

Recap through August

- **ENVIRON + BAAQMD effort to reconcile UCR and ENVIRON CAMx simulations**
 - Met differences ° less than half the ozone differences
 - District/ATMET/ENVIRON/ARB still see issues with MM5 performance
 - IC/BC differences ° most of the ozone differences
 - Domain depth not a big player
 - Remaining CAMx inputs not big players

Recap through August

- **CCOS data processed and being used**
- **Investigated fires and their role on ozone performance**
 - Emissions (rates, locations, durations)
 - IC/BC/TC
- **RAMS vs. MM5 vs. others for July/August 2000**
- **RAMS + MM5 for July 1999 finishing up**

Latest Developments

- **Modeling of fire emissions**
 - Review of ARB estimates, Alpine processing
 - Species emissions, ratios vs. papers
 - CAMx simulation of fire using RAMS vs. MM5
 - Revised IC/BC's
- **July/Aug 2000 Modeling Updates**
 - Revised RAMS run w/ observational FDDA
 - Emission sensitivities
- **July 1999 Modeling**
 - RAMS results
 - Initial CAMx run and IC/BC sensitivity

Modeling Fire Emissions

- **ENVIRON reviewed ARB estimation methodology**
 - Understand level of detail and resulting inventory
 - CAMFER's EES is based on USFS' FOFEM
 - Runs in ArcView using FOFEM-derived parameters
 - Overlays burned areas with GIS vegetation distrib
 - Estimates emissions from flaming and smoldering
 - NO_x, NMHC, SO_x, NH₃, etc, from CO and CO₂
 - Fairly robust approach

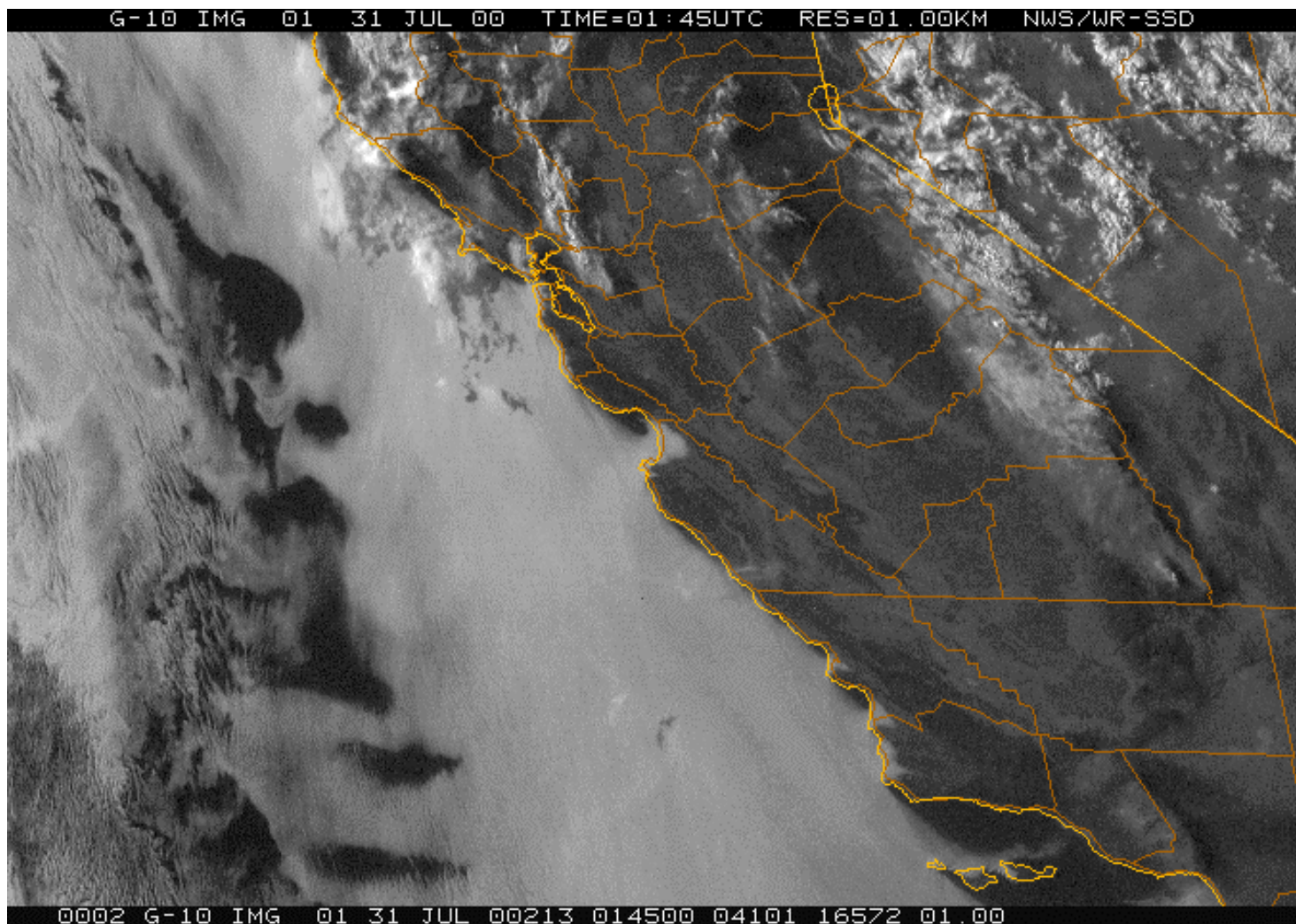
Modeling Fire Emissions

- **ENVIRON discussed processing with Alpine**
 - Alpine temporally and vertically allocates daily emissions, speciates, develops model-ready inputs
 - Approach based on WRAP's FEJF
 - Vertical distribution:
 - Approach uses burned acreage/day to classify fire size and plume top/bottom
 - Alpine was using acreage burned per cell => low plume rises
 - Approach revised to use total acreage burned => higher plume rises

Modeling Fire Emissions

- **Emissions (July 30, peak day)**
 - CO: 36,700 tons
 - NO_x: 1,120 tons
 - VOC: 2,460 tons C (as CH₄)
 - CO:VOC 8.5 (lit mean: 3.9, range: 2.4 – 18.5)
 - CO:NO_x 54 (lit mean: 36.5, range: 9.5 – 83)
 - VOC:NO_x 6.3 (lit mean: 9.4)

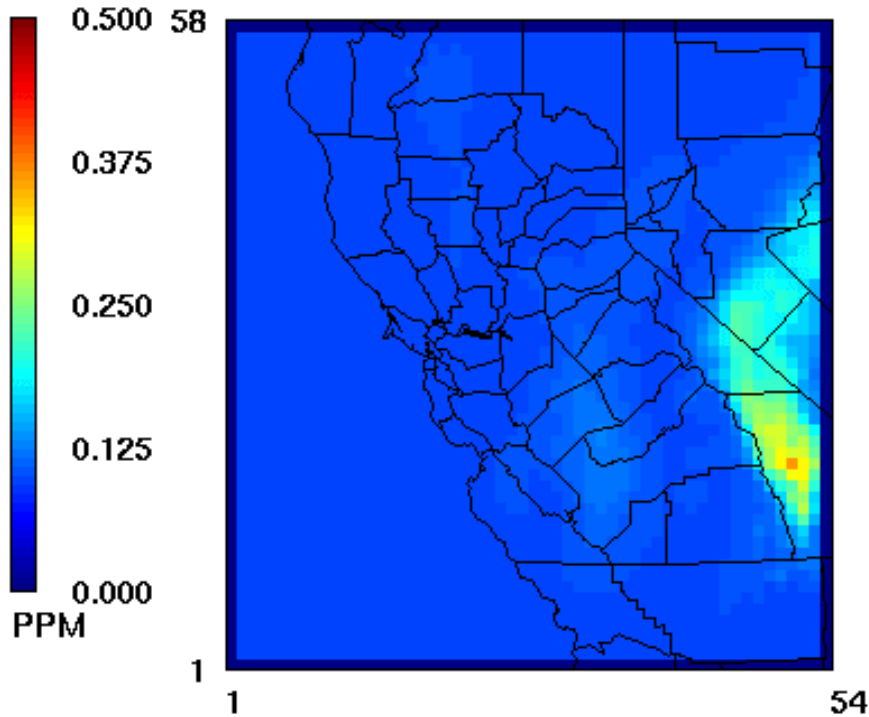
Modeling Fire Emissions



Modeling Fire Emissions

CO at ~3 km

CAMx v3.10 run5c (MM5 met)

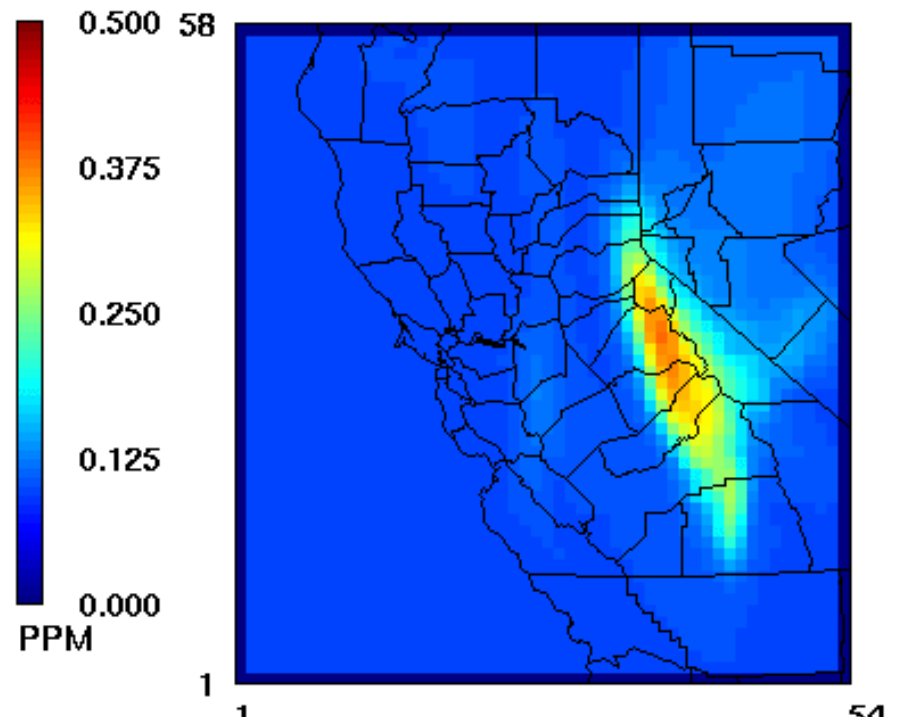


July 31,2000 0:00:00
Min= 0.000 at (1,1), Max= 0.362 at (51,19)

PAVE
by
MCNC

CO at ~3 km

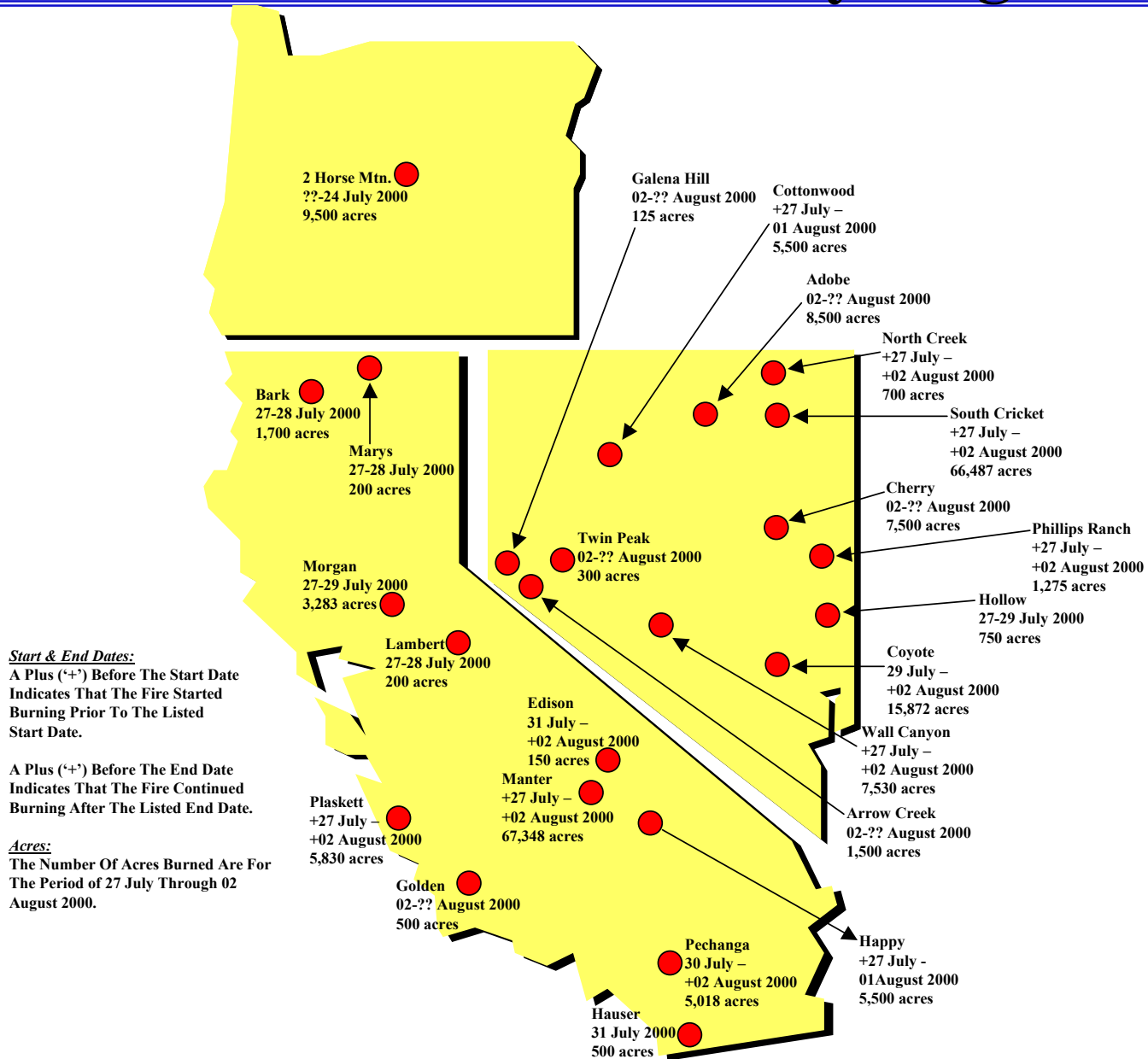
CAMx v3.10 run5d (RAMS met)



July 31,2000 0:00:00
Min= 0.000 at (1,1), Max= 0.386 at (38,31)

PAVE
by
MCNC

Fires Recorded July/Aug 2000



Revised IC/BCs

- **Many fires during July/August 2000 episode**
- **Fires dominate regional ozone and precursor buildup**
- **Effects need to be included via IC/BCs**
- **ENVIRON developed procedure for this**
 - Start with UCR SARMAP-based BC's
 - Modify west and south boundaries slightly (aircraft and surface obs)
 - Add additional NO_x and VOC on certain boundaries likely influenced by fires

Boundary Conditions

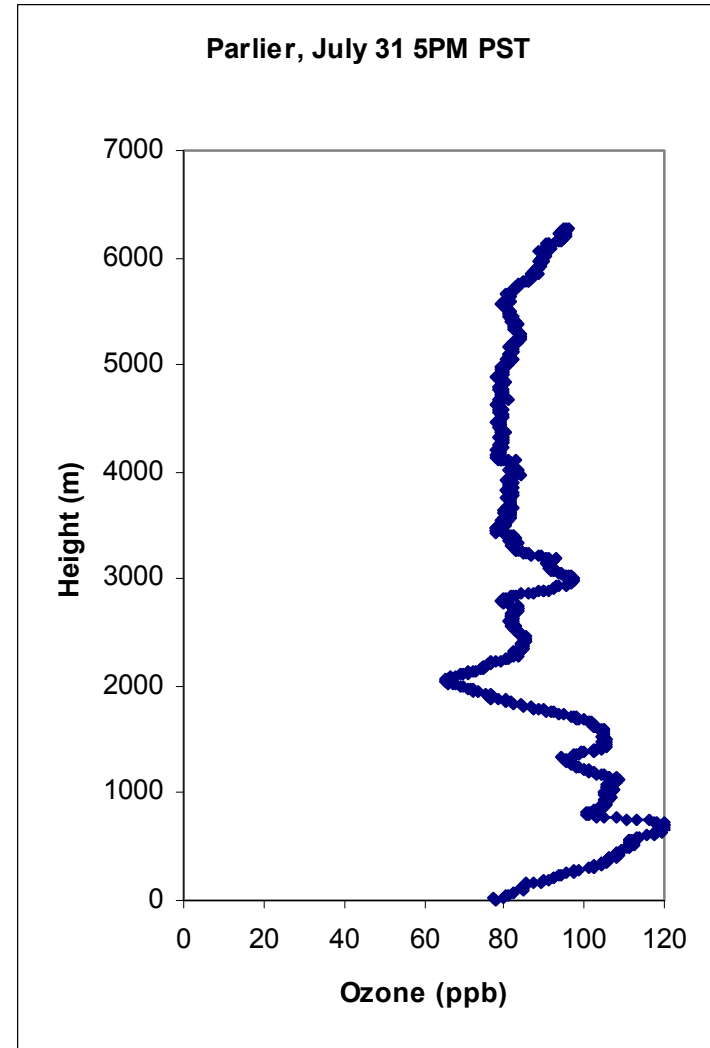
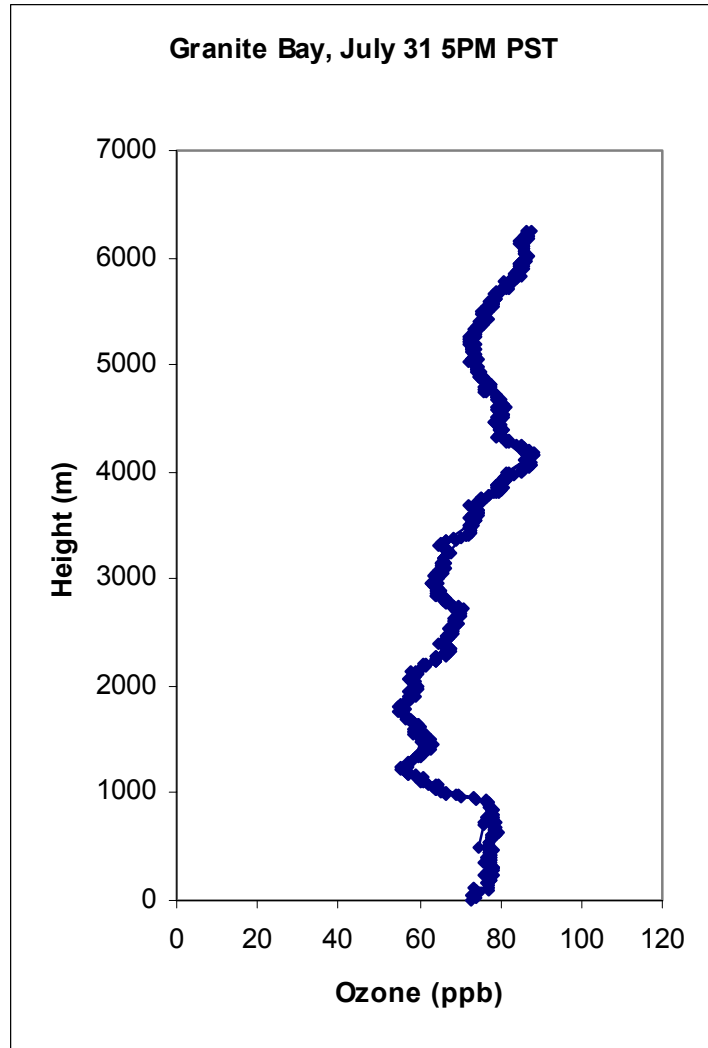
**VOC (ppbC)
Others (ppb)**

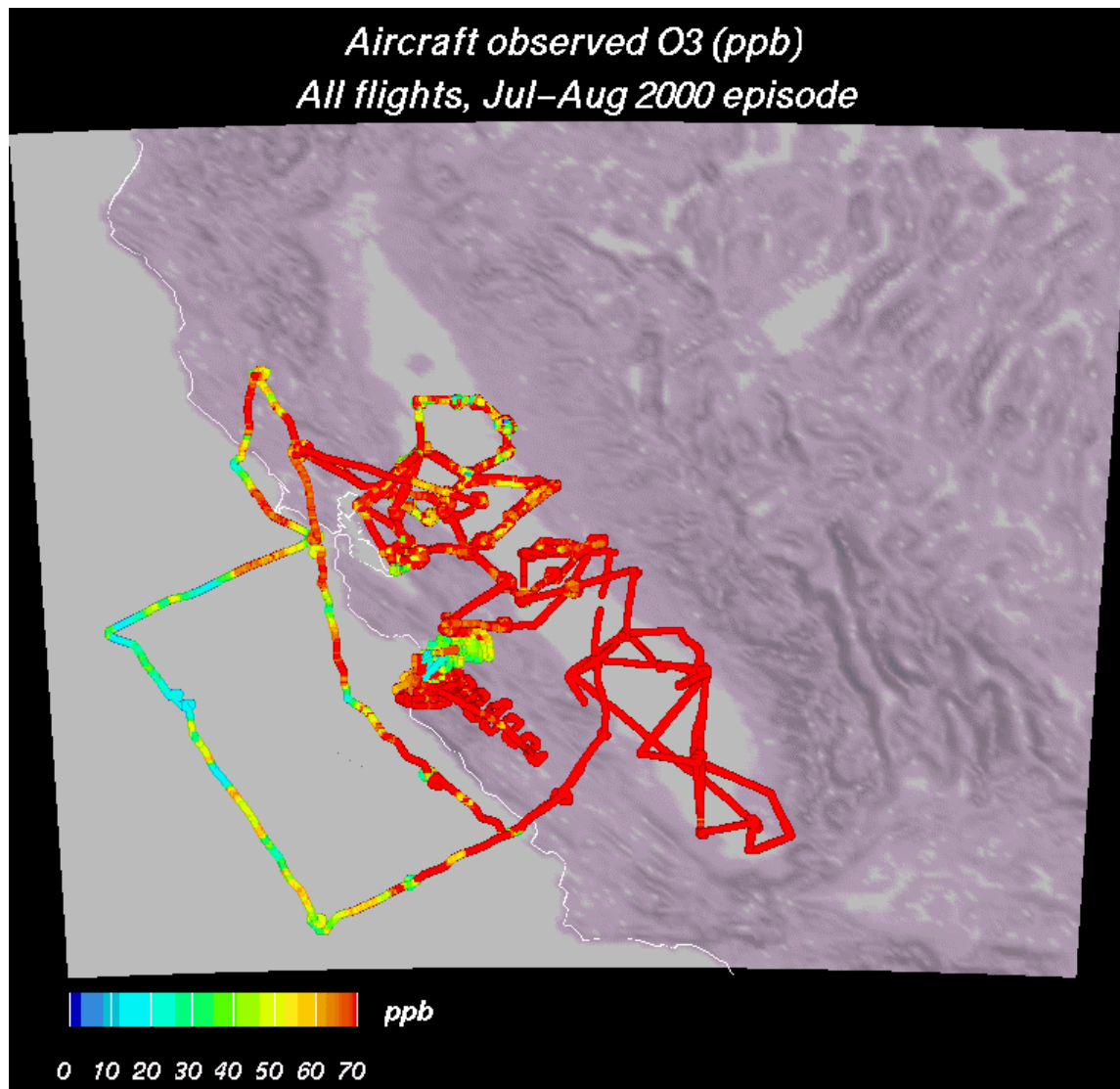
CB-IV	UCR/SARMAP	Environ/OTAG
Species	Layer 1	Everywhere
Ozone	25/40	35
CO	200	100
NO	0.3	0
NO2	1.3	0.1
NOx	1.5	0.1
PAR	20.5	3.1
OLE	0.8	0
ETH	1.4	0
TOL	1.7	0
XYL	1.1	0
ISOP	0.3	0
FORM	5.8	1.1
ALD2	3	0.2
VOC	34.6	4.4

Vertical ozone profile (ppb)

Layer	Height (m)	West	Other
1	24	25	40
2	49	26	42
3	105	27	43
4	168	28	47
5	240	30	51
6	370	32	55
7	526	35	62
8	704	39	70
9	904	43	70
10	1129	46	70
11	1387	48	70
12	1733	49	69
13	2207	51	68
14	2854	53	67
15	3751	55	65
16	5131	57	63
17	7277	60	60
18	9325	67	67
19	12162	73	73
20	14939	75	75

Ozonesonde Profile for July 31, 2000





Revised IC/BCs

- **Revised western boundary:**
 - Ozone set to UCR SARMAP-based western profile
 - Lowest 1 km:
 - NO_x reduced to 0.04 ppb NO, 1 ppb NO₂
 - SARMAP-based VOC reduced by 1/3 (~20 ppbC)
 - Aloft:
 - SARMAP-based NO_x and VOC profile

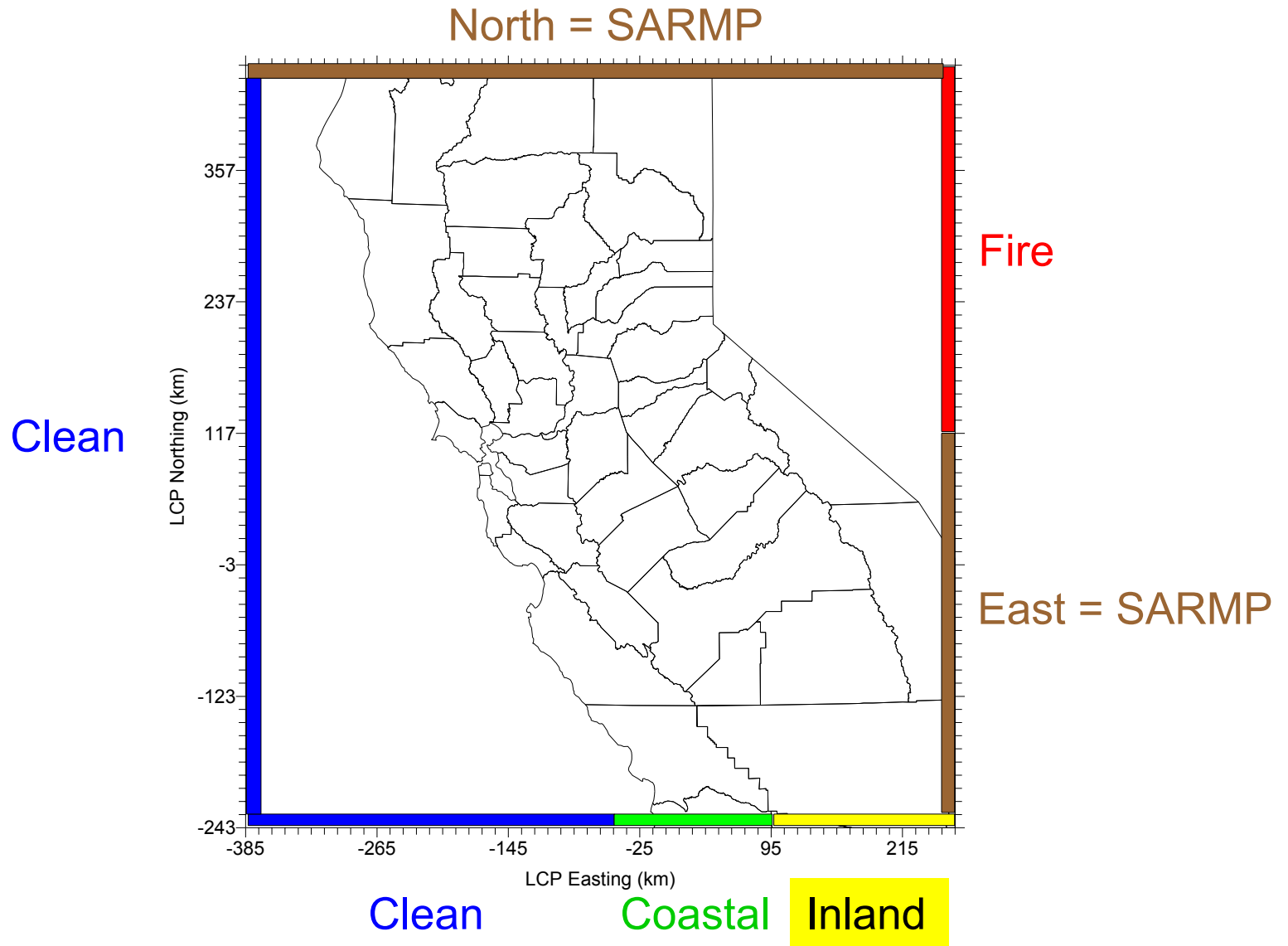
Revised IC/BCs

- **Revised southern boundary:**
 - Clean (over ocean): Set to revised western BCs
 - Coastal and **Inland**:
 - Lowest 1 km (coastal) or 2 km (inland):
 - Average diurnal ozone profile from surface obs
 - NO_x increased to 0.5 ppb NO, 3.5 ppb NO₂ based on surface obs
 - UCR SARMAP-based VOC BCs
 - Aloft:
 - UCR SARMAP-based ozone BCs
 - NO_x and VOC held constant at UCR SARMAP-based surface BCs to account for Pechanga fire in SoCal

Revised IC/BCs

- **Fire boundary:**
 - UCR SARMAP-based ozone BCs used
 - Lowest 3 km:
 - UCR SARMAP-based NO_x and VOC BCs used
 - Aloft:
 - NO_x, VOC, and CO constant at doubled UCR SARMAP-based surface BCs

Revised IC/BC



Revised IC/BCs

- **Revised ICs**
 - Clean areas:
 - UCR SARMAP-based ozone profile from west BC
 - UCR SARMAP-based NO_x, VOC, CO profiles used
 - Dirty areas:
 - UCR SARMAP-based ozone profile from inland BC
 - Doubled UCR SARMAP-based BCs

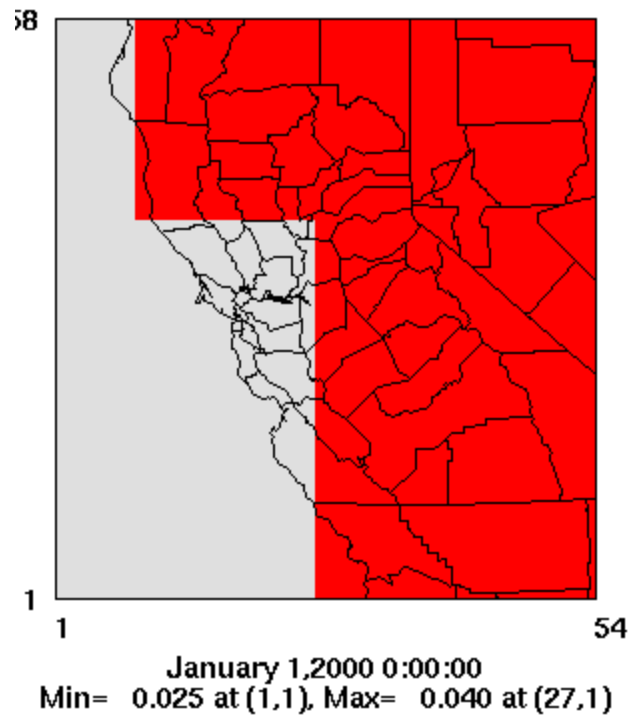
Revised IC/BCs

Variable Initial Conditions

Layer 1 Ozone

Grey = Clean

Red = Dirty



Revised IC/BCs

- **CAMx results with RAMS met:**
 - Go to: www.environ.org/basip2004
 - Results page, Run 5e

July 1999 Results

- **Run 1:**
 - Initial RAMS meteorology (Run “c3”)
 - Clean OTAG IC/BCs
 - Latest emissions from Alpine (no fires this time)
 - Go to: www.environ.org/basip2004
 - Results page: Run 1
- **Run 2:**
 - Substitute SARMAP IC/BCs
 - Results page, Run 1a

July 1999 Results

- **Summary**
 - Promising initial performance
 - Higher ozone than July/August 2000 (w/o fires)
 - Hotter, stronger off-shore push during core days
 - Higher emissions, hotter chemistry, less early ventilation of Bay Area
 - Generally under predicting:
 - Predicted: 85-100 ppb in Concord/Livermore
122/128 ppb peak SE of Livermore
 - Observed: 146/156 ppb in Concord/Livermore



RAMS Episode 1 – “Latest” Configuration

- 3 and 4 grids
- Extra smoothing of topography on SE quadrant of grid 3 (4 km)
- Analysis nudging with NCAR archived data
– no ARB data
- Weak analysis nudging
 - 4.0, 5.0, 6.7, 10 hour timescales on grids 1-4
- Bay temperature constant at 19C
- No irrigated crop designation
- “Medium” soil moisture initial conditions



Obs Nudging – Best Configuration

- Re-started RAMS 3 grid run
- Nudge model fields to horizontal surface winds only
- Timescale – 15 min
- Outer radius of influence – 10 km
- Only CCOS data used for nudging
- Only NWS data used in statistics
- Verification domain – 5 x 5 deg

Statistics Definitions

- *root mean square vector error - RMSVE* - average of the wind vector differences between forecast and observations

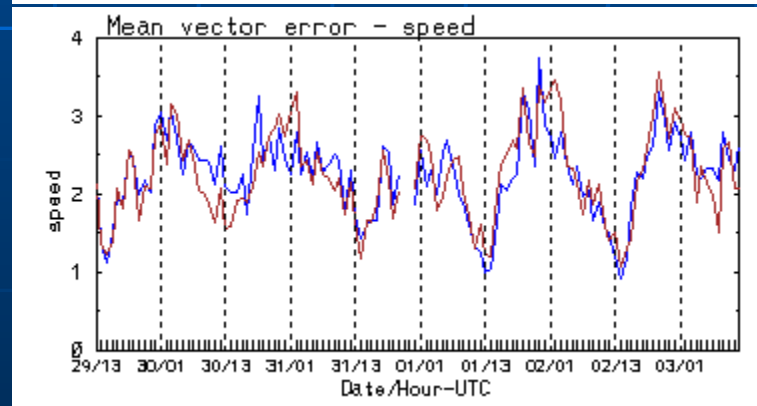
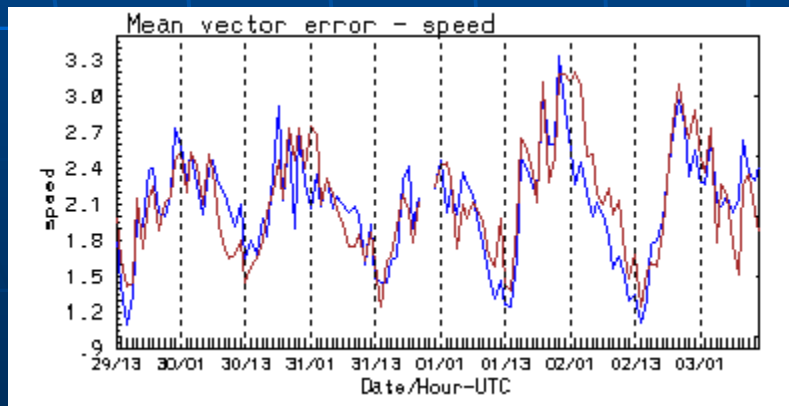
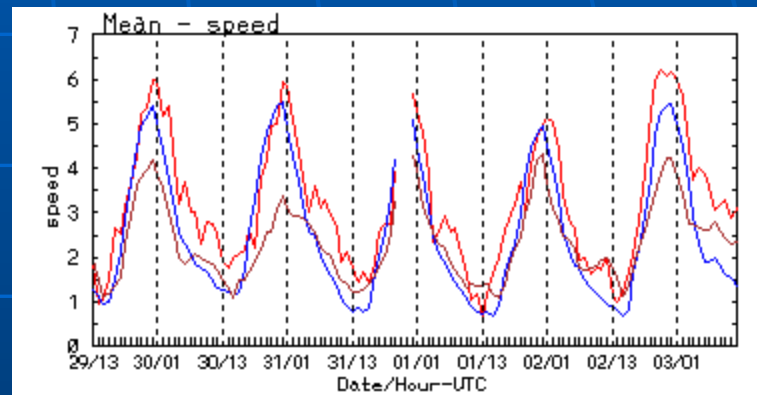
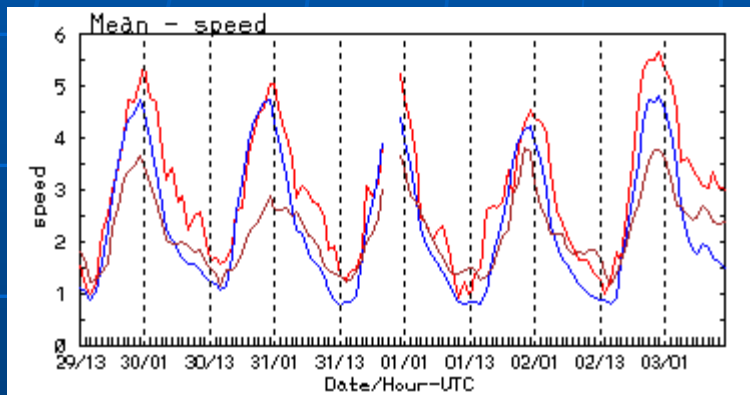


$$RMSVE = \frac{\sum_1^N \sqrt{(u_{fore} - u_{obs})^2 + (v_{fore} - v_{obs})^2}}{N}$$



Jul/Aug 2000 RAMS/NOAA-MM5 runs

NWS stations



3.0x3.0 deg

rams-obs4

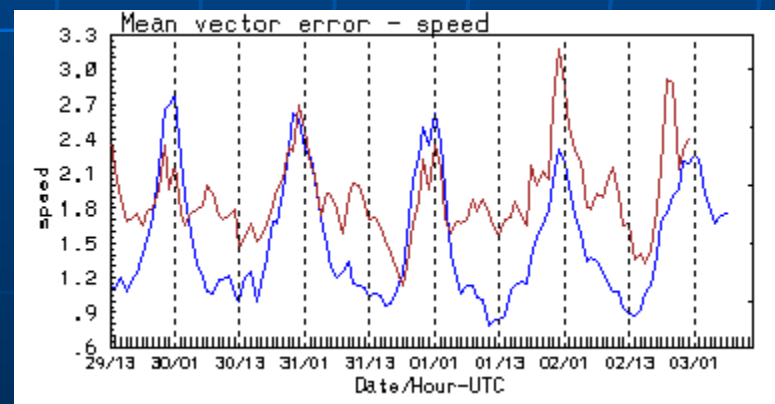
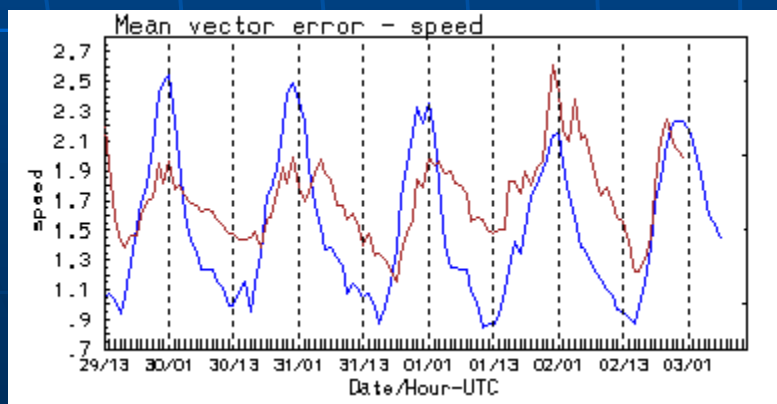
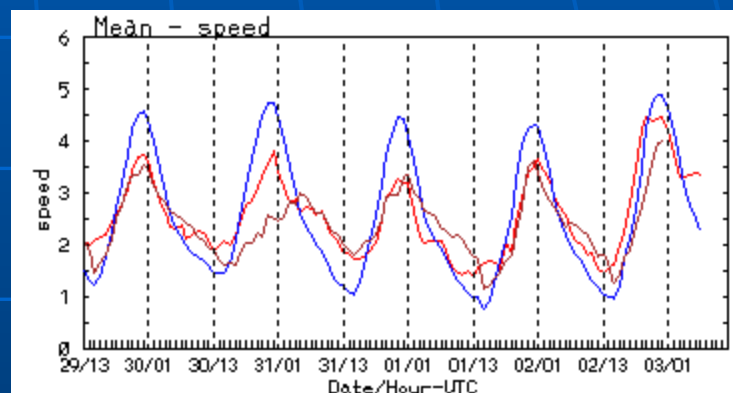
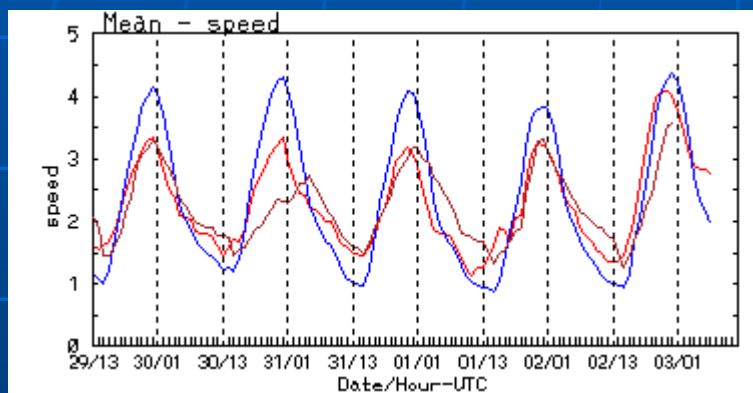
mm5-3g

1.5x1.5 deg



Jul/Aug 2000 RAMS/NOAA-MM5 runs

CARB database stations



3.0x3.0 deg

— rams-obs4 — mm5-3g

1.5x1.5 deg



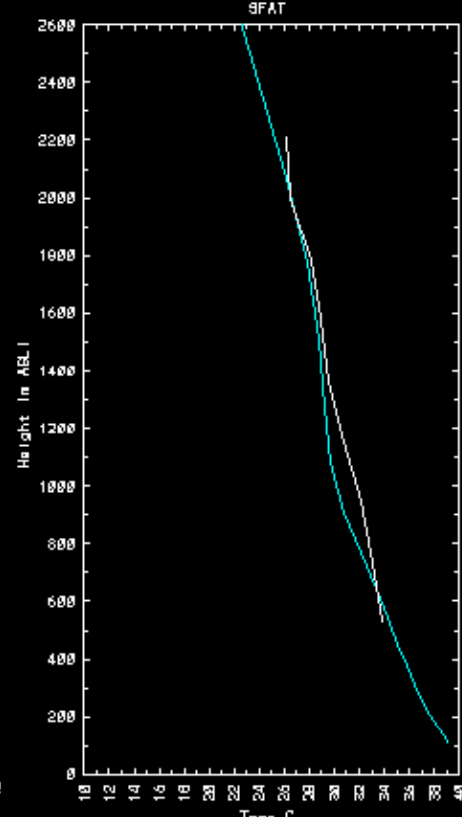
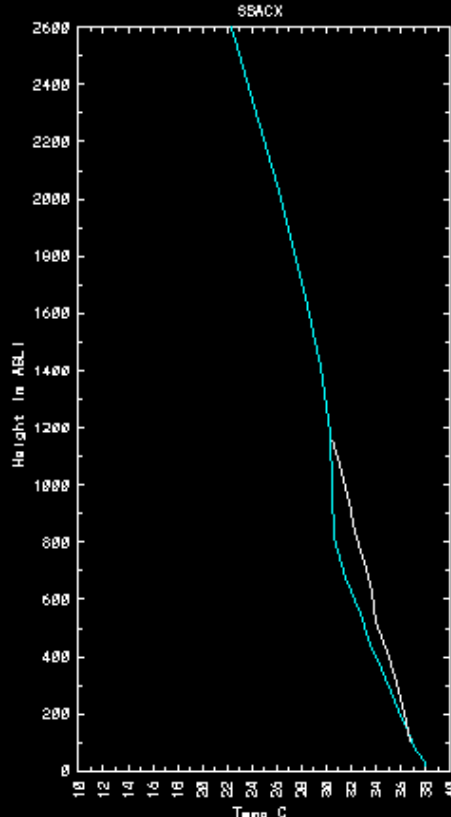
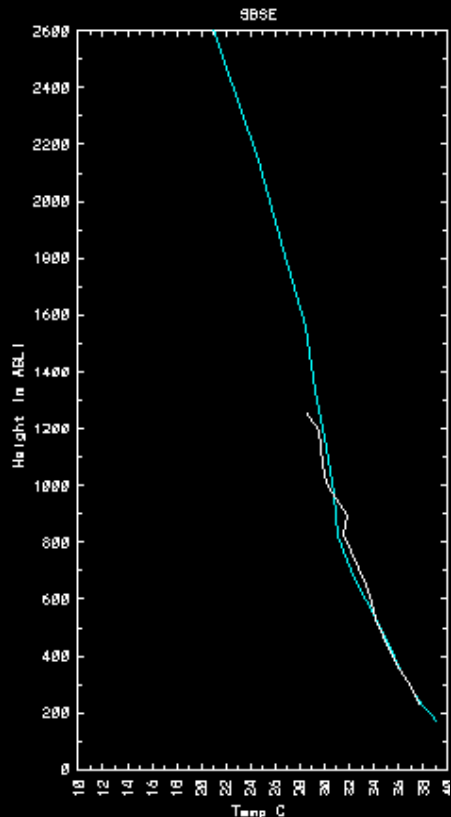
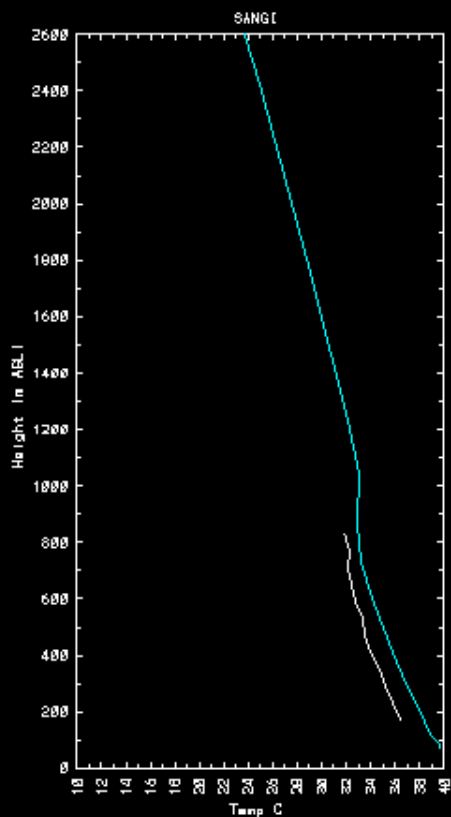
Comparison to CARB stations

- Does RAMS have a high speed bias during the day?
- It turns out that the vast majority of the stations in CARB database had wind observations at 2 meters height, rather than the standard 10m.
- Statistics used RAMS/MM5 winds from the first model level (about 15m).
- Comparison of NWS and CARB obs over same domain shows NWS speeds are about 50% larger than CARB during late afternoon.
- NOAA/MM5 first level wind speed matched CARB obs – further evidence that there was a significant slow wind speed bias.



RASS Comparisons

- Beginning look at RAMS-RASS comparisons
- 2000-08-01-0000 UTC, RAMS -cyan, RASS-white



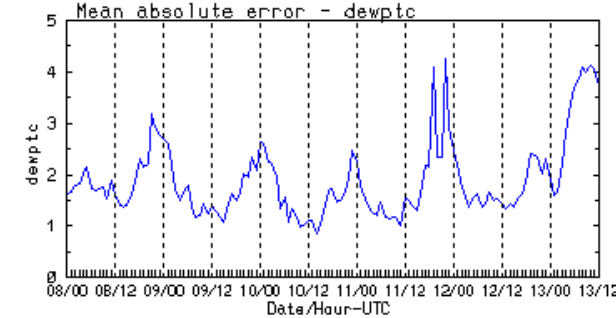
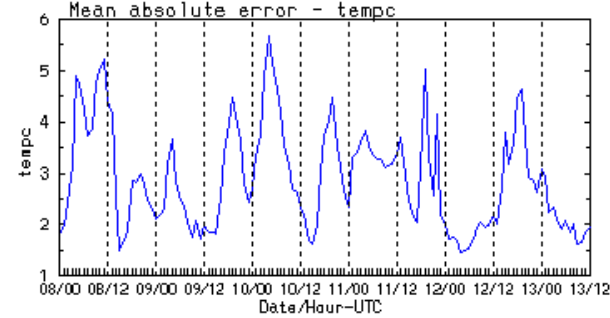
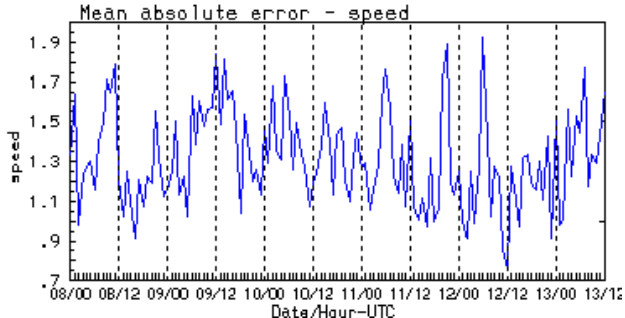
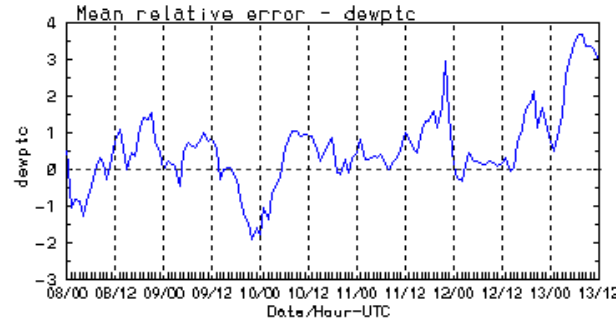
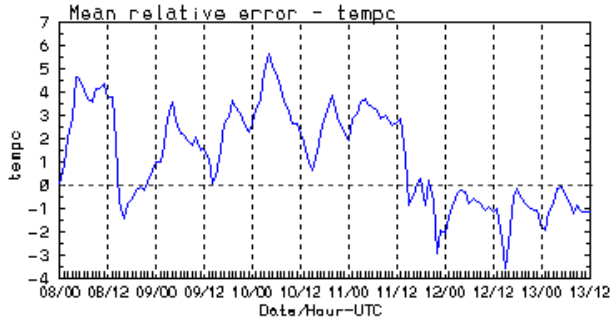
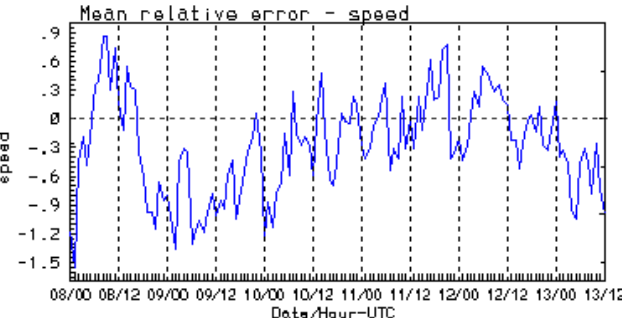
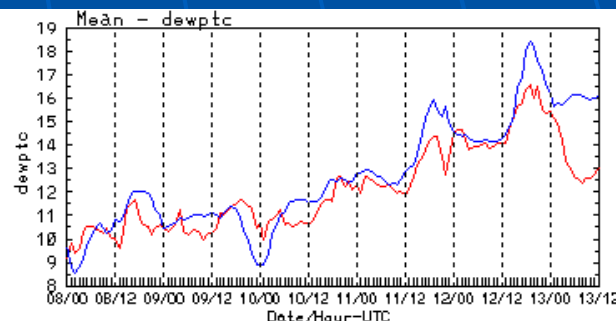
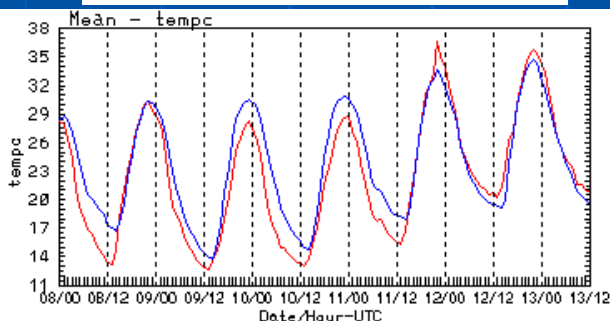
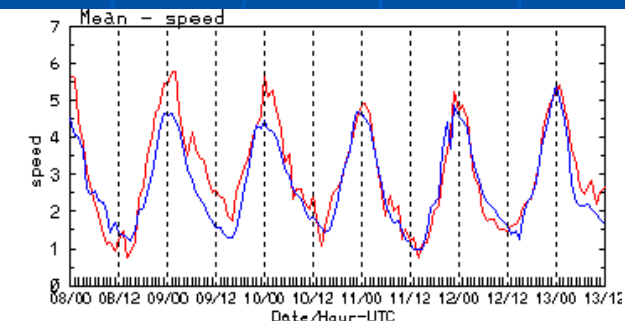


July 1999 Episode

- First runs finished in similar configuration as original episode 1 and 2.
- Easier to simulate than June 2000; large-scale controlled by *existing* weather systems, rather than *developing* systems

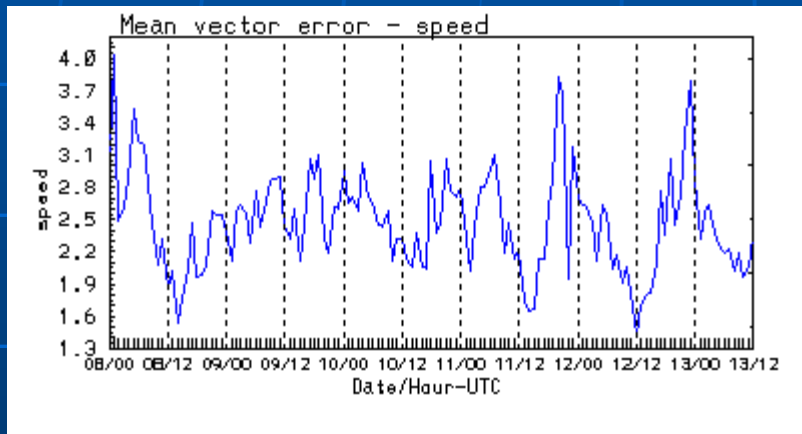


July 1999 Verifications



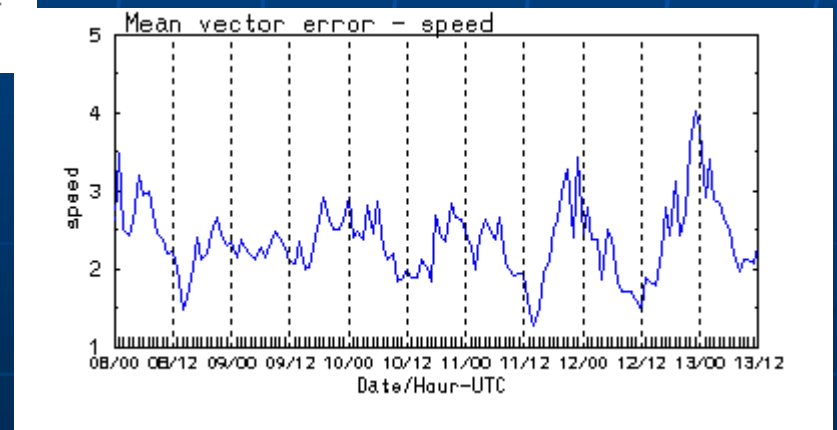
July 1999 Episode

- 3 grid RMSVE



1.5x1.5 deg

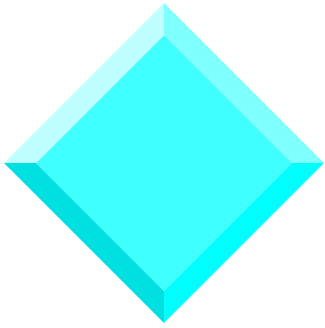
3.0x3.0 deg





July 1999 Episode

- 3 grid run has relatively low errors
- Two 4 grid runs complete with obs nudging in different configurations
- Errors are higher, which points to possible data problems
- Using surface data from cimis, raws, baaqmd, buoy, and airs mesonets.
- Not sure what level of QA/QC has been done on these



*BAAQMD SIP:
Status Of Emissions Modeling*

James G. Wilkinson

Cynthia F. Loomis

Alpine Geophysics



Overview

- ❖ Data that have been delivered
- ❖ Problems
- ❖ Current standing of overall emissions modeling effort



*Emissions Data From ARB &
BAAQMD*

❖ No new data

EMS-95 Episodic Emissions Comparison For BAAQMD

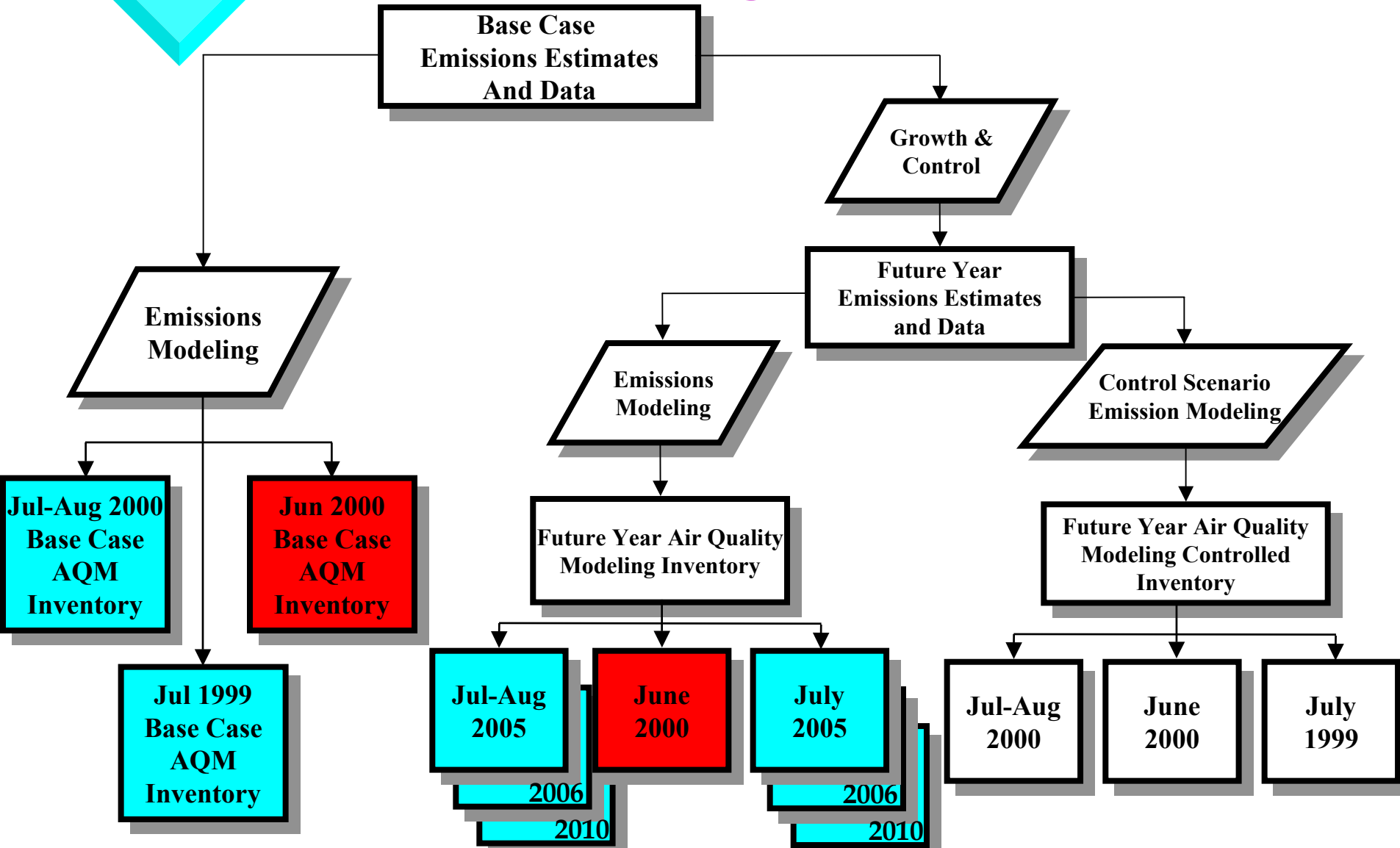
Source	CO						NOX						PM						SOX						TOG					
	July-August 2000			Jul-99			July-August 2000			Jul-99			July-August 2000			Jul-99			July-August 2000			Jul-99			July-August 2000			Jul-99		
	J-WE	J-WD	A-WD	WE	WD		J-WE	J-WD	A-WD	WE	WD		J-WE	J-WD	A-WD	WE	WD		J-WE	J-WD	A-WD	WE	WD		J-WE	J-WD	A-WD	WE	WD	
EGU	14	29	41	9	9		21	27	30	15	16		3	3	4	2	2		1	2	2	1	1		17	18	20	14	14	
Other	37	39	251	36	38		84	87	86	77	81		11	24	26	10	23		72	70	66	62	63		361	413	420	361	413	
Area	20	20	20	22	22		19	19	19	23	23		270	395	395	277	389		-	-	-	-	-		380	385	385	387	393	
Ship	2	3	3	2	2		10	13	14	10	10		1	1	1	1	1		5	7	7	5	5		1	1	1	1	1	
Off-road	864	478	478	877	487		161	214	214	163	217		15	15	15	15	15		10	10	10	10	10		156	88	88	160	90	
On-road	1,781	2,054	2,047	1,673	1,689		263	343	331	296	296		9	10	10	-	-		2	3	3	2	2		196	228	229	222	227	
Bio							9	10	10	11	13														337	454	419	638	726	
Total	2,718	2,623	2,840	2,619	2,247		567	713	704	595	656		309	448	451	305	430		90	92	88	80	81		1,448	1,587	1,562	1,783	1,864	



Problems Fixed & New Problems

- ❖ On-Going: emissions reasonableness checks
- ❖ On-Going: biogenic NO (possibly a factor of two too high; unknown impact on AQ modeling results)
- ❖ On-Going: EGU CO and NOX emissions differences between July 1999 and July-August 2000
- ❖ On-Going: Treatment of wildfire emissions in future years
- ❖ Fixed: commercial marine emissions (July-August 2000 complete; July 1999 in progress)
- ❖ Fixed: biogenic isoprene emissions estimates are now correct for 01-August (temporal problem resolved)

Current Standing





Next Updates

- ❖ Finalize shipping emissions estimates for July 1999 episodes