Maintenance, Performance Evaluation and Development of the National Air Quality Forecasting Capability (NAQFC)

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National Oceanic & Atmospheric Administration (NOAA)

Changes for FY12

Updated Emissions:	**Mobile** sources: new projection methodology **Area** sources: non-road used 2012 cs NEI **Point** sources updated by latest CEM Canadian 2006 Emission Inventory
NAM Upgrades:	**Domain extend** changed **Grid staggering** changed **Vertical grid structure** changed **L**and **U**se **L**and **C**over data-base changed

Summary of the multiple domains

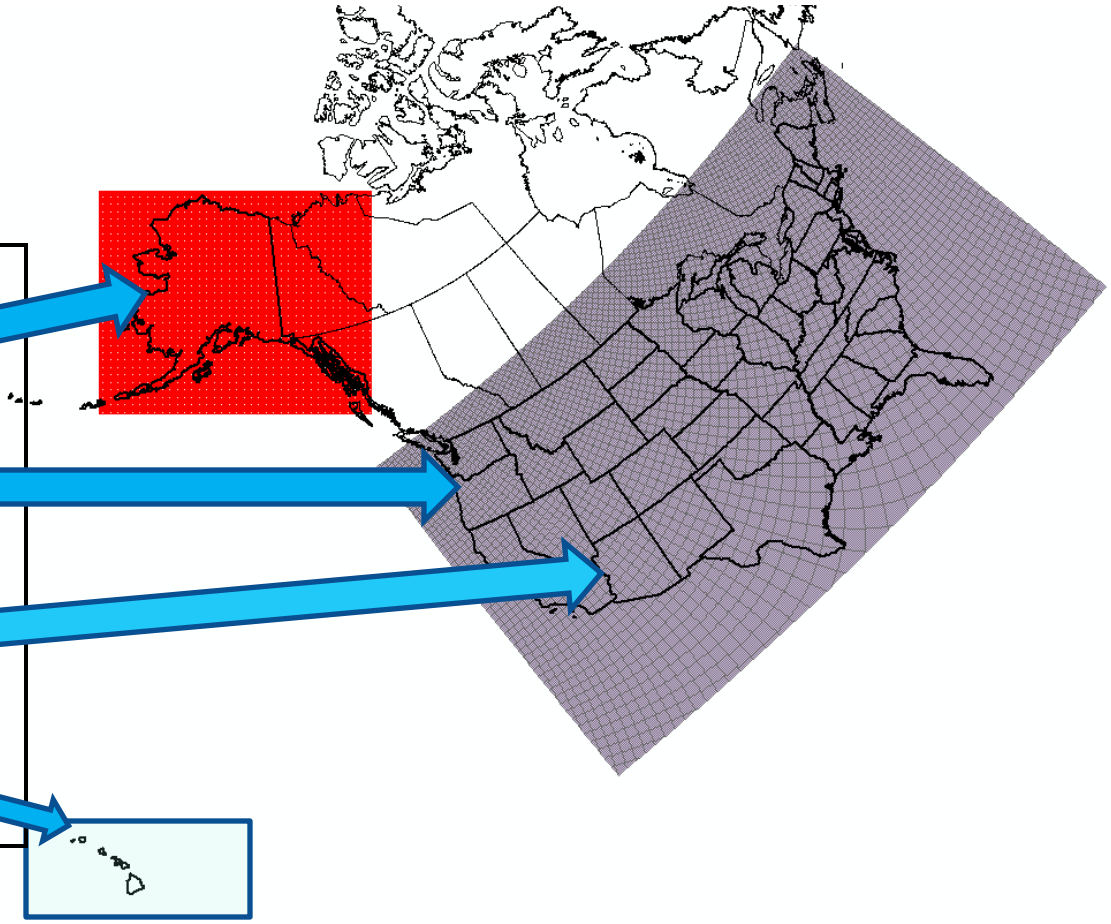
Three domains and four runs

oAK CB05, monthly LBC

oCONUS with CBIV gas

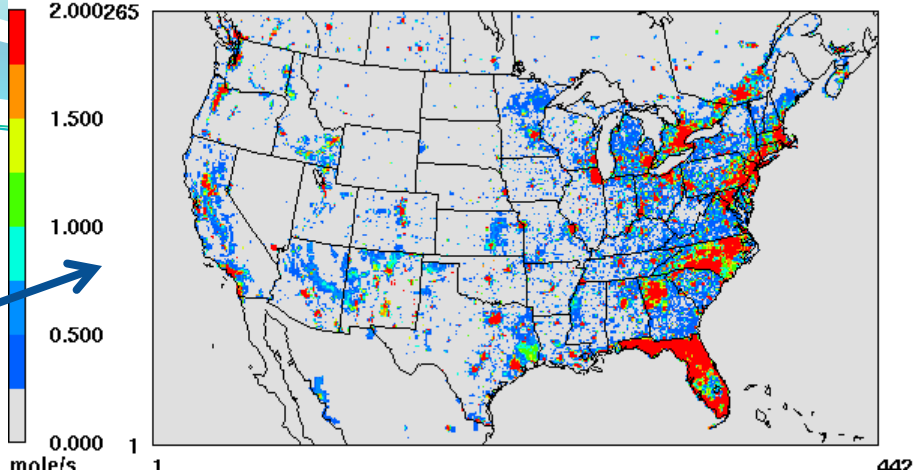
oCONUS CB05 & aero5
Monthly LBC

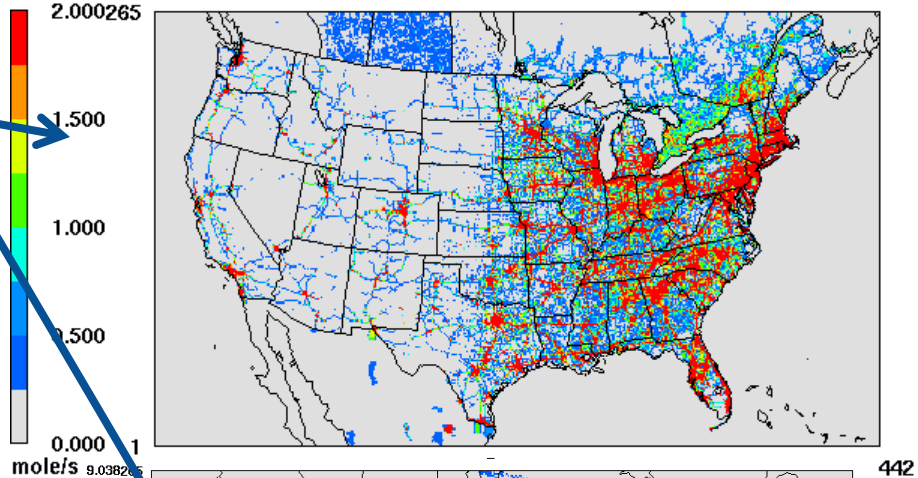
oHI CB05, monthly LBC

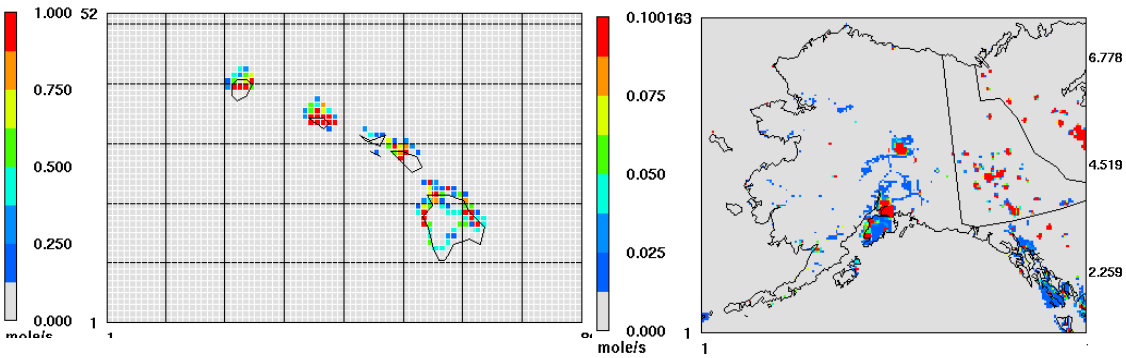


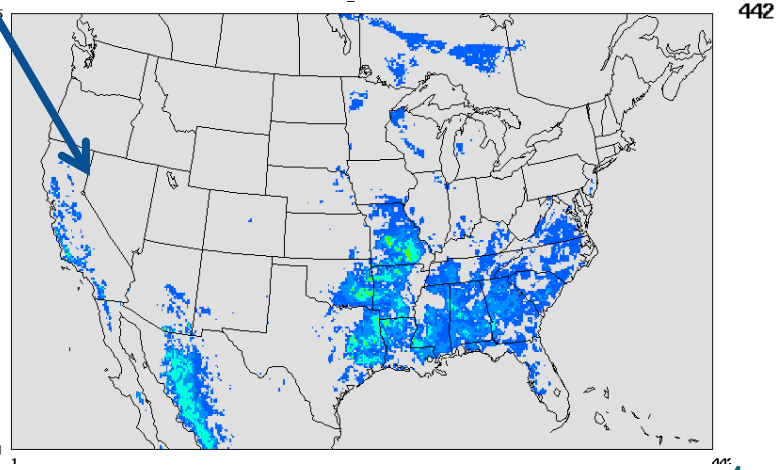
Emissions & Quality Control

- **Mechanism:**
  CBIV and CB05
- **Sources:**
  Area and mobile (CO), and biogenic (ISOP)
- **Regions:**
  CONUS, HI, and AK
- **Others:**
  No fire, small fire









Emission configurations considered for 2012 emission

Source		Option 1	Option 2	Option 3	Used
Mobile Source		2005 MOVES	2012 MOVES	2005 MOBILE6	**2005 MOBILE6 + '05 to '12 Projections**
Point Sources		2010 CEM + 2012 Energy Outlook			**2010 CEM + 2012 DoE Energy Outlook**
Area Source	**Nonroad**	2005aa	2005cs	2012cs	**2012 Cross-state Rule Projection**
	Other sectors	2005aa	2005cs		2005 cs
Biogenic Emissions		BEIS 3.11 (PREMAQ)	BEIS3.13 (CMAQ inline)		BEIS3.11
Canadian Emissions (Area, Mobile, and Point)		2006 EI/New Surrogates			**2006 EI**

CEM data (Point Source Monitoring)

Summary

Data obtained from US EPA and processed by ARL;

Comparisons to 2009 CEM:

Replaced records: 4647 in 2009; 4555 in 2010;

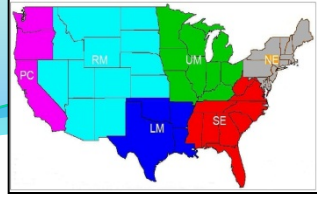
NOx Emissions: 4.11E09 lbs in 2009; 4.29E09 lbs in 2010;
SO2 Emissions: 1.16E10 lbs in 2009; 1.03E10 lbs in 2010;

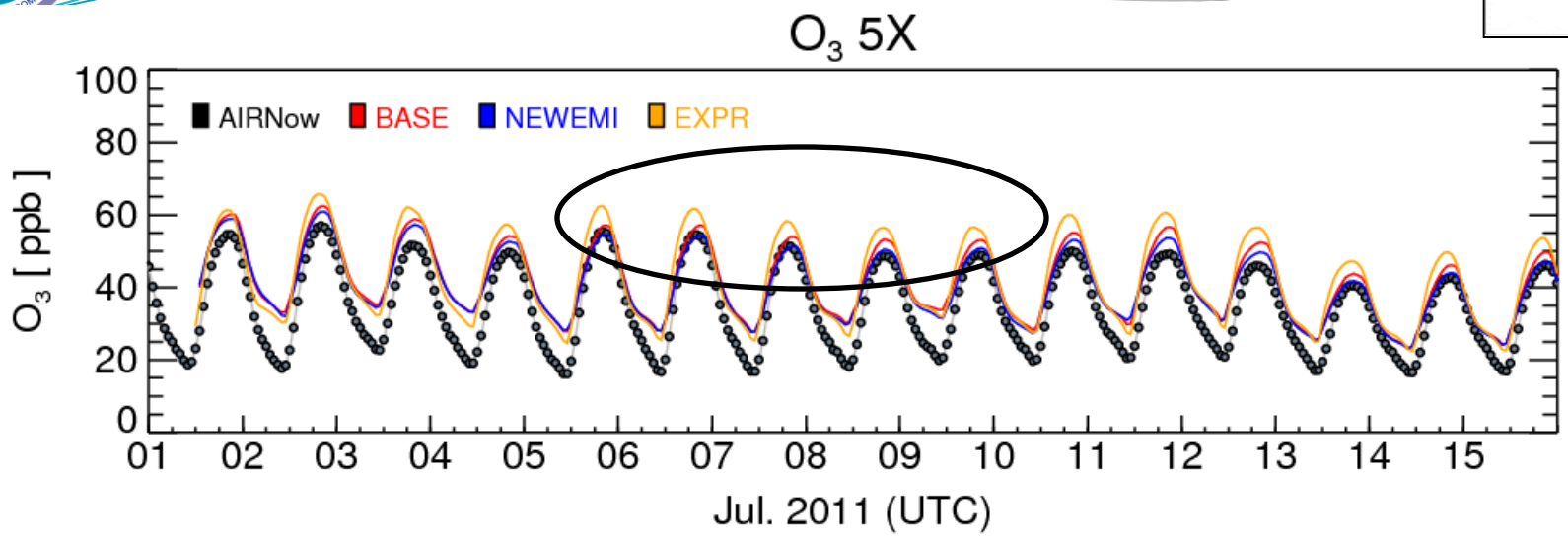
CEM Summaries: NOx 4.4% ↑; SO2 11.1%↓;

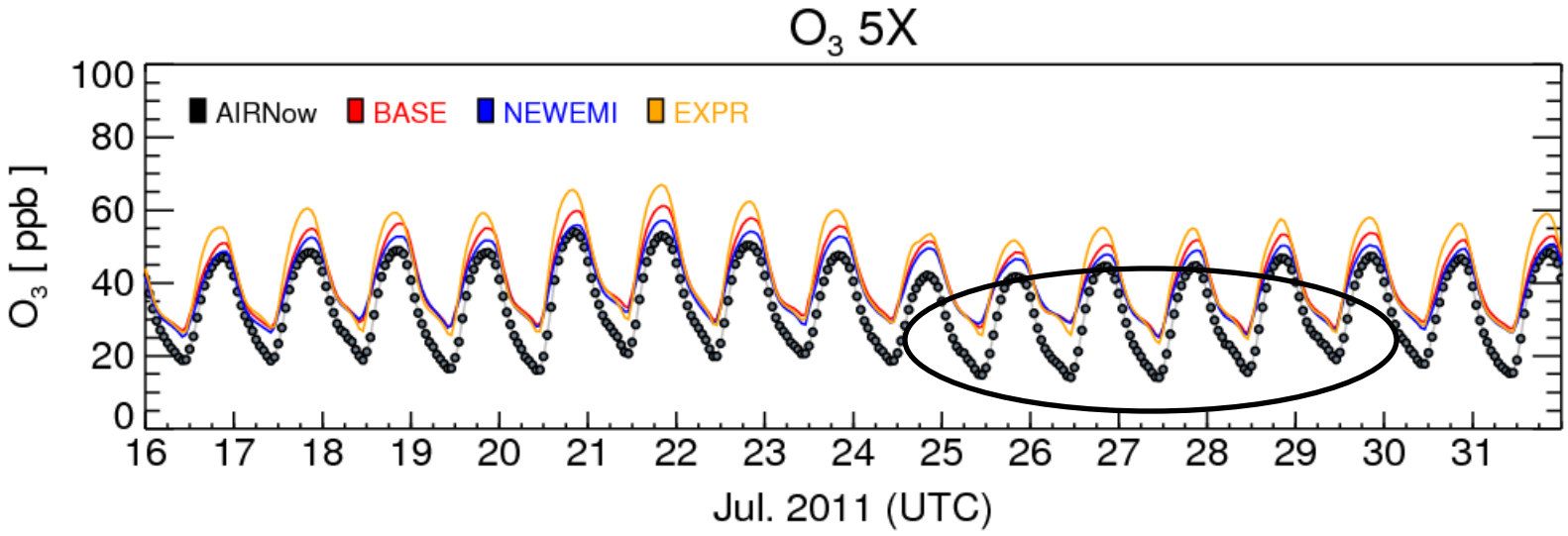
Nomenclature of sensitivity runs tested for July 2011

RUN I.D.	CMAQ version	NAM dynamic core	Non-road area sources
EXPR	4.6	Wrf-nmm	2005 NEI
BASE	4.7.1	NMMb	2005 NEI
NEWEMI	4.7.1	NMMb	2012 CS from EPA

Hourly surface O3 Comparison



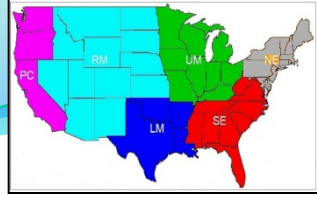


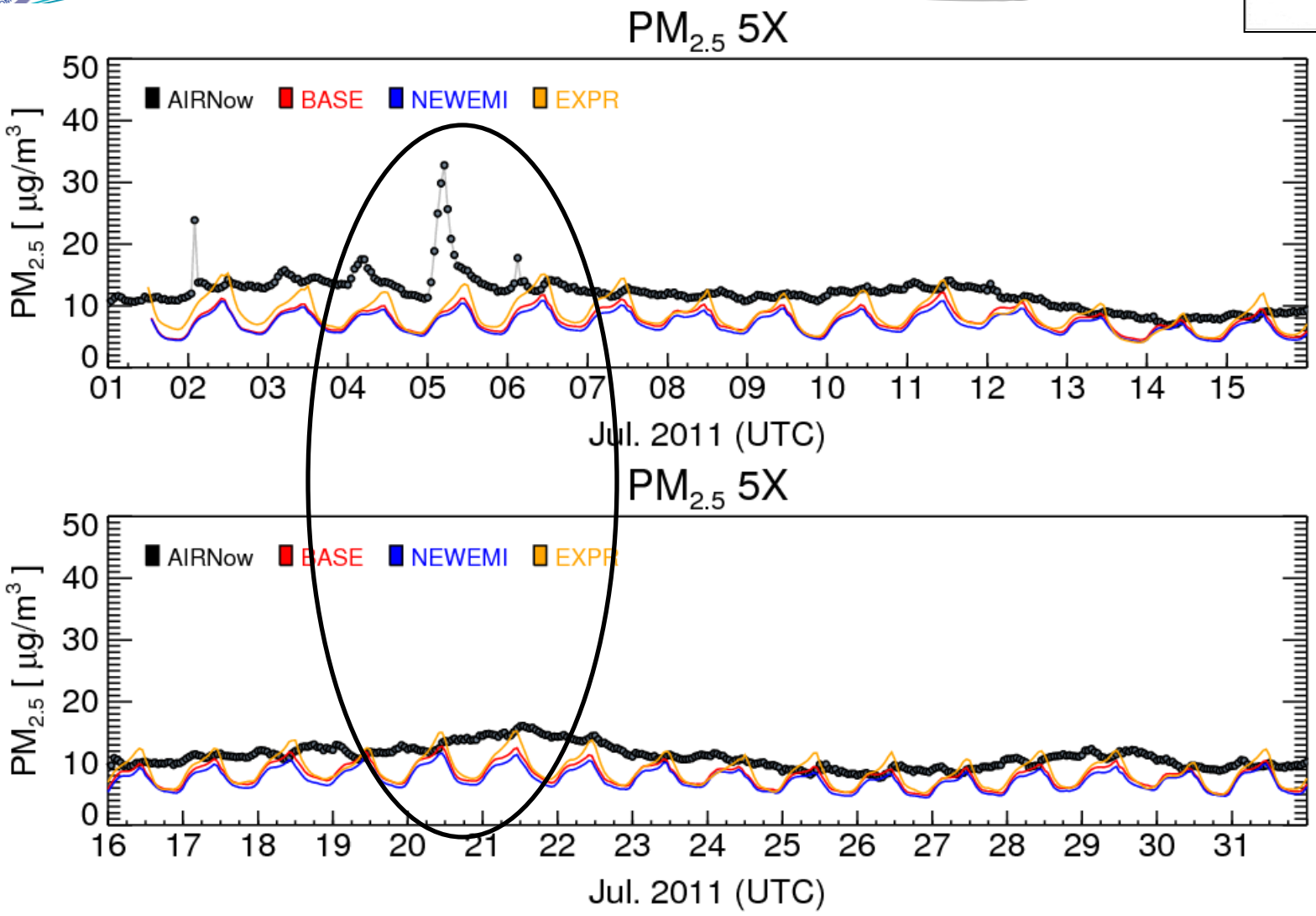


NOAA/ARL/AQUEST-APL1210

Significantly reduced bias at daytime peaks. Small improvement at night.

Hourly surface PM2.5 Comparison

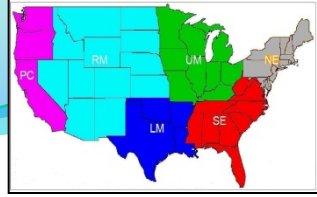


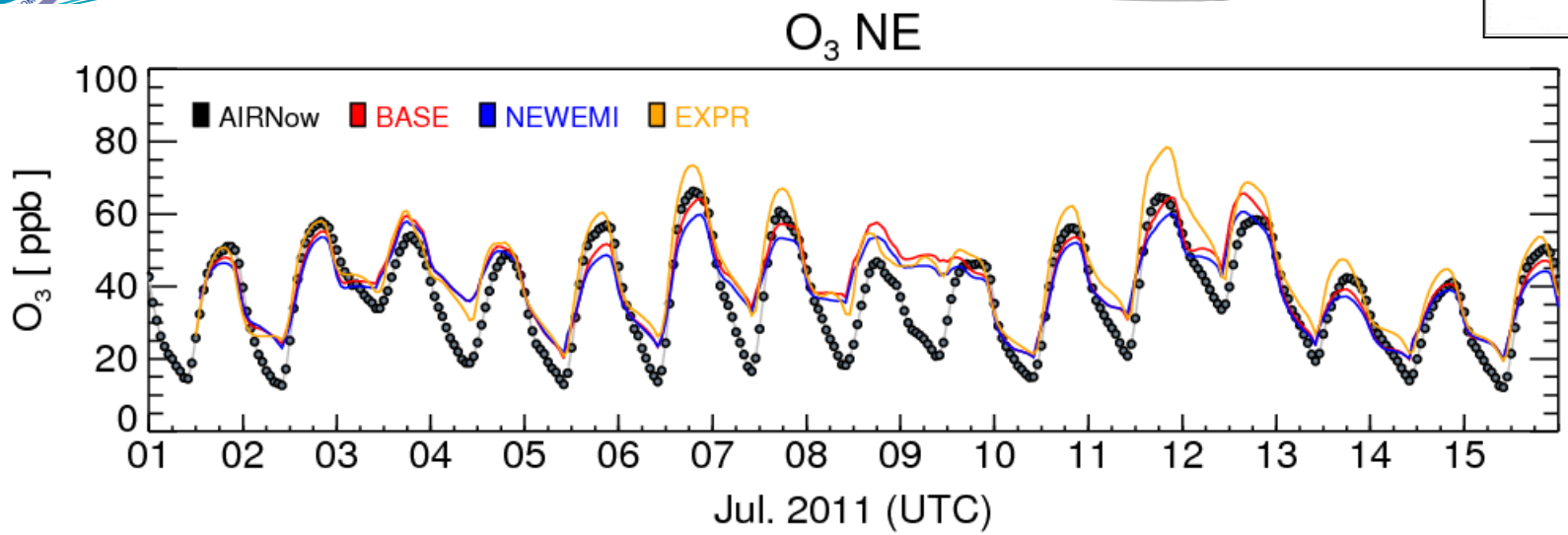


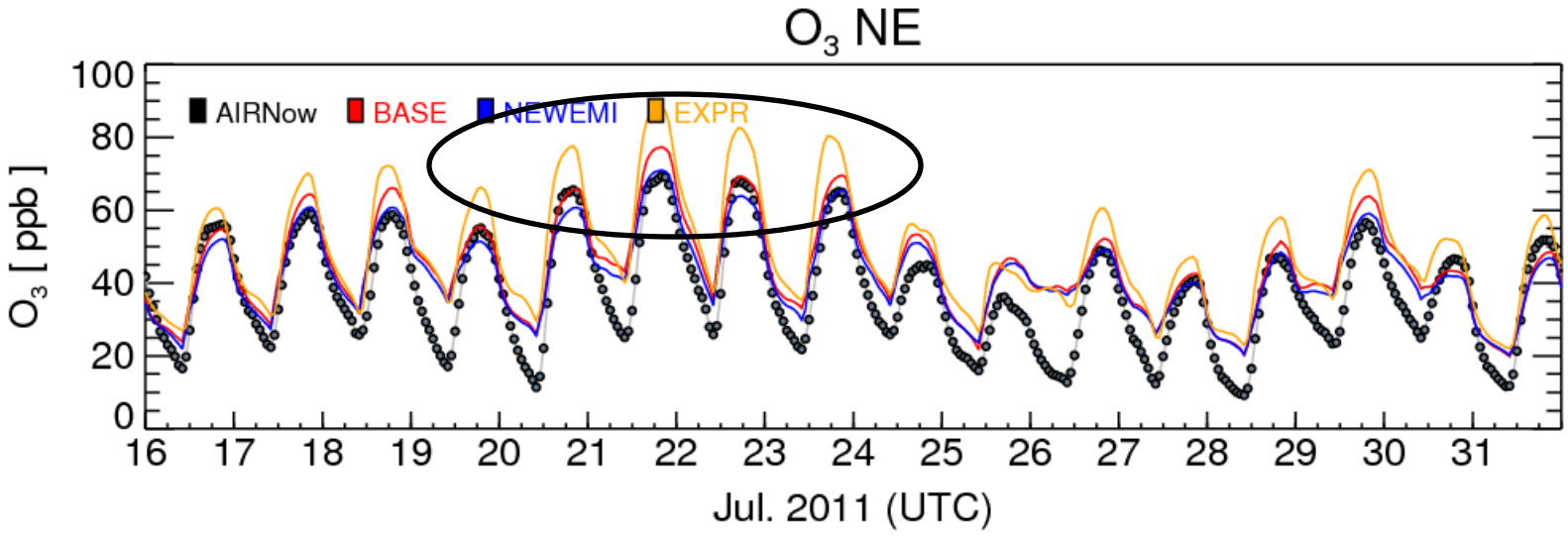
NOAA/ARL/AQUEST-APL1210

July 2nd was Saturday. July 5th was Monday holiday after independence Day. Reduction in NO_x emission exacerbated PM low-bias further.

Hourly surface O3 Comparison



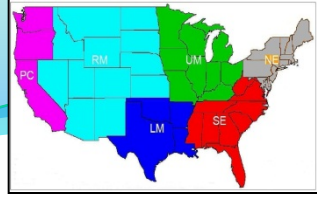


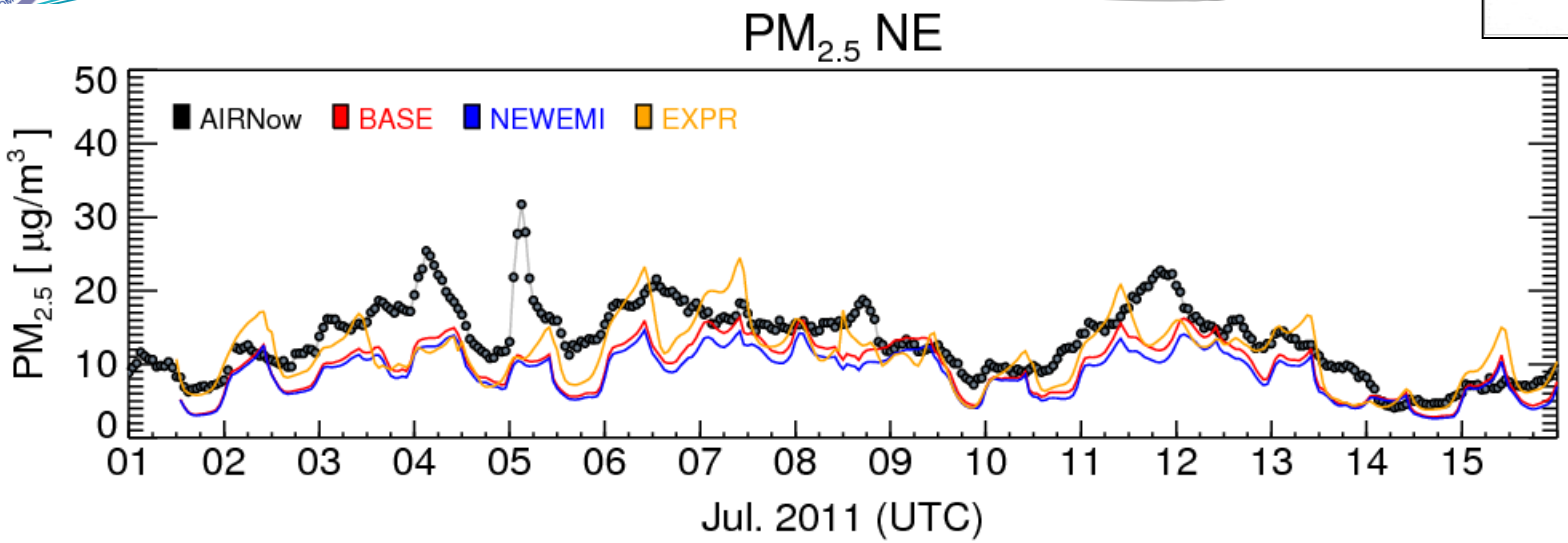


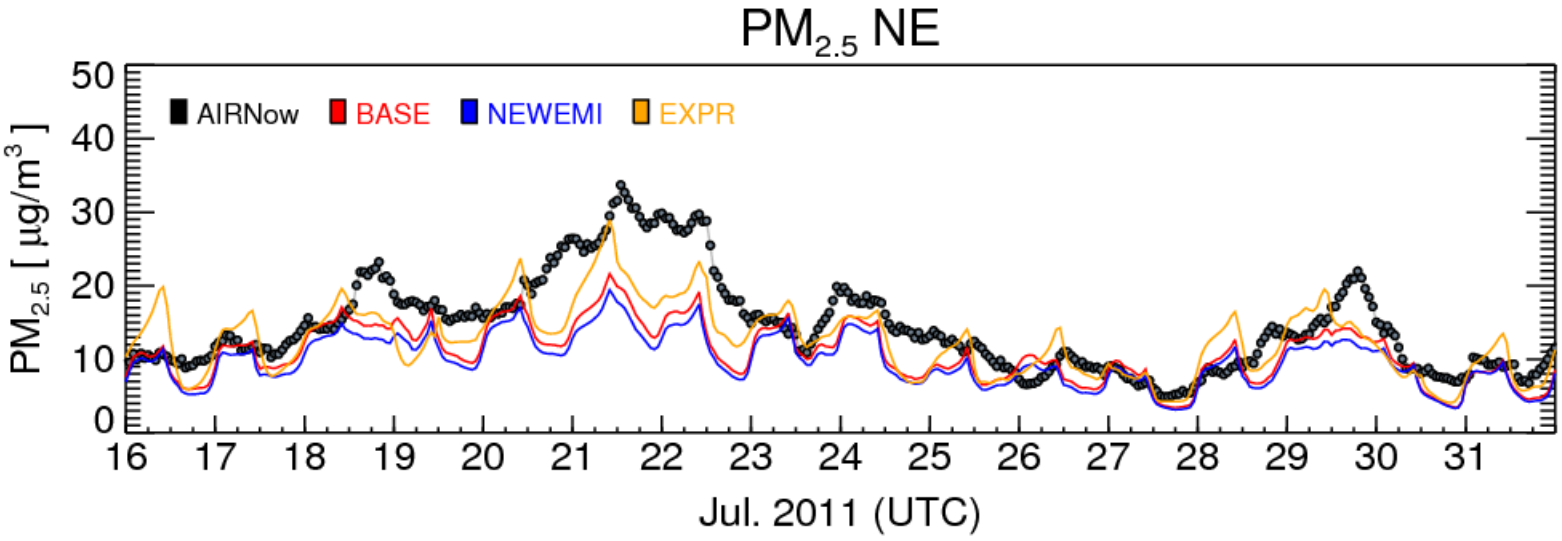
NOAA/ARL/AQUEST-APL1210

Modeled domain peak hourly O_3 over CONUS for July appeared in NE

Hourly surface PM2.5 Comparison



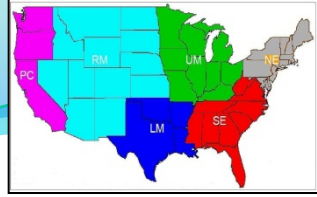


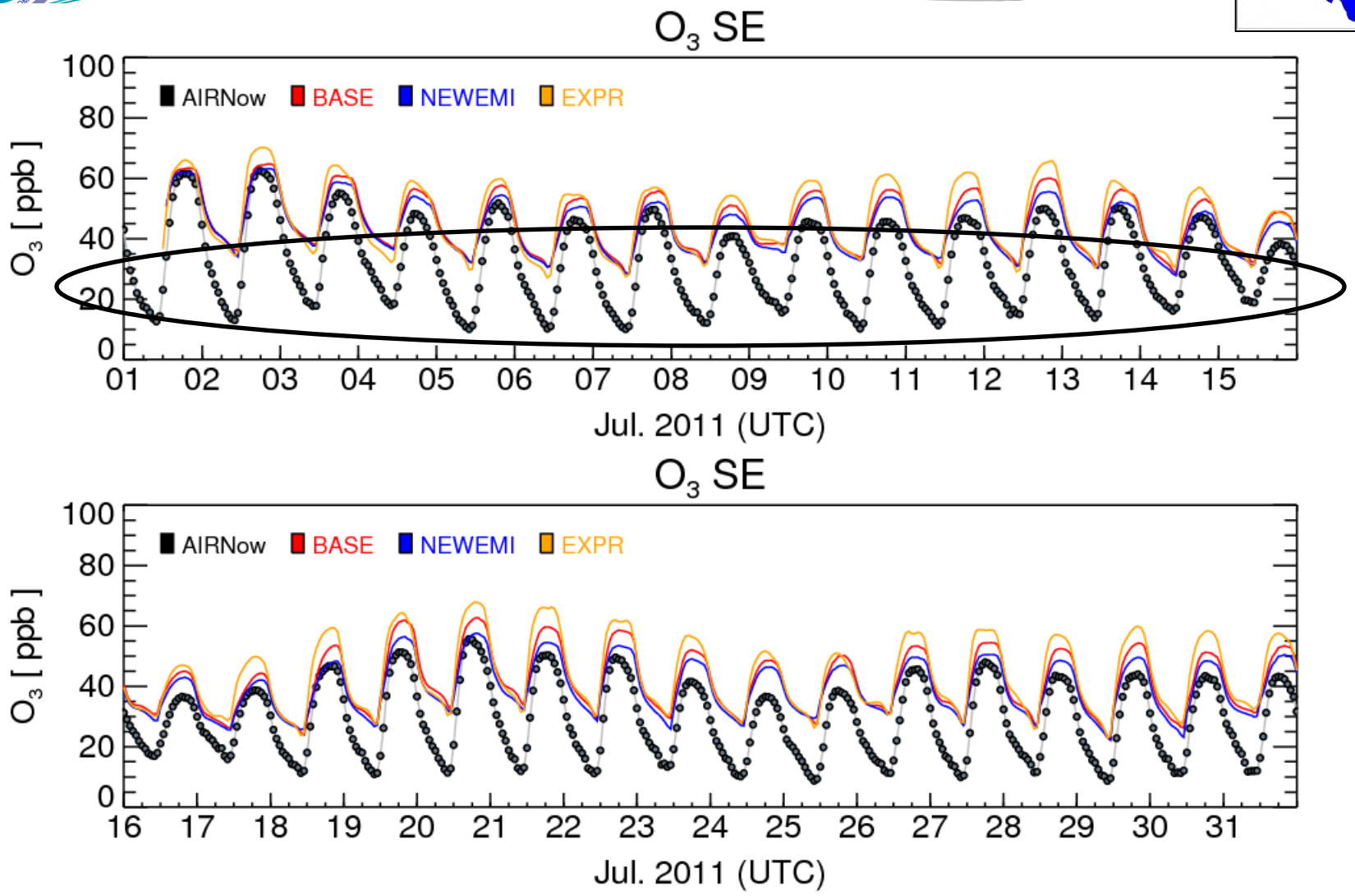


NOAA/ARL/AQUEST-APL1210

PM for the NEWEMI Case is consistently lower

Hourly surface O3 Comparison

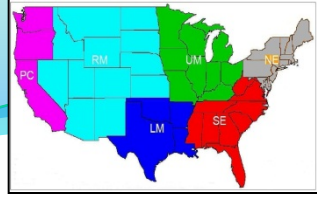


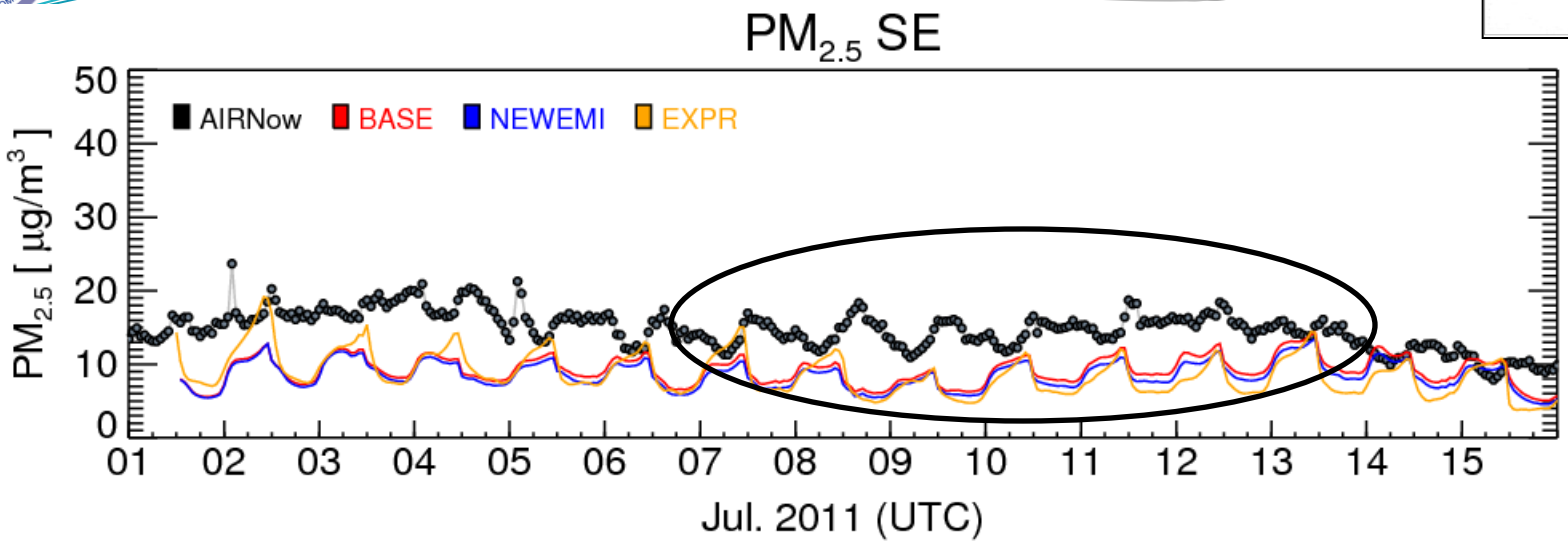


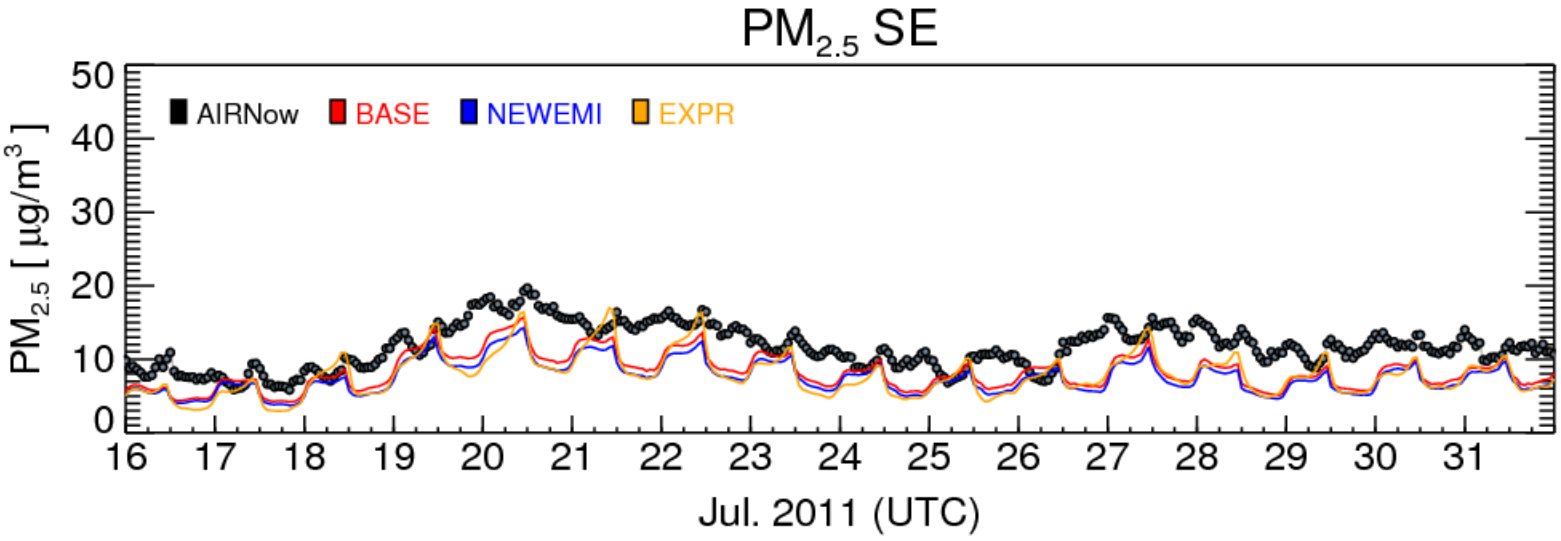
NOAA/ARL/AQUEST-APL1210

High over-bias at night: Possibly missed soil NO_x in rural/suburban

Hourly surface PM2.5 Comparison



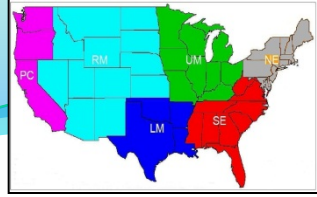


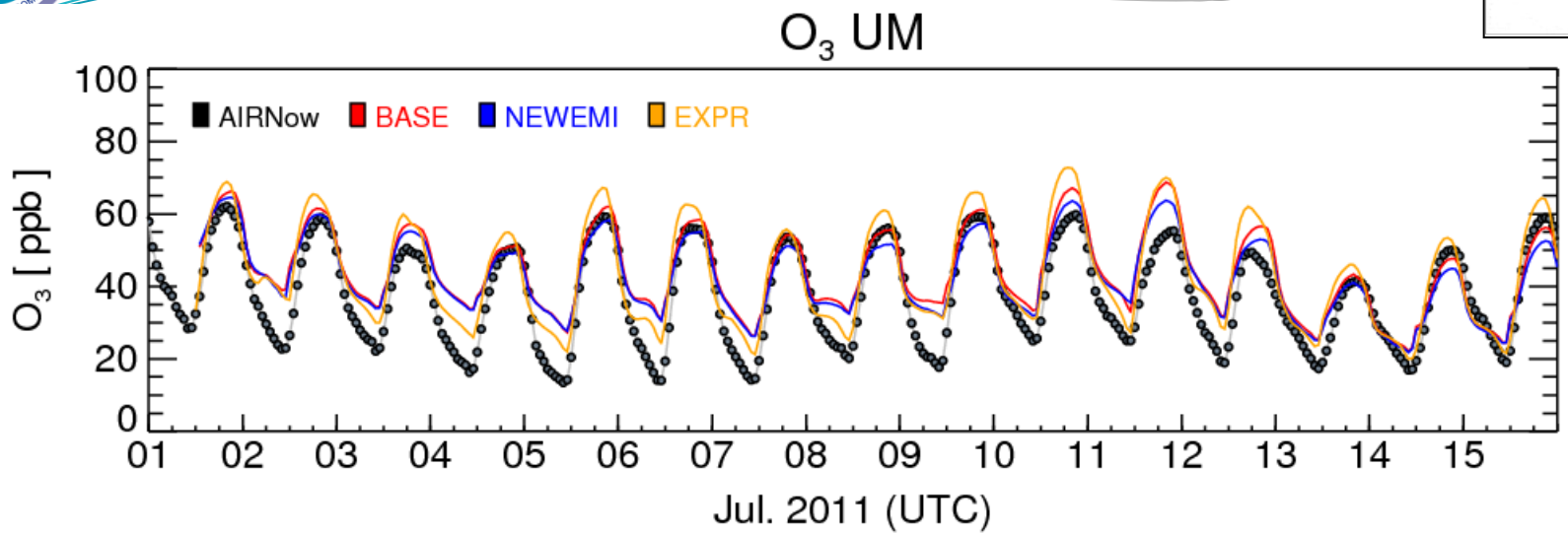


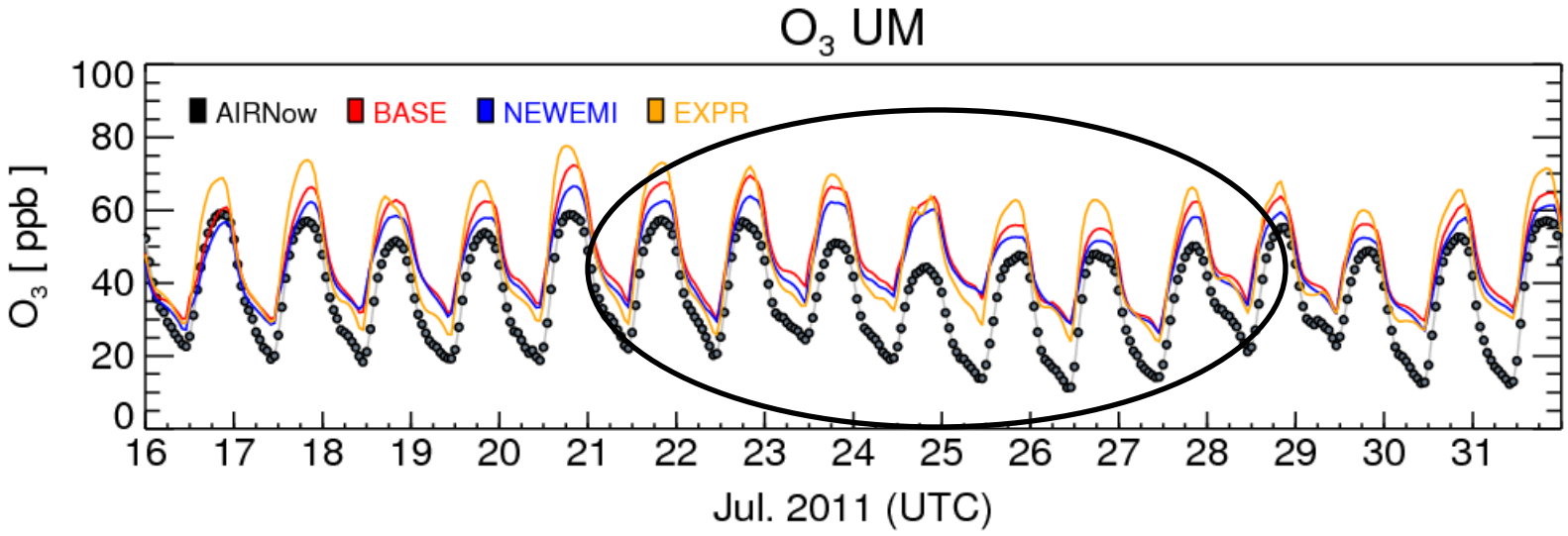
NOAA/ARL/AQUEST-APL1210

Issues in diurnal cycle?

Hourly surface O3 Comparison



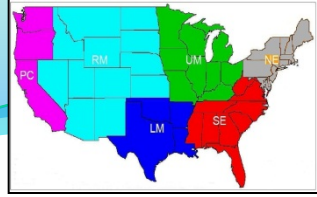


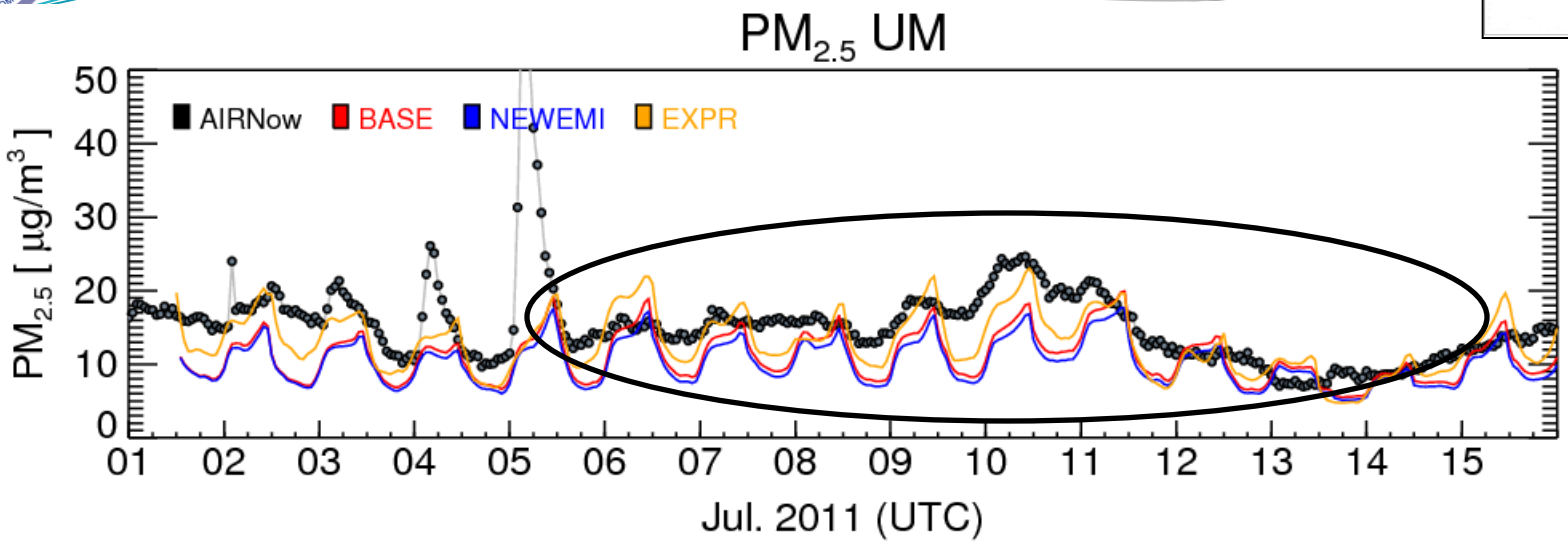


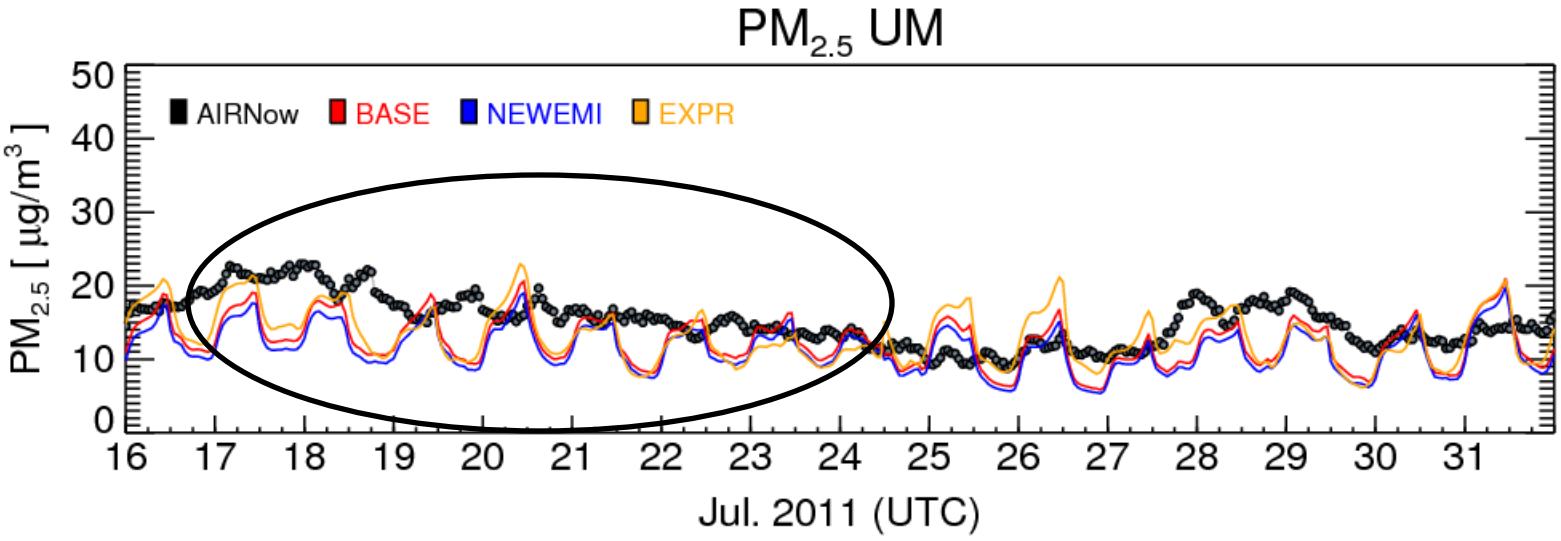
NOAA/ARL/AQUEST-APL1210

Very low O_3 in night time. Can It be missed Soil NO_x?

Hourly surface PM2.5 Comparison



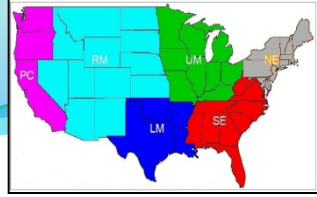


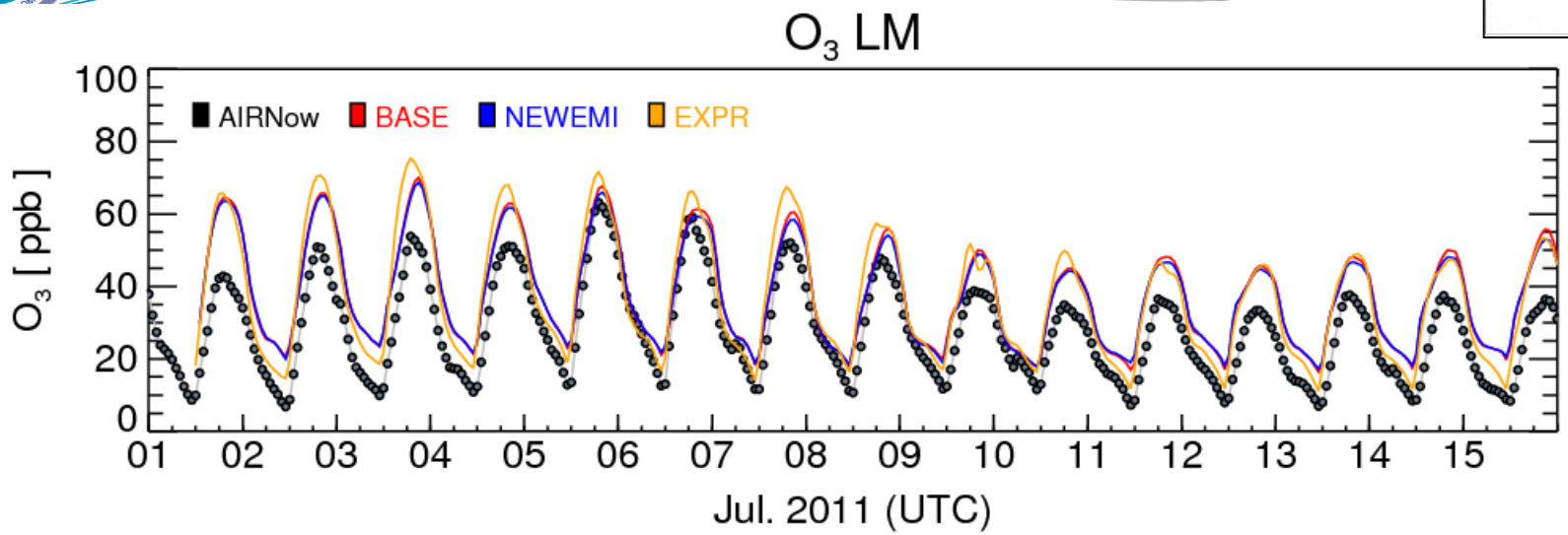


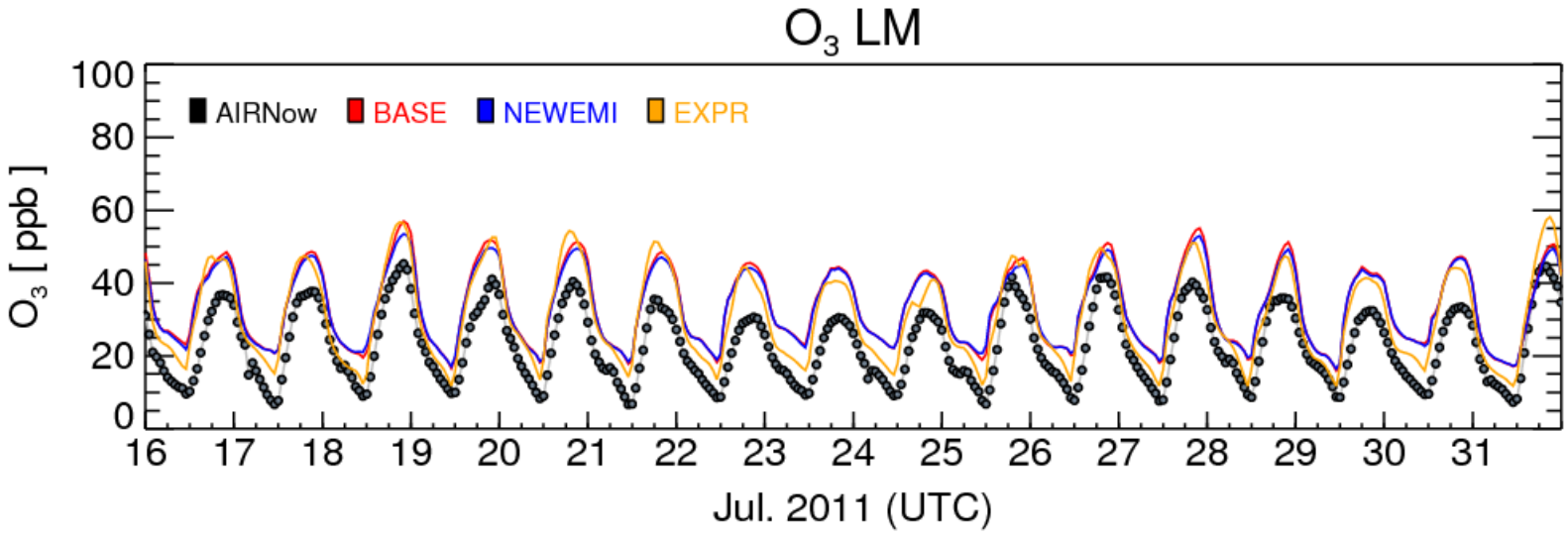
NOAA/ARL/AQUEST-APL1210

Issues in capturing synoptic impact ?

Hourly surface O3 Comparison







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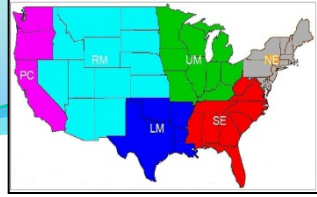
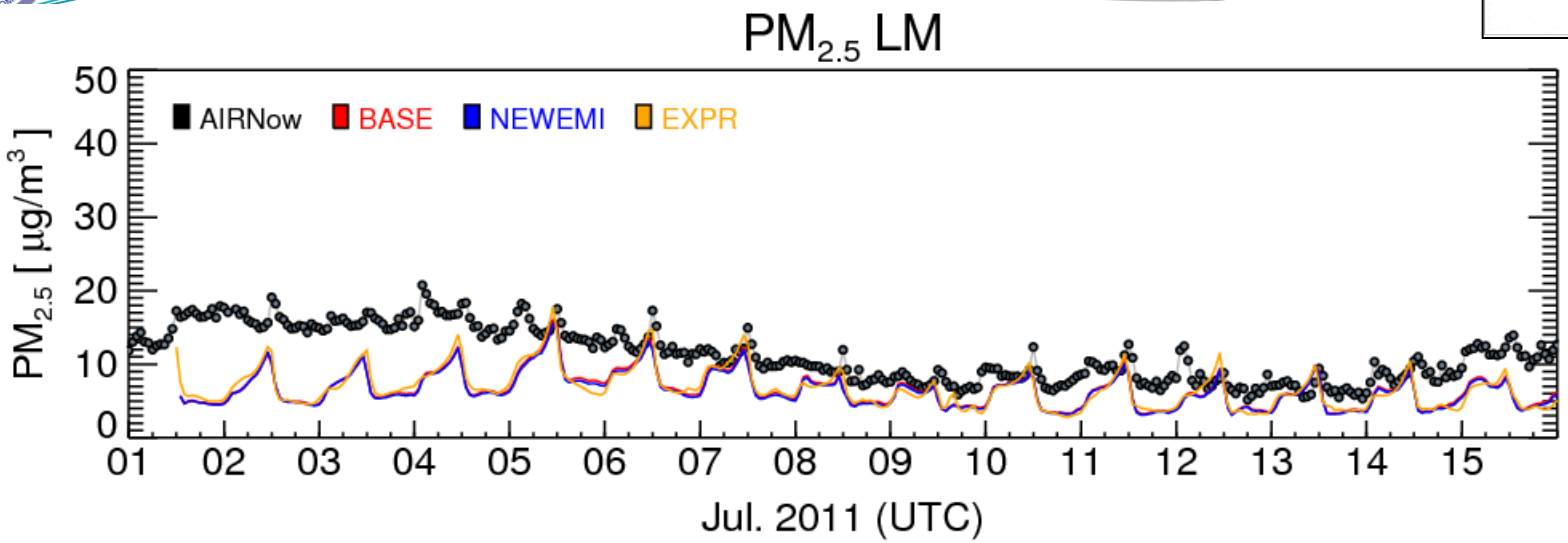
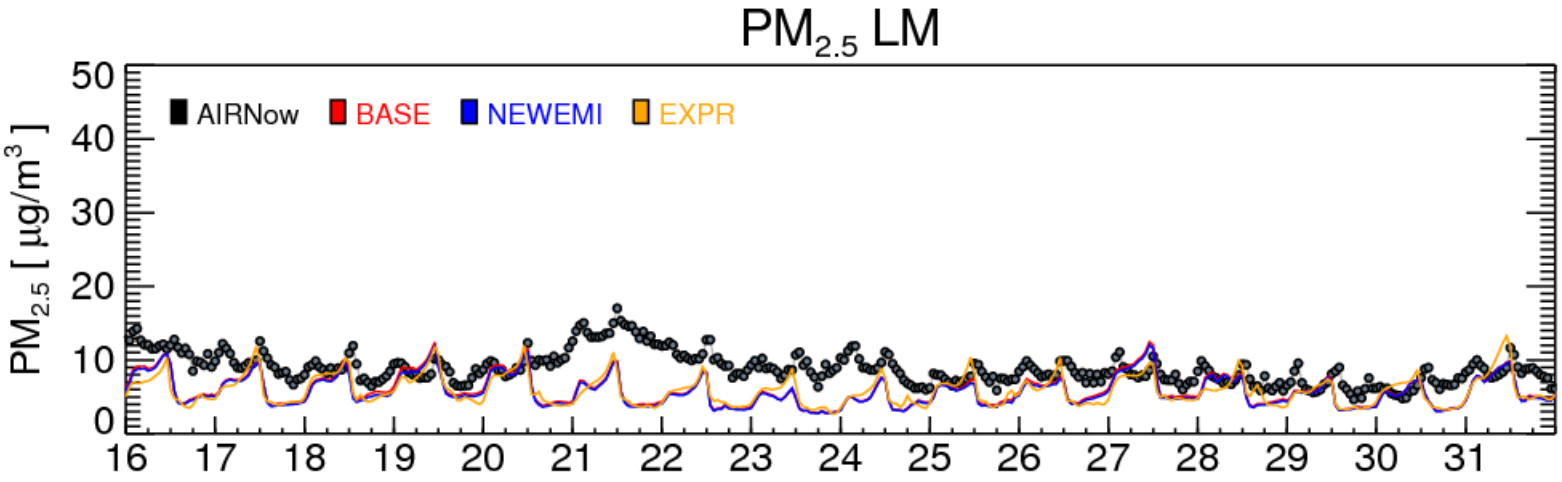
Hourly surface PM2.5 Comparison







Modeled PM missed the day to day variability e.g. Trend of high maxima on July 3-6 and again July 22-23 were not reproduced.

Summary:

- **Substantial emission upgrades**

  Different then previous years:
  e.g. Mobile6 for mobile inventory as base data
  but scaled by growth/reduction rate for 2012
  - **Non-road area source used Cross State Rule Inventory**
  - **Canadian Emission used 2006 EI**

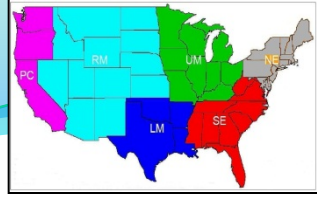
  Routine CEM updates for point sources

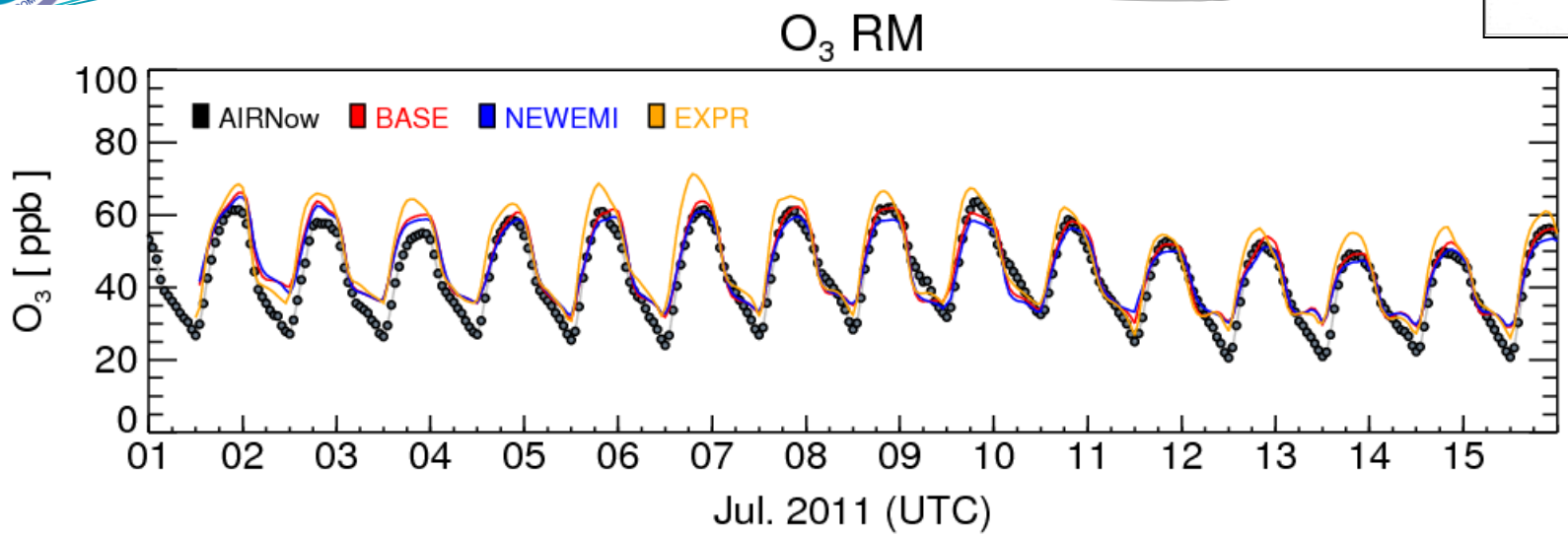
- **NAM was upgraded: Land-data from USGS to IGBP, Grid-staggering, and vertical grid structure.**

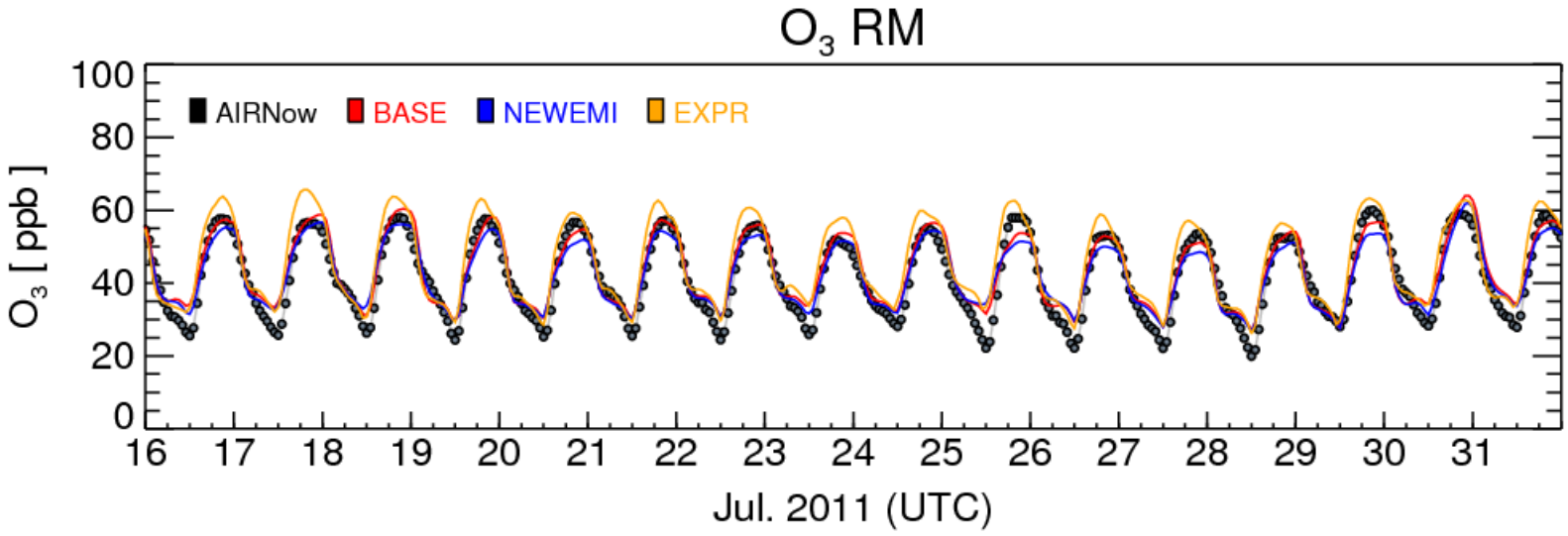
- **Looking ahead:**
  - **CMAQ471 looked promising**
  - **Real-time capturing of intra and exo-domain wild fire and dust**
  - **Finer horizontal grid resolution for limited domains**
  - **Make better use of in-situ and air-borne platform acquired data for model evaluation**

BACK Up Slides

Hourly surface O3 Comparison







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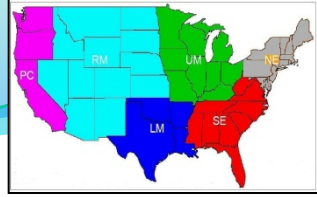
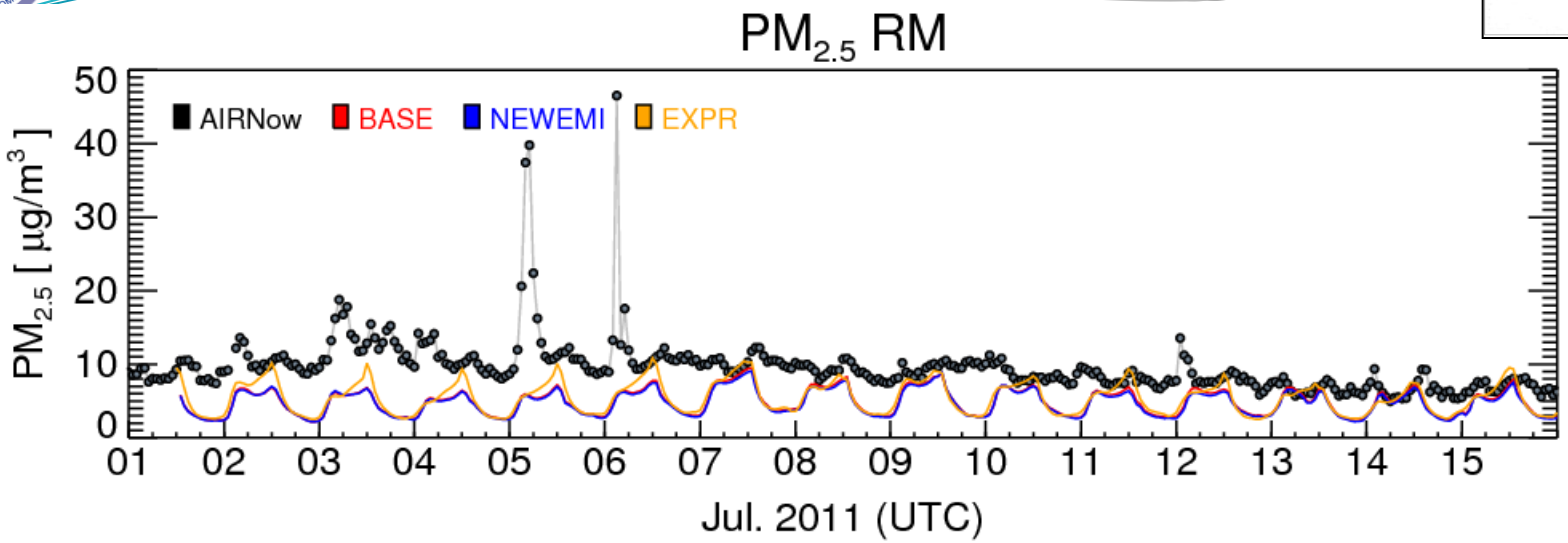
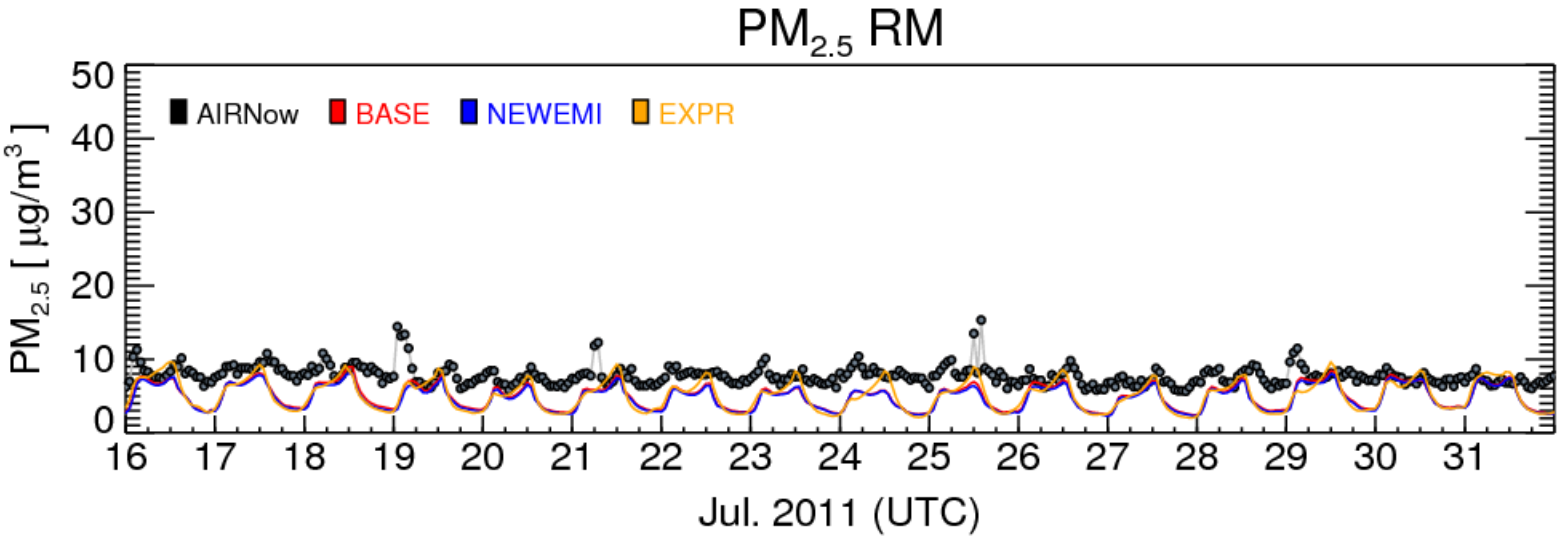
Hourly surface PM2.5 Comparison







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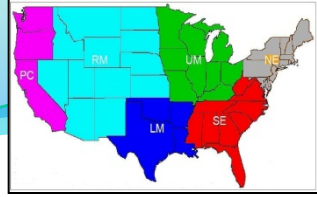
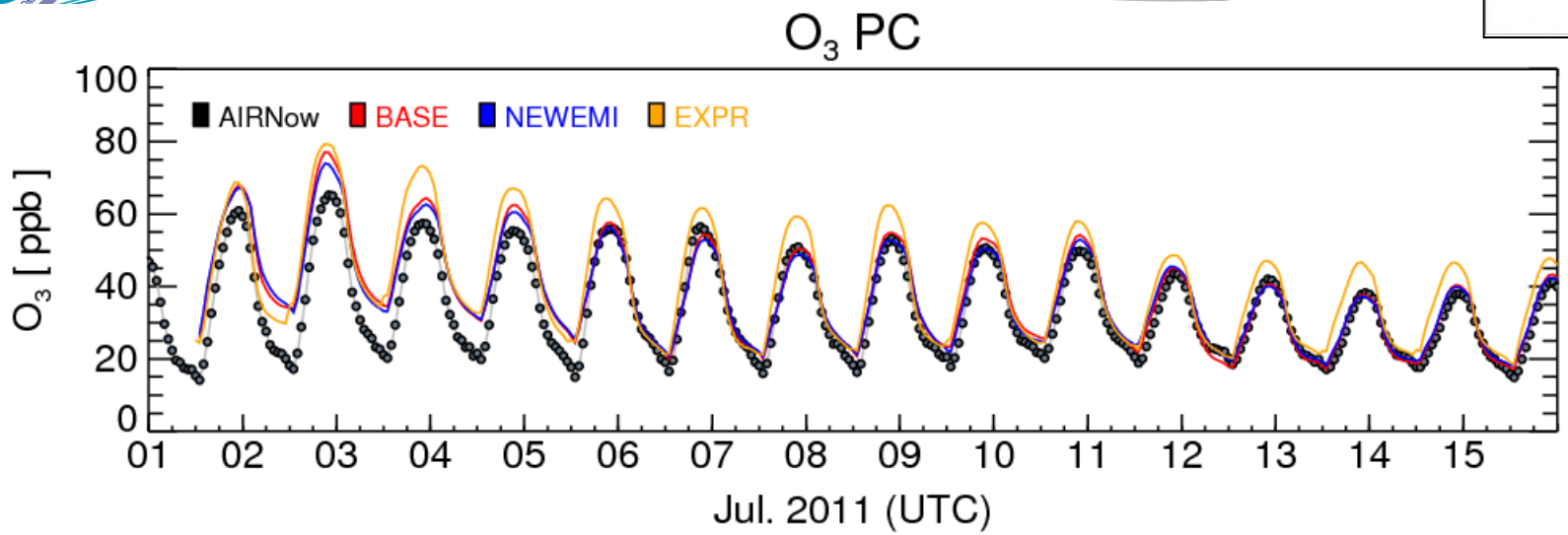
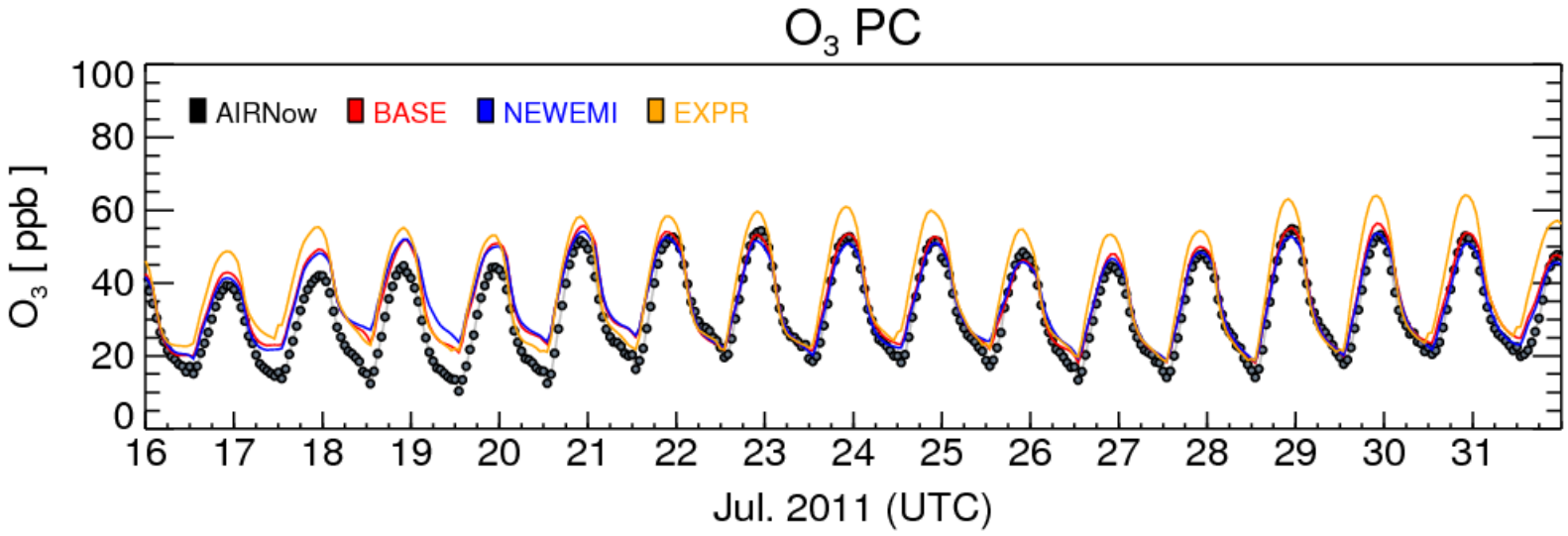
Hourly surface O3 Comparison

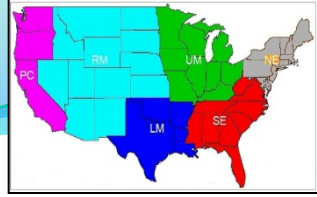


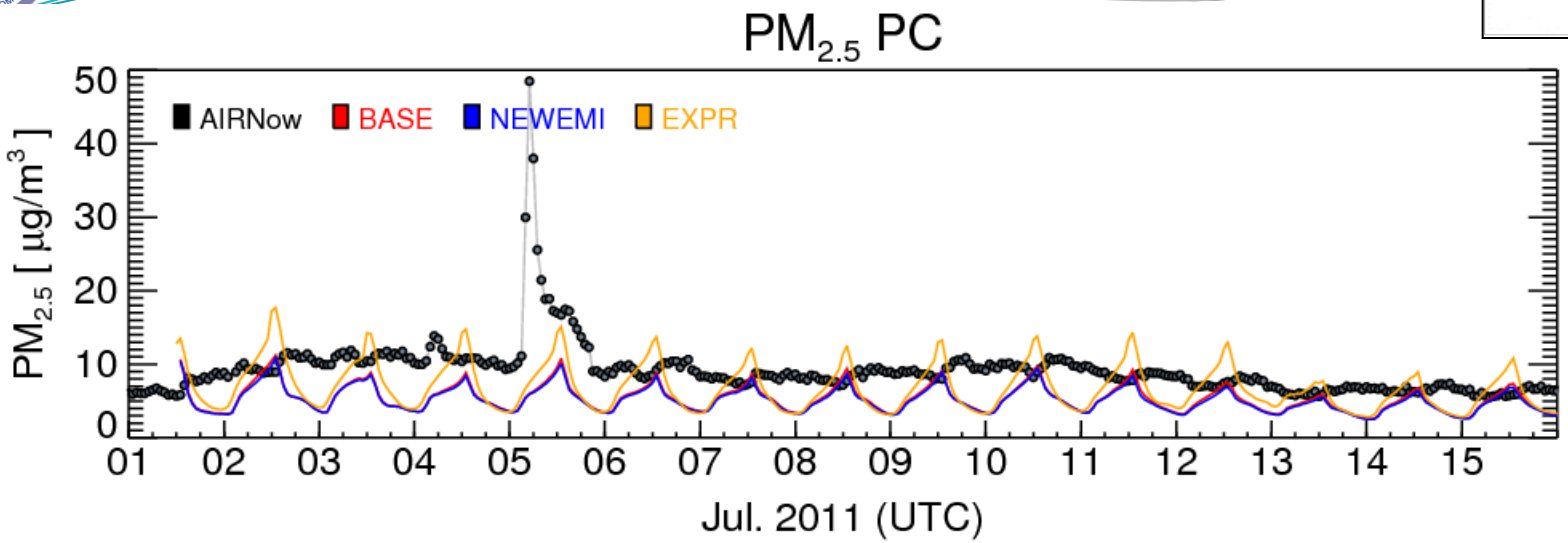


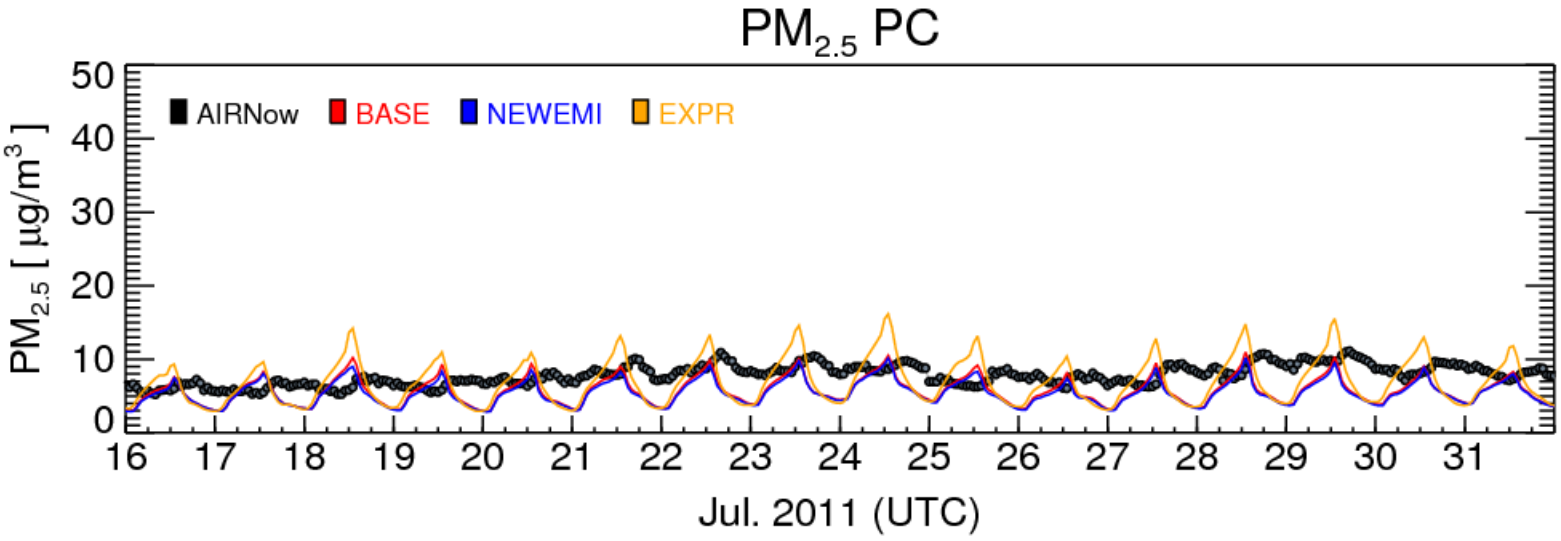


NOAA/ARL/AQUEST-APL1210

Hourly surface PM2.5 Comparison

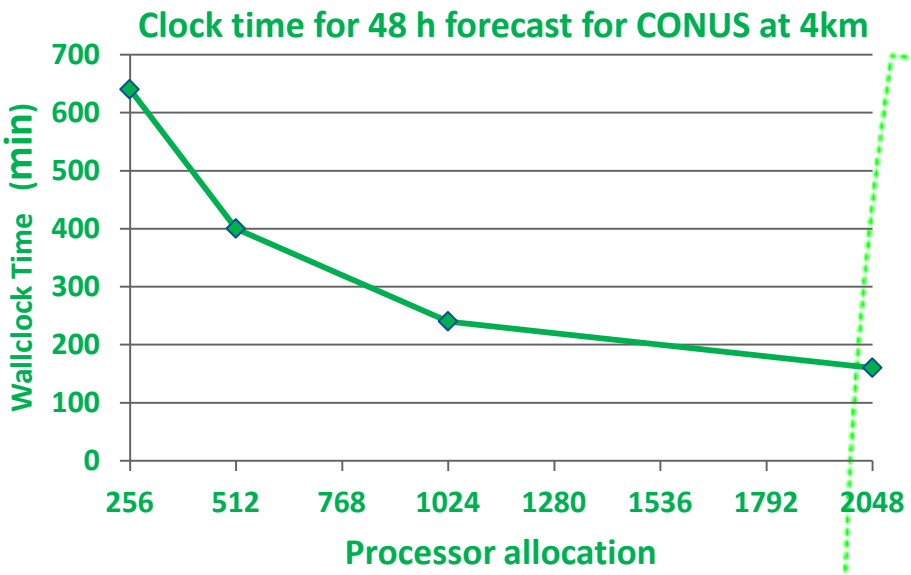


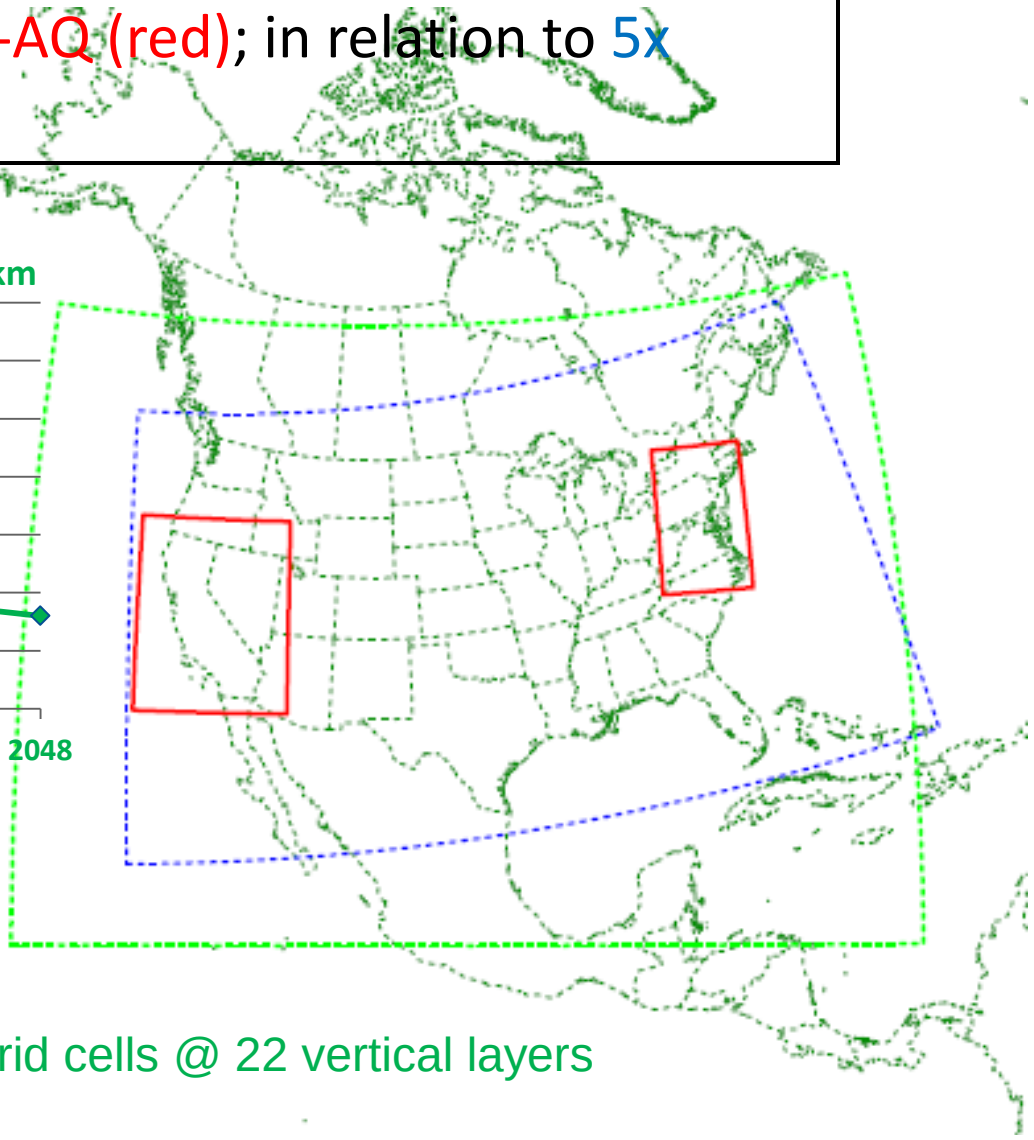




NOAA/ARL/AQUEST-APL1210

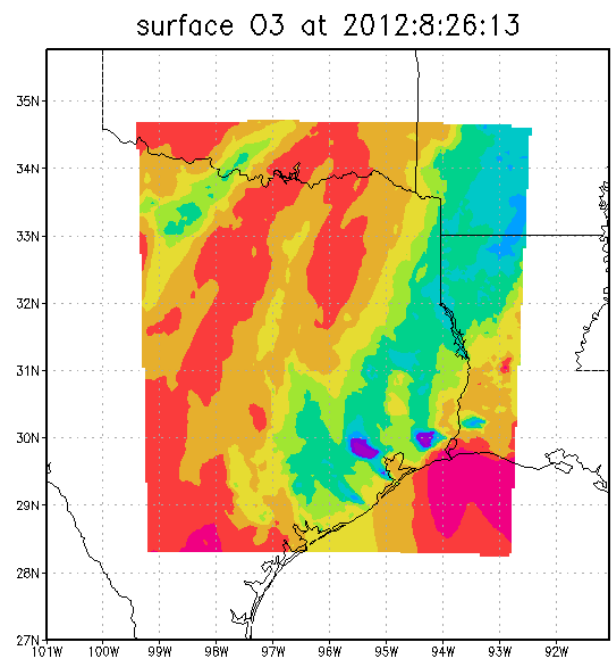
Nmmb grids: nested CONUS (green)*, nested CalNex and Discover-AQ (red); in relation to 5x (blue)

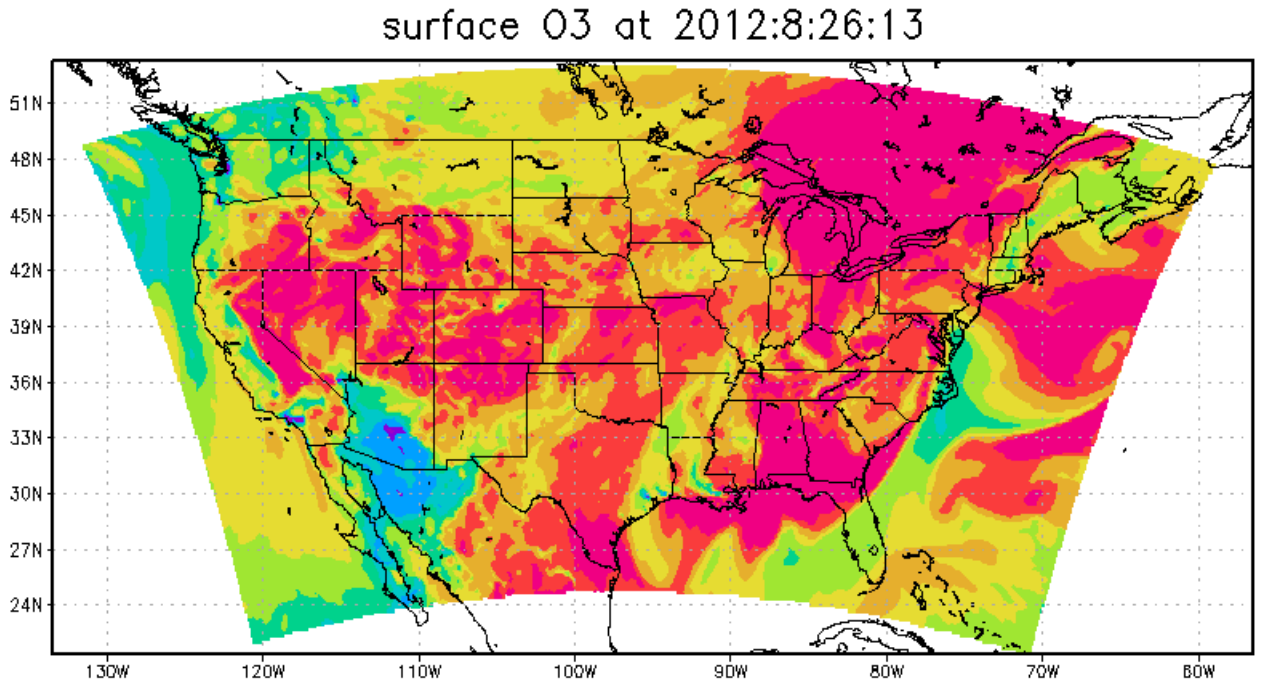




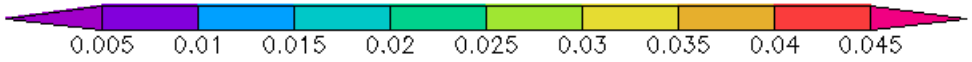
*1326*795=1.05 million horizontal grid cells @ 22 vertical layers

A nesting of CMAQ model run was tested over eastern TX on Aug 26 2012

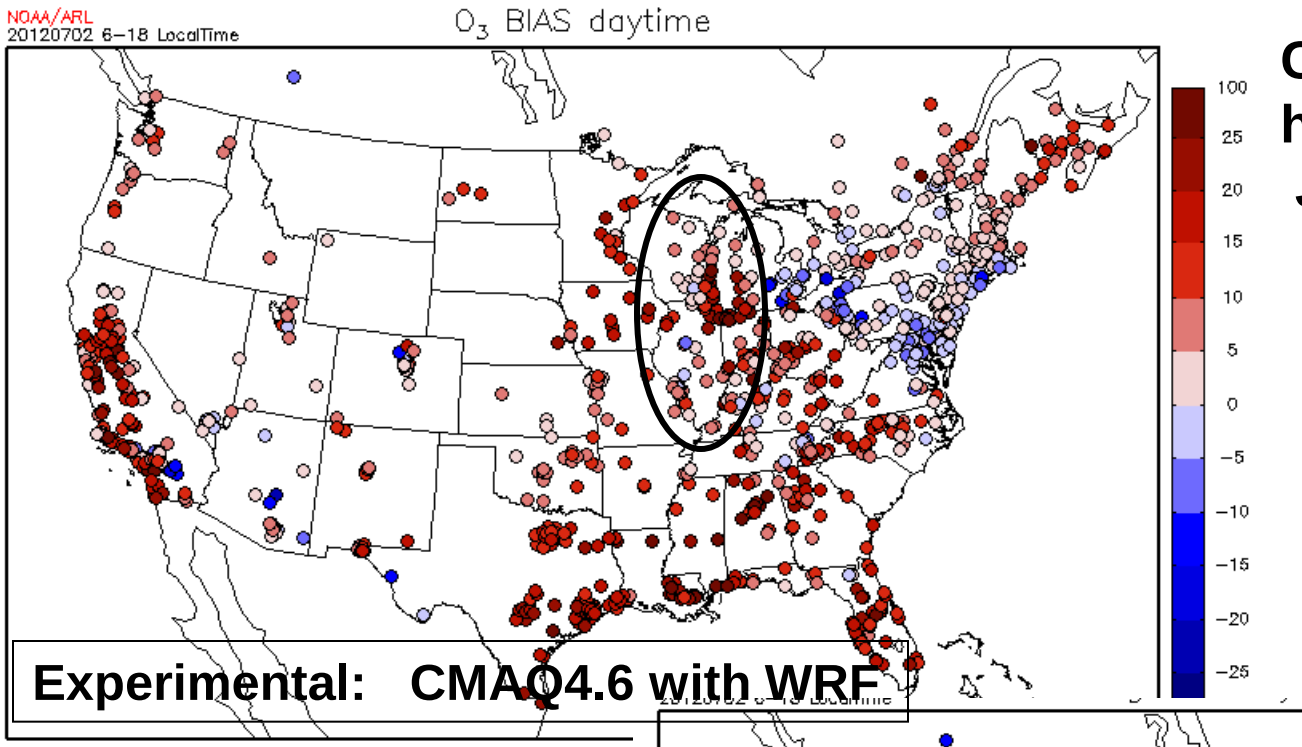




4km with 160*180 grid cells



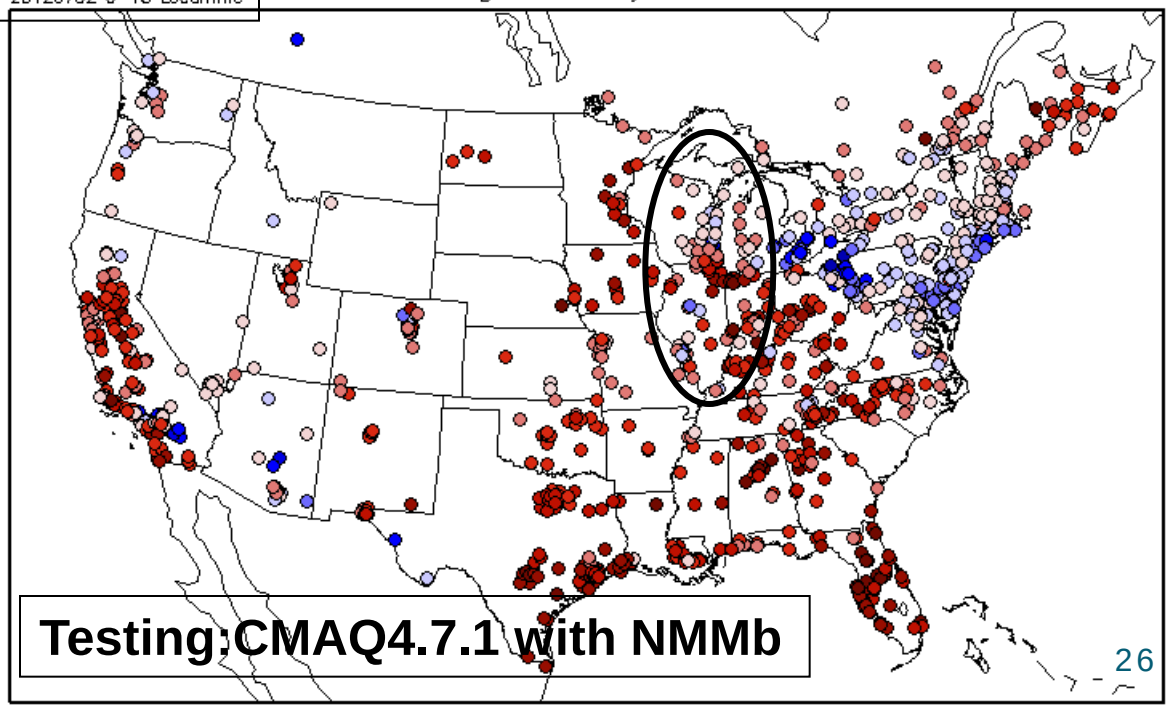
Parent domain provides dynamic LBC for nested-in domain



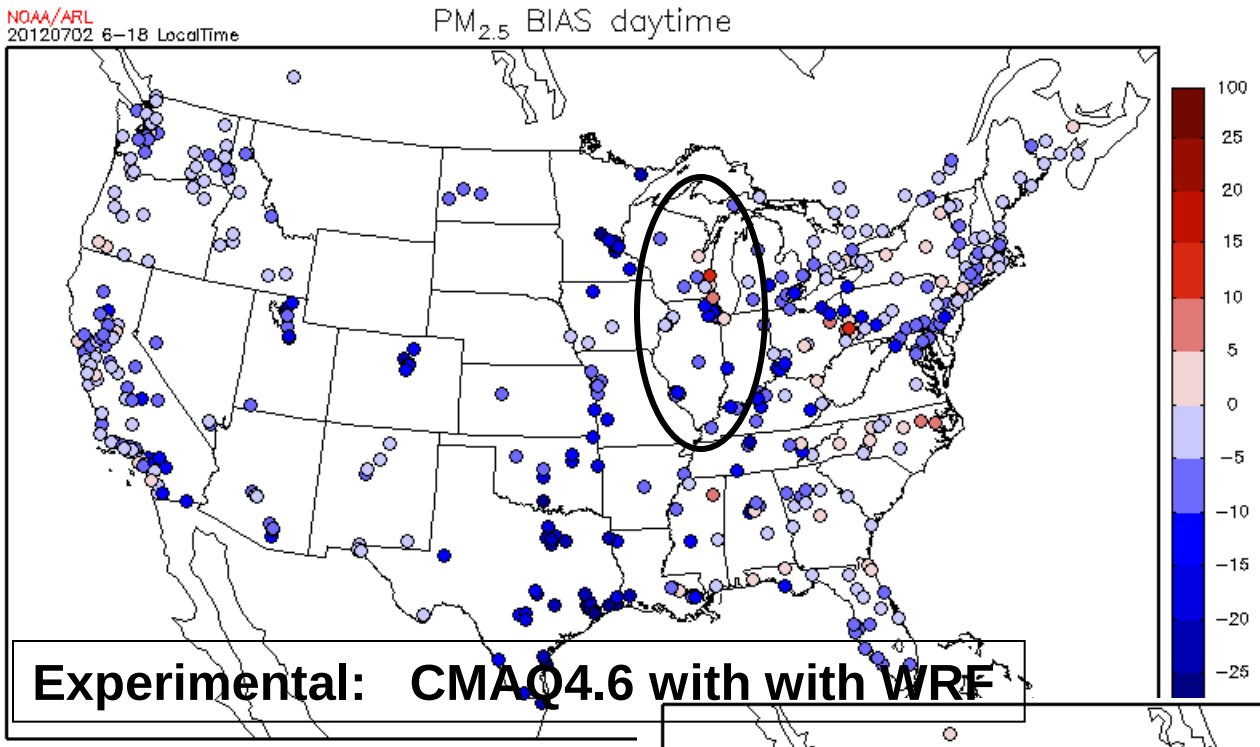
CMAQ 4.7.1
has been tested over :
July 2nd, 2012

Daytime O3 bias

Experimental: CMAQ4.6 with WRF



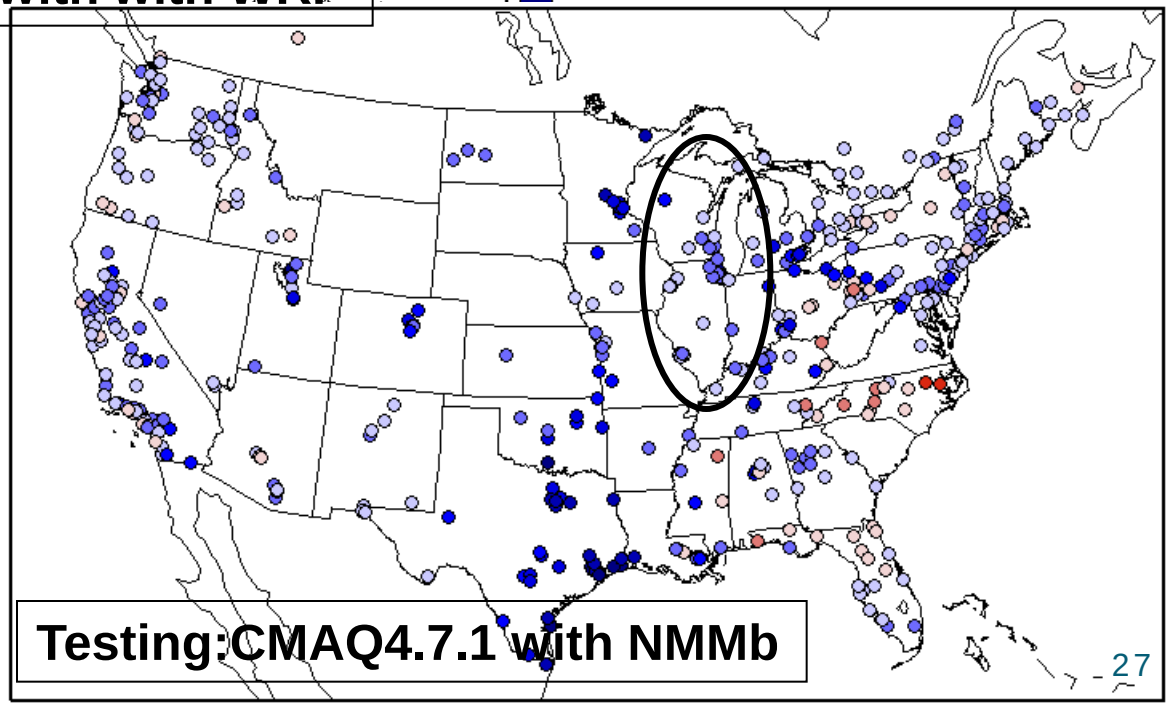
Testing:CMAQ4.7.1 with NMMb



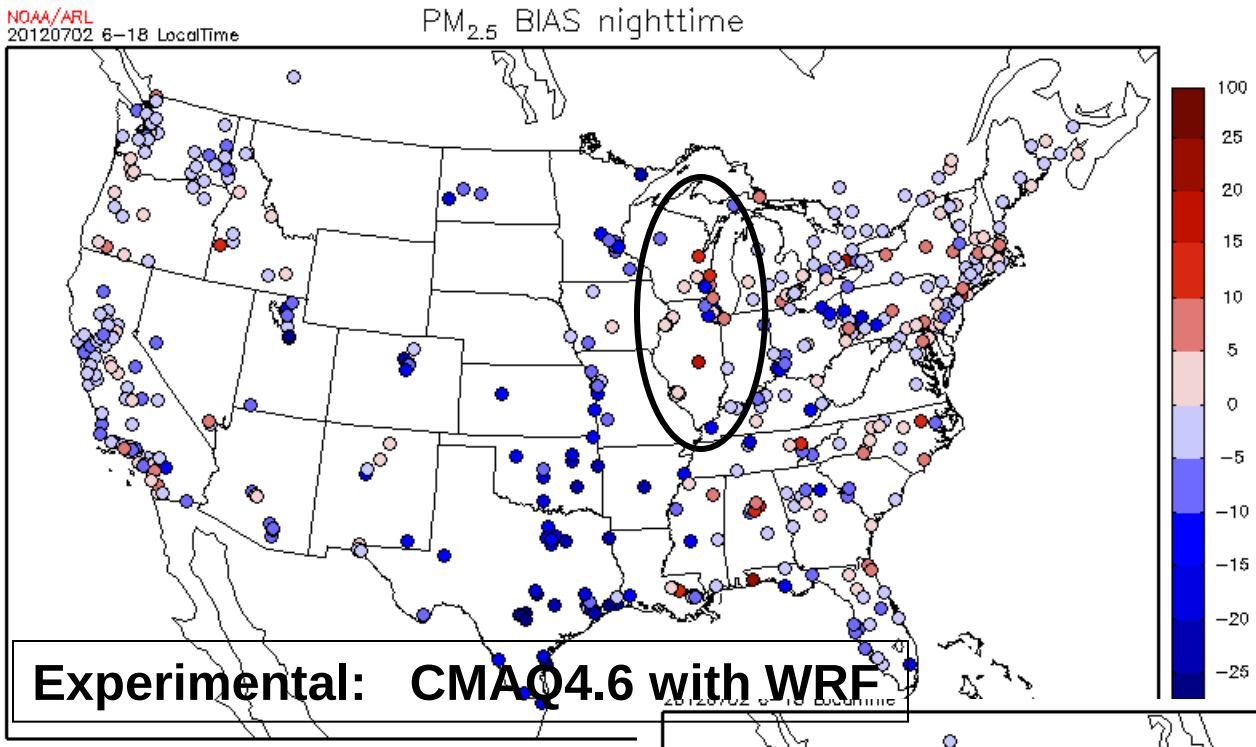
CMAQ 4.7.1
has been tested over :
July 2nd, 2012

Daytime PM bias

Experimental: CMAQ4.6 with with WRF



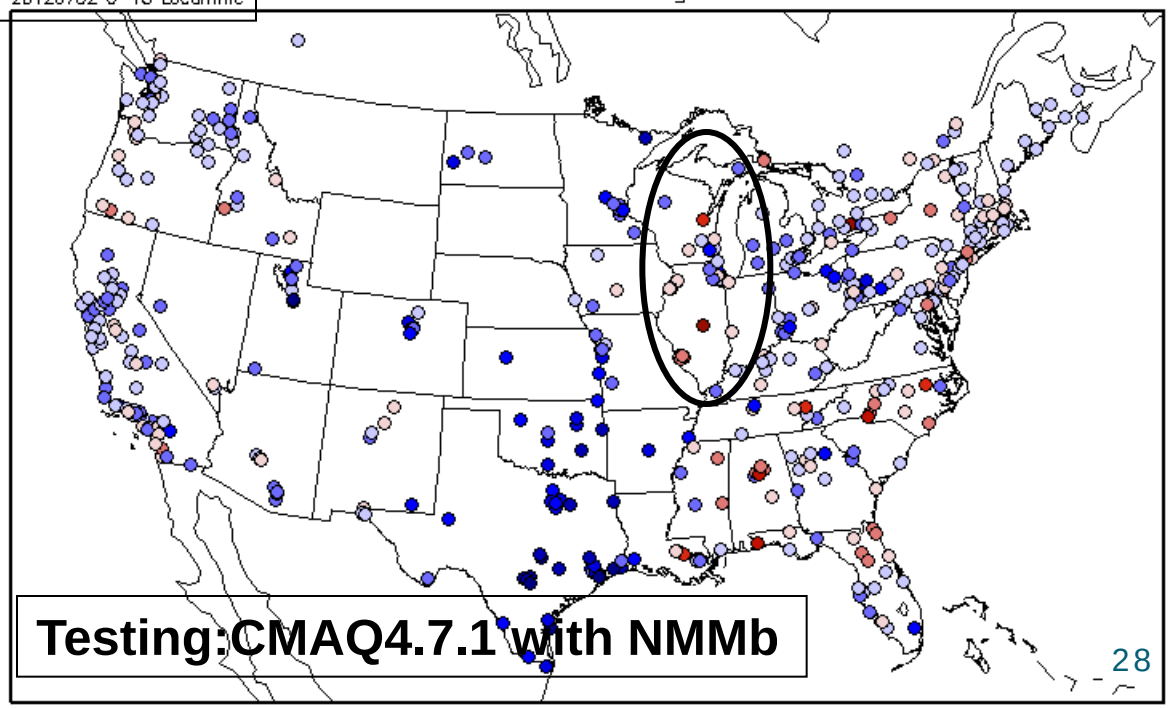
Testing:CMAQ4.7.1 with NMMb



CMAQ 4.7.1
has been tested over :
July 2nd, 2012

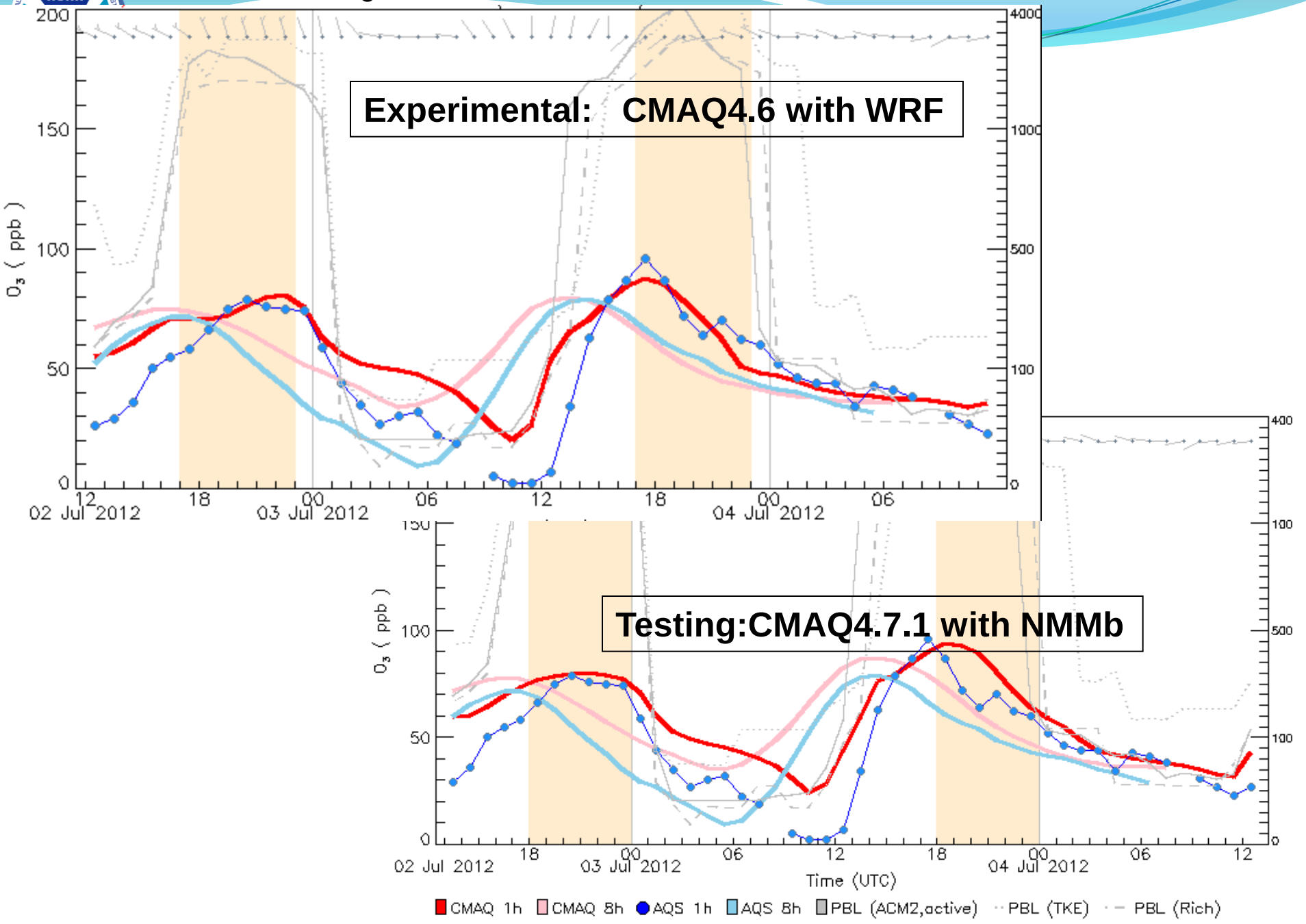
Nighttime PM bias

Experimental: CMAQ4.6 with WRF

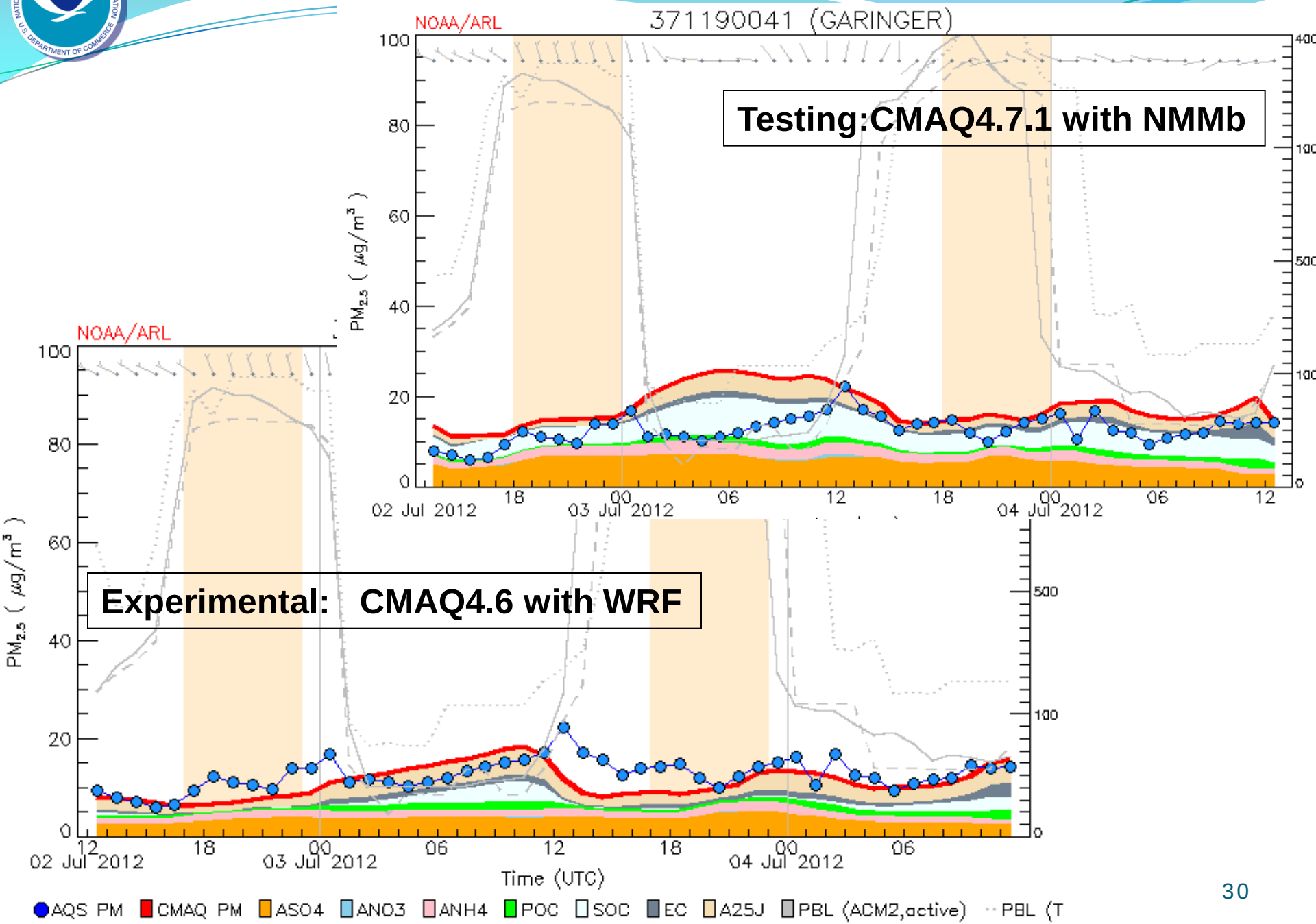


Testing:CMAQ4.7.1 with NMMb

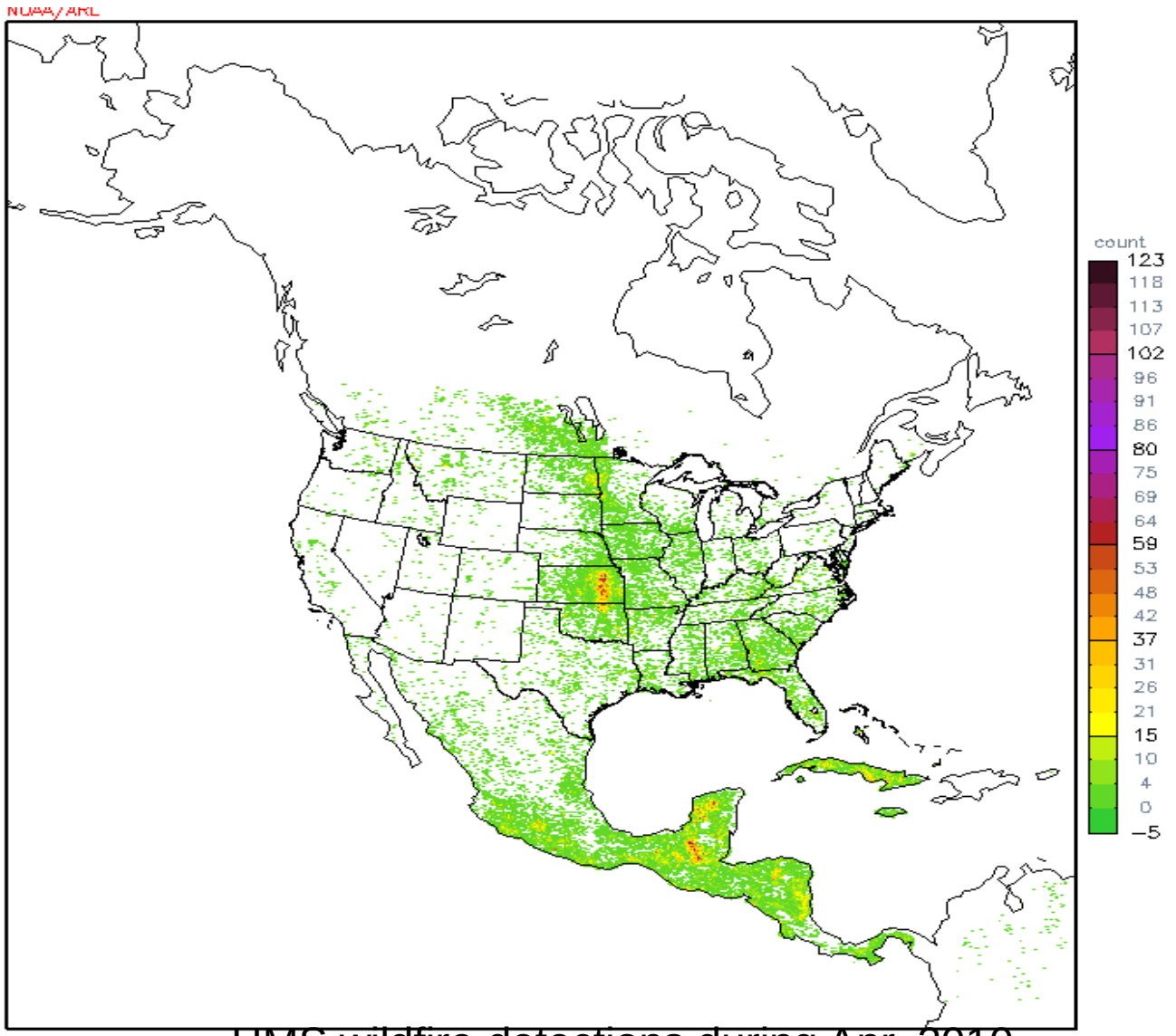
Surface O_3 in Charlotte, NC, during July 2 – 4 , 2012



Surface O_3 in Charlotte, NC, during July 2 – 4 , 2012

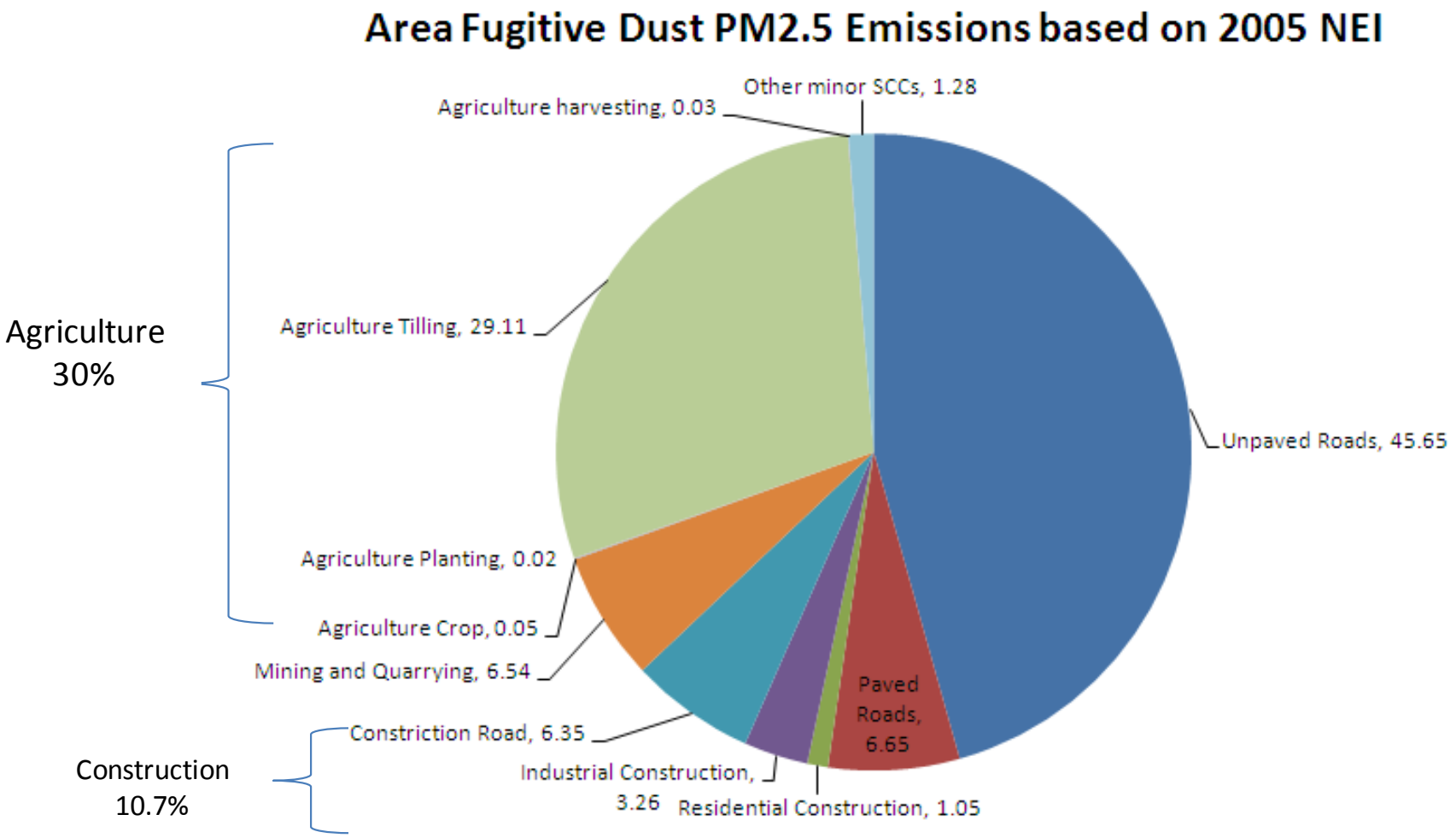


Emission should include Exo and intra domain wild fire



HMS wildfire detections during Apr. 2010

Investigation on apparently poor dust emission temporalization



Investigation on apparently poor dust emission temporalization cont'd