

# An Inter-Regional Comparison of Ozone Sensitivity to Reductions in Emissions in Central California

By

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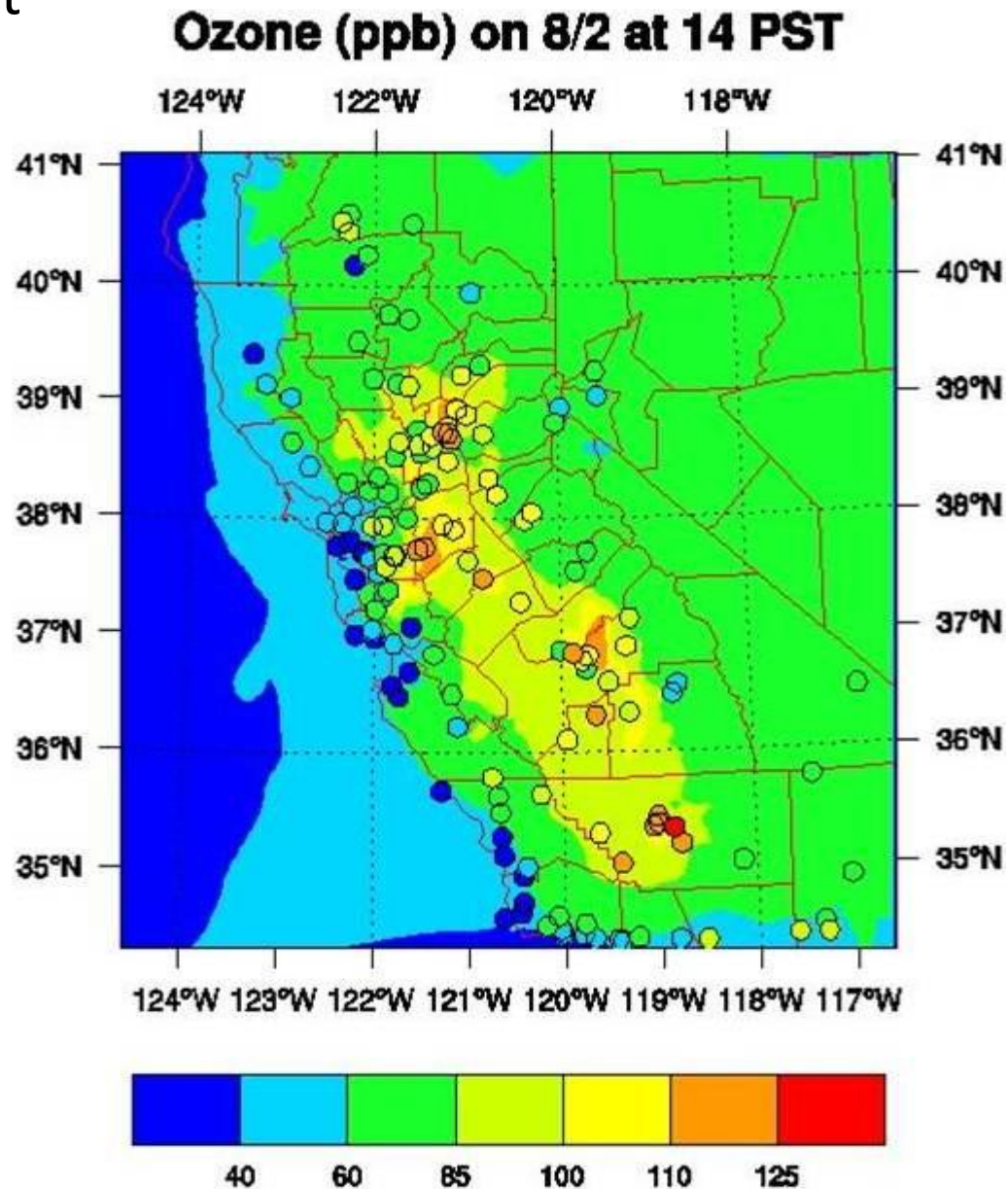
# Motivation for this study

- Past attainment demonstrations have not accurately predicted future ozone amount
- One explanation may be that past modeling studies have underestimated the amount of ozone in Central California, especially in the San Joaquin Valley
- Recent improvements in models lead to better model performance
- The improved model performance is likely to give a more reliable attainment demonstration

# Meteorological and Air Quality Models

- WRF model version 3.2
- Horizontal resolutions: 36, 12, 4 km
- Vertical layers: 50 (lowest model layer 24m)
- Surface and boundary layer scheme: Pleim-Xu
- Model period: July 12-27, 2006
  
- CMAQ model version 4.7
- Horizontal grid: 185x185
- Horizontal resolution: 4 km
- Vertical layers: 20
- Weekday and weekend emissions

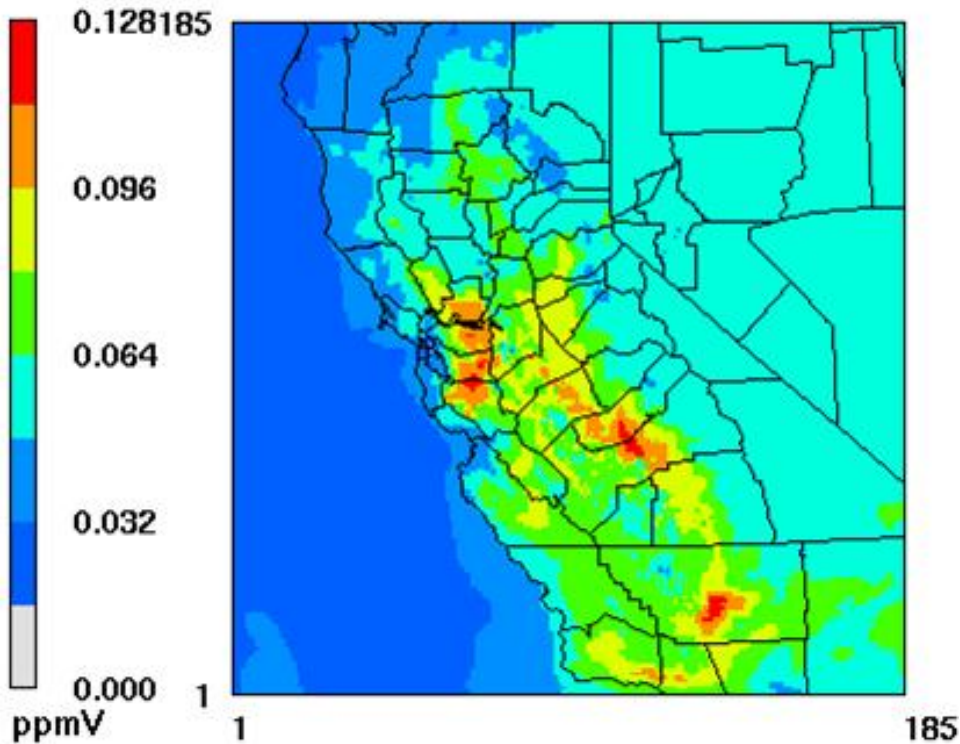
Example of a past  
MM5-CAMx  
simulation



# WRF-CMAQ results

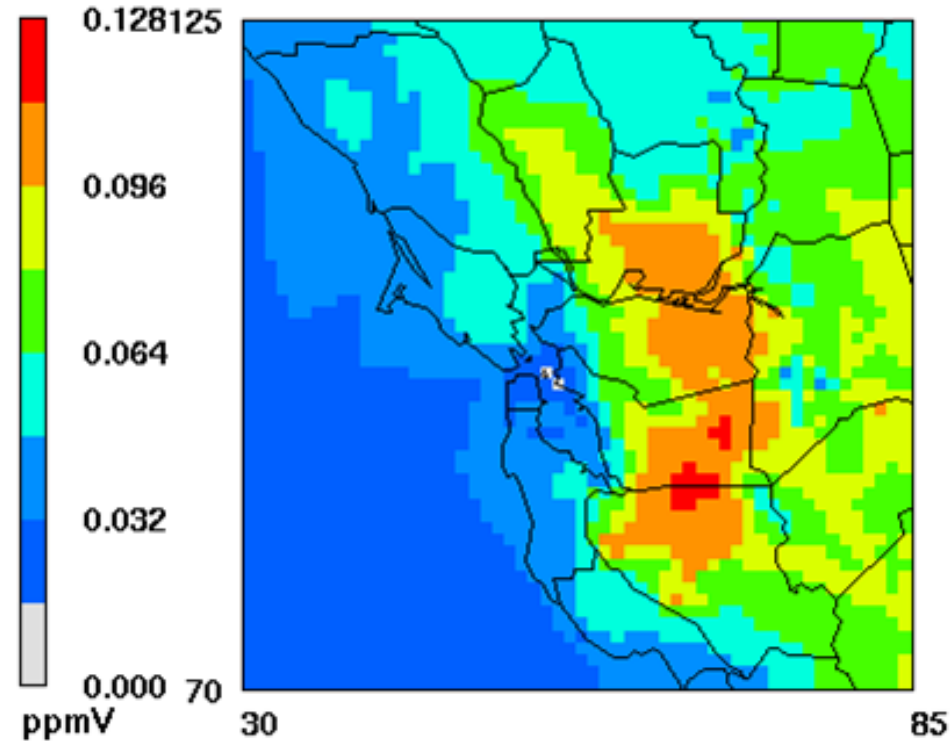
## Layer 1 O3 Model Domain

1-Hr O3 4PM PDT July 17, 2006



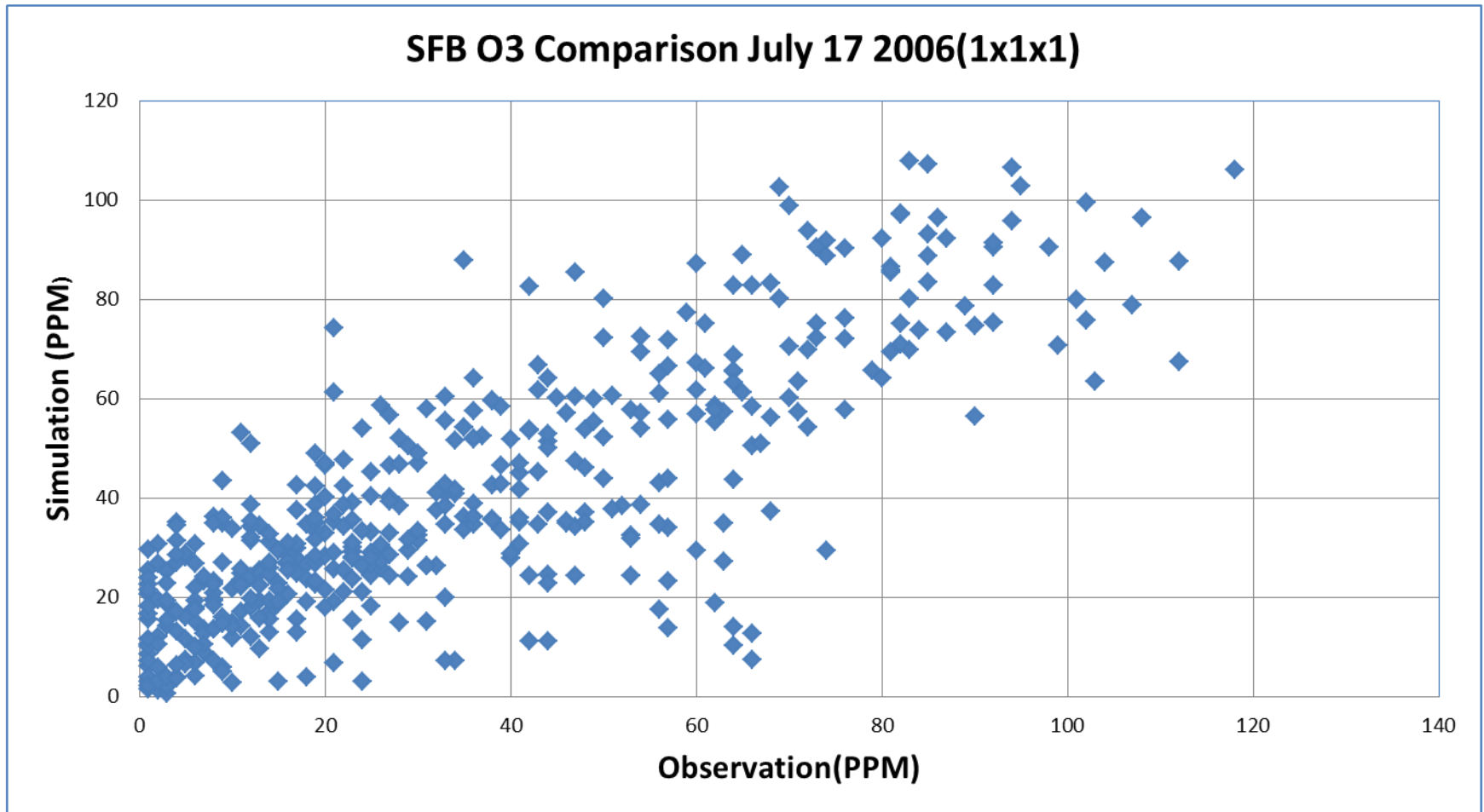
## Layer 1 O3 Bay Area

1-Hr O3 4PM PDT July 17, 2006



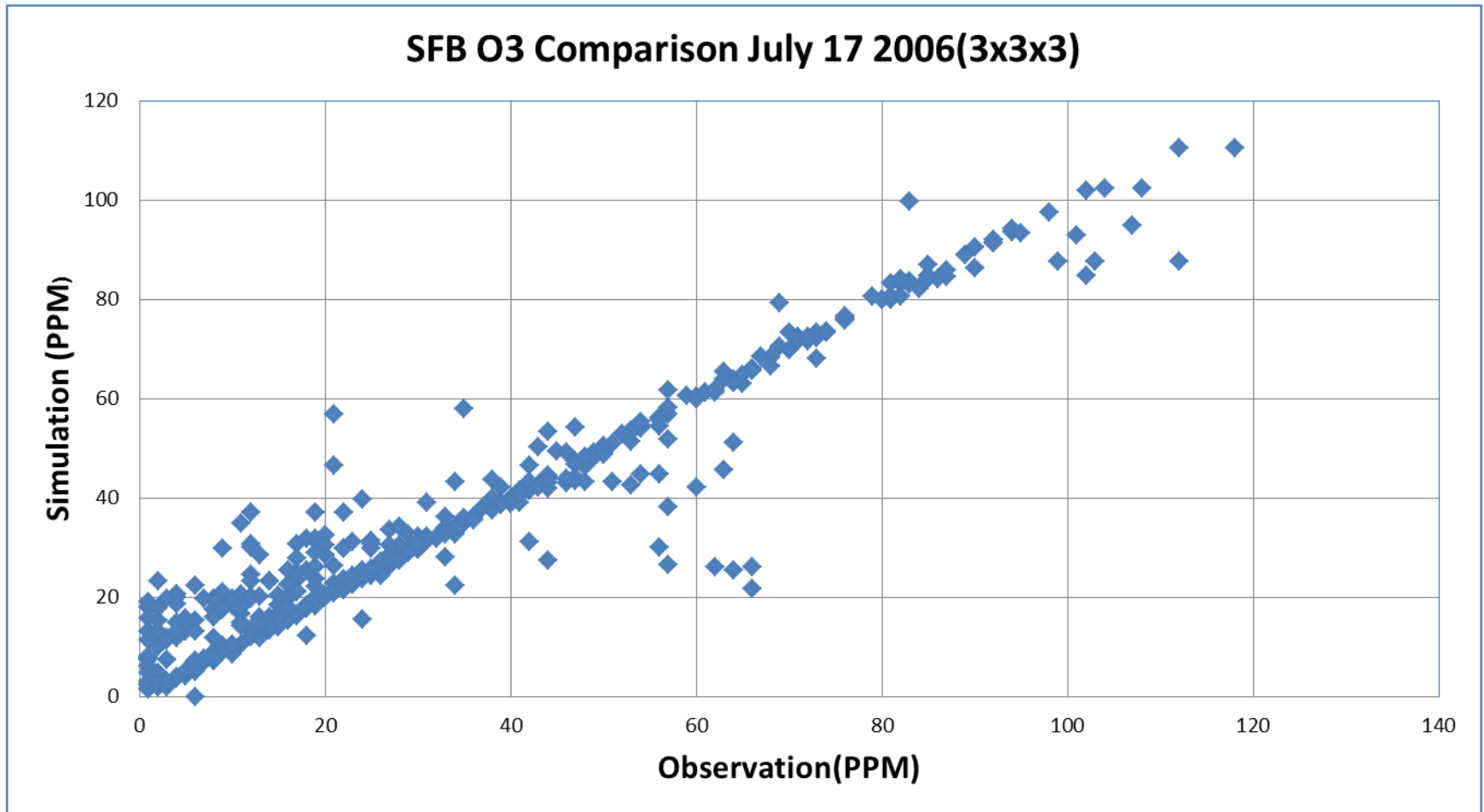
# Scatter Plot for Livermore July 17, 2006

Paired in cell and hour



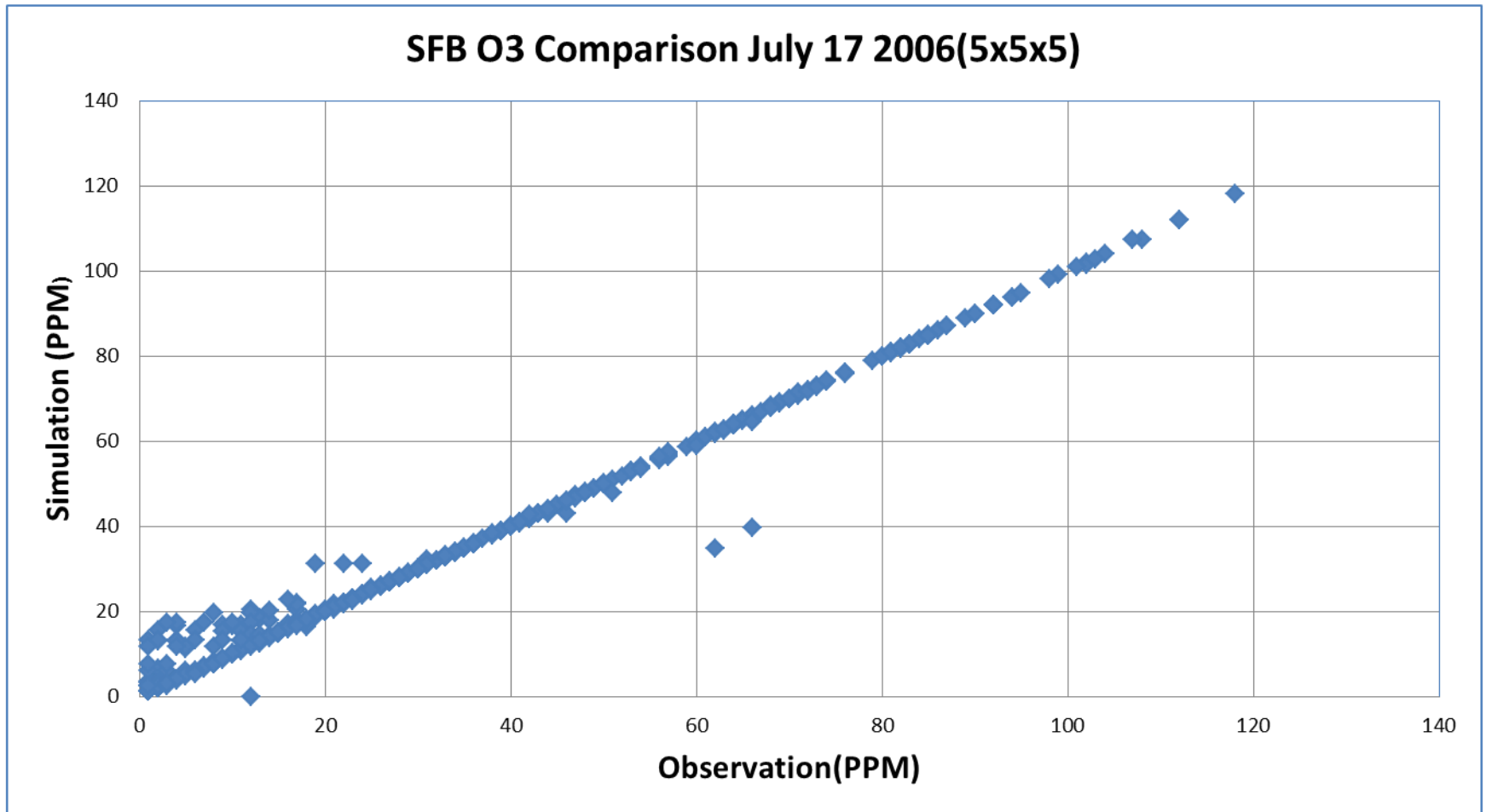
# Scatter Plot for Livermore July 17, 2006

Best in 9 cells and within 1 hour



# Scatter Plot for Livermore July 17, 2006

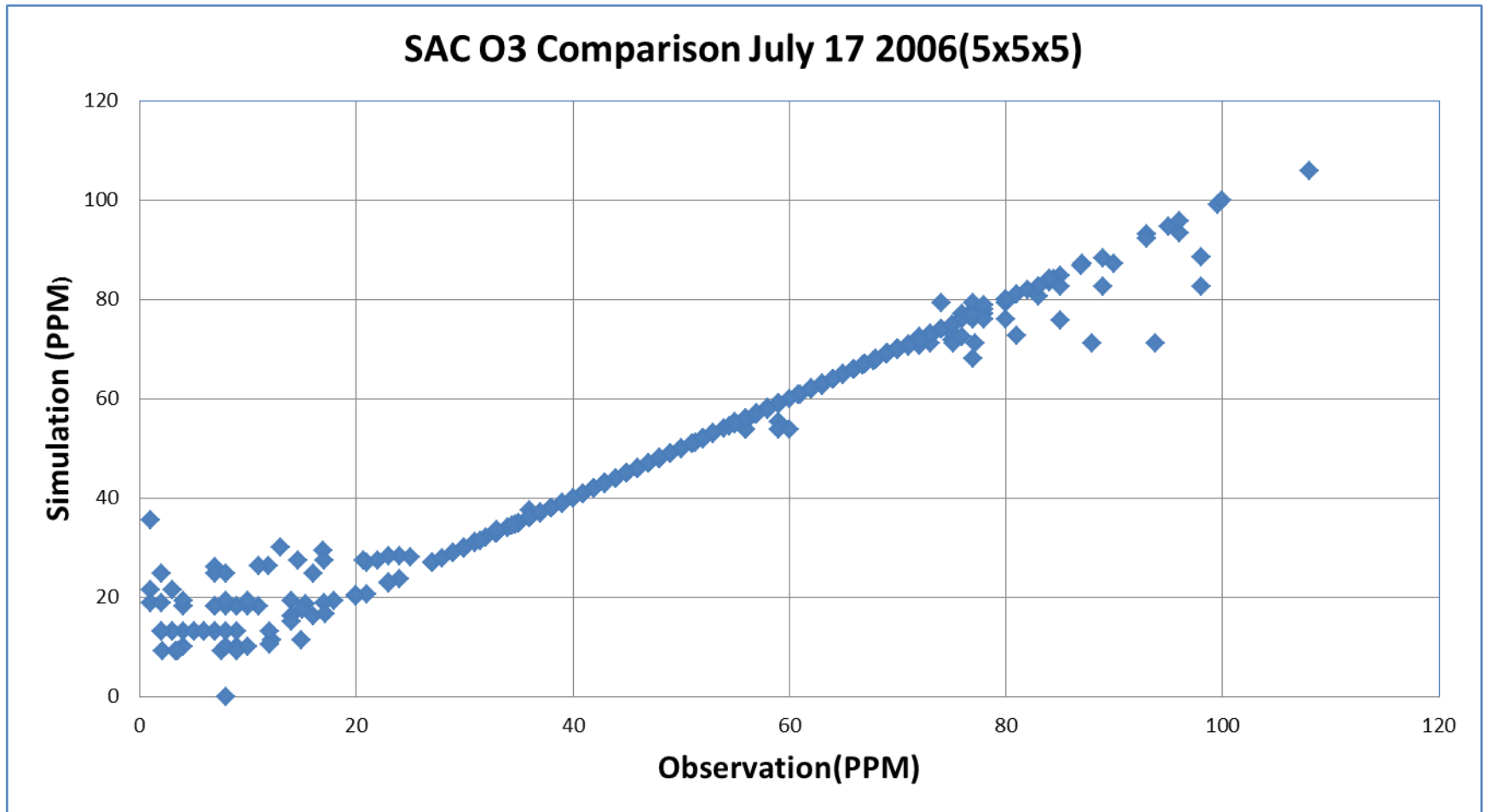
Best in 25 cells and within 2 hours





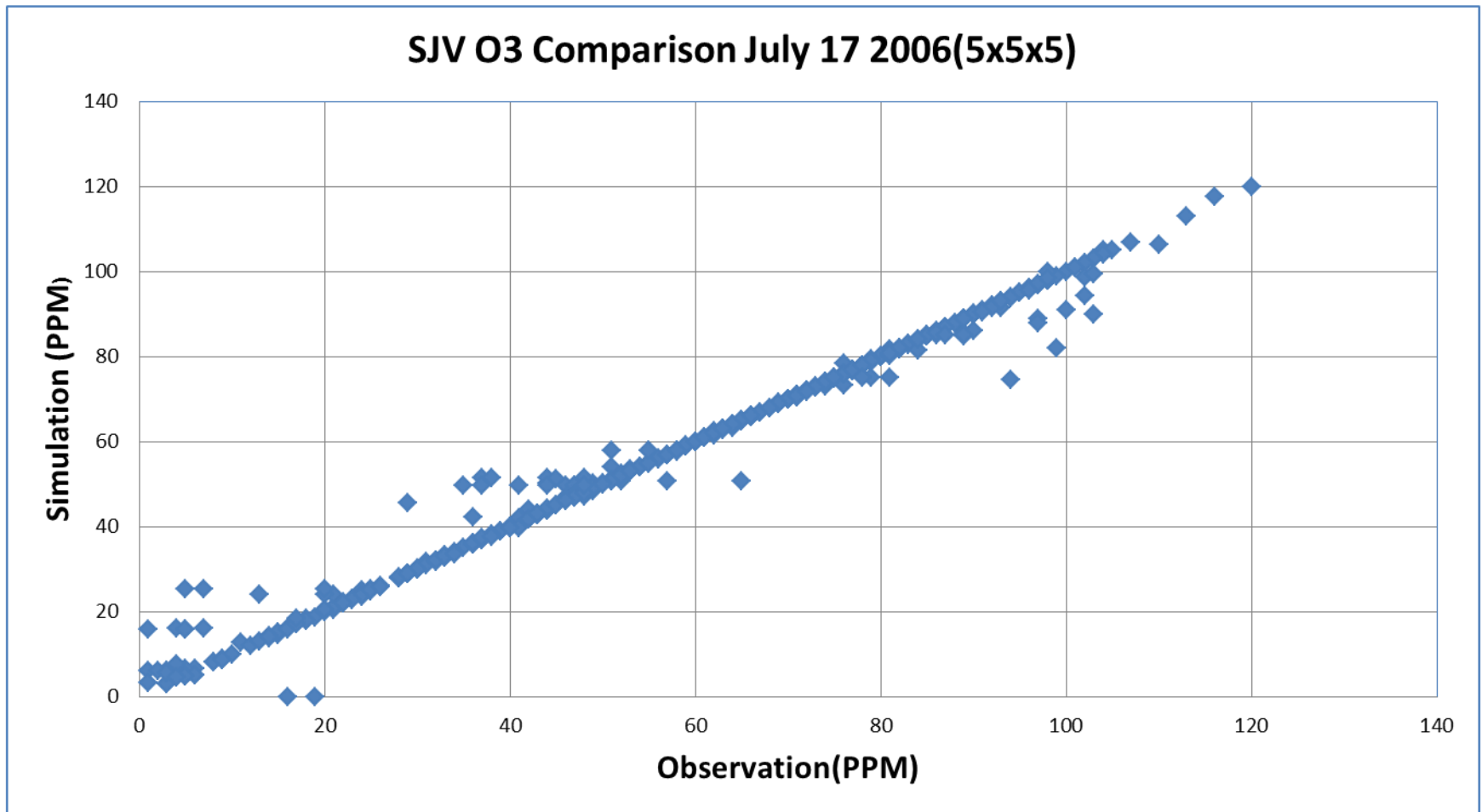
# Scatter Plot for Folsom July 17, 2006

Best in 25 cells and within 2 hours



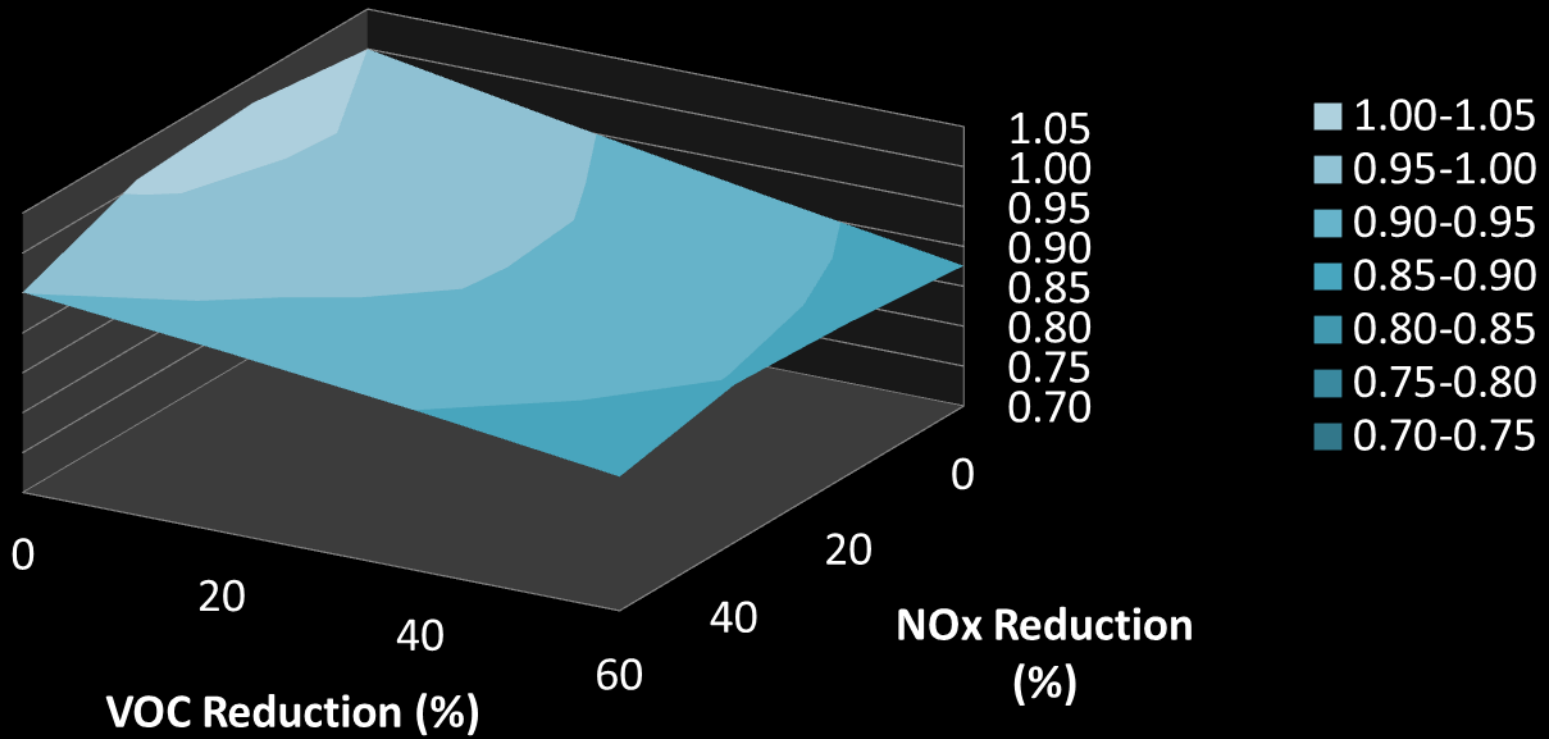
# Scatter Plot for Arvin July 17, 2006

Best in 25 cells and within 2 hours



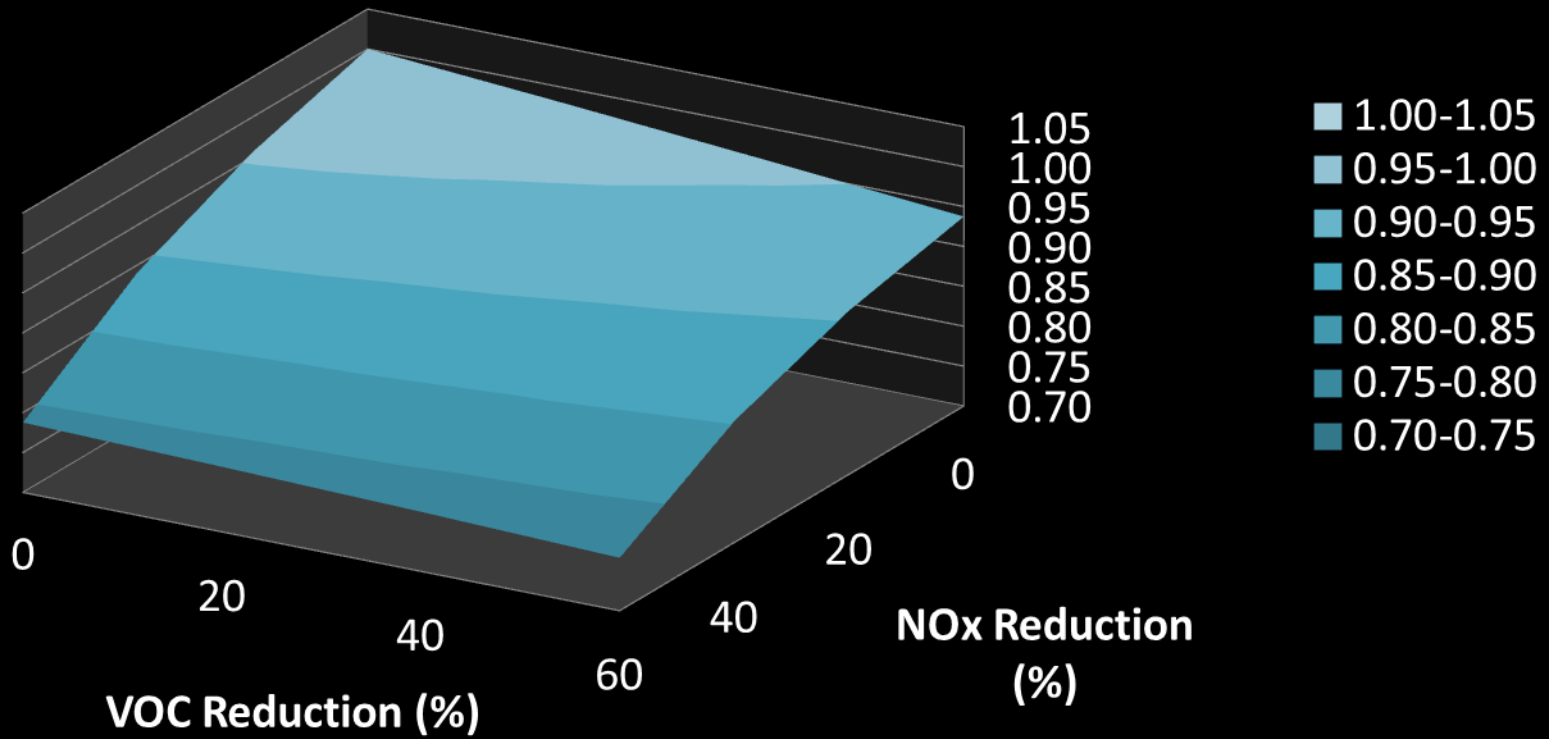
# RRF for Livermore

## RRF for Livermore



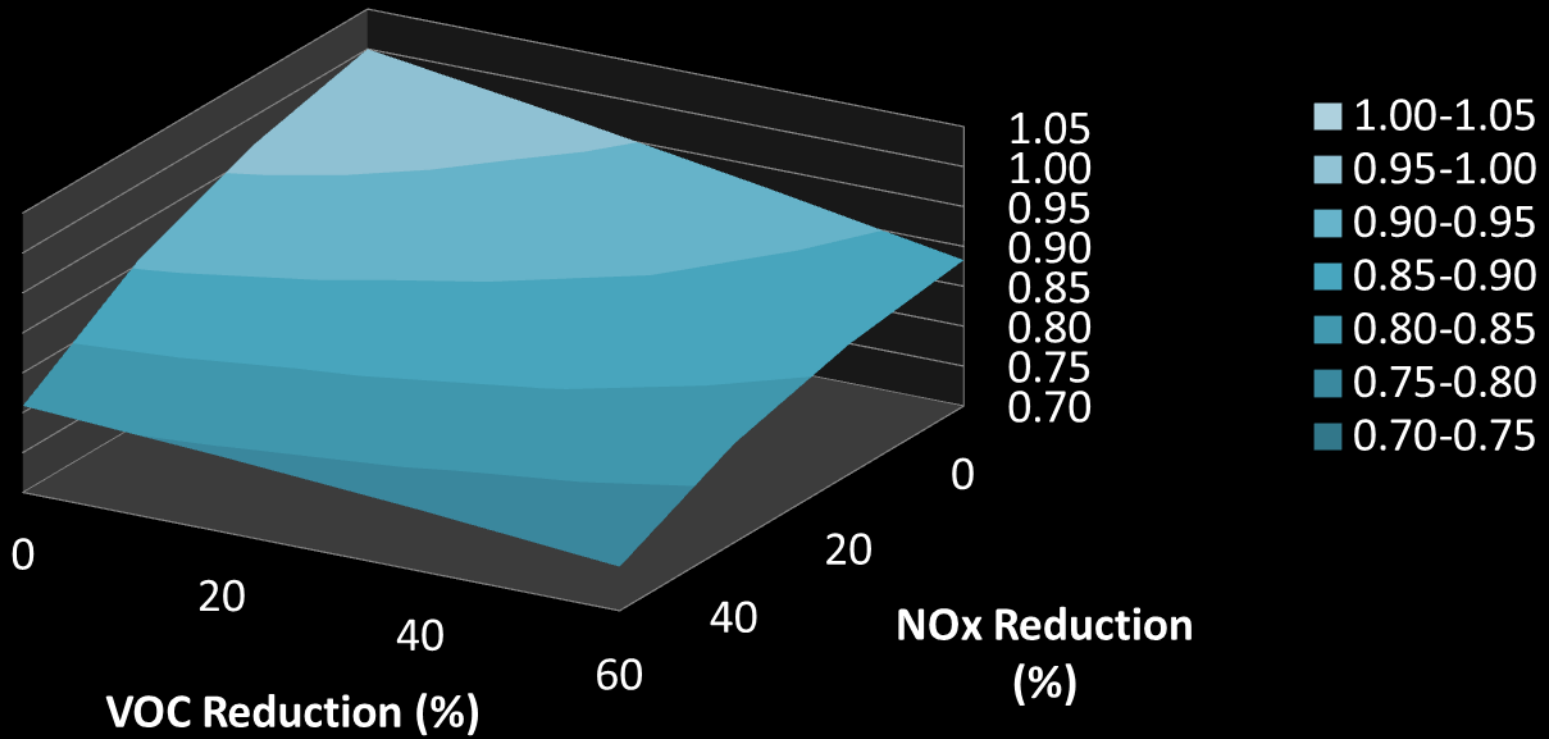
# RRF for Folsom

## RRF for Folsom



# RRF for Arvin

## RRF for Arvin



# Effect of NOx and VOC Reductions (%)

Livermore										
PPB					RRF					
VOC\NOx	0	20	40	60	VOC\NOx	0	20	40	60	
0	87.84	89.38	88.51	83.50	0	1.00	1.02	1.01	0.95	
20	84.01	85.76	85.46	81.38	20	0.96	0.98	0.97	0.93	
40	80.37	82.02	82.29	78.97	40	0.91	0.93	0.94	0.90	
60	76.92	78.17	78.83	76.22	60	0.88	0.89	0.90	0.87	
Folsom										
PPB					RRF					
VOC\NOx	0	20	40	60	VOC\NOx	0	20	40	60	
0	95.54	91.34	85.13	75.23	0	1.00	0.96	0.89	0.79	
20	93.66	89.85	84.00	74.65	20	0.98	0.94	0.88	0.78	
40	91.65	88.25	82.77	73.99	40	0.96	0.92	0.87	0.77	
60	89.56	86.46	81.40	73.19	60	0.94	0.90	0.85	0.77	
Arvin										
PPB					RRF					
VOC\NOx	0	20	40	60	VOC\NOx	0	20	40	60	
0	107.47	103.63	97.27	86.89	0	1.00	0.96	0.91	0.81	
20	103.63	100.37	94.75	85.34	20	0.96	0.93	0.88	0.79	
40	99.42	96.74	91.86	83.44	40	0.93	0.90	0.85	0.78	
60	94.89	92.72	88.55	81.14	60	0.88	0.86	0.82	0.75	

# How to Achieve 8-hr Ozone NAAQS (% reductions)

	2006 DV	84 PPB			75 PPB		
		RRF	NO <sub>x</sub>	VOC	RRF	NO <sub>x</sub>	VOC
SFB	80				0.94	0	30
SAC	97	0.87	40	40	0.77	60	40
SJV	110	0.76	60	60	0.68	>60	>60

# Additional Issues

Changes in the design values (ppb) and design value stations

	2004	2005	2006	2007	2008	2009	2010
SFB	84	78	80	77	81	78	80
SAC	102	97	97	98	102	100	102
SJV	116	113	110	107	108	105	104

Cool	102	97	95	96	98	93	89
Folsom	97	97	97	98	102	100	102