BAY AREA AIR QUALITY MANAGEMENT DISTRICT

AMS 2006 Atlanta

Comparison of WRF/CAMx and MM5/CAMx simulations for an ozone episode in California

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Purpose of the study

Evaluate the capabilities of the MM5/CAMx and WRF/CAMx modeling systems in air quality simulations in Central California.

- **MM5 – NCAR / Penn State Mesoscale Model Version 5**
- **WRF – Weather Research and Forecast Model**
- **CAMx – Comprehensive Air quality Model with extensions**

Is it time to switch from MM5/CAMx to WRF/CAMx for regulatory applications?

Episode selection

<u>CCOS (Central California Ozone Study)</u>:

- **Comprehensive meteorological and air quality measurements in Central California**
- **June – September 2000**

<u>Episode selected</u>:

- **July 31 – August 2, 2000**
- **Ozone exceeded the federal standards in 3 major regions in Central California: SFB (San Francisco Bay), SAC (Sacramento), SJV (San Joaquin Valley)**

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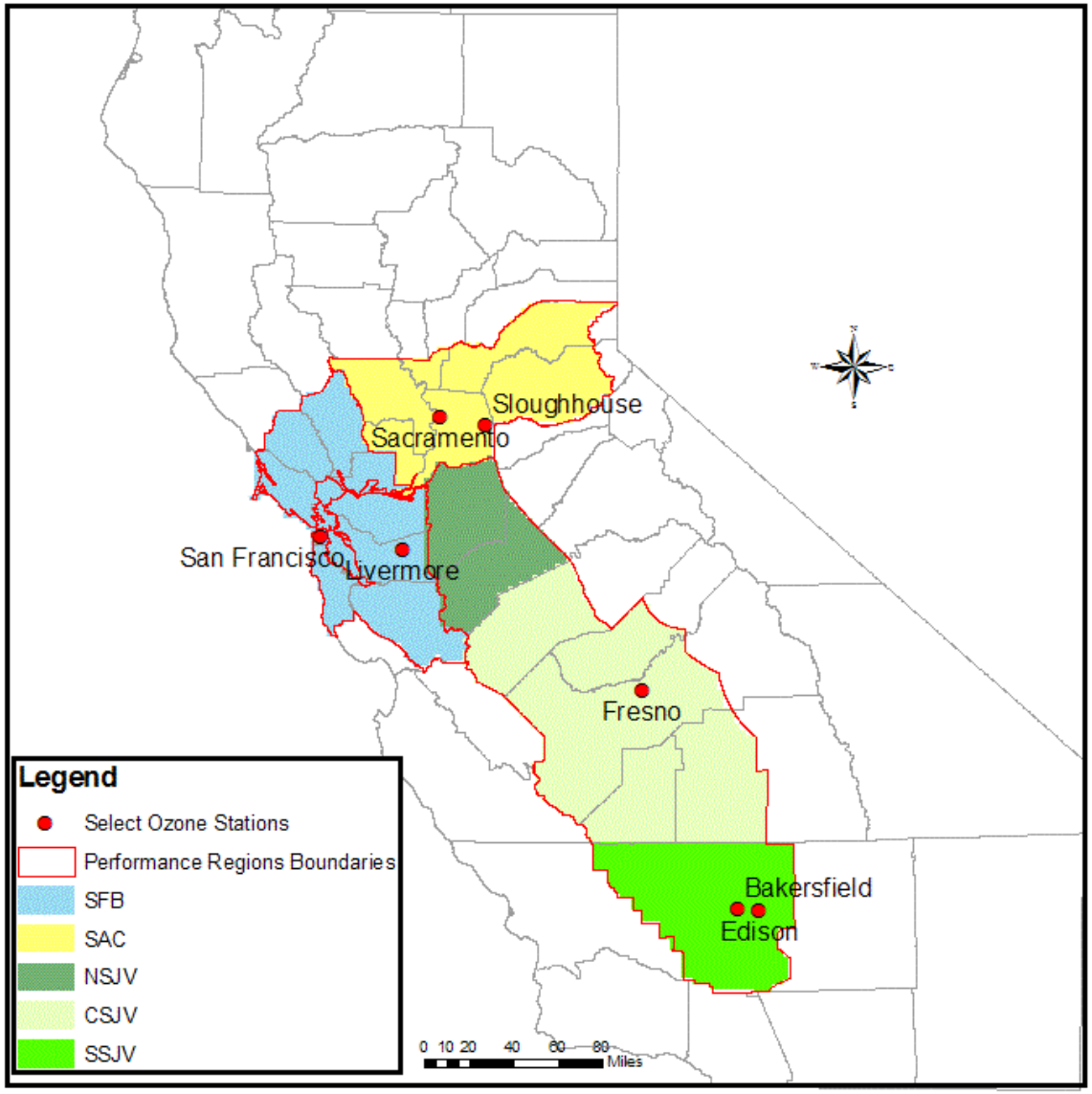
CCOS domain and regions



Observed maximum ozone in ppb

	1-Hour				8-Hour			
	SFB	SAC	Central SJV	Southern SJV	SFB	SAC	Central SJV	Southern SJV
DATE								
7/31/2000	126	103	118	115	89	89	103	95
8/1/2000	94	133	118	116	76	108	109	104
8/2/2000	98	115	119	151	84	107	106	112

Model specifications

Meteorological Models (MM5 and WRF):

- **Triple-nested grids: 36, 12 and 4 km**
- **Noah land surface scheme**
- **Eta PBL scheme**
- **FDDA in MM5 model run but NO FDDA in WRF model run**

Air Quality Model (CAMx):

- **4 km grid resolution**
- **TKE vertical diffusion scheme**

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Summary of MM5 and WRF model results

Temperature:

- **Both models overestimated coastal temperatures (~5C)**
- **Both models underestimated inland valley temperatures of the SFB region (~3C)**
- **The WRF model overestimated nighttime temperatures in the Central Valley (~5C)**

Wind:

- **Both models overestimated wind speeds in the SFB region**
- **MM5 wind directions in the Central Valley are better than those in the WRF model**

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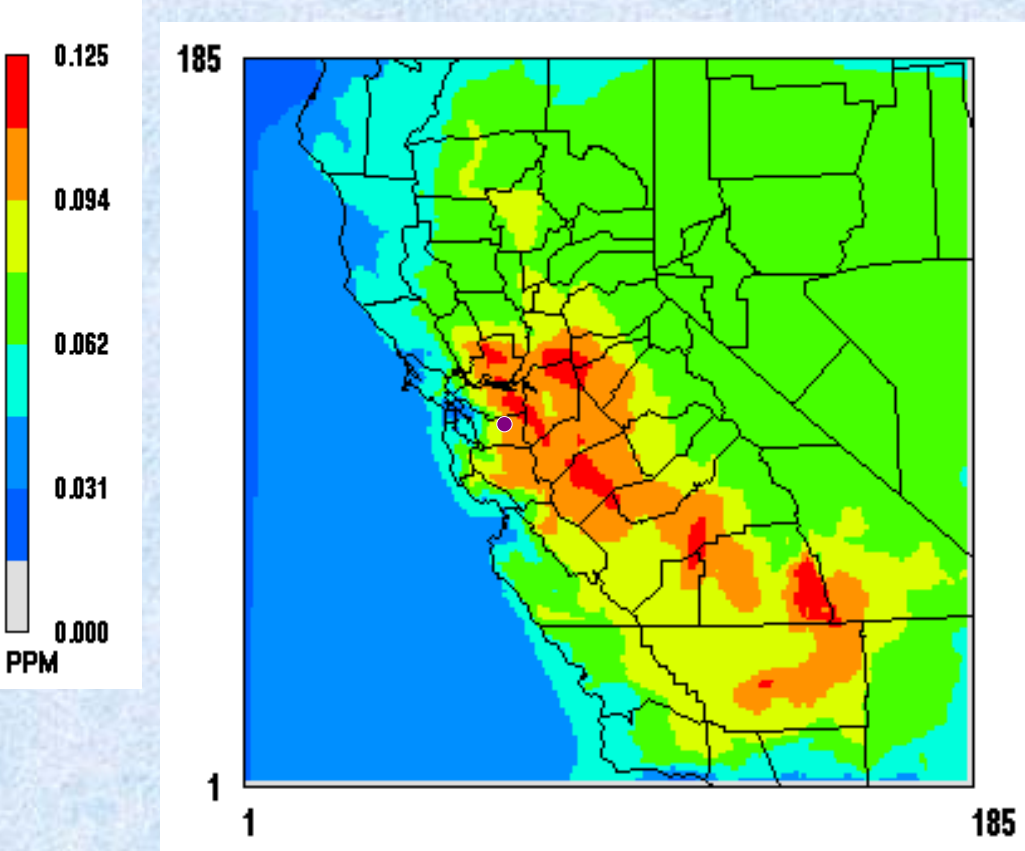
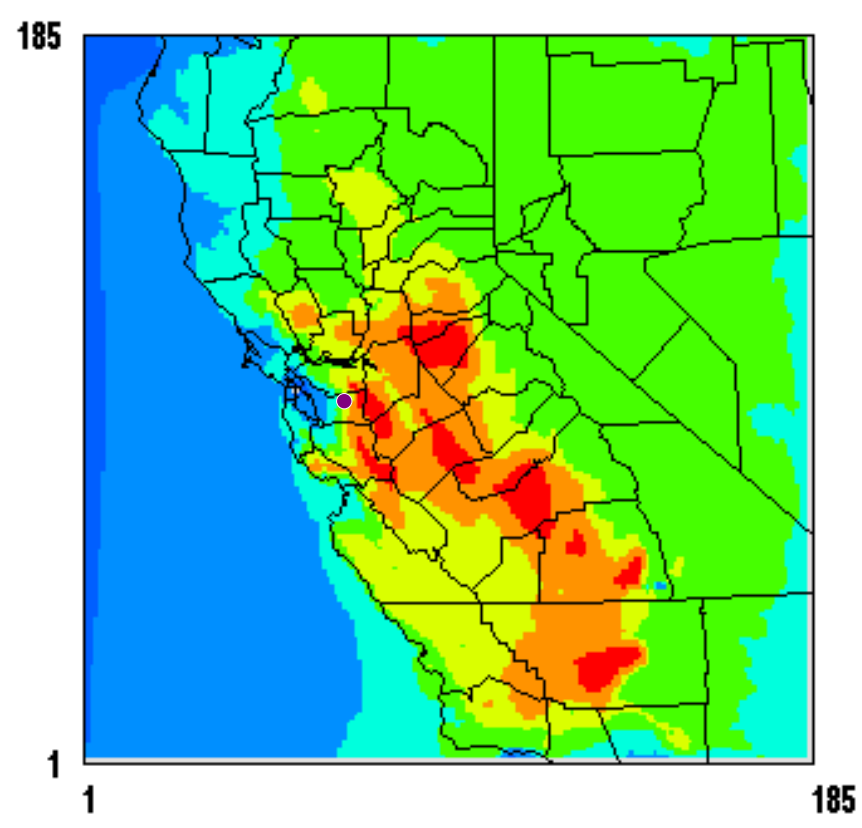
Simulated ozone – 16 PDT July 31

MM5/CAMx



WRF/CAMx



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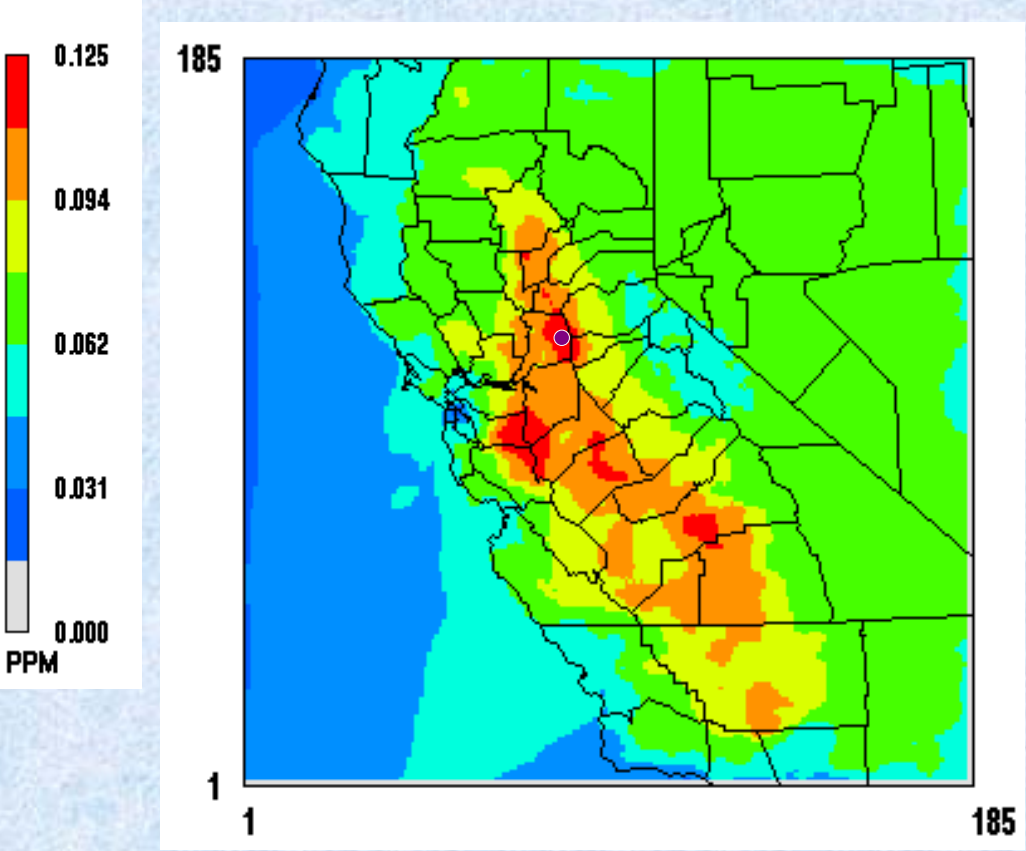
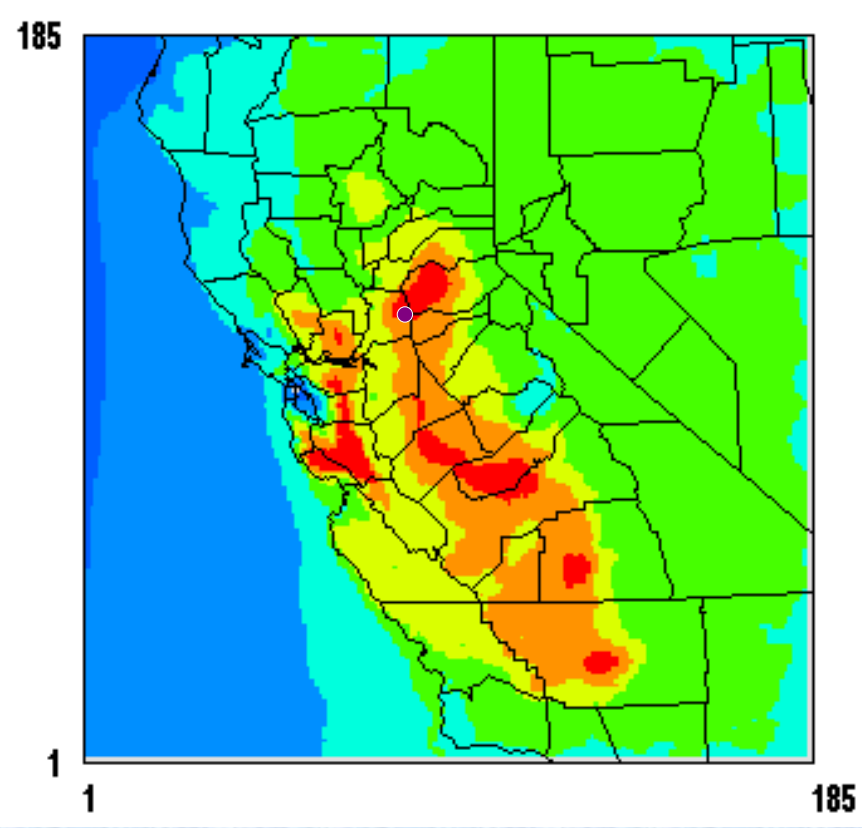
Simulated ozone – 16 PDT August 1

MM5/CAMx

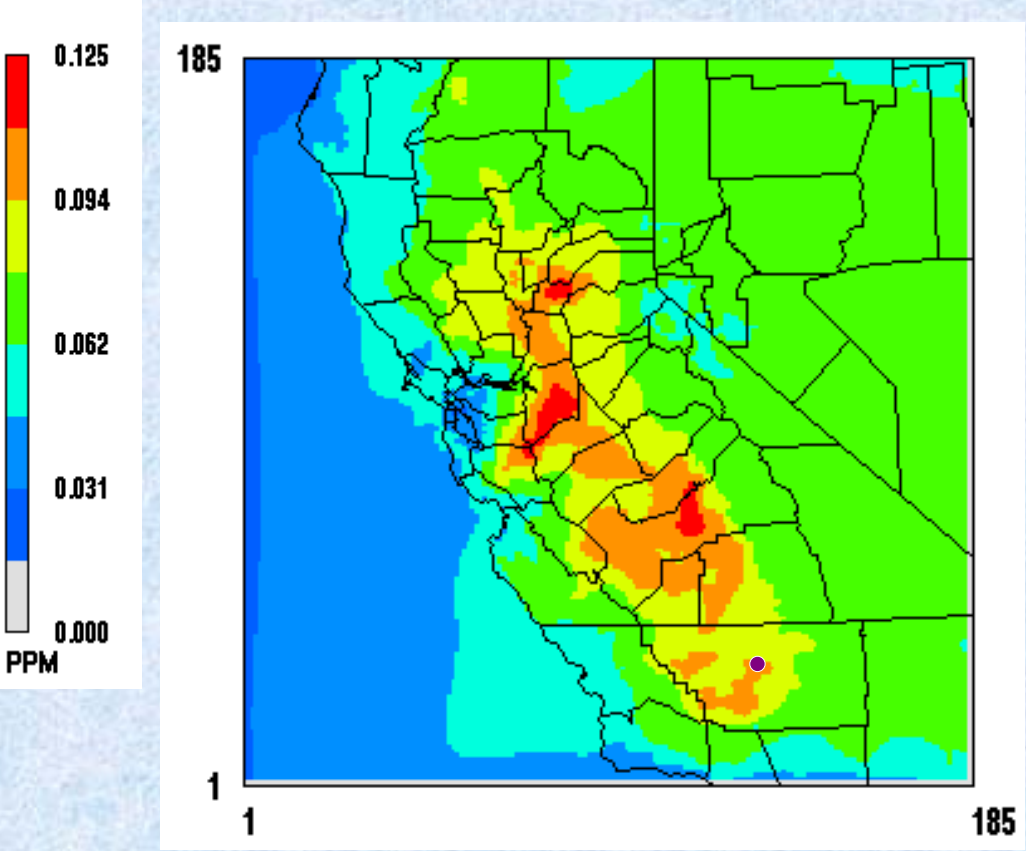


WRF/CAMx

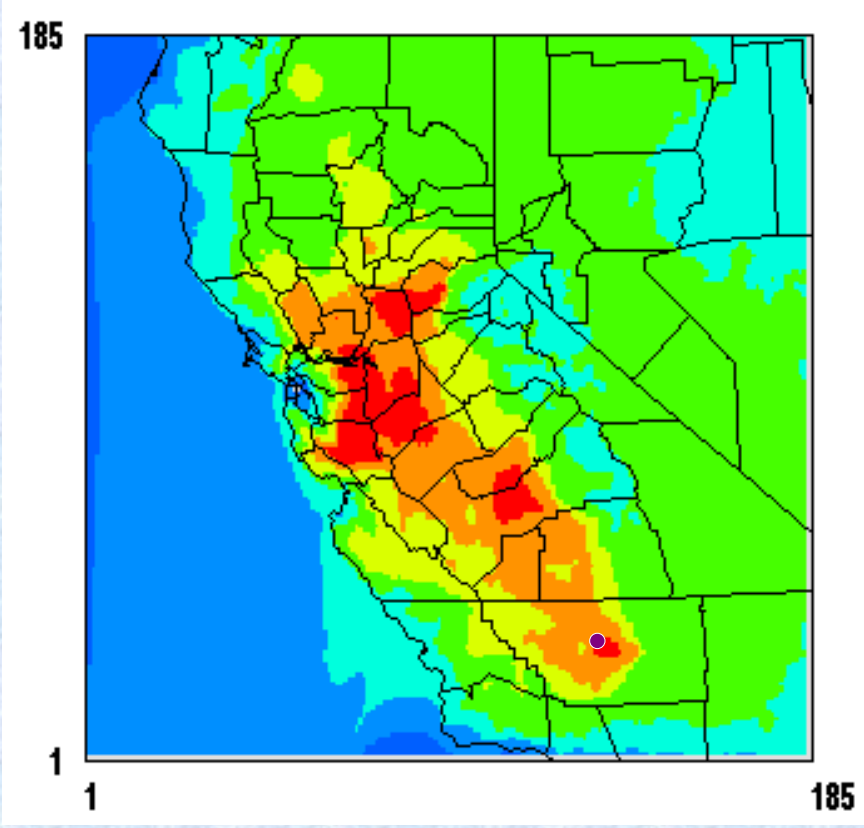


Simulated ozone – 16 PDT
August 2

MM5/CAMx

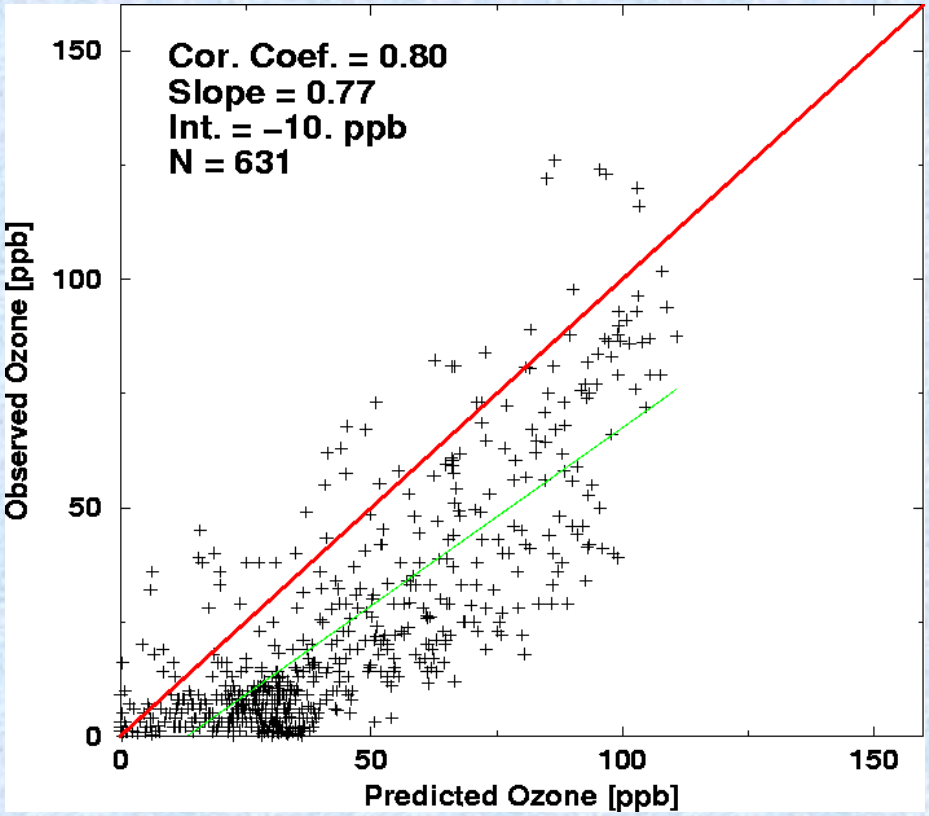


WRF/CAMx

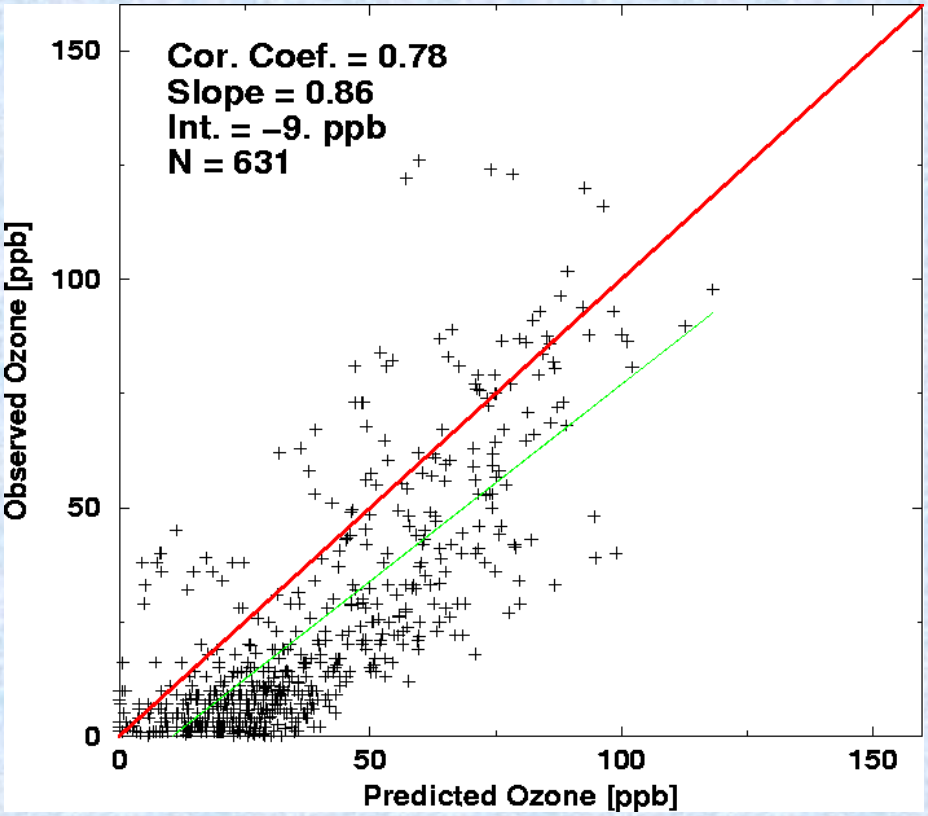


Scatter Plot – SFB region
July 31

MM5

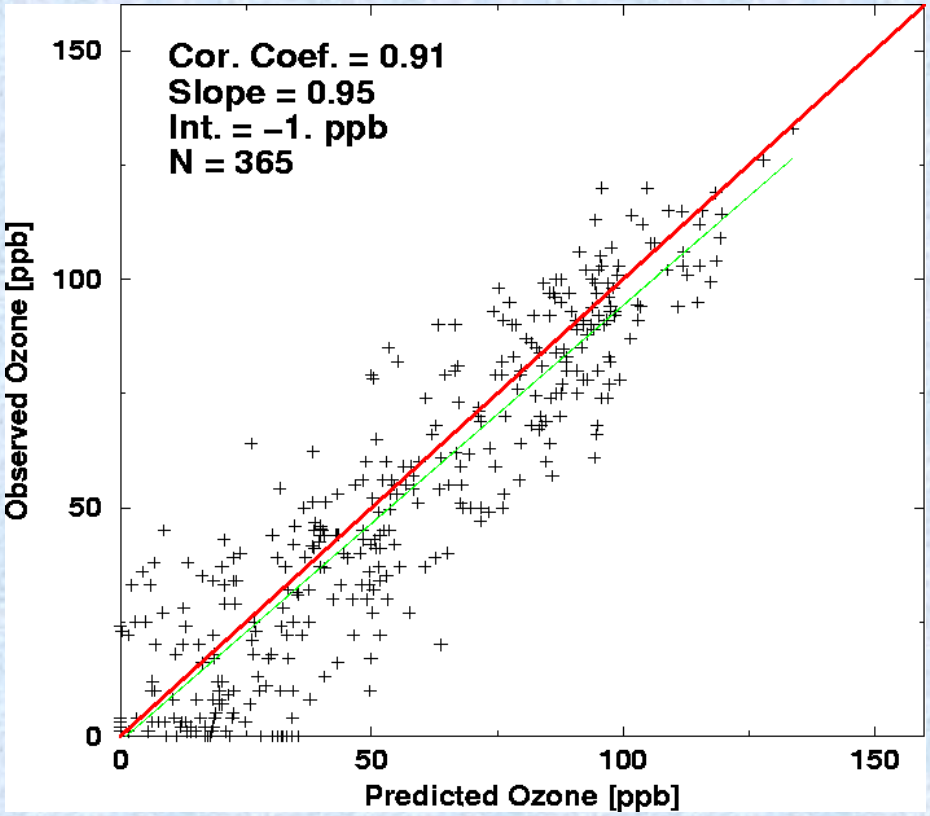


WRF

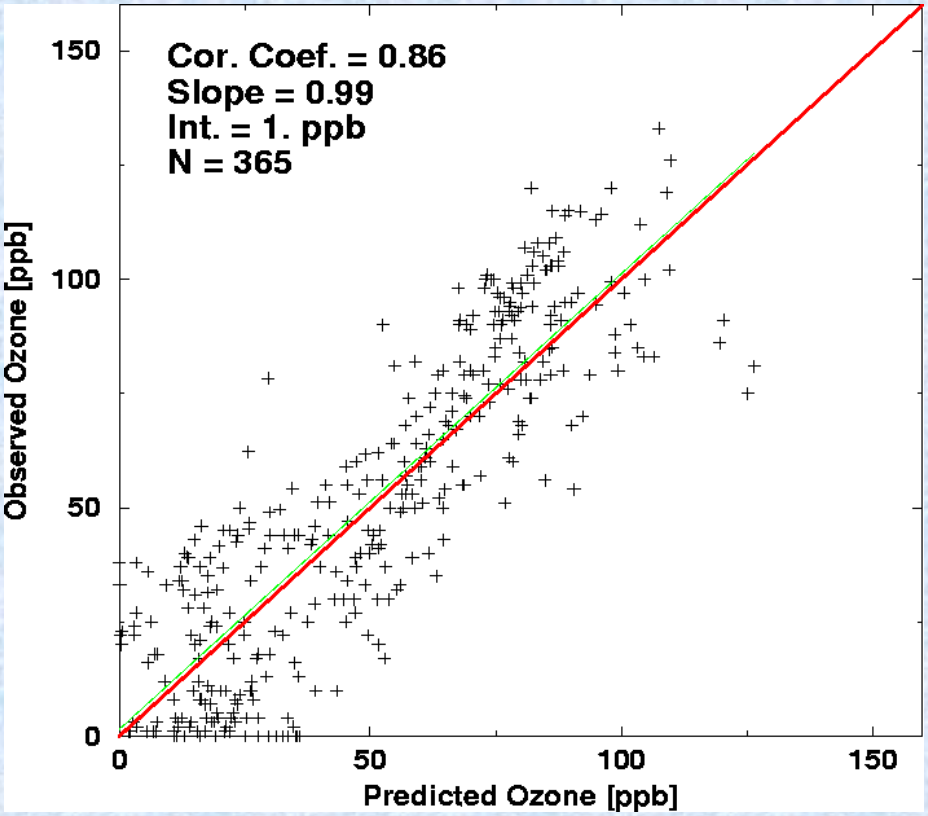


Scatter Plot – SAC region
August 1

MM5

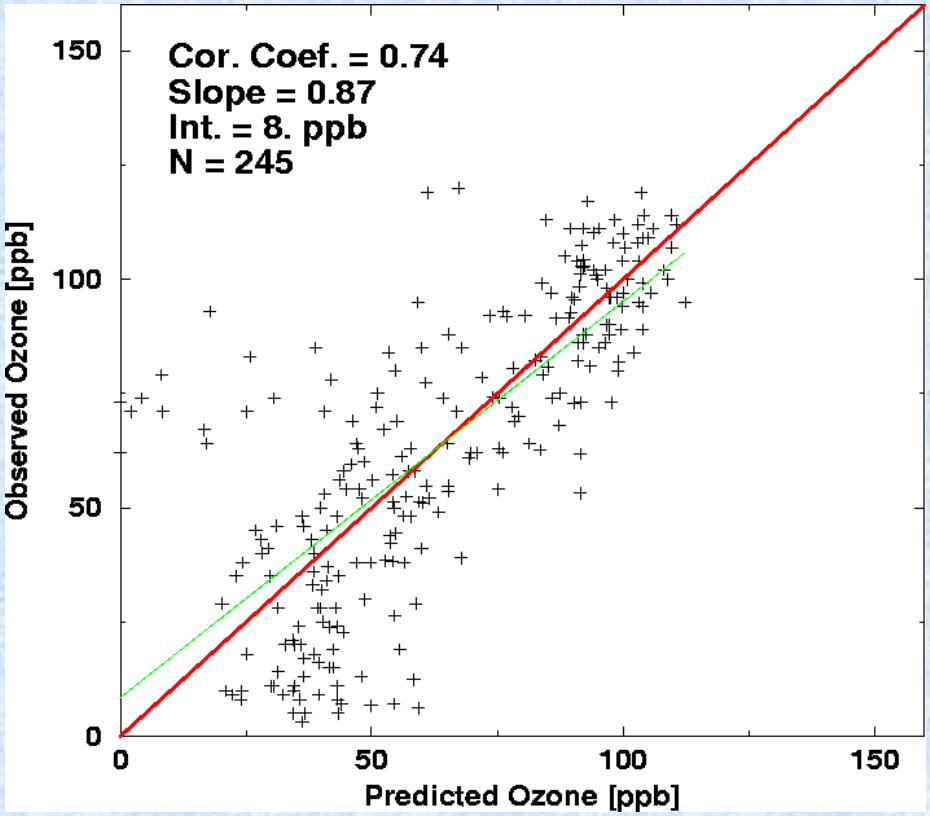


WRF

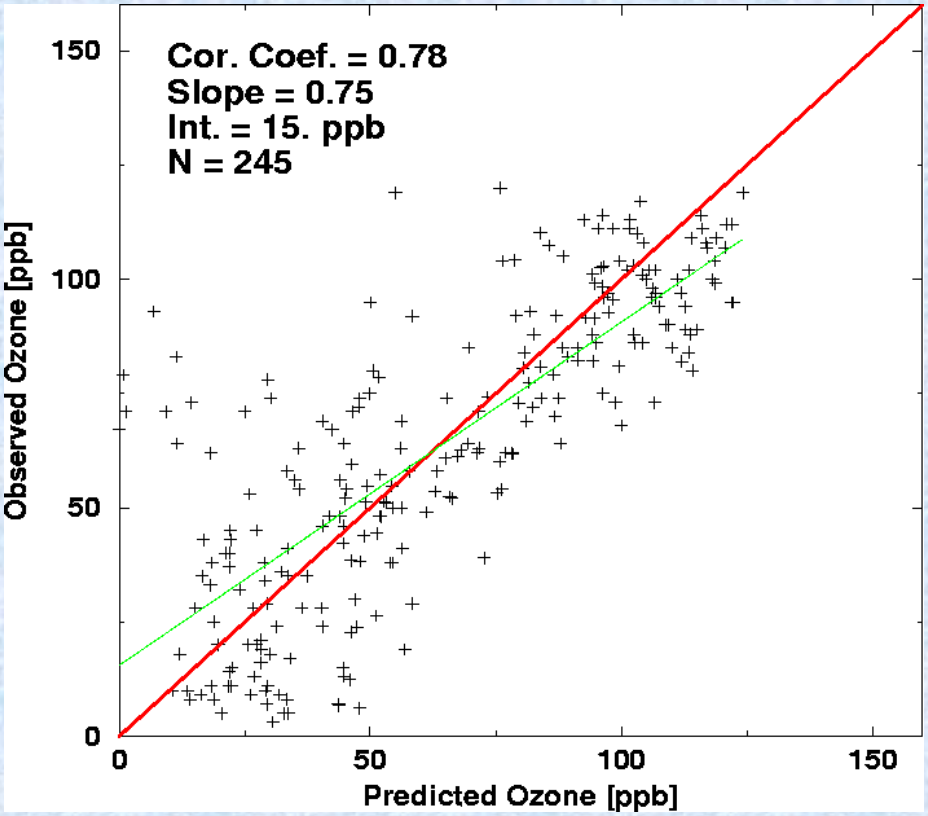


Scatter Plot – C SJV subregion August 2

MM5

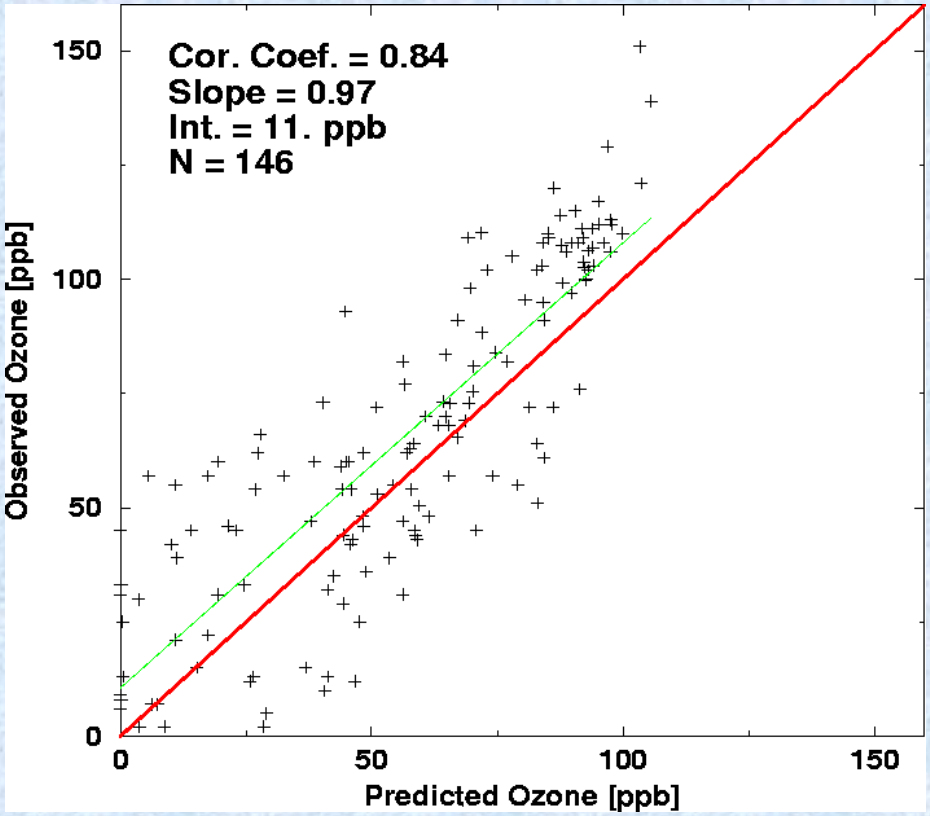


WRF

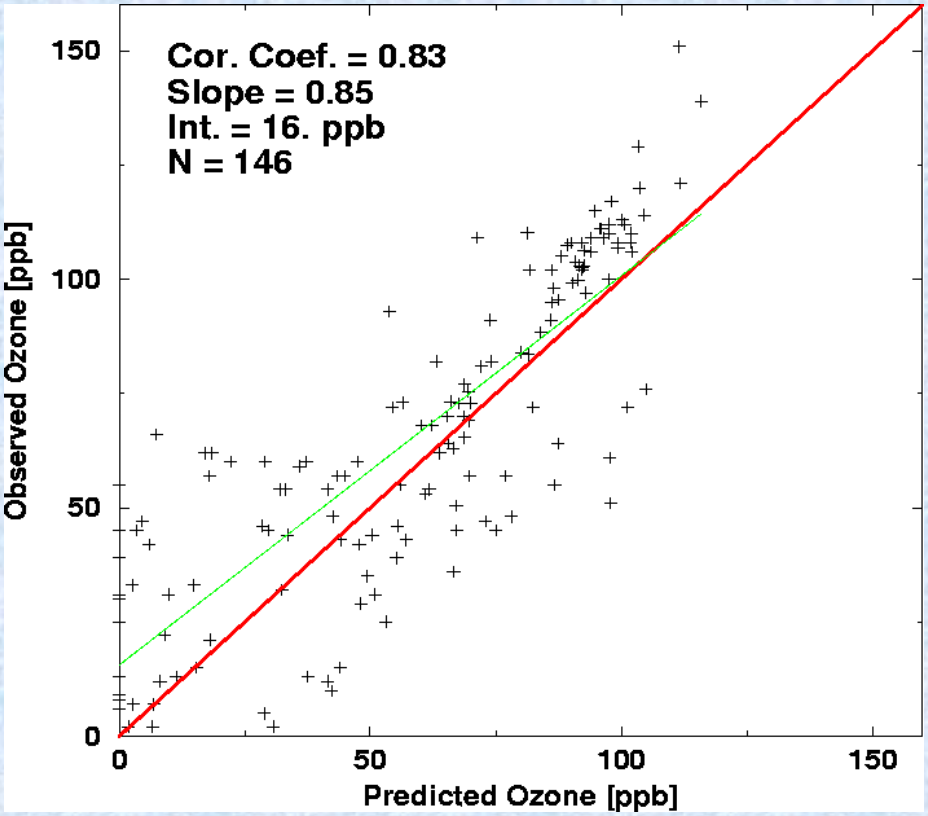


Scatter Plot – S SJV subregion August 2

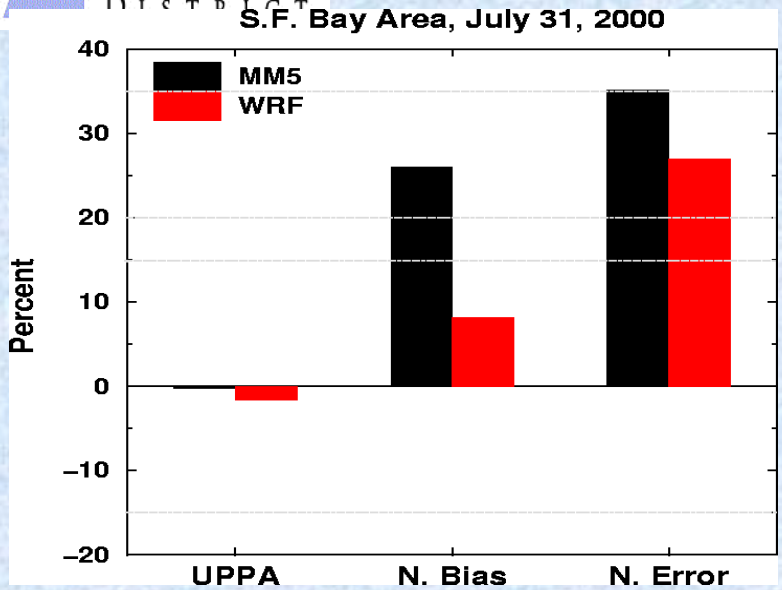
MM5

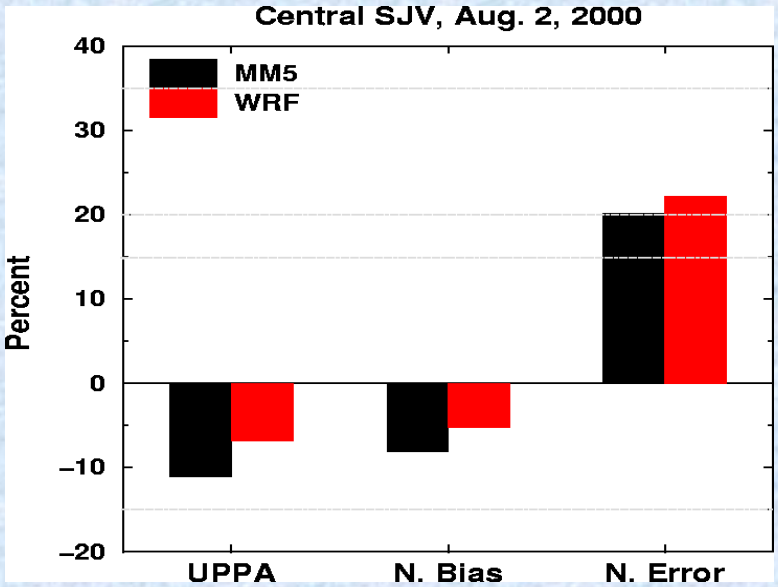


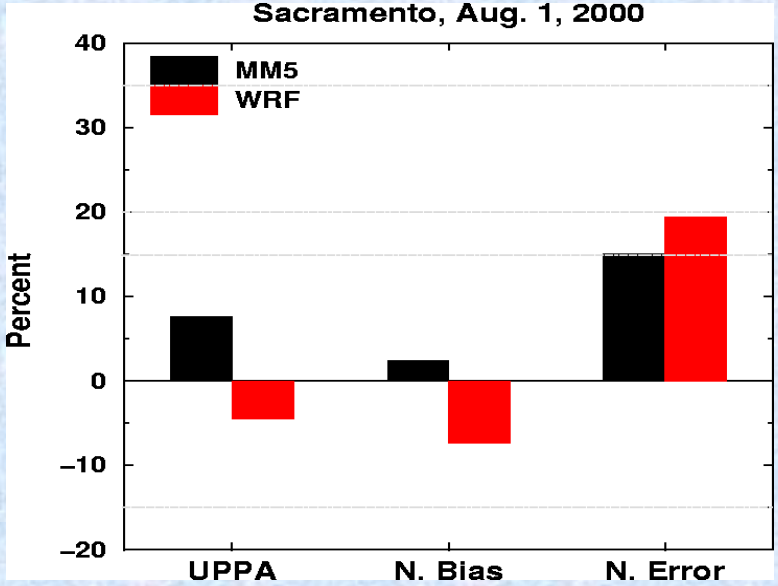
WRF

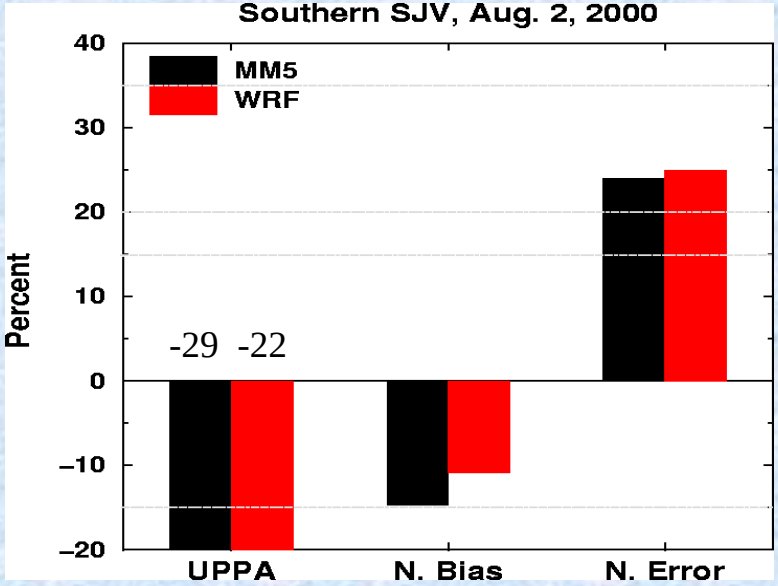


Statistical analysis









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Conclusions

- **The performance of the MM5 model is better than the current version of the WRF model**
- **The performances of the MM5/CAMx and WRF/CAMx modeling systems are similar**
- **The performance of the WRF/CAMx modeling system is expected to improve with planned improvements of the WRF model, including the implementation of FDDA**