

Modeling Nitrates in the San Joaquin Valley

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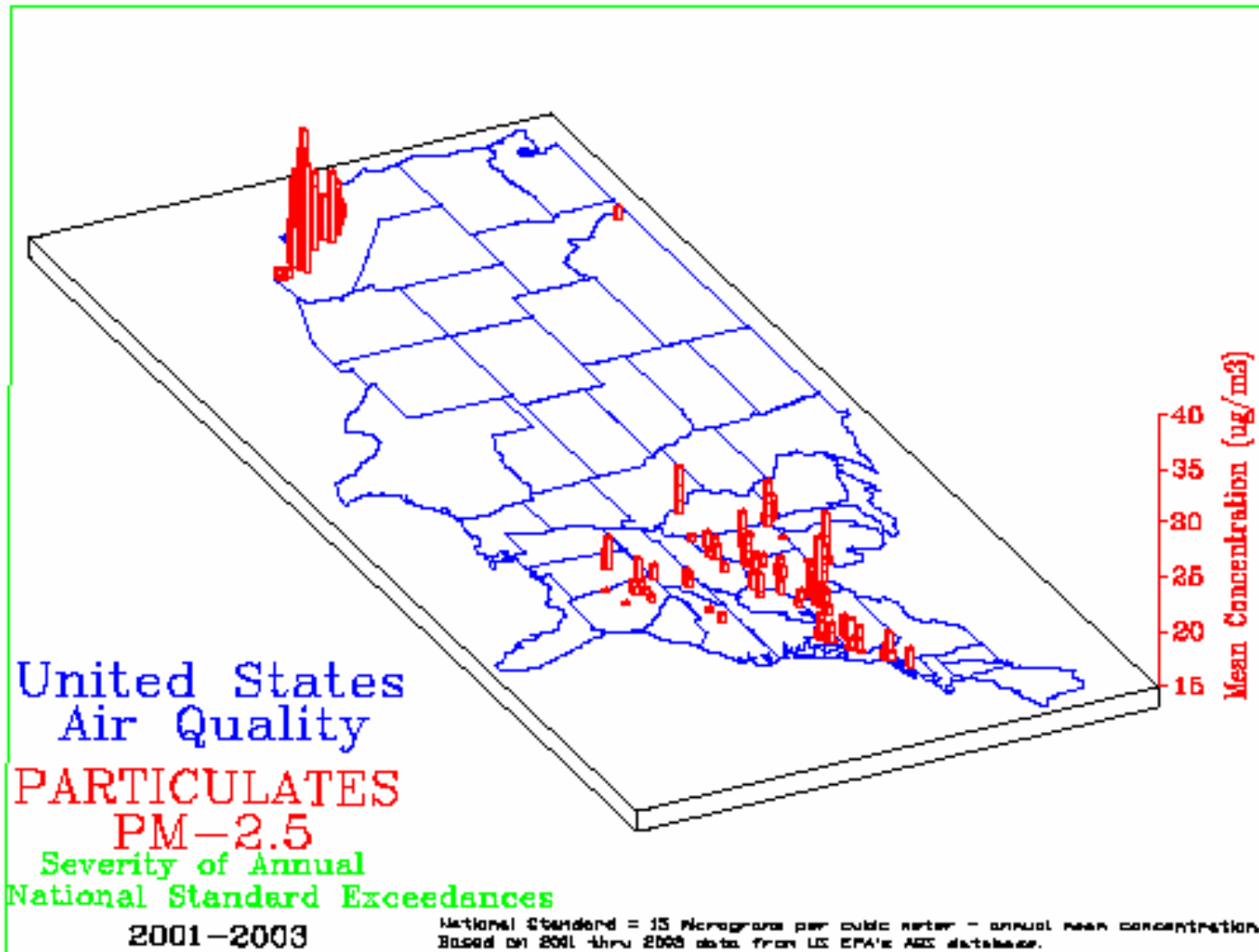
Collaborators

- ARB:
 - Jinyou Liang
 - Kemal Gürer
 - Paul Allen
 - Karen Magliano
- UCD:
 - Michael Kleeman
 - Anthony Wexler
 - Max Zhang
 - Qi Ying
- CRPAQS Technical Committee
- DRI:
 - John Watson
- STI:
 - Neil Wheeler
 - Clinton McDonald
- Future:
 - Christian Seigneur - AER
 - Yang Zhang - NCSU
 - Mark Jacobson - Stanford
 - Kim Prather - UCSD
 - Steven Reynolds, Envair

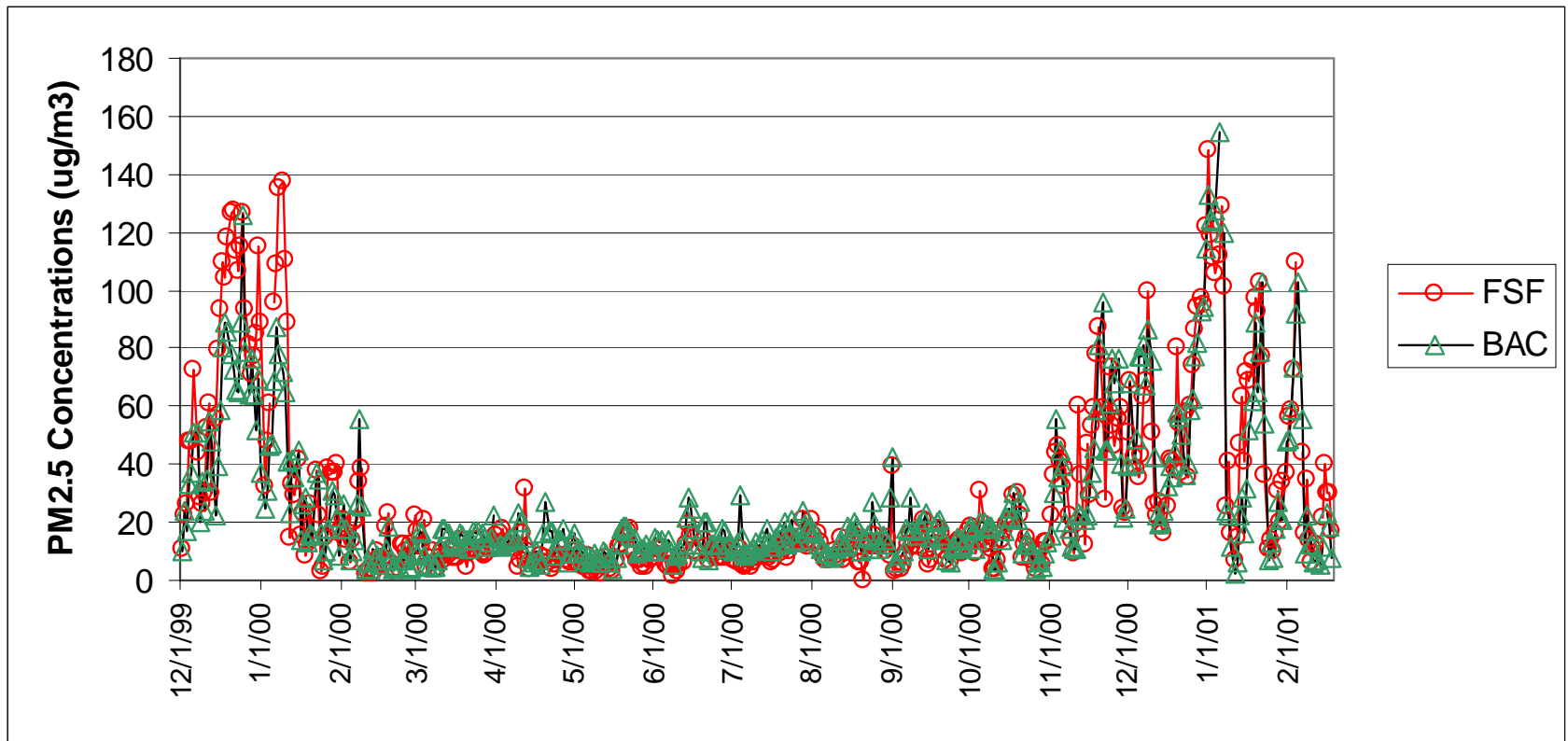
Outline

- PM_{2.5} problem in the SJV
- Meteorology Modeling
 - MM5
 - CALMET/ETA
 - CALMET/MM5?
- Emissions Inventory
- Air Quality Modeling
 - CMAQ
 - CMAQ-UCD
 - CIT-UCD

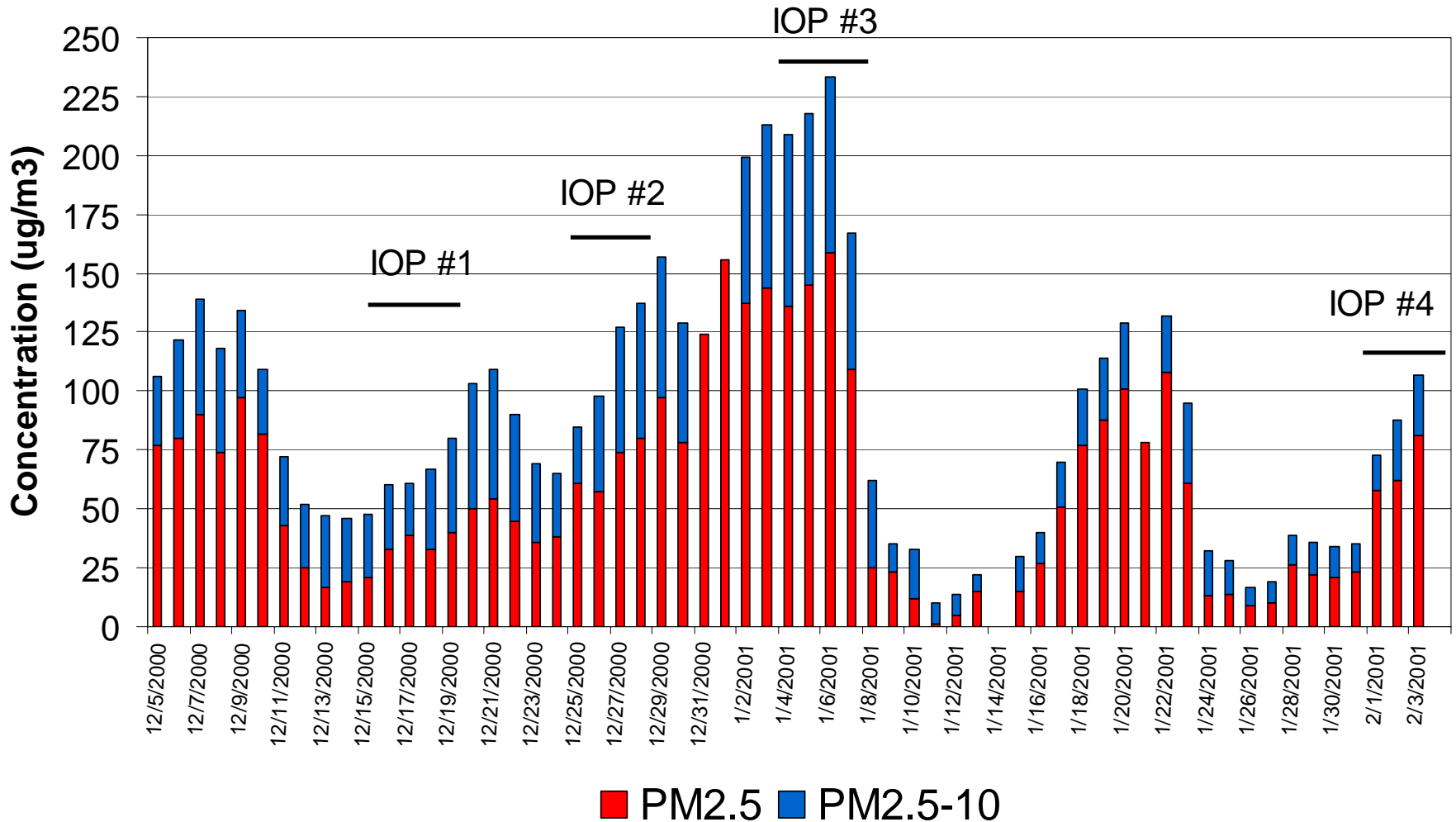
PM2.5 Annual Averages Above NAAQS



PM_{2.5} Concentration

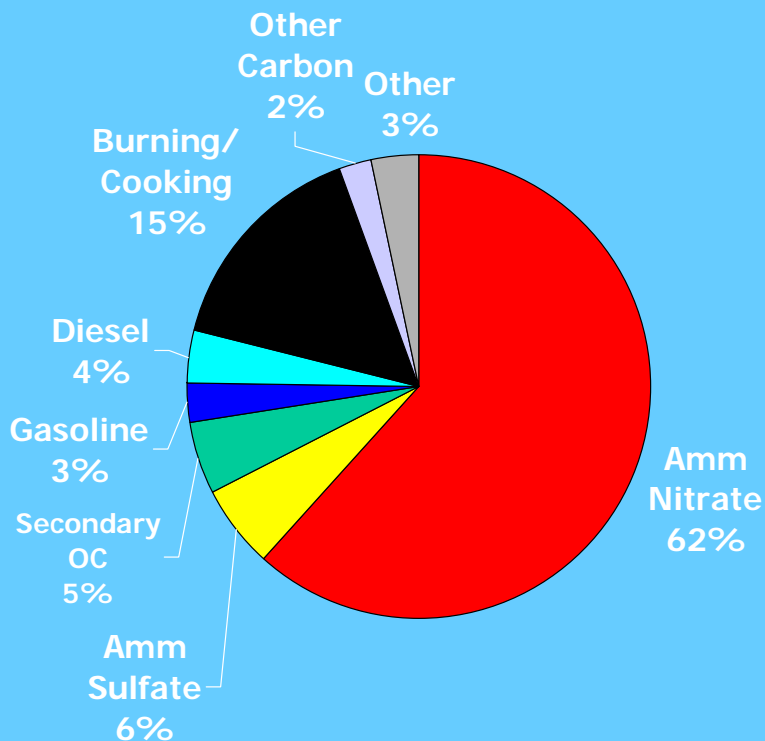


Preliminary PM Concentrations at Bakersfield-California

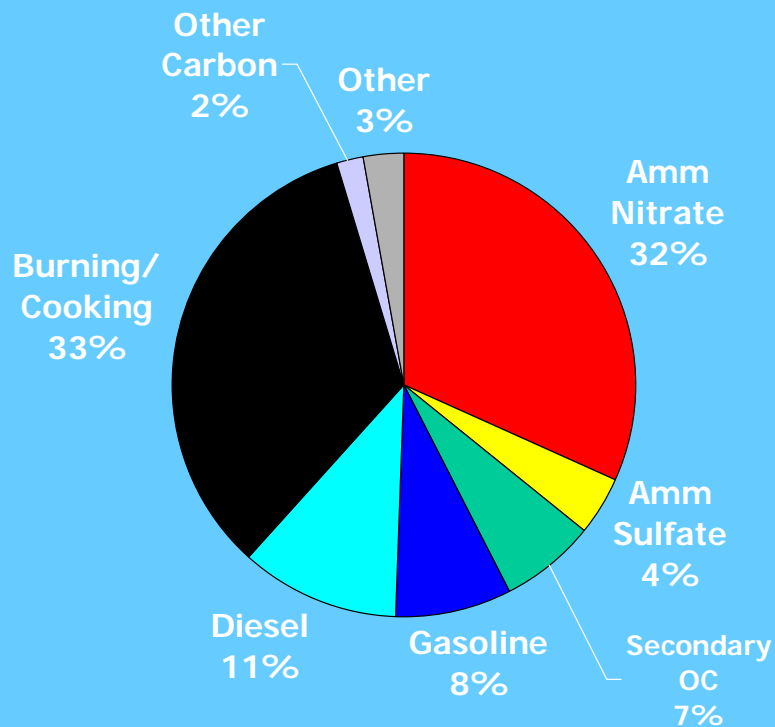


Contributing Sources

24-Hour PM2.5 Spatial Variation



Bakersfield
76 ug/m3

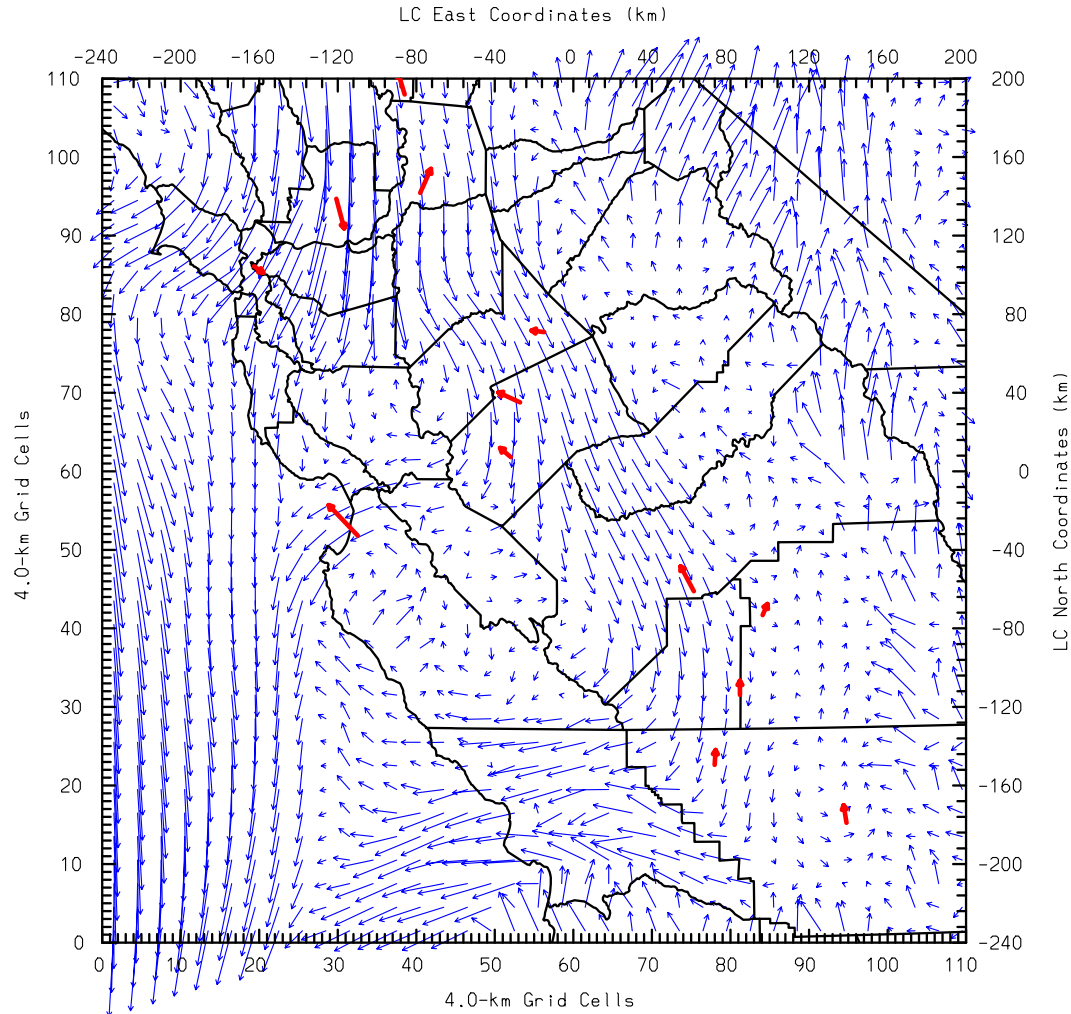


Fresno
69 ug/m3

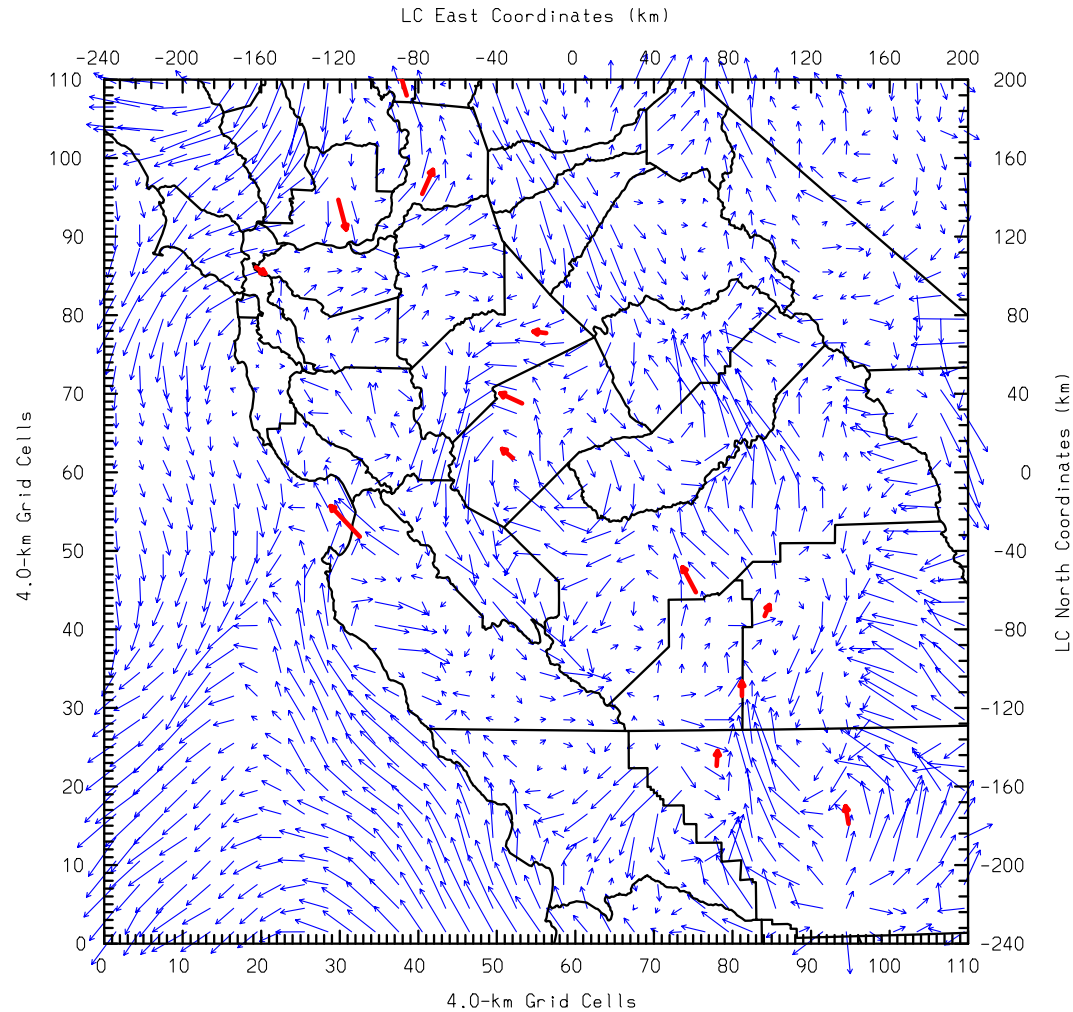
Mesoscale Model 5

- First serious application of MM5 to a winter episode in northern California
- No observation nudging so far. Too cold, too windy.
- We could not get observational nudging to work across calendar years
- Observation data for nudging being agreed upon by stakeholders

Simulated 500 magl winds for August 01, 2000 at 0600 PDT using the MM5 model without observational FDDA



Simulated 500 magl winds for August 01, 2000 at 0600 PDT using the MM5 model with observational FDDA



Emissions Inventory

- Less confidence in PM inventories compared to gas-phase inventories
- Lack of source profiles for PM with sufficient size resolution
- Lack of information on biogenics
- Surrogates inadequate in Bakersfield (under investigation)

ARB CMAQ Modeling

- Liang *et al.* at ARB
- 4 km² horizontal grid (185x185) with 15 vertical layers up to 15 km
- Internal mixture, modal approach, SAPRC99_ae3_aq
- ~22-day run on 16-CPU Linux cluster in ~4 days
- ~132 GB of output per run

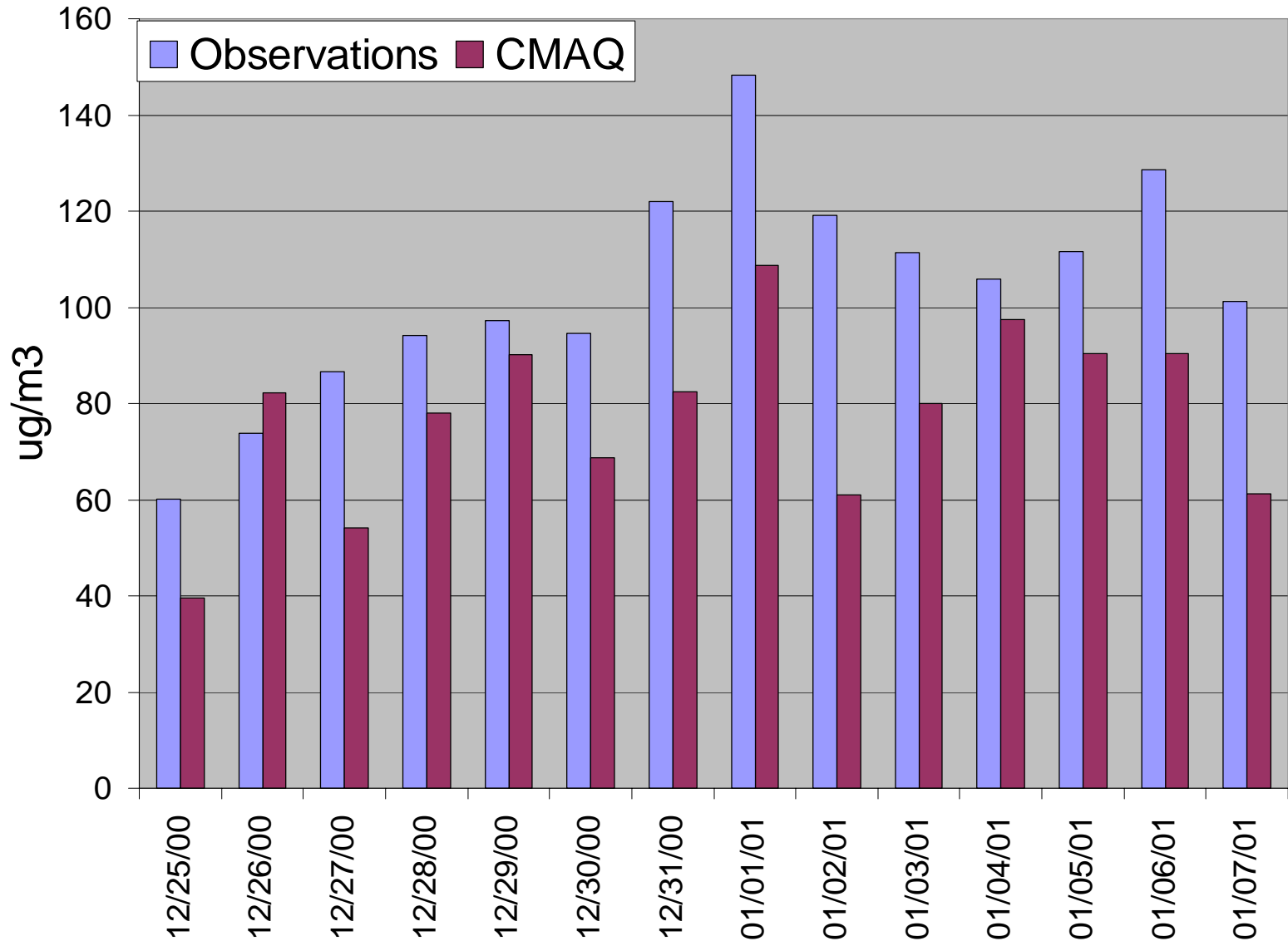
CMAQ Modeling Issues I

- Sulfate emissions double counting
 - emissions in both gas and particle phases
- Code crash due to large V_d for wet PM
 - ARB fix for California-specific condition
- Gas SULF emissions to PM SO₄
 - EPA fixed unit conversion (Prakash Bhave)
- Allow for hourly averaged emissions
 - ARB modification

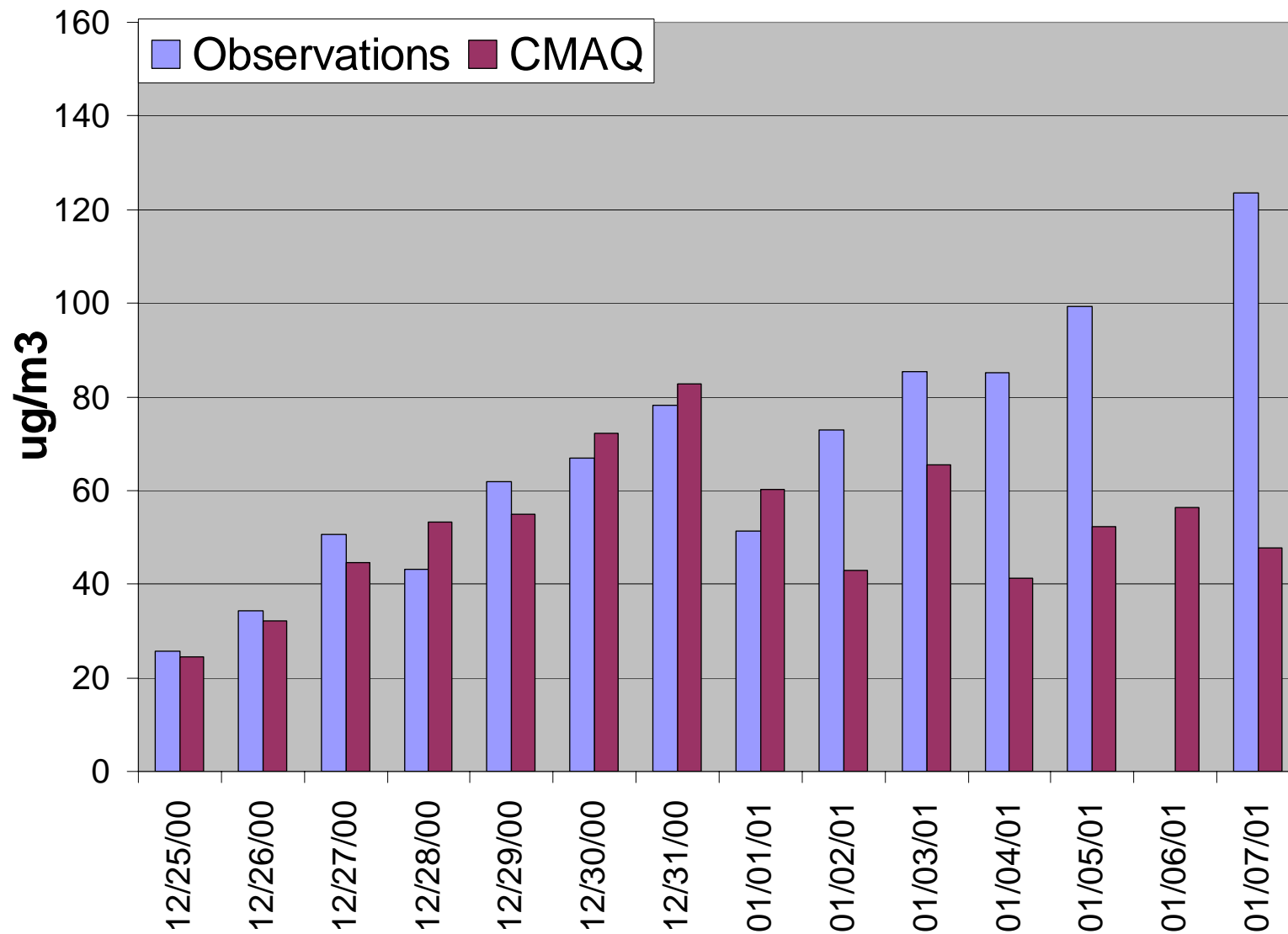
CMAQ Modeling Issues II

- Set minimum $k_z=0.1 \text{ m}^2/\text{s}$
 - ARB modification based on CO evaluation and CAMx experience in California
- DMS emission from the ocean and subsequent oxidation into sulfate
 - ARB modification for SECA
- D_p and σ_g inputs for PM emissions
- Few other minor modifications

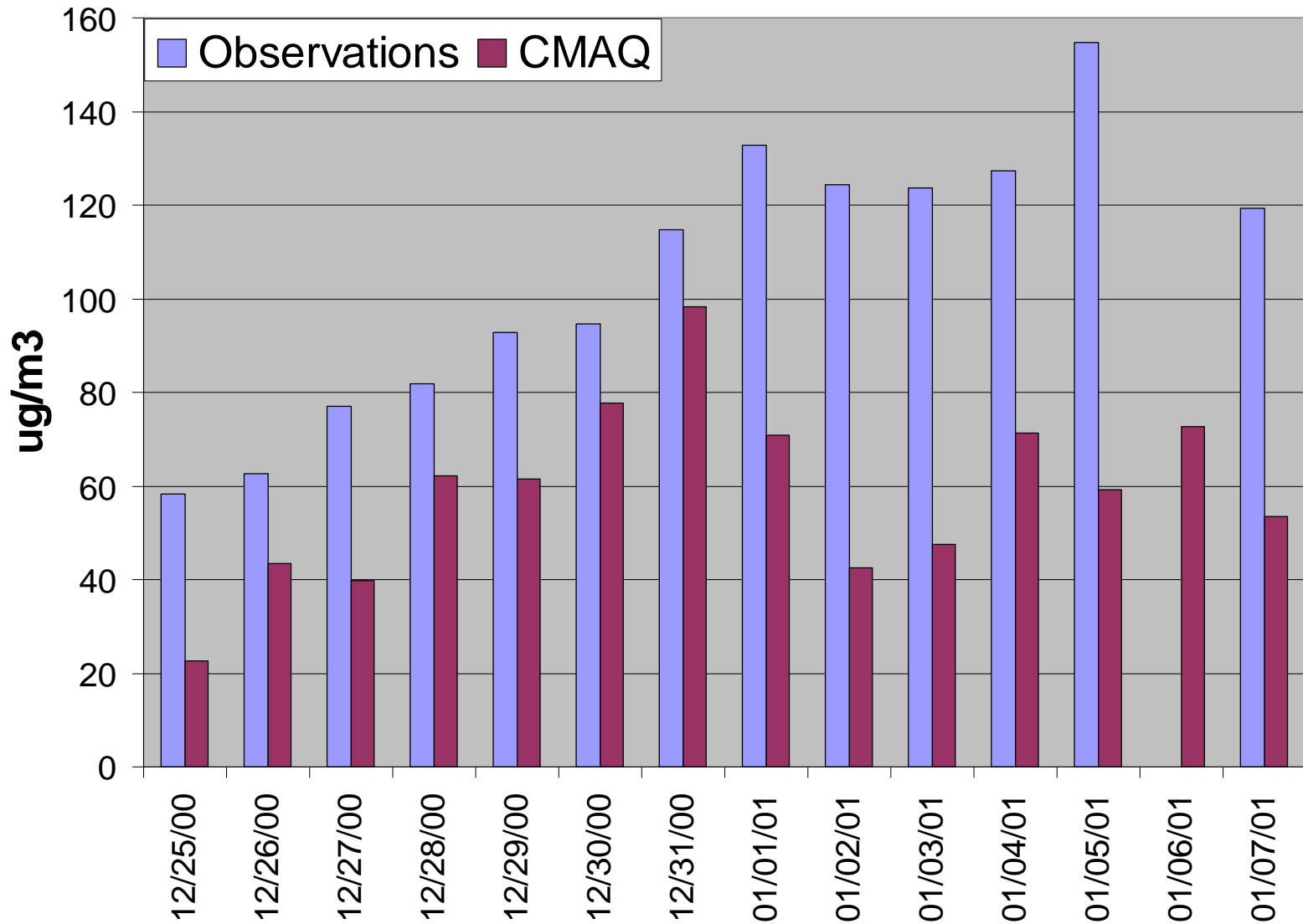
PM2.5 at Fresno



PM2.5 at Angiola



PM2.5 at Bakersfield



CMAQ-UCD Modeling

- Zhang and Wexler at UC Davis
- 4 km² horizontal grid (185x185) with 15 vertical layers up to 15 km
- Internal mixture, sectional approach with dynamic partitioning, SAPRC99_ae3_aq
- ~22 day run on 16-CPU Linux cluster in 8 days
- ~180 GB of output per run

CIT-UCD Modeling

- Ying and Kleeman at UC Davis
- 4 km² horizontal grid (>185x185) with 5 vertical layers up to 2 km
- External mixture, sectional approach with dynamic partitioning, SAPRC93
- ~22 day run on ?-CPU Linux cluster in ? days
- ~?GB output per run

Future

- PM_{10} SIP update in 2006 for the San Joaquin Valley is the first milestone
- CMAQ-MADRID in the near future
- 8-Hour Ozone SIP in 2007 is the second milestone
- $PM_{2.5}$ SIP and Regional Haze SIP in 2008 (with a possible regional collaboration) is the third milestone