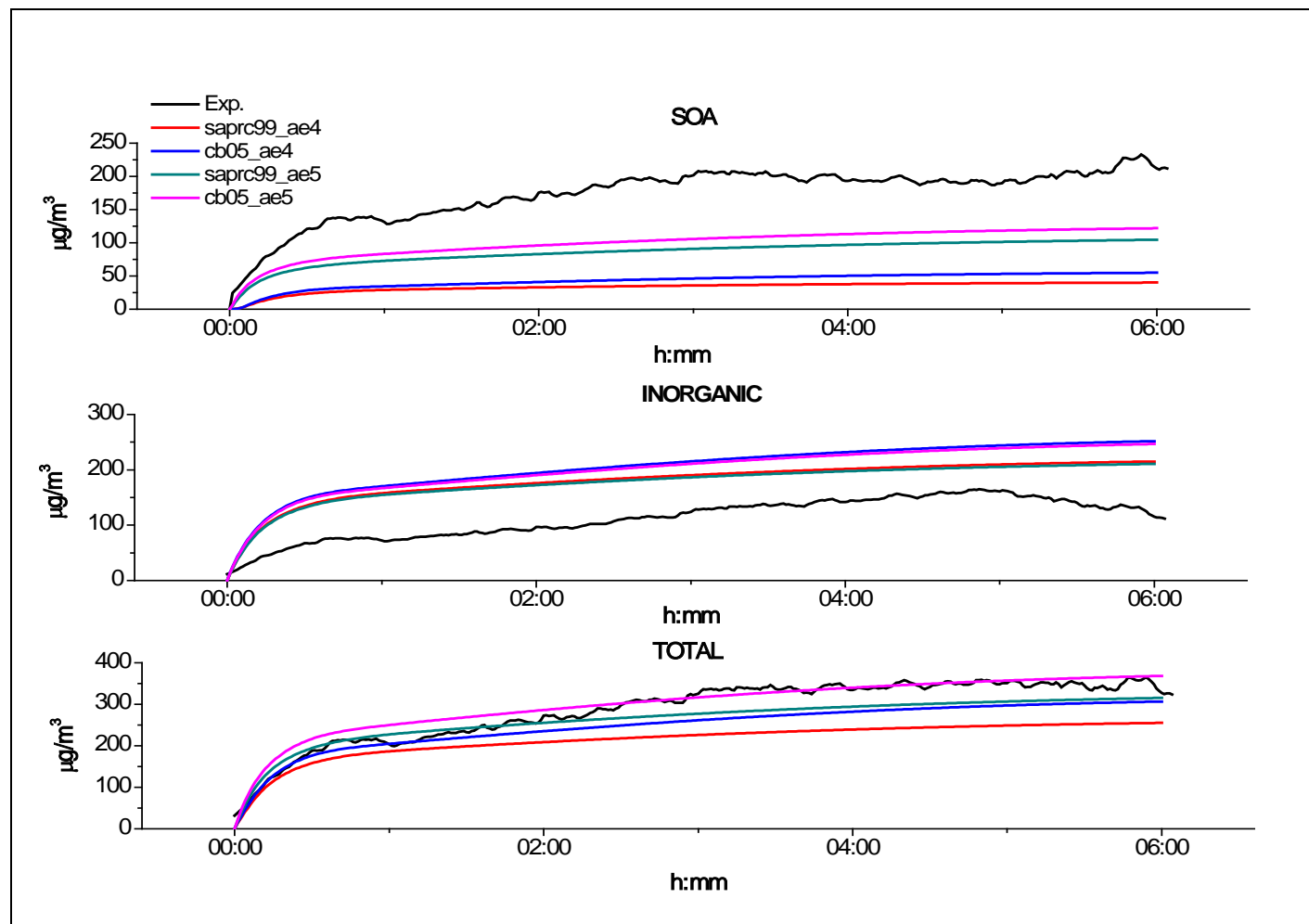
Comparison of Speciated PM_{2.5} Measurements with Model Forecasts





Evaluation of the CMAQ aerosol module with smog chamber data

Stein et al.
poster



Collaboration with CIEMAT (Research Center for Energy, Environment and Technology) Madrid, Spain



Future Model Improvements

- Anthropogenic emissions
 - New national inventories (NEI 2008), update surrogate inputs
- Incorporation of near real-time fire emissions
 - Remove climatological fire emissions
- Improvements in fugitive dust emissions
 - Seasonal variation, transportable fraction
- Develop tighter linkages between NAM and CMAQ
 - Grid and dynamics, input datasets (e.g., LULC)
 - Tighter coupling of NAM data to CMAQ model processes
 - Better linkage to surface conditions (e.g., snowcover, soil moisture)
- Update CMAQ PM module
 - Additional SOA precursors, nonvolatile SOA, updated thermodynamics
- Chemical data assimilation Chai et al. poster



Indicators of Success

- Successful transition of new knowledge and data to the NAQFC
- Publications
 - Recent papers in peer-reviewed journals
 - *Atmospheric Environment, Journal of Geophysical Research, Journal of Applied Meteorology and Climatology*
 - Invited seminars and review articles
- Analysis tools and methods
 - Emissions Quality Control (mechanisms, source sectors, domains)
 - Daily AQ analysis graphics (meteorology, emissions, air quality)
 - Statistical and GIS-based analysis tools
- Improved modeling techniques and input data
 - Improved process algorithms
 - More accurate model inputs (LULC, surrogates, vegetation, ...)



Collaborators



Earth System Research
Laboratory, NOAA

NESDIS, NOAA





Related Posters

- **Emission Modeling for the National Air Quality Forecasting Capability (NAQFC),**
D. Tong, et al.
- **Using Smog Chamber Data to Improve the Understanding of SOA Formation,**
A. Stein, et al.
- **Improving NAQFC O₃ Predictions Over Remote Sensing Derived Chemical Regimes,**
Y. Choi, et al.
- **Identifying the Causes of Differences in Ozone Production from the CB05 and CBMIV Mechanisms,** *R. Saylor et al.*
- **Comparison of NAQFC PM_{2.5} Speciation with IMPROVE and SEARCH Data: Initial Findings,** *R. Saylor et al.*
- **Chemical Data Assimilation: Integrating Atmospheric Chemistry Observations into Air Quality Modeling,** *T. Chai et al.*