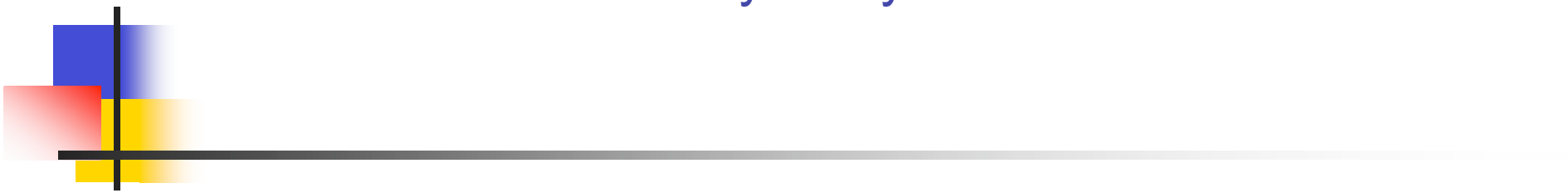
Chemical data assimilation of ozone and fine aerosols. Initial results using the NMM-WRF/Chem and the Gridpoint Statistical Interpolation (GSI) Analysis System



Mariusz Pagowski, Georg A. Grell, Steven E. Peckham, Stuart McKeen, Dezso Devenyi

NOAA/ESRL and CIRA/CIRES, Boulder, CO

Current Status

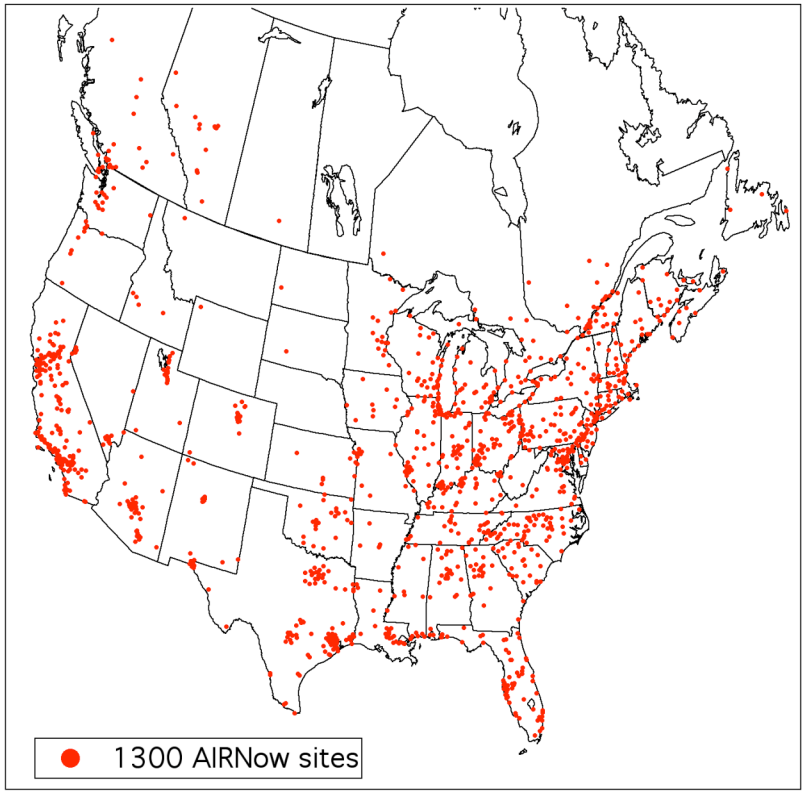
- Specified variances and length scales for ozone and PM2.5 (aerosols with diameter smaller than 2.5 μm) for recursive filters
- Implemented surface ozone and PM2.5 assimilation in GSI code
- Performed initial evaluation for ozone and PM2.5

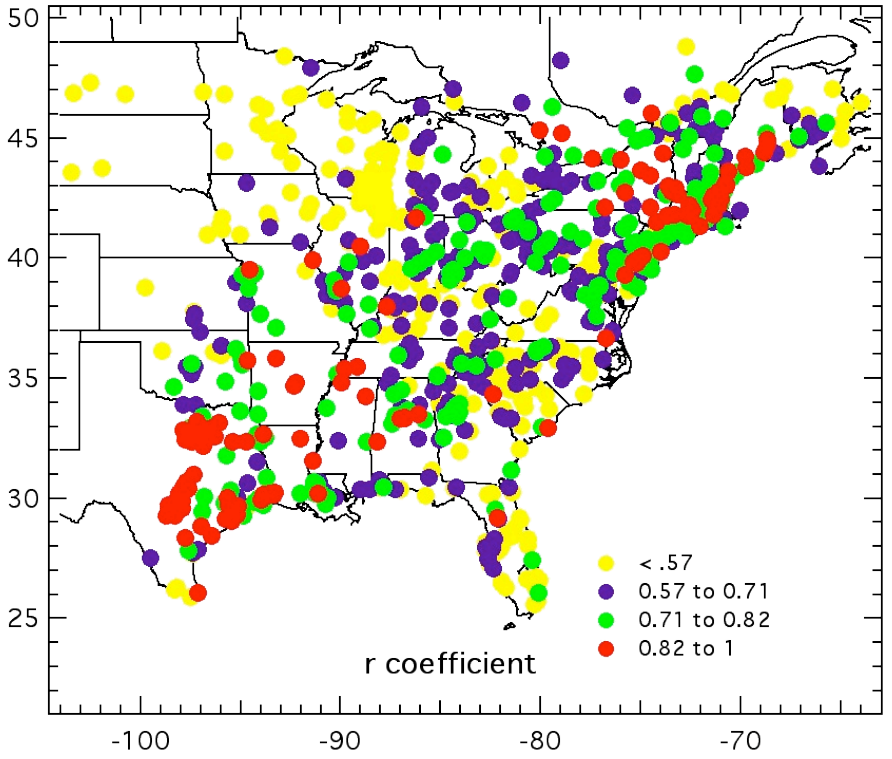
Observations and model

Real-time ozone measurements network AIRNow

NMM WRF-Chem updated version 2.2

Effective grid length ~12 km, 31 vertical levels





O3 correlation coefficient next day 8hr max

Background error covariance derived from continuous forecasts

issued at 00 UTC in July-August 2004

24-hour assimilation cycle performed at 00 UTC in August 2006

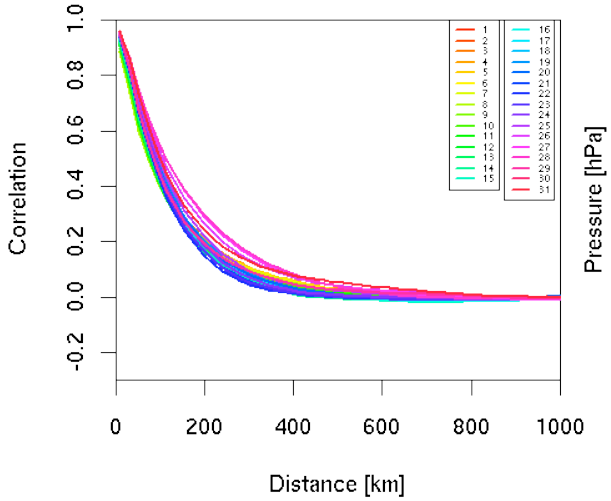
Background error covariance

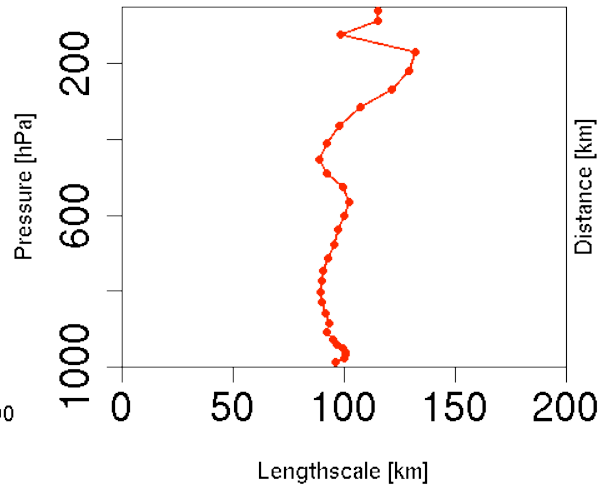
NMC method

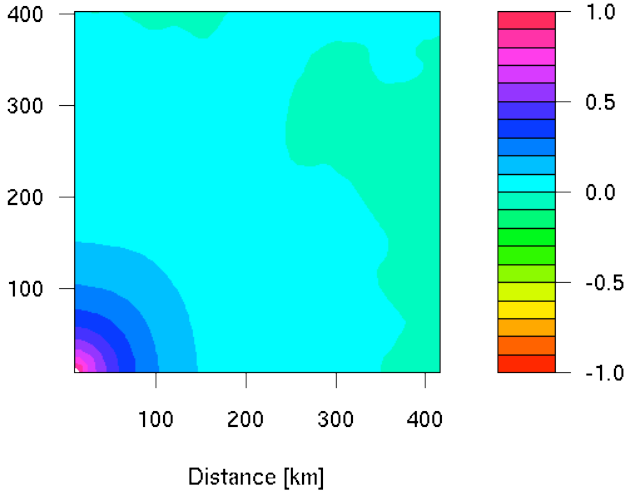
Horizontal lengthscales (00 UTC)

Anisotropy

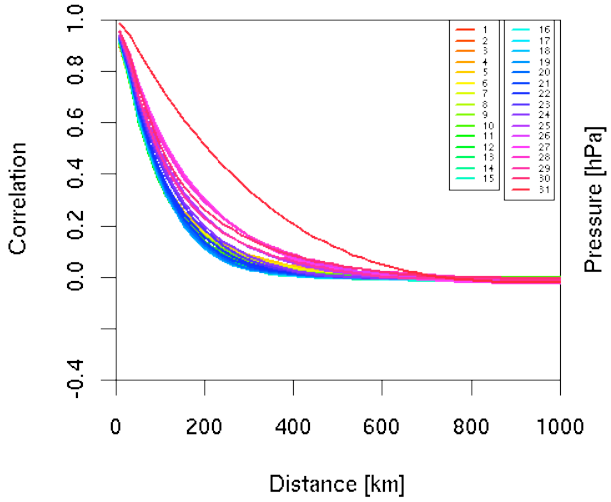
o3

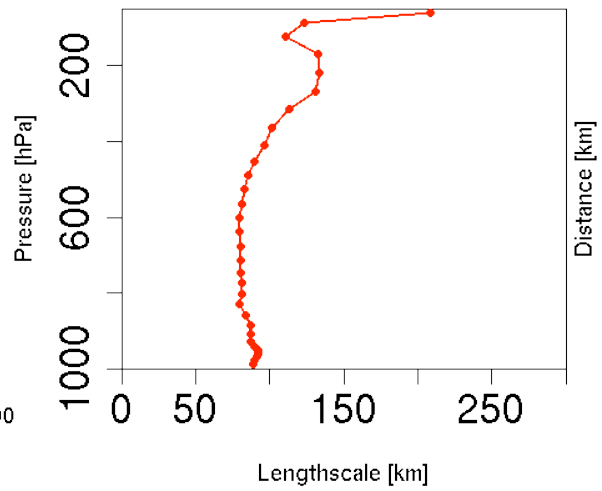


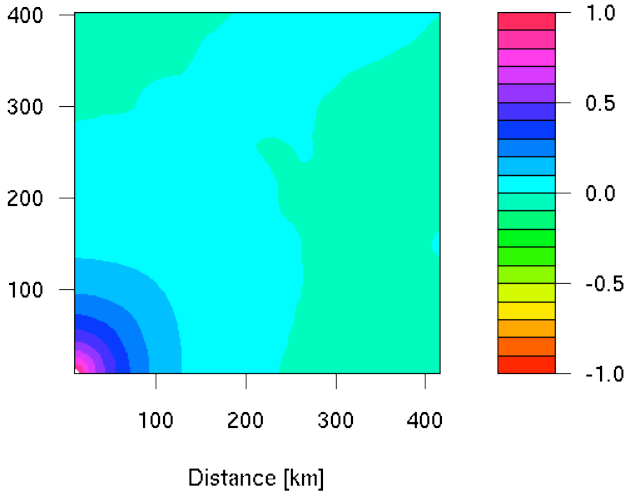




PM2.5





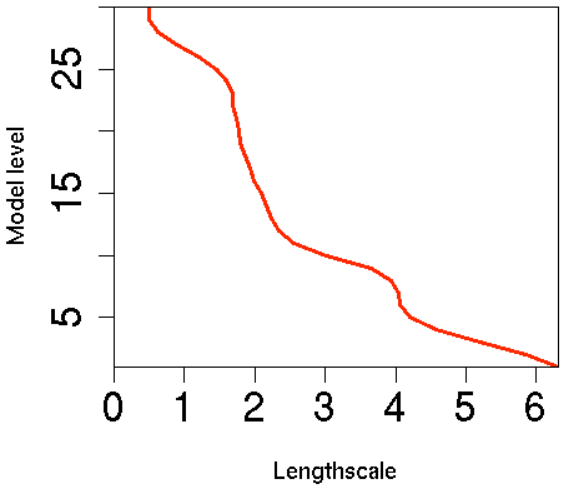


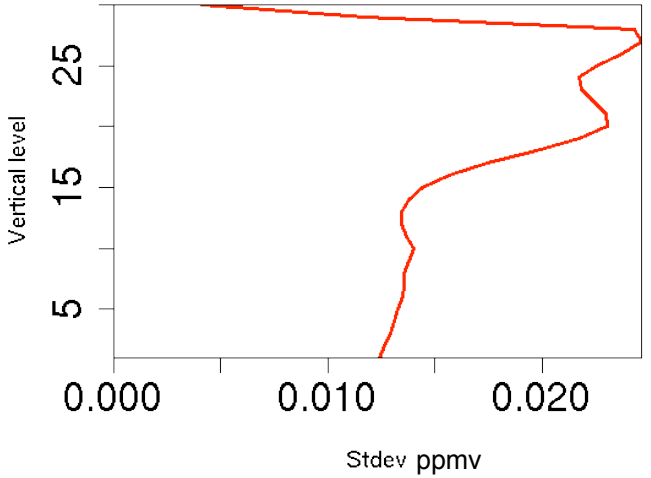
Background error covariance

NMC method

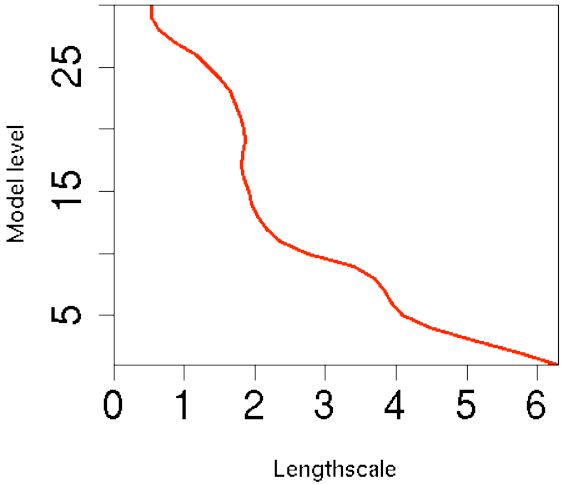
Vertical lengthscales & standard deviations (00 UTC)

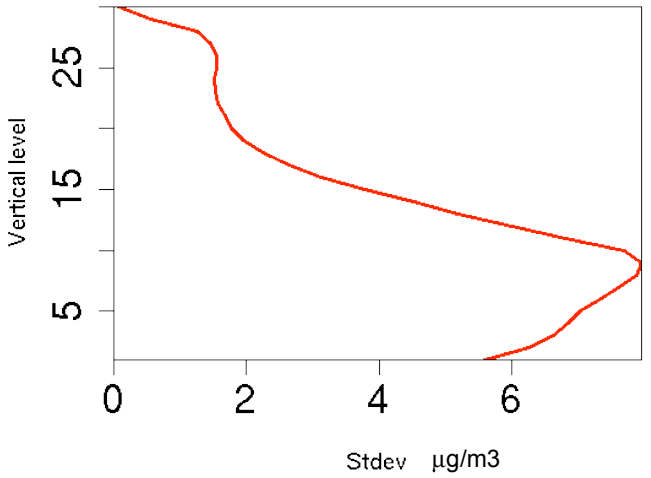
o3





PM2.5

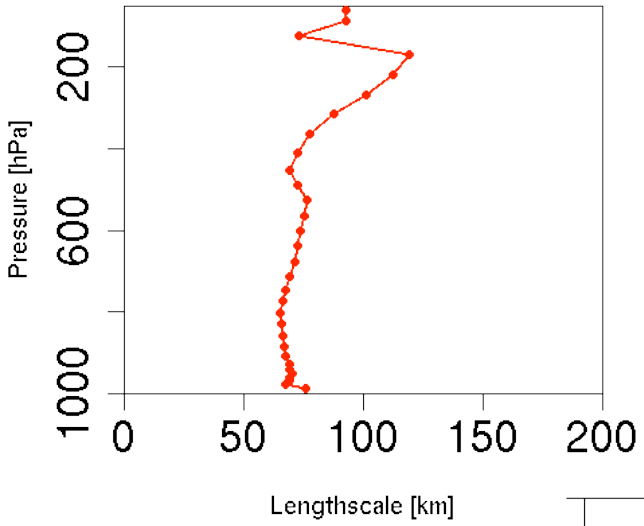


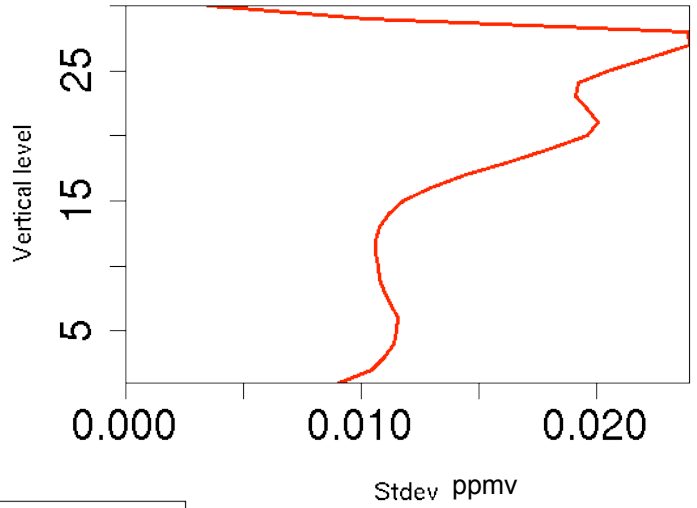


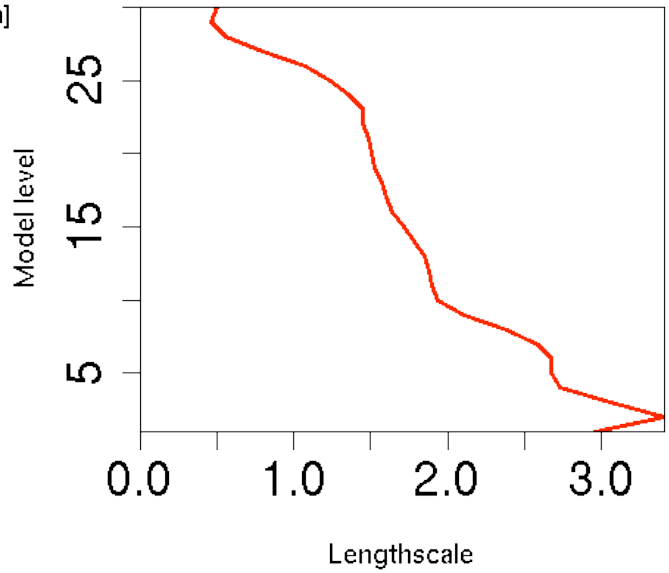
Background error covariance

NMC method

O3 early morning (12 UTC)

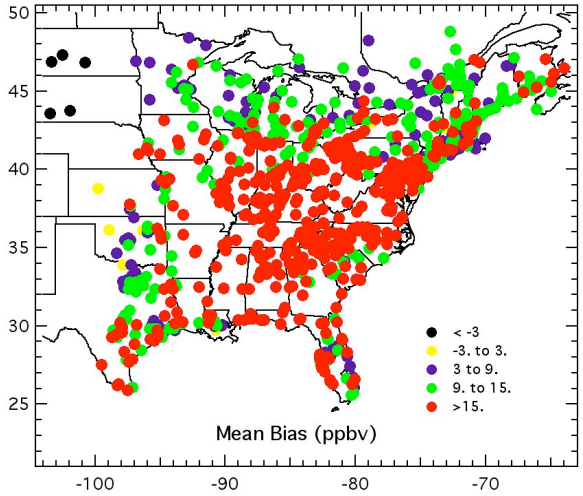


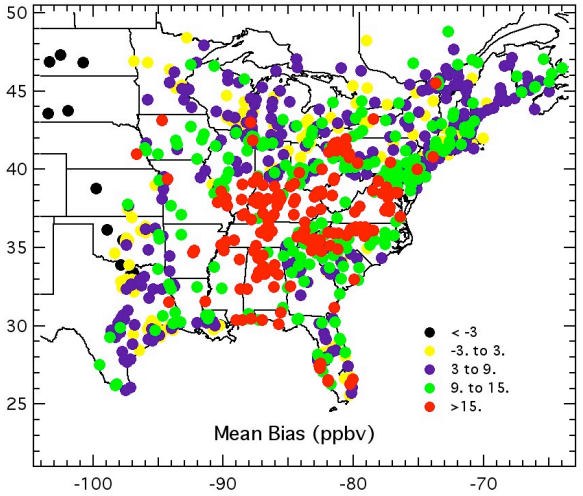


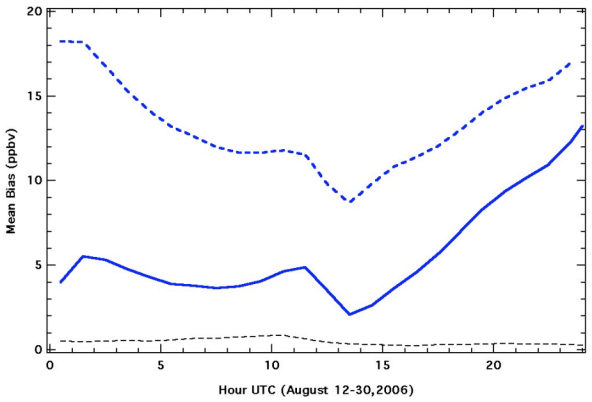


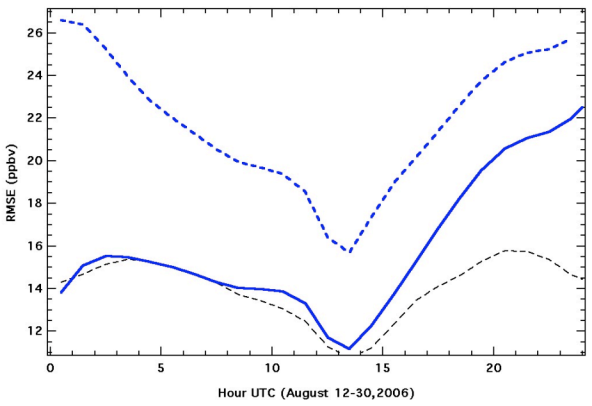
Results

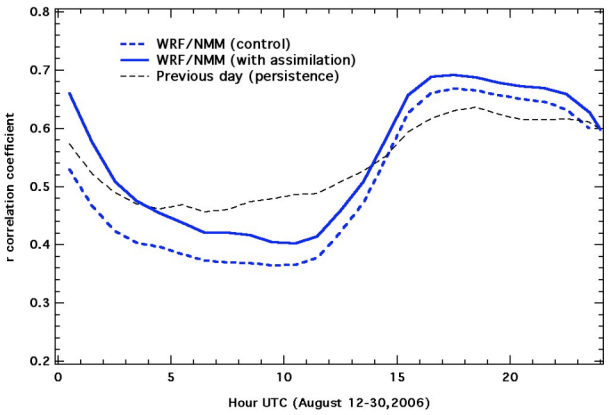
O3: 24 hour forecasts at 00 UTC, Aug 12-30, 2006





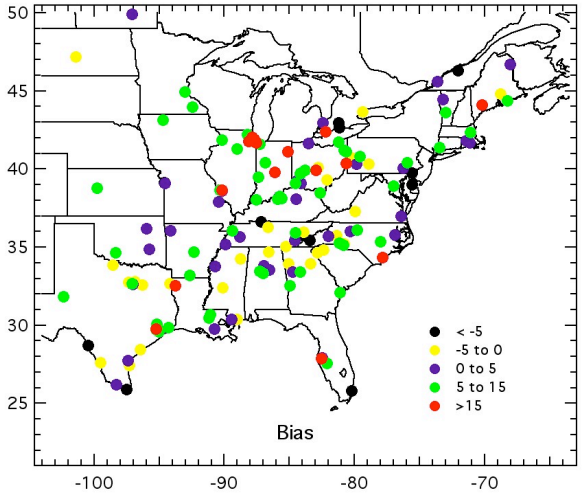


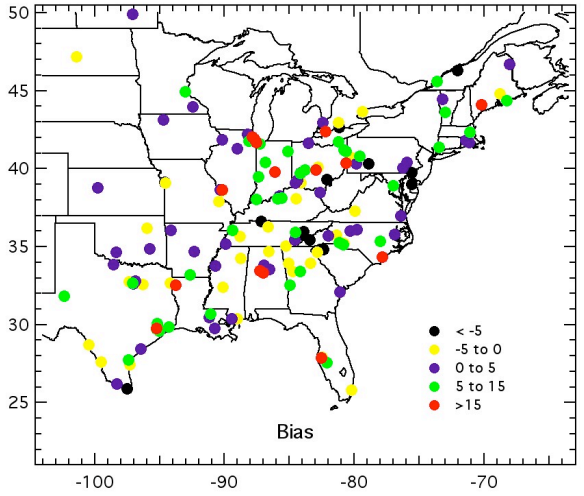


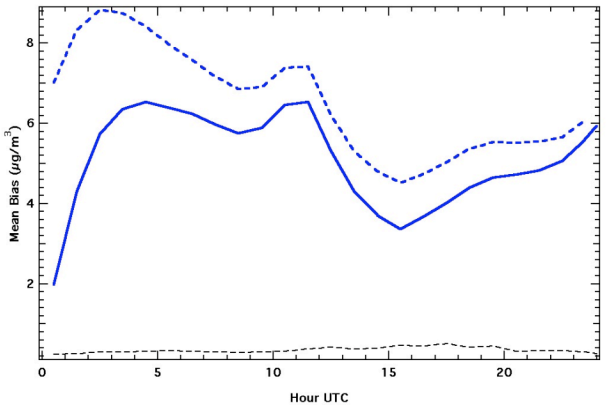


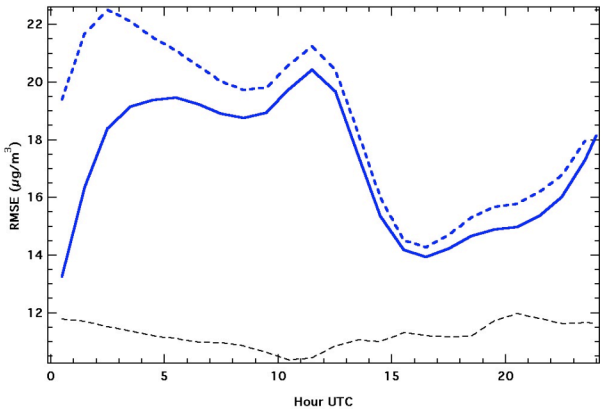
Results

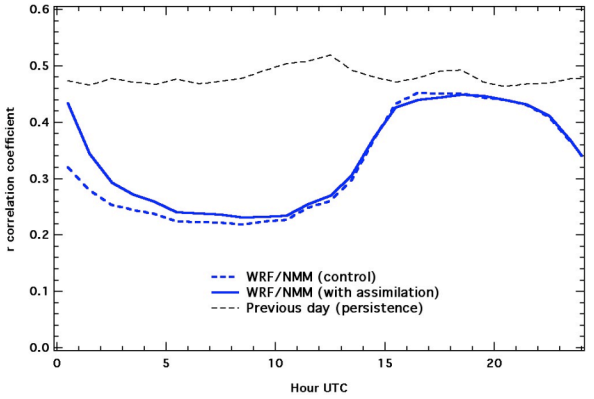
PM2.5: 24 hour forecasts at 00 UTC, Aug 11-30, 2006











Plans

- Tune length scales and variances
- Assimilate vertical profiles (from aircraft and soundings)
- Develop bias correction procedure
- Implement assimilation cycle for real time WRF-Chem forecasts with higher frequency (6h/12h)
- Implement DA cycle with ARW core
- Develop adjoints for chemical reactions to partition total PM2.5 to different aerosol species
- Assimilate other chemical species.