

**Question on MM5
Temperature Performance in the BA
Using METSTAT**

**BAAQMD MAC Meeting
March 16, 2004**

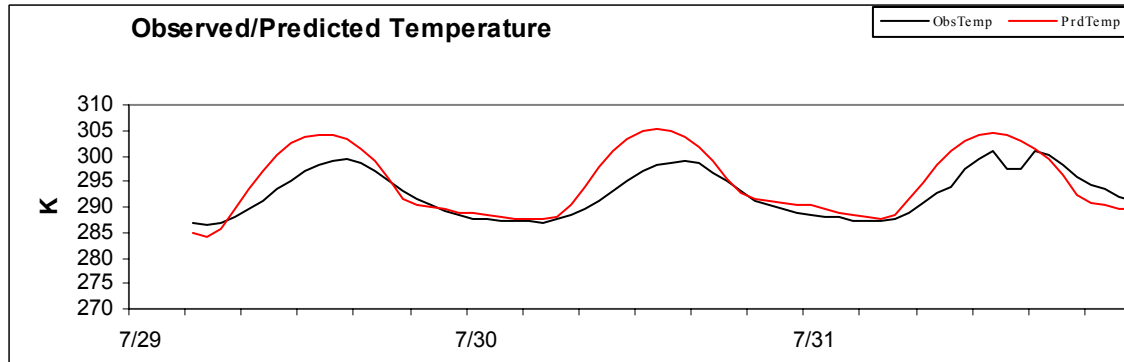
MM5 Temperature Performance

- **Unexpected result from example METSTAT figures:**
 - 2-m temperatures are OVER predicted
 - Previous evaluations have suggested large UNDER predictions
 - What gives?
- **Could be our weeding out of all but known 2-m probe heights**
 - But that seems to go the wrong way: mean obs should get warmer

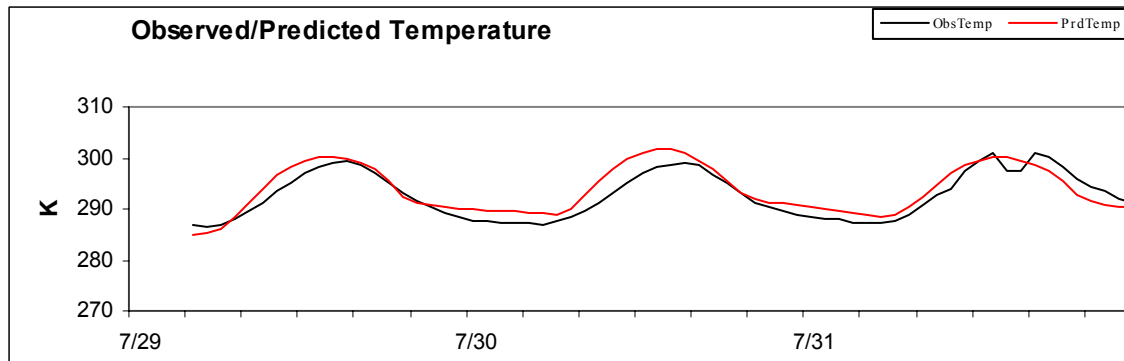
MM5 Temperature Performance

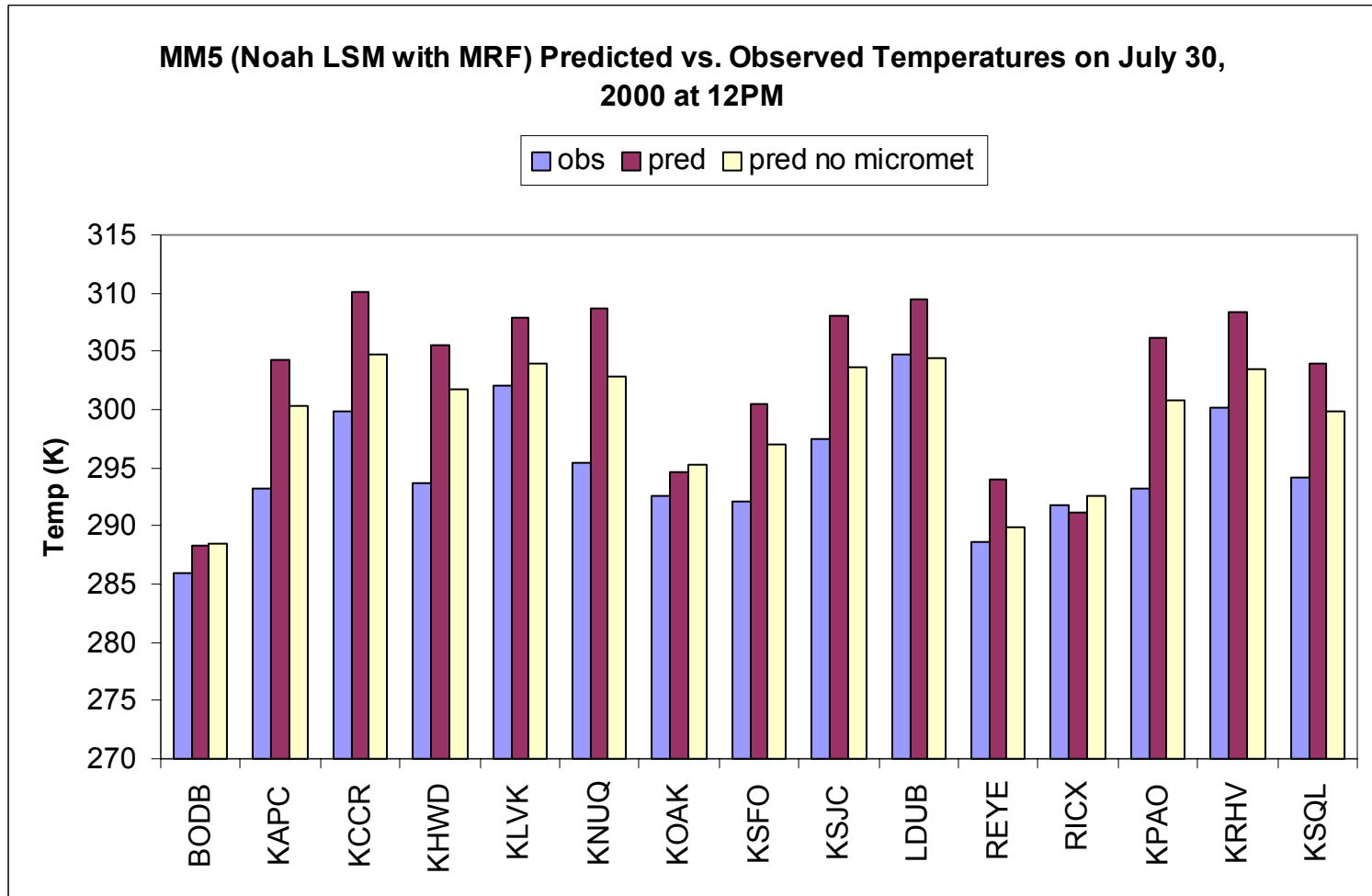
- **Could be METSTATs extrapolation from surface layer midpoint (~12-15 m) to 2 m level**
 - Maybe leads to overly high 2 m temp predictions
 - Check by removing the micro-meteorological extrapolation
 - Just compare layer 1 MM5 output to 2-m obs
- **Result: MM5 still over predicts 2-m temps, but not as bad**
- **Ramification: surface temps too warm, aloft temps too cool**
 - MM5 not NEARLY stable enough in vertical?

METSTAT with micro-meteorological extrapolation to 2 m



METSTAT with no micro-meteorological extrapolation





**Use of the Decoupled Direct Method
(DDM) Probing Tool on the ARB July 1999
CAMx Simulation**

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The CAMx DDM

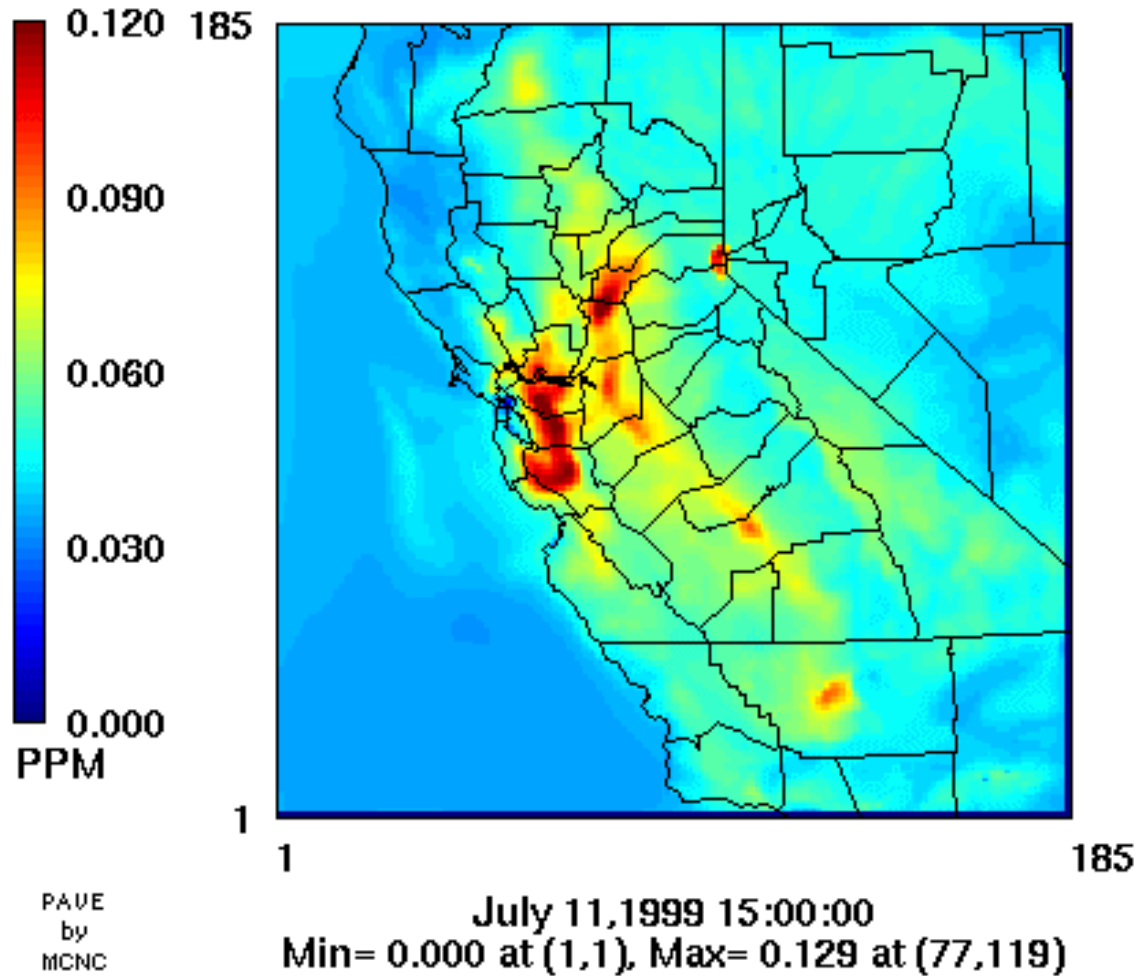
- Provides 1st-order sensitivity of a parameter to another parameter:
 - For example, $d[\text{O}_3]/d[\text{NO}_x]$
 - Output parameters are referred to as “sensitivity coefficients”
 - Any species, any source (IC/BC, emissions by source category/region)
 - Higher-order terms include $\sim 1/3$ of the total sensitivity

CAMx DDM Simulation

- **Run on ARB July 1999 simulation**
 - High ozone, good performance July 11-12
 - Model top = 5000 m, top O₃ BC = 70 ppb
 - Is it a result of low domain top + high O₃ BC's?
- **Specified DDM sensitivity output for:**
 - N, S, E, W, and top boundaries
 - Initial conditions
 - O₃, NO_x, VOC, CO
 - Results shown for July 11, 3 PM
- **Sensitivity for emissions in the oven now**

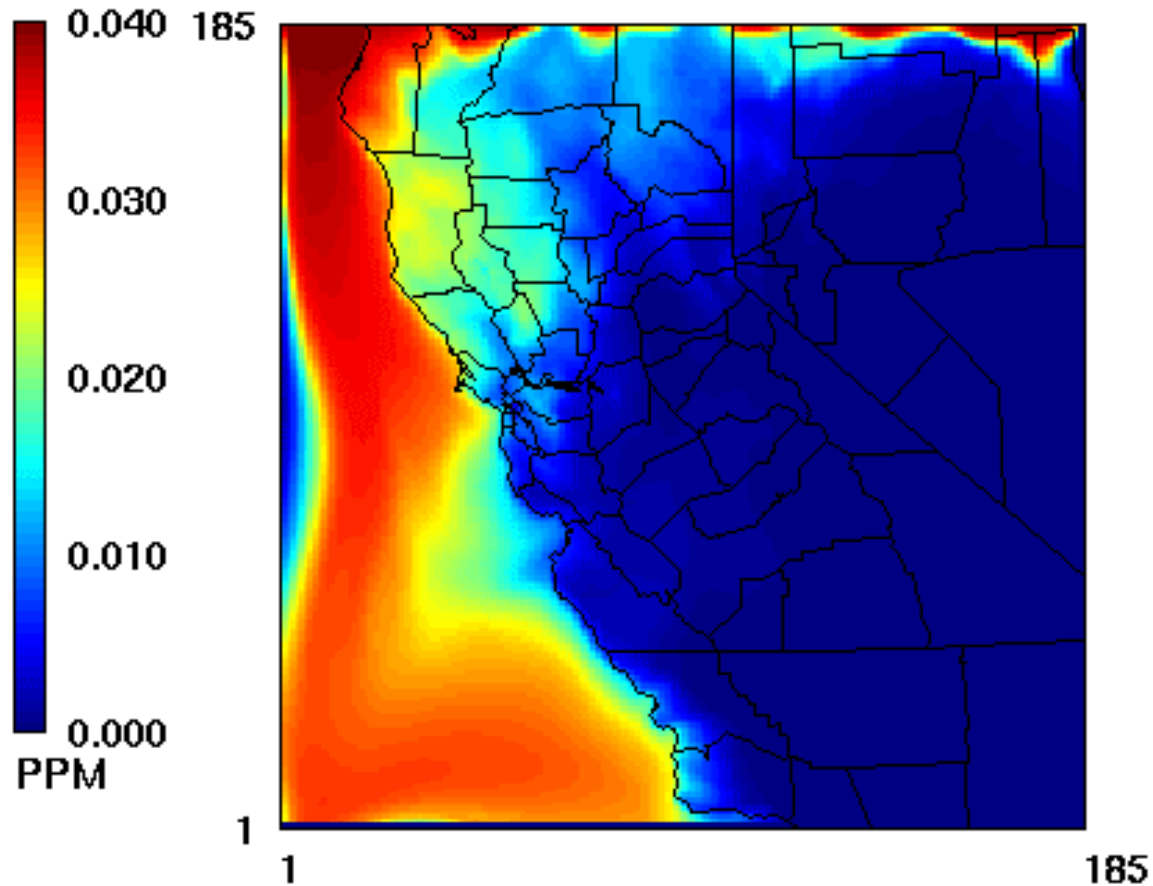
Hourly Ozone

July 1999 ARB Configuration



Ozone Sensitivity

Northern Boundary Ozone

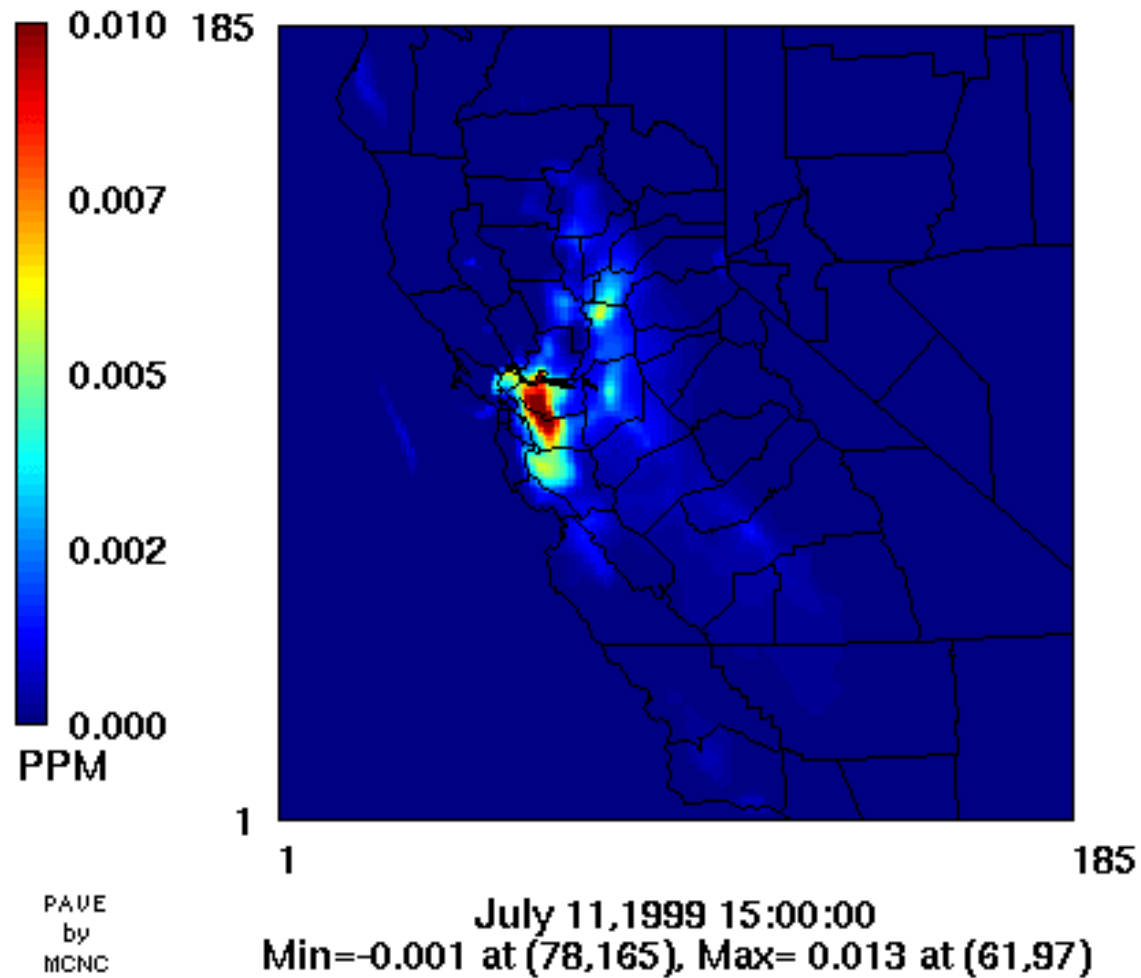


PAVE
by
MCNC

July 11, 1999 15:00:00
Min=-0.000 at (89,118), Max= 0.041 at (3,183)

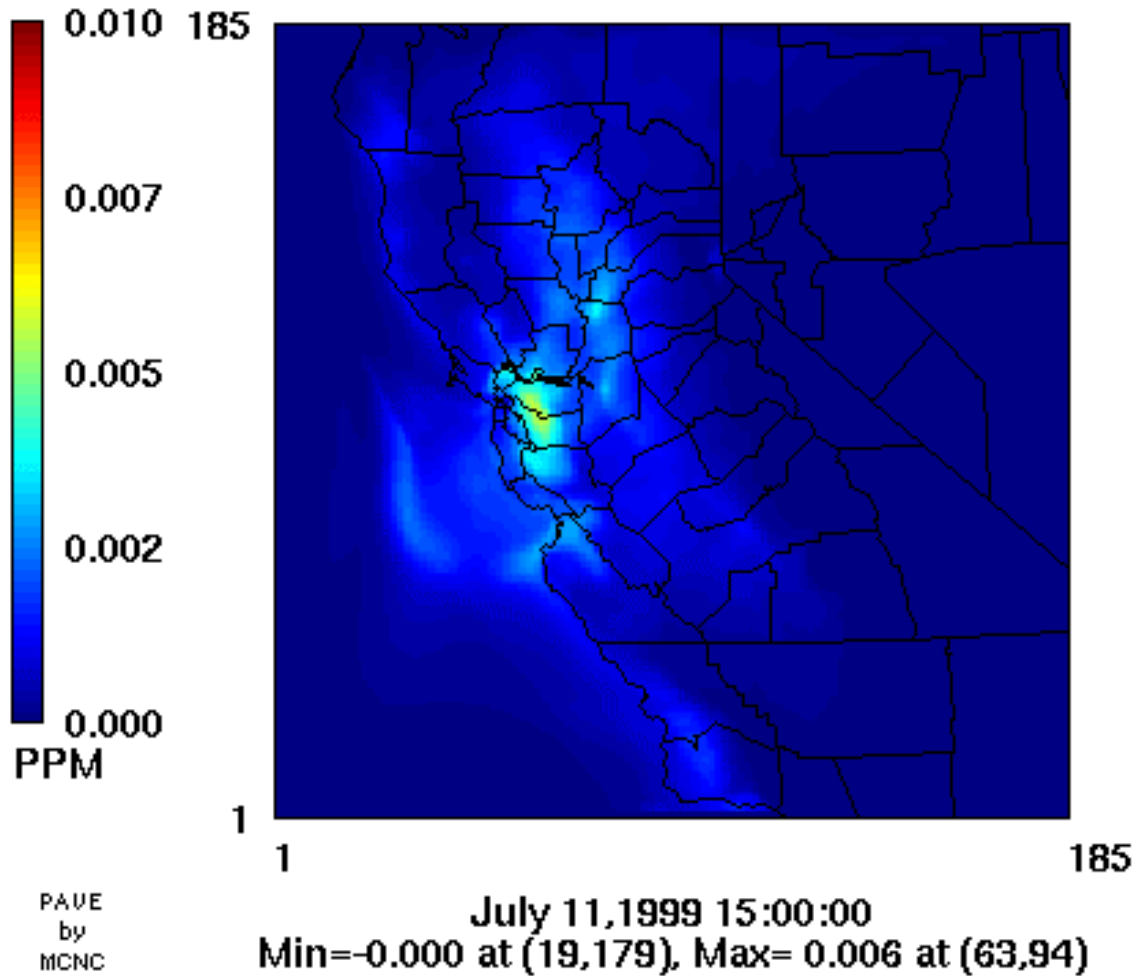
Ozone Sensitivity

Northern Boundary VOC



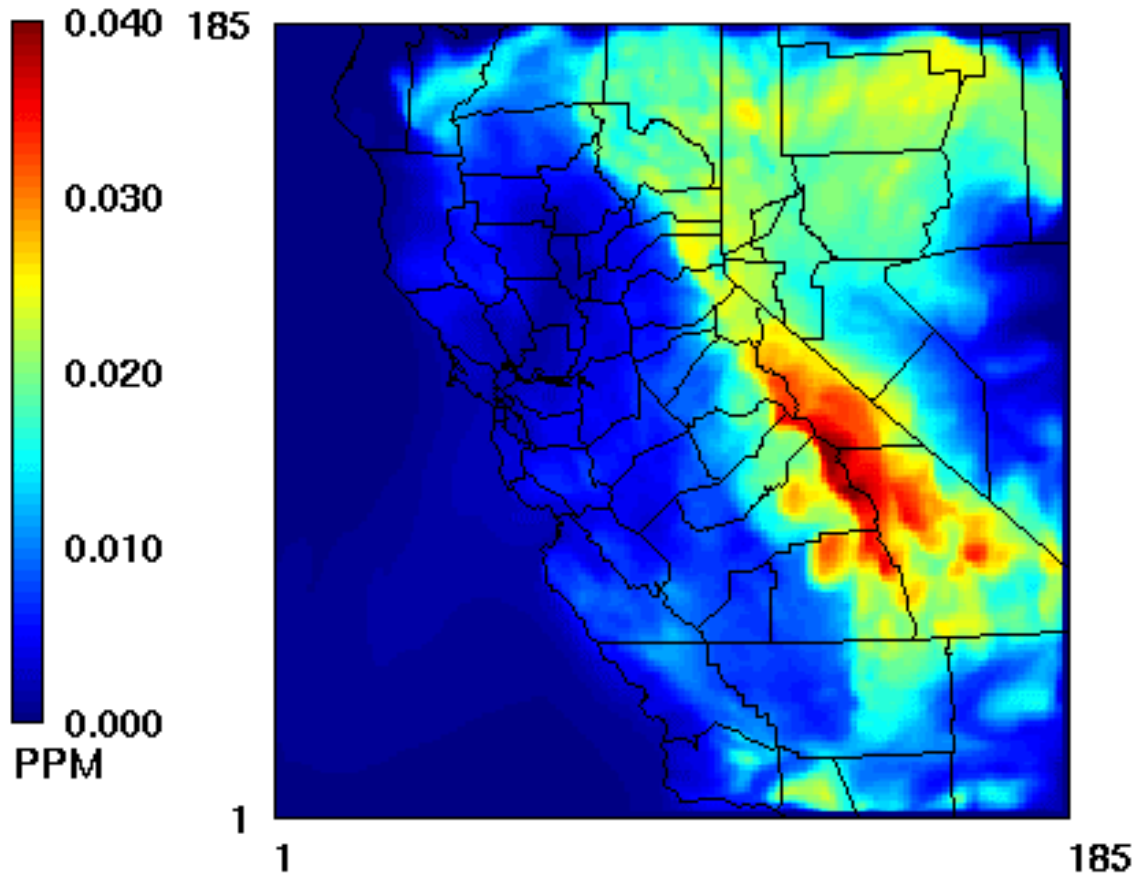
Ozone Sensitivity

Northern Boundary CO



Ozone Sensitivity

Top Boundary Ozone



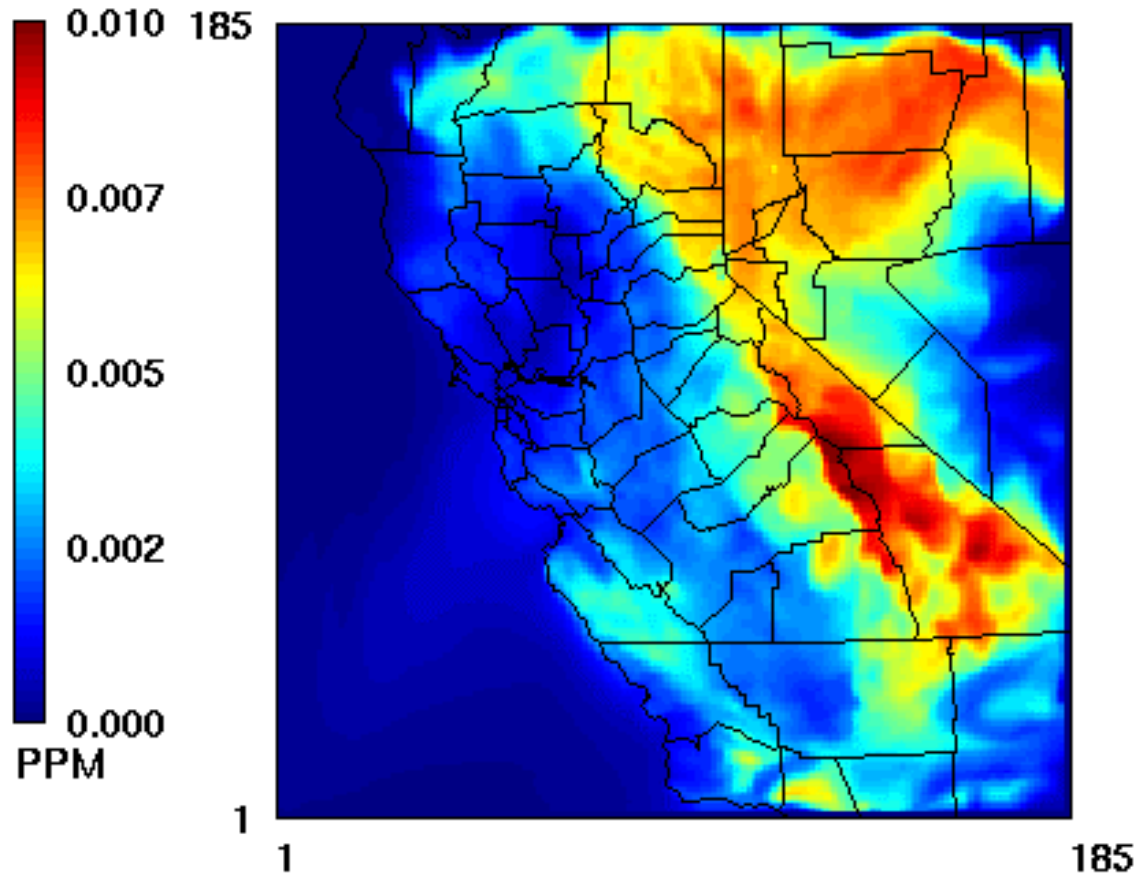
July 11, 1999 15:00:00

Min=-0.000 at (169,184), Max= 0.041 at (130,85)

PAVE
by
MCNC

Ozone Sensitivity

Top Boundary NOx

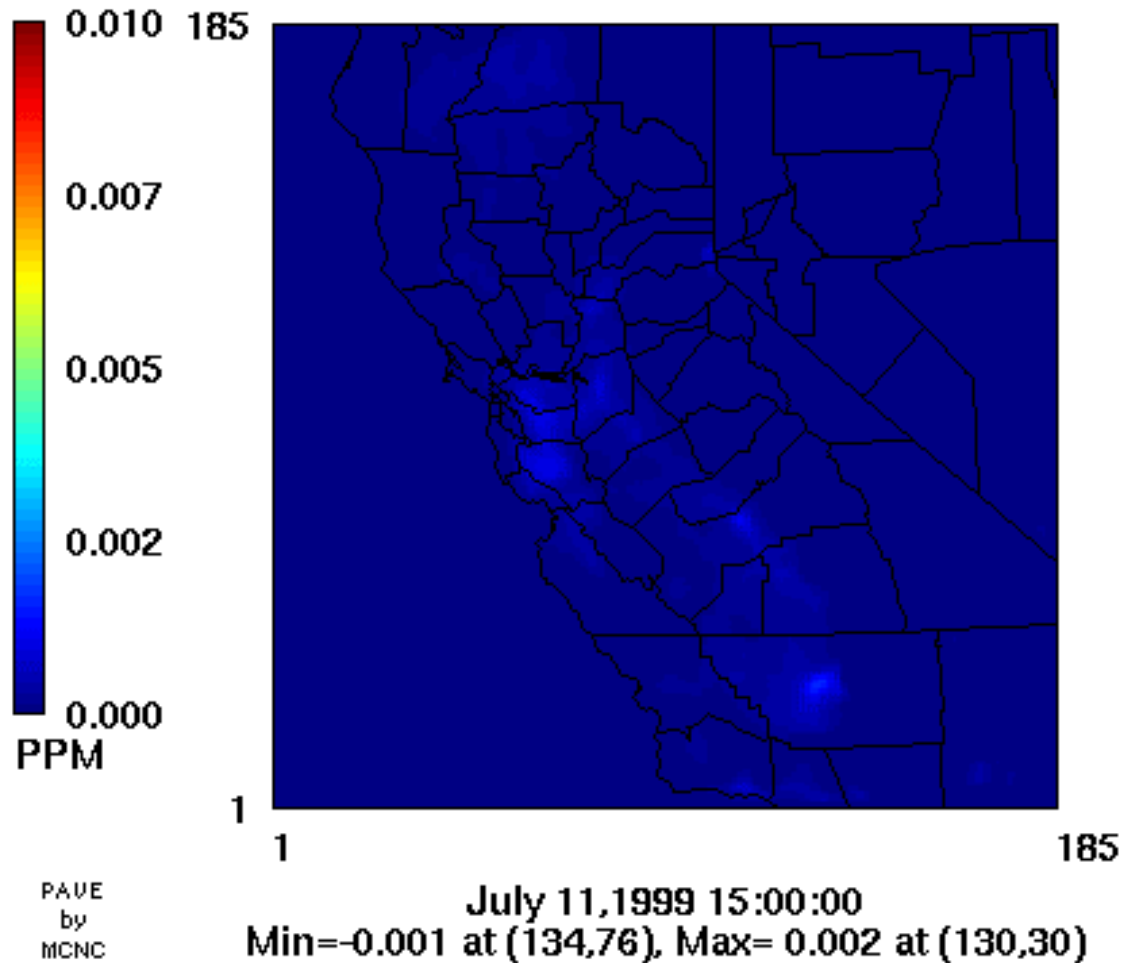


PAVE
by
MCNC

July 11, 1999 15:00:00
Min=-0.000 at (169,184), Max= 0.010 at (130,86)

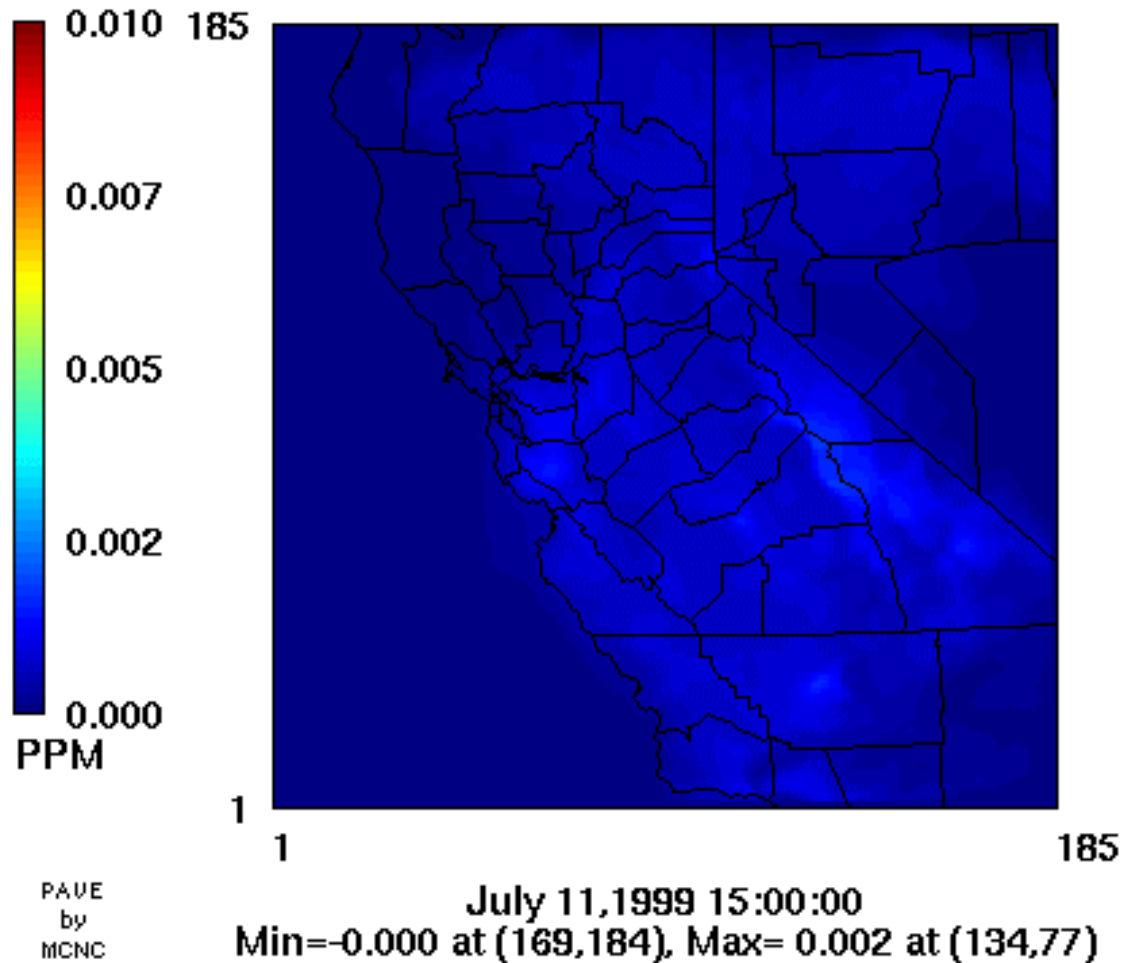
Ozone Sensitivity

Top Boundary VOC



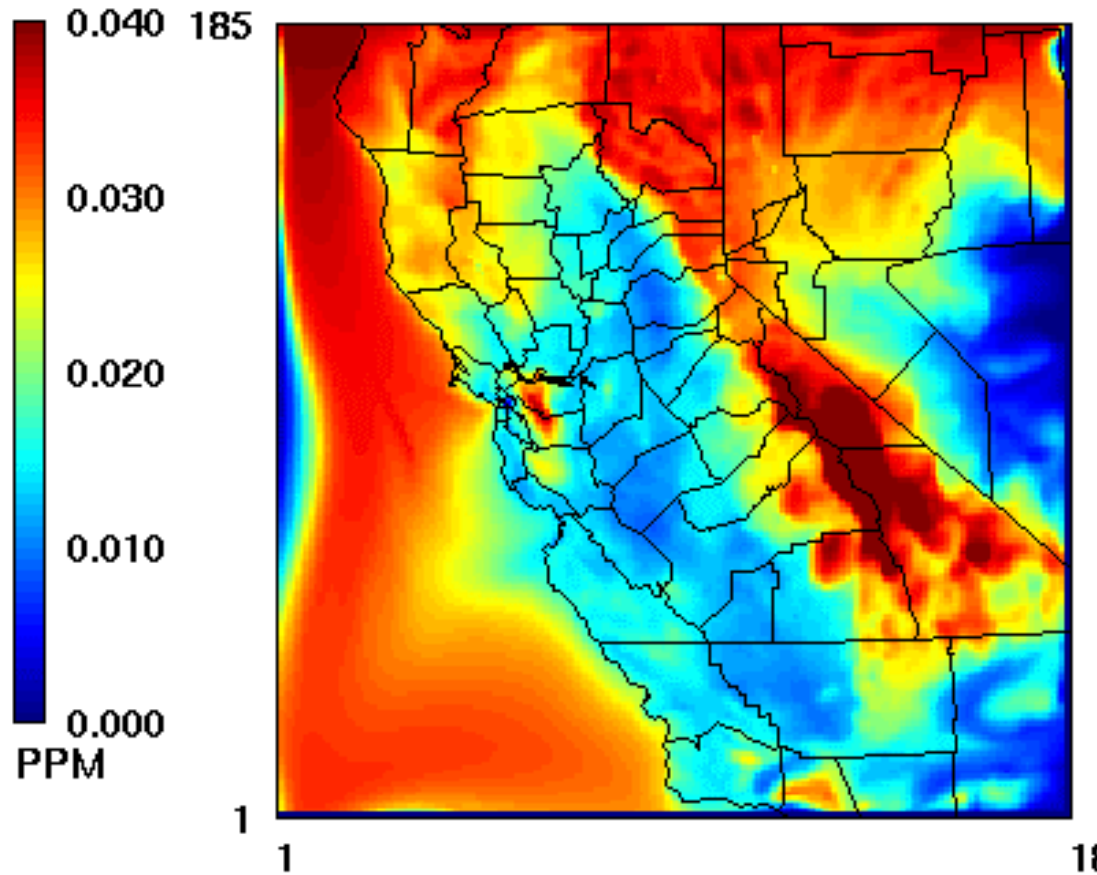
Ozone Sensitivity

Top Boundary CO



Total Ozone Sensitivity

All Species, North/Top Boundaries

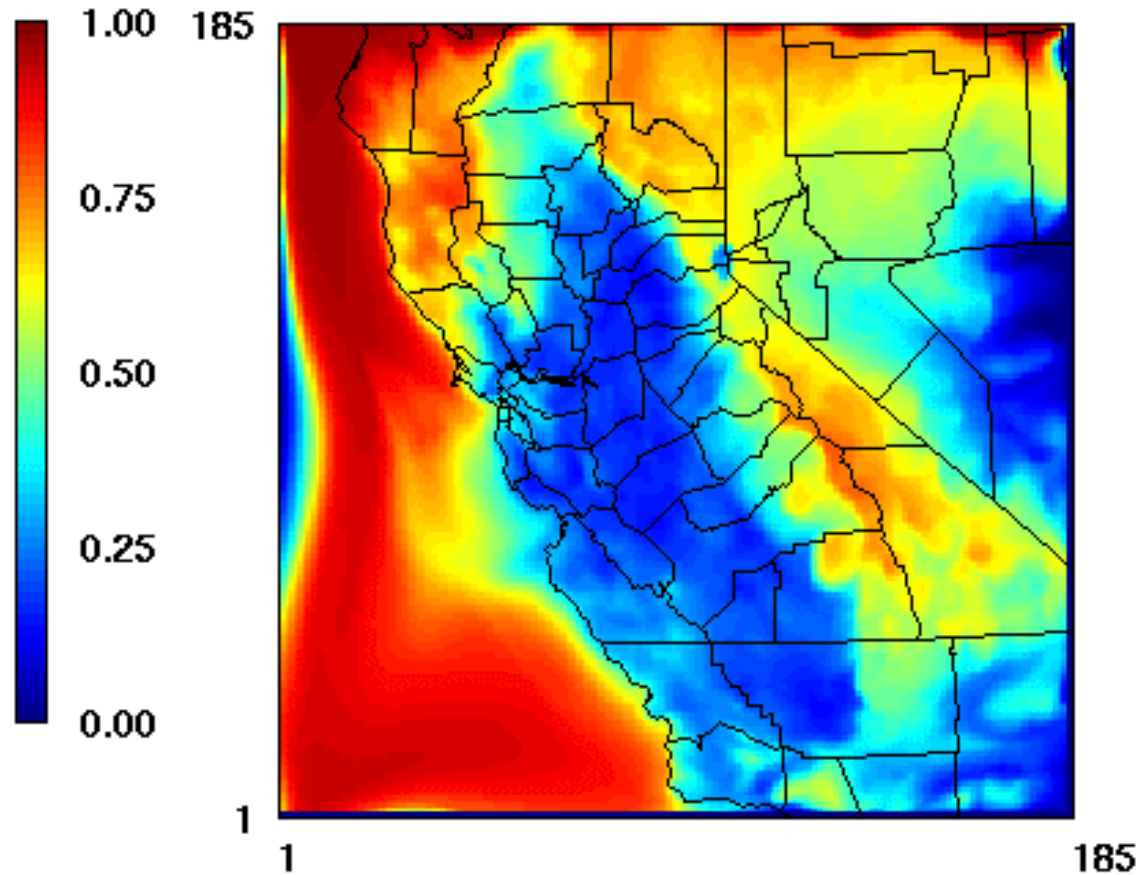


PAVE
by
MCNC

July 11, 1999 15:00:00
Min= 0.000 at (1,1), Max= 0.052 at (130,85)

Normalized Total Ozone Sensitivity

All Species, North/Top Boundaries
Total Sensitivity / Total Predicted Ozone



PAVE
by
MCNC

July 11, 1999 15:00:00
Min= 0.00 at (1,1), Max= 1.00 at (19,178)

DDM Findings

- **Largest ozone sensitivity in BA from northern and top boundaries on high ozone days**
 - All other boundaries and IC's much less important
 - Top boundary sensitivity ~1-3 ppb each for O₃, NO_x, VOC, CO
 - Max north boundary sensitivity 5-15 ppb for O₃, VOC, and CO (in decreasing order)
 - NO_x lateral BC's = 0
- **Max sensitivity relative to total peak ozone is ~35% (mainly north boundary O₃ and VOC)**

DDM Findings

- **Low model top + top BCs are not effectively impacting model performance**
- **More to come...**