

O₃ and PM_{2.5} Forecasts with Hi-Res Air Quality Modeling System: Evaluation of 2007 & Outlook for 2008

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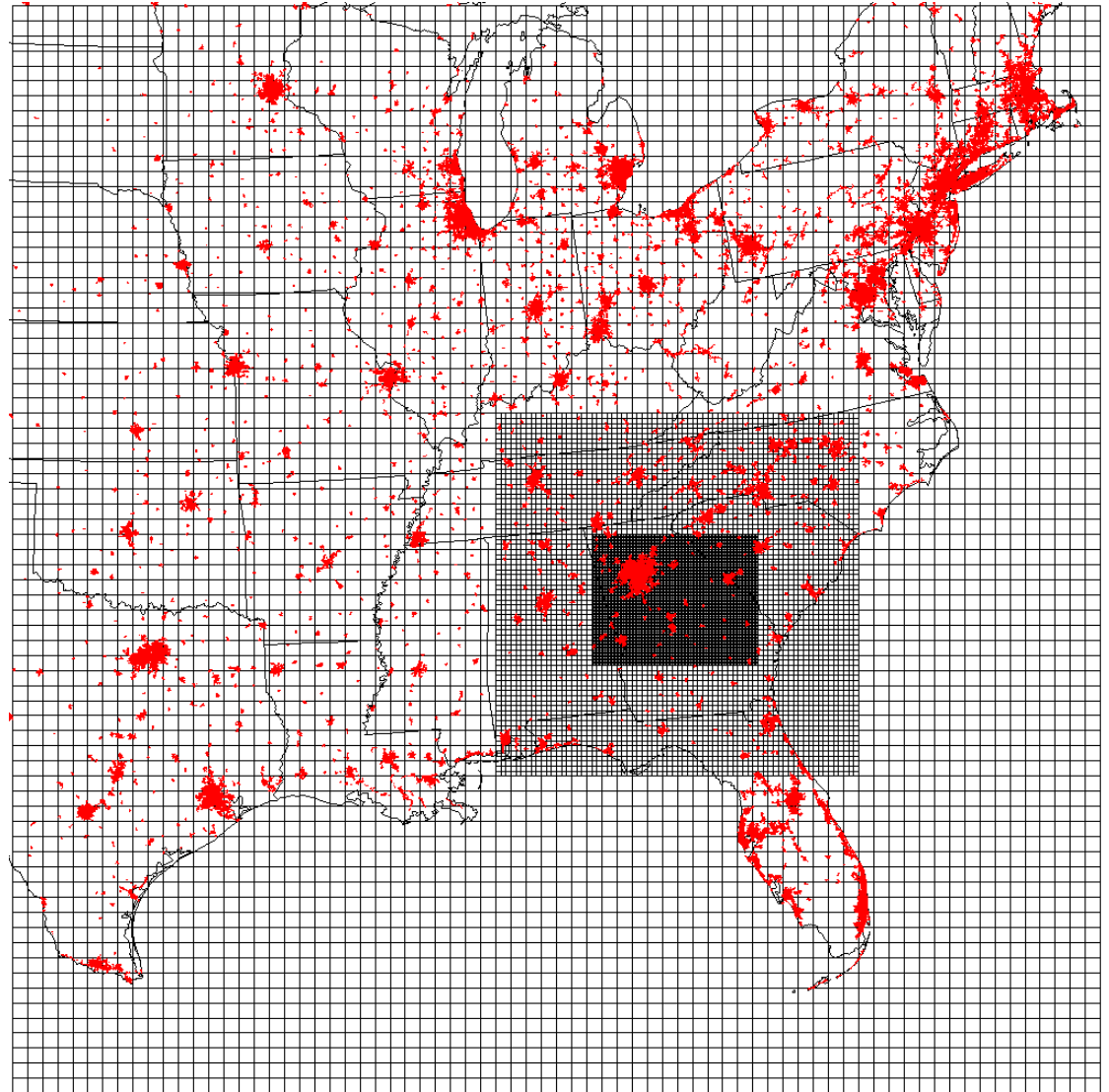
13th Annual Georgia Air Quality Forecasting Workshop

April 15, 2008

GA EPD, Air Protection Branch

Modeling Domain and Grids

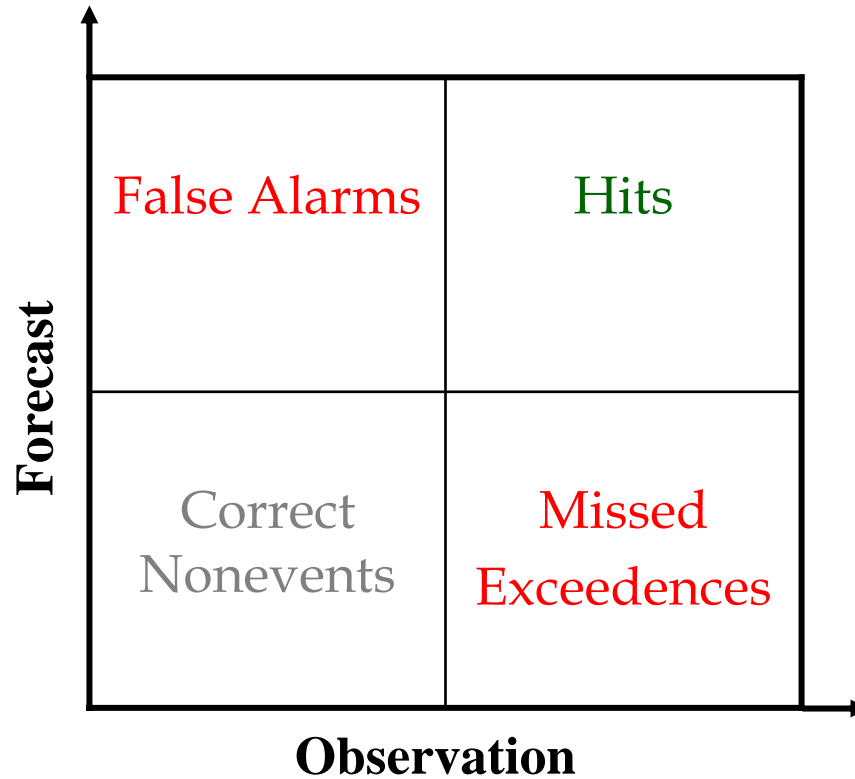
- Three grids:
 - 36-km (72x72)
 - 12-km (72x72)
 - 4-km (99x78)
- 34 vertical layers used in WRF
- 13 layers in CMAQ



Our 2007 Forecasting

- Updated Models:
 - WRF Version 2.2.1
 - Urban canopy model, improved cloud schemes, bug fixes
 - CMAQ Version 4.6
 - New vertical wind adjustment scheme that works
- Updated Emissions:
 - New PM profiles for fire emissions
- Improved Operations:
 - Reduced processing time so that 60-hr (instead of 84-hr) NAM meteorological forecasts can be used for initialization
 - Reported forecasts for **Macon** and **Columbus** in addition to Atlanta

Performance Metrics

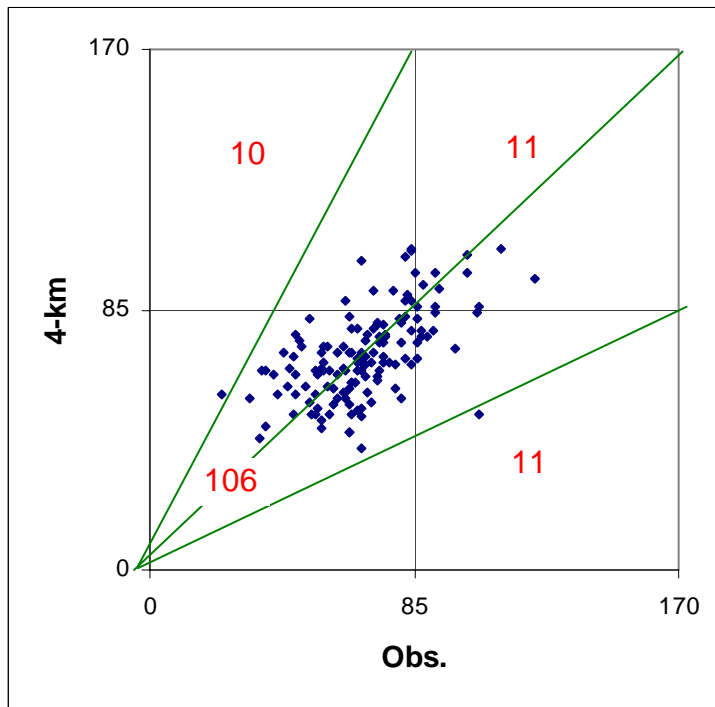


$$\text{NMB} = \frac{1}{N} \sum_{k=1}^N \frac{c_k^m - c_k^o}{c_k^o}$$

$$\text{NME} = \frac{1}{N} \sum_{k=1}^N \frac{|c_k^m - c_k^o|}{c_k^o}$$

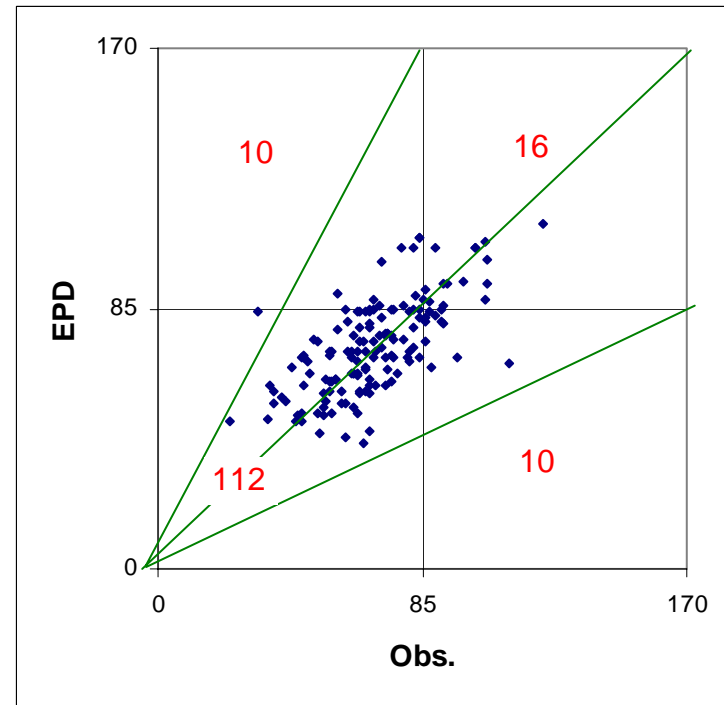
O₃ Performance: 4-km vs. EPD's

Our 4-km Forecast



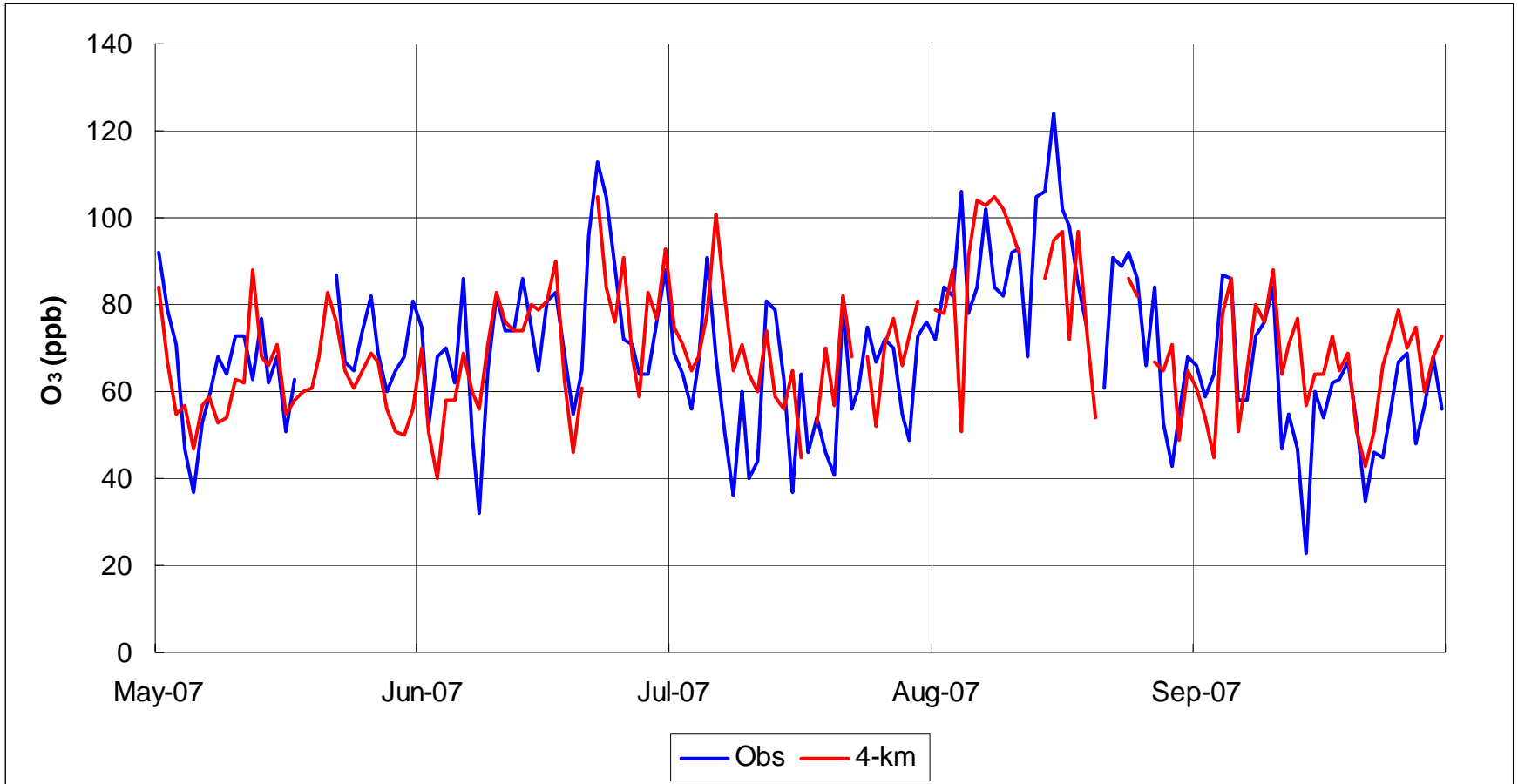
MNB	8.5%
MNE	19%

EPD Ensemble Forecast

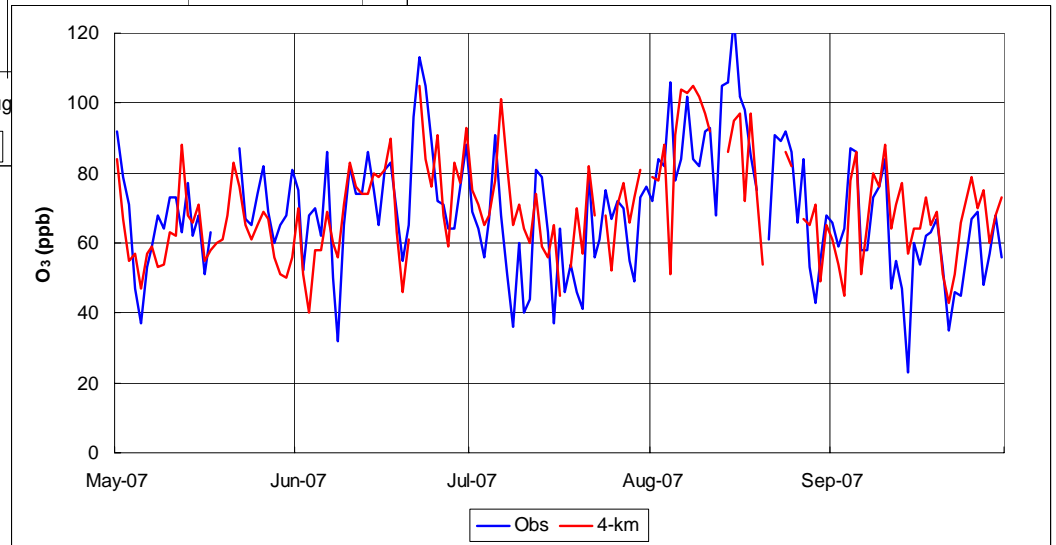
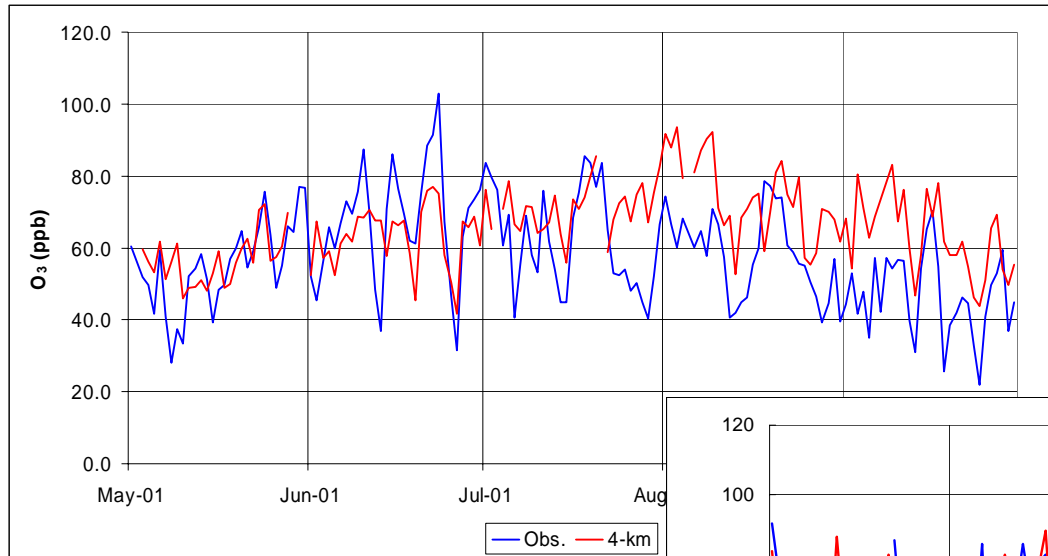


MNB	9.0%
MNE	18%

Forecasted vs. Observed O₃

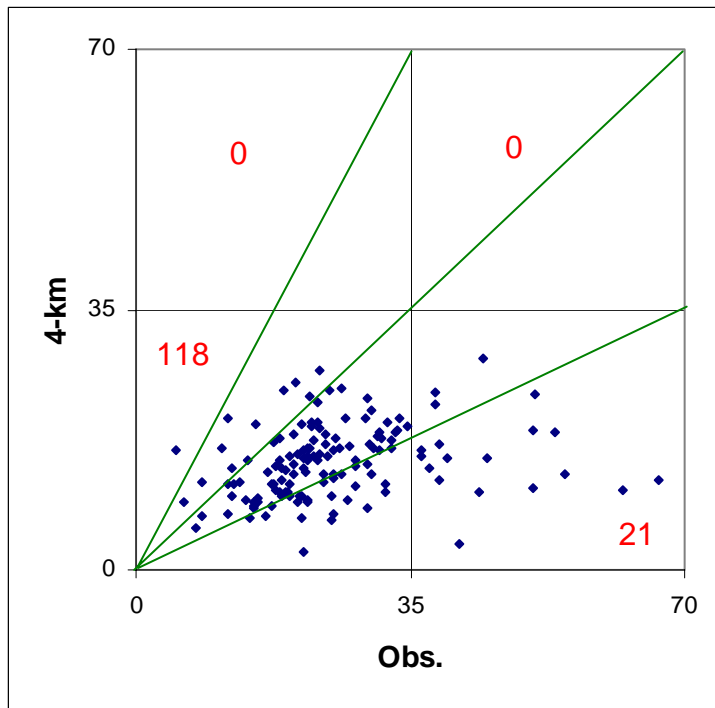


Ozone Season 2006 vs. 2007

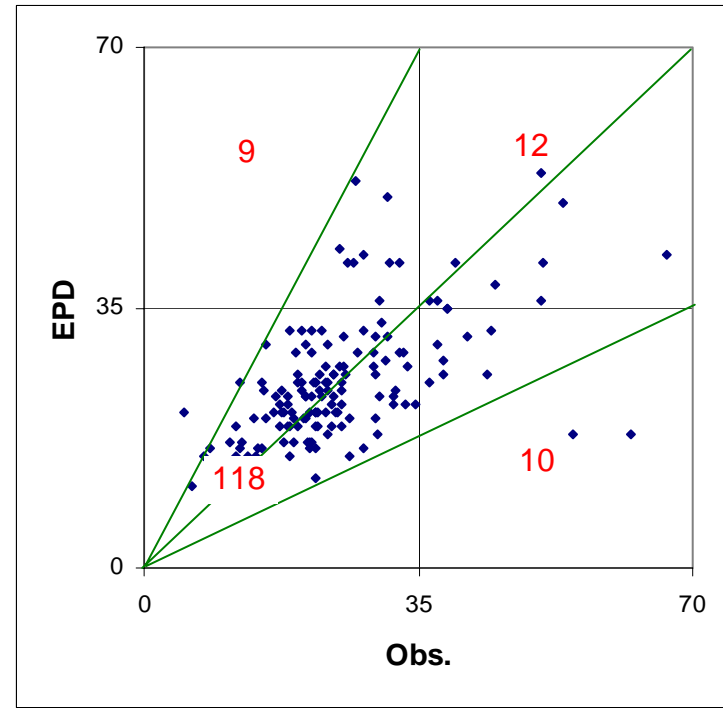


PM_{2.5} Performance: 4-km vs. EPD's

Our 4-km Forecast



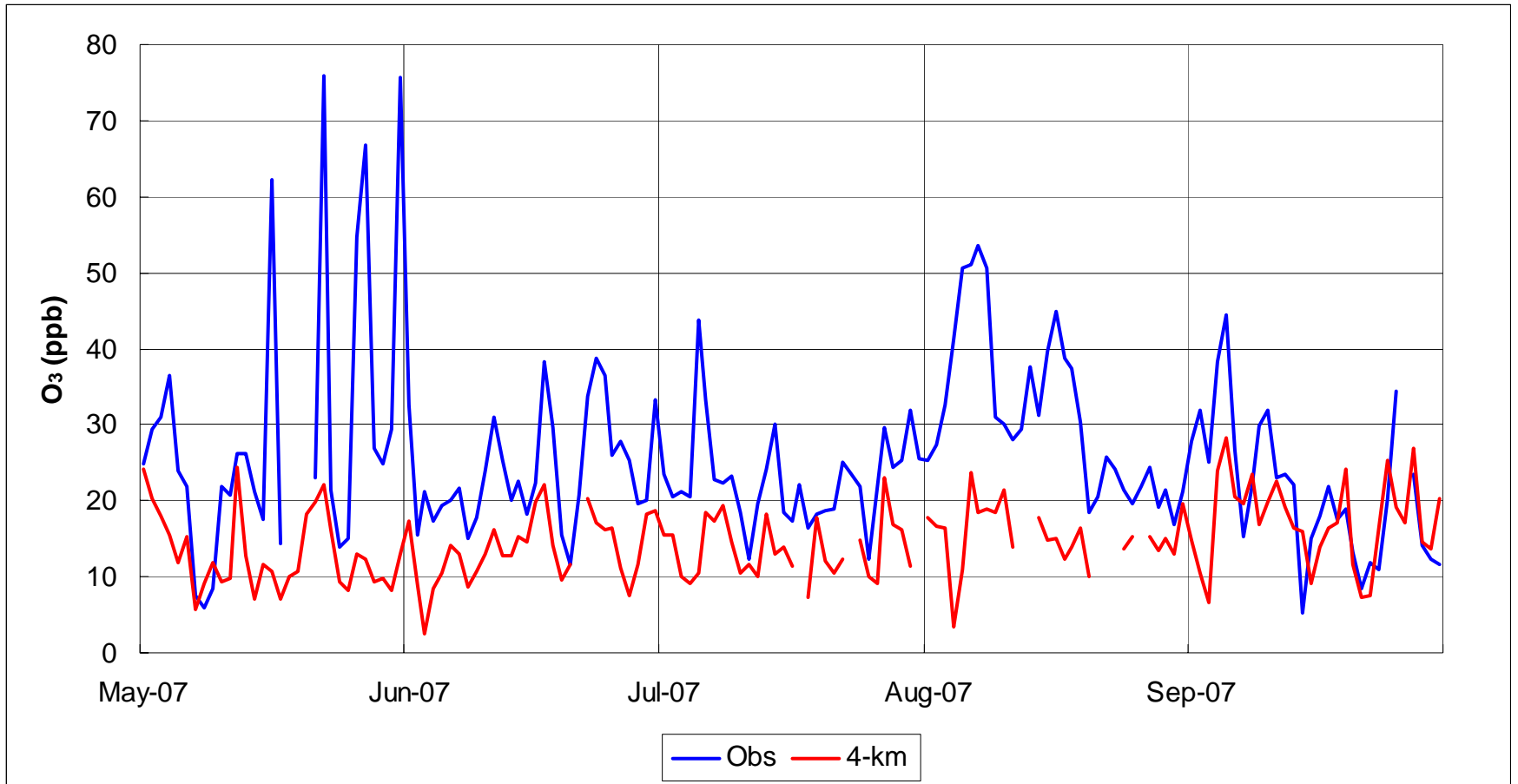
EPD Ensemble Forecast



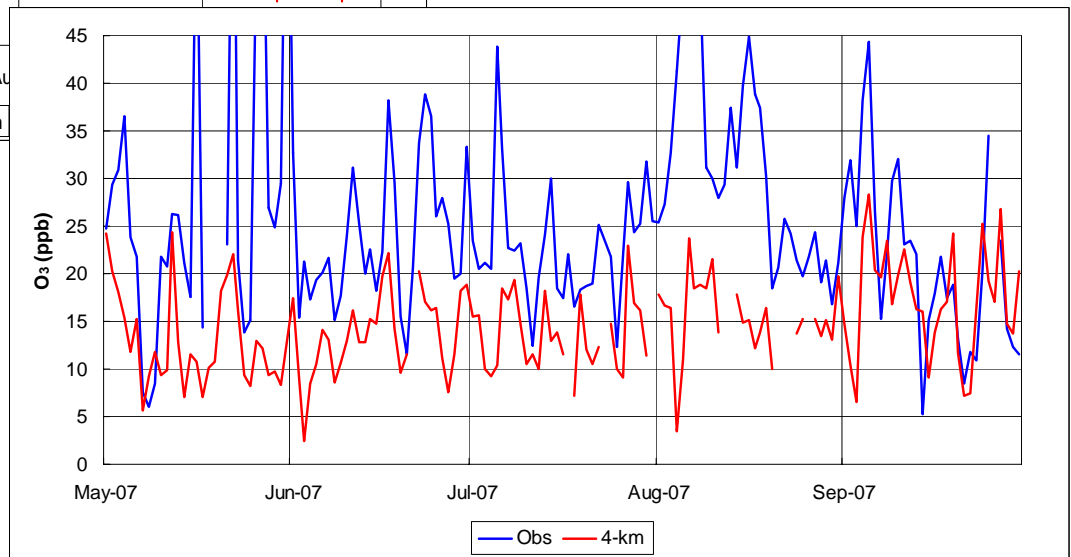
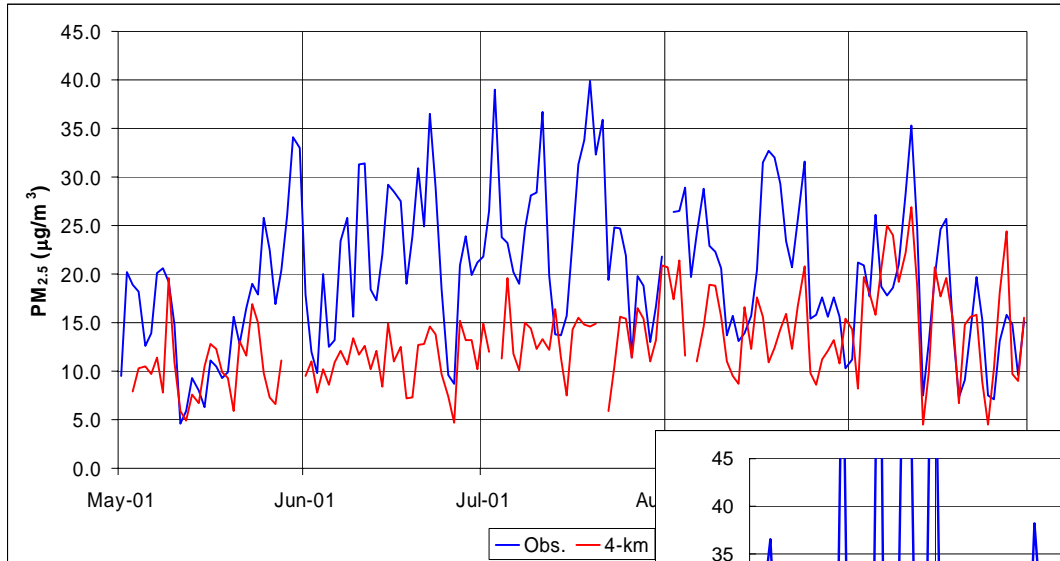
MNB	-37%
MNE	44%

MNB	8.6%
MNE	28%

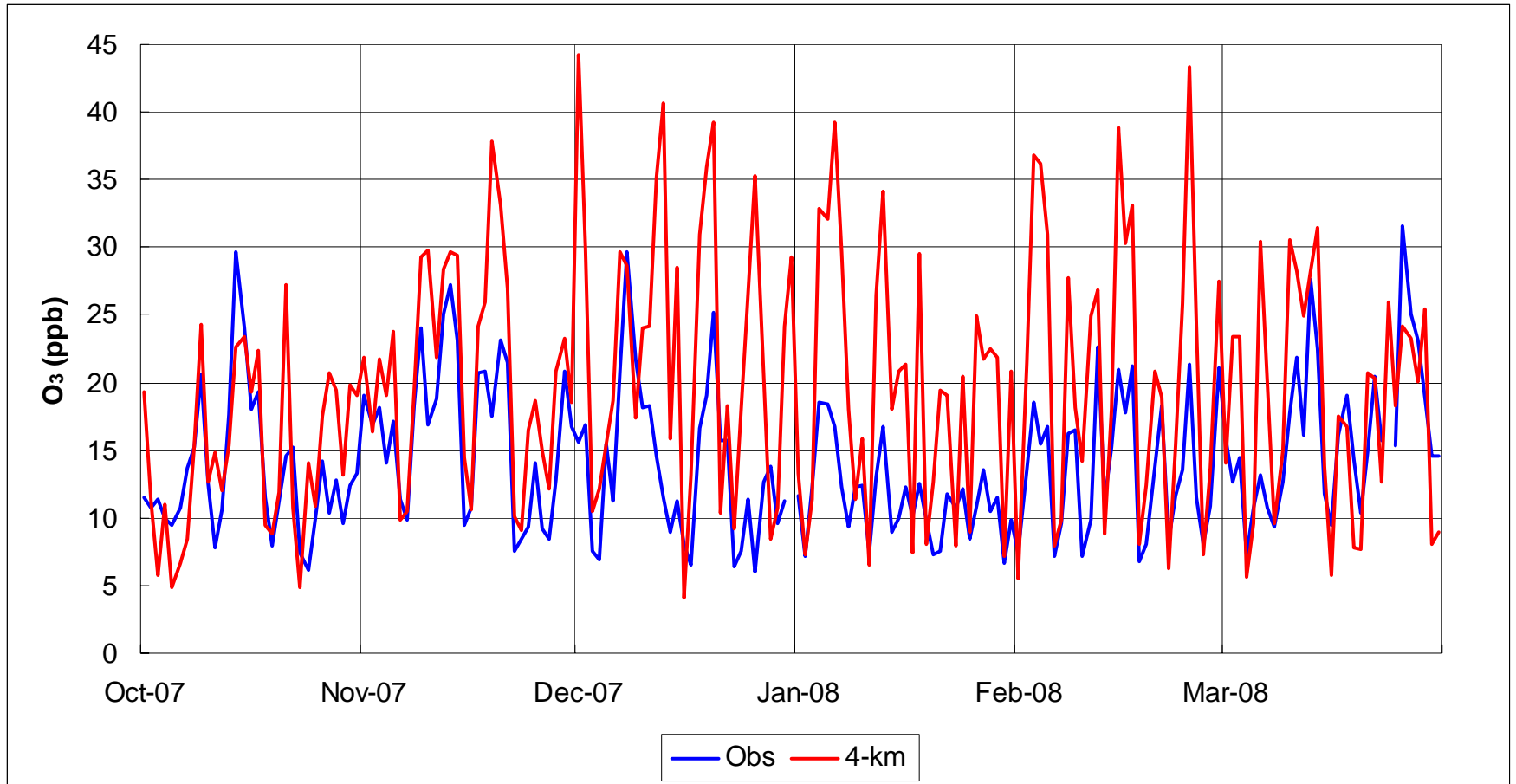
Forecasted vs. Observed PM_{2.5}



Summer 2006 vs. 2007



Forecasted vs. Observed PM_{2.5}



Summary

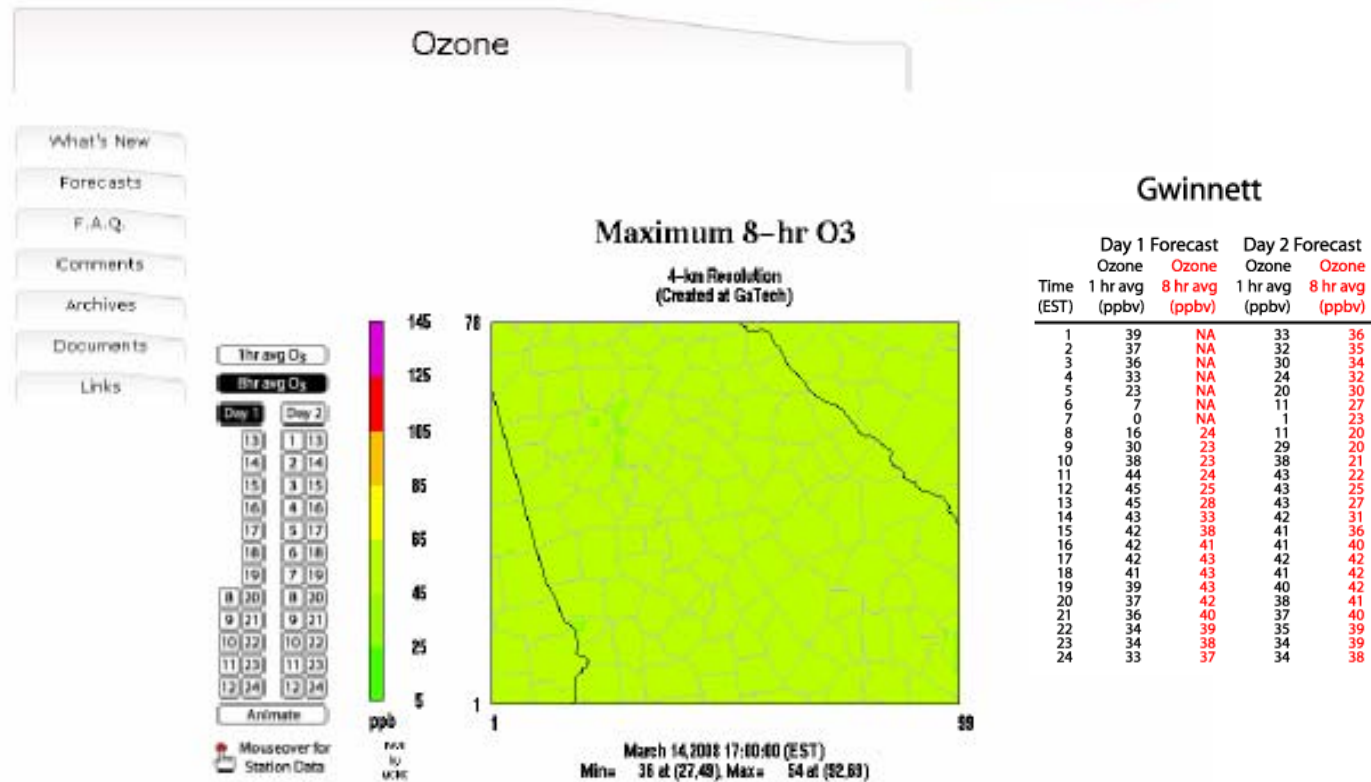
- Ozone forecasts improved compared to 2006
 - Overall bias is +8.5% and error is 19%
 - Improvements are most likely due to the new version of WRF
- PM_{2.5} forecasts are not very accurate (still).
 - May-September bias is -37% and error is 44%
 - Secondary organic aerosol formation is underestimated
 - FL-GA wildfires of 2007
 - Performance is much better in Fall and Spring
 - Wintertime PM_{2.5} is overestimated

New in 2008

- 48-hr Forecasts:
 - updated every 12 hours
- Model Updates:
 - Latest versions of WRF, SMOKE, CMAQ
 - SOA Formation
 - SVOC → SOA
 - Isoprene → SOA
- Emissions:
 - NEI 2002 → 2008
 - CEM data: 2004-07 average
- Evaluations:
 - Daily & Periodic
 - Including meteorology
- Rx-Burn Impact Forecast:
 - All non-urban forests
 - Initially in 9 counties around Ft. Benning
 - GA: Muscogee, Chattahoochee, Harris, Talbot, Marion, Stewart, Webster
 - AL: Lee, Russell

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Last modified: 03/11/08.