

**Update on Ozone Modeling to Support
Denver 8-Hour Ozone Early Action
Compact
2007 Control Strategy Evaluation**

**Ralph Morris and Gerard Mansell
ENVIRON International Corporation
and**

**Dennis McNally and T.W. Tesche
Alpine Geophysics, LLC**

**Denver EAC
Modeling Review Panel Meeting
December 10, 2003
Denver, Colorado**

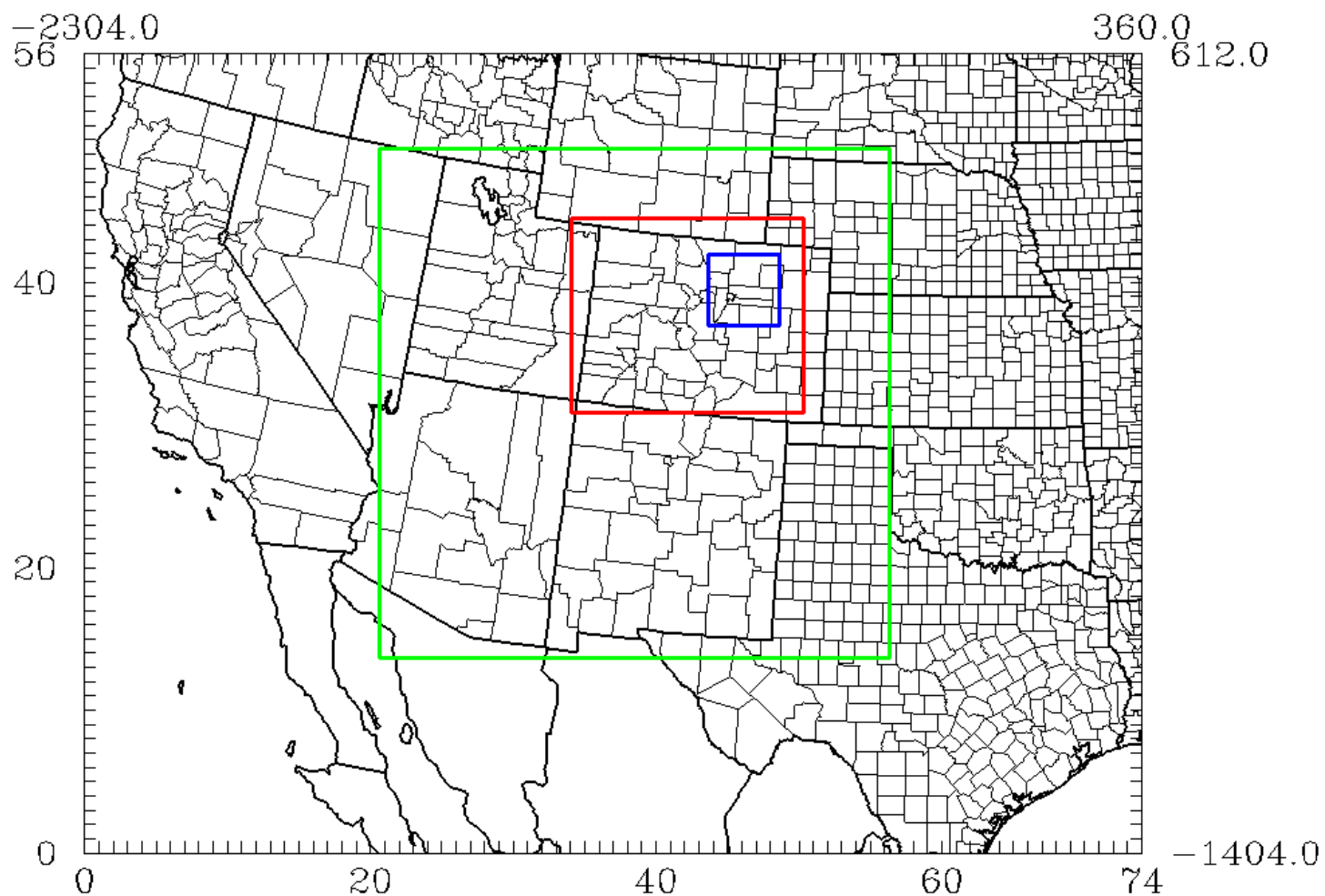
Denver EAC Modeling - Current Status

- May 2003: Modeling Protocol**
- July 2003: MM5 Meteorological Modeling Report**
- Sep 2003: 2002 Emissions Inventory Report and Addendum**
- Oct 10, 2003: Modeling Review Panel (MRP) Meeting**
- Preliminary Model Performance Evaluation
 - Recommend Additional Diagnostic Tests
 - (1) Minimum PBL sensitivity – Done/Rejected
 - (2) Northern BCs Update – Done/Adopted
 - (3) No clouds/wet dep – Done/Rejected
 - (4) Add wildfire emissions – Done/Adopted
- Nov 19, 2003: 2002 Base Case/Evaluation Report**
- Dec 10, 2003: Modeling Review Panel (MRP) Meeting**
- 2007 Base Case and 4 Control Strategies
 - 2007 Projected 8-hr Ozone Design Values

Denver 8-Hour Ozone Modeling

- **MM5 Meteorological Model**
- **EPS2x Emissions Model**
- **CAMx Photochemical Grid Model**
- **June 7 – July 22, 2002 Modeling Period**
 - Run whole period with 36/12 km grid
- **Three Episodes – Initially run with 36/12/4 km and 36/12/4/1.33 km grids (1.33 km grid dropped due to time issues)**
 - June 8 - 12, 2002 (dropped at outset due to wildfires)
 - June 25 – July 1, 2002
 - July 18 – 21, 2002 (dropped due to performance/time issues)

36/12/4/1.33 km Modeling Domain



Denver EAC AQ Domains

36/12/4/1.3 km

Updates Since October 17, 2003 MRP Meeting

- **Performed 5 diagnostic sensitivity tests**
 - Little change in model performance
 - Adopted updated northern BCs and wildfire emissions
 - Rejected minimum PBL heights and no clouds/wet dep
- **Focus on June 2002 episode and 36/12/4 km grid**
 - Drop July 2002 episode due to performance issues
 - Insufficient time to perform runs with 1.33 km grid
 - Previous runs indicated nearly identical model performance using 4 km and 1.33 km grids
- **Revised Model Evaluation (Nov 19, 2003 Report)**
- **2007 Base Case and Control Strategy Simulations**

2002/2007 Base Case VOC Emissions (TPD) DMA+Weld

<u>Category</u>	<u>2002</u>	<u>2007</u>	<u>%</u>
Points	192	203	+5.8%
Area	95	104	+9.5%
Non-Road	75	54	-28.2%
On-Road	139	102	-26.2
Total Anthro	501	463	-7.4

DMA+Weld = Adams, Arapahoe, Broomfield, Boulder, Denver, Douglas, Jefferson and Weld Counties

Pre-modeling inventory based for typical summer weekday (no day-specific, temporal or spatial adjustments)

2002/2007 Base Case NO_x Emissions (TPD) DMA+Weld

<u>Category</u>	<u>2002</u>	<u>2007</u>	<u>%</u>
Points	105	107	+1.9
Area	26	28	+7.8
Non-Road	88	83	-6.2
On-Road	144	107	-25.6
Total Anthro	363	325	-10.3

CAMx Base Case Evaluation

- **Follow EPA Draft 8-Hour Ozone Modeling Guidance Evaluation Procedures**
 - Big Picture Graphical Performance
 - Spatial Maps of Predictions and Observations
 - Scatter and Q-Q Plots
 - Time Series Plots
 - Ozone Metrics
 - New 8-Hour Ozone Performance Metrics
 - Performance Goals
- **Initial Evaluation Ozone Only**
 - Evaluation for ozone precursors and indicator species after ozone performance has been accepted??

CAMx Sensitivity Tests To Date (12/03)

2002 Diagnostic Sensitivity Runs

11 Sensitivity Simulations Conducted

Run11 Adopted as 2002 Base Case Simulation

2007 Emission Scenarios

07Run11: 2007 Base Case

07Run11_Cntl1: RVP @ 8.1 psi w/ 1 psi EtOH waiver (40% EtOH penetration)

07Run11_Cntl2: 37.5% Reduction in Flash VOC emissions

07Run11_Cntl3: Control on RICE > 250 HP

07Run11_Cntl4: Combined RVP, Flash and Rice Controls

Updated Boundary Conditions

- **Using three sets of BCs**
 1. Clean Continental
 2. Mixed Clean Continental / Clean Oceanic
 3. Clean Oceanic
- **Original BCs**
 - (1) On Eastern; (2) On Southern and Northern; and (3) on Western Boundaries plus above 1,700 m AGL
- **Revised BCs**
 - Use (1) on Northern Boundary

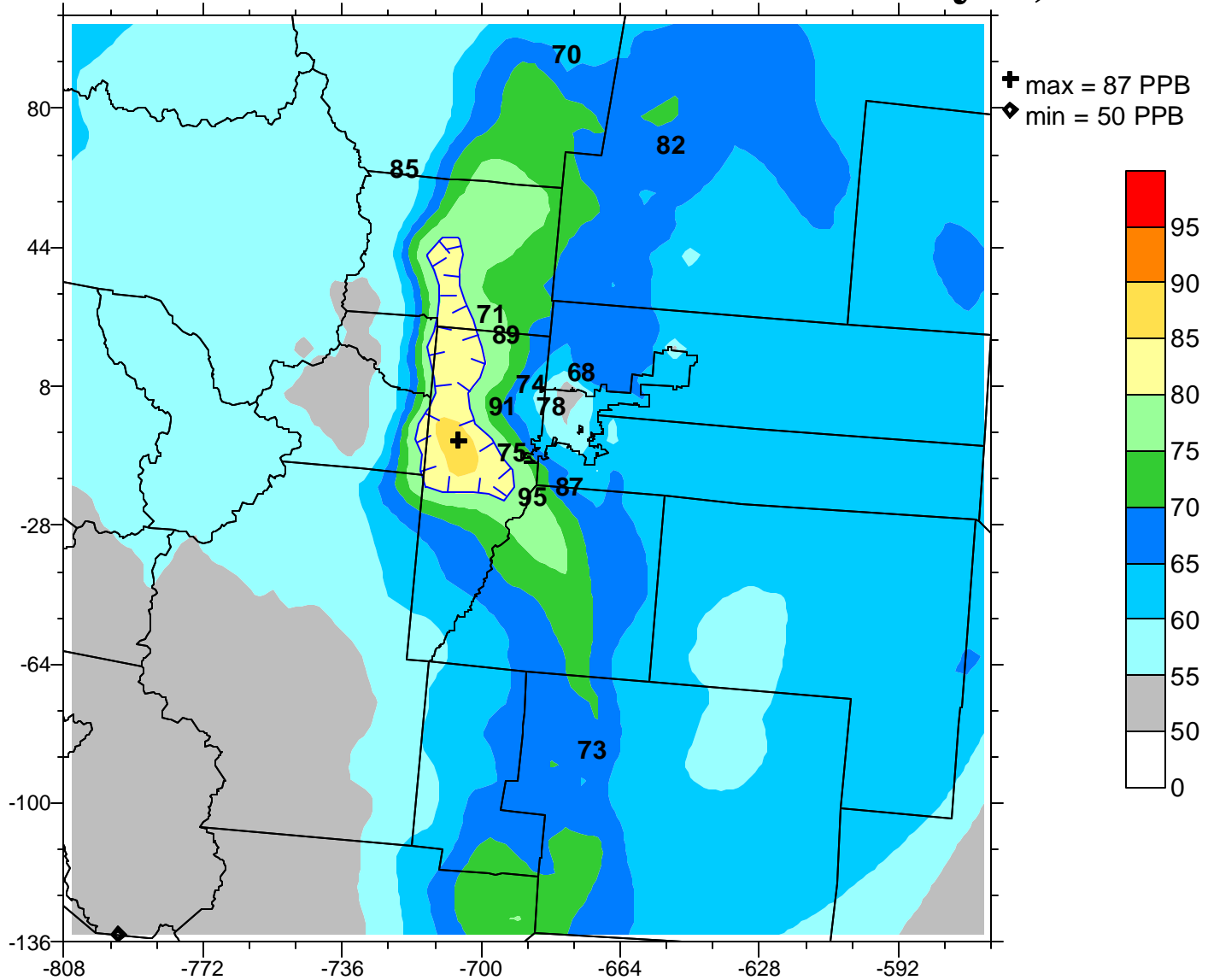
Updated Boundary Conditions

Species	Eastern and Northern Boundaries below 1700 m (ppb)	Southern Boundary Below 1700 m (ppb)	Western Boundary and Above 1700 m (ppb)
O3	40.0	40.0	40.0
NO	0.1	0.1	0.1
NO2	1.0	1.0	1.0
CO	200.0	200.0	100.0
PAR	14.9	14.9	14.9
HCHO	2.1	2.1	0.05
ETH	0.51	0.51	0.15
ALD2	0.555	0.555	0.05
TOL	0.18	0.18	0.0786
PAN	0.1	0.1	0.1
HNO2	0.001	0.001	0.001
HNO3	3.0	3.0	1.0
H2O2	3.0	3.0	1.0
OLE	0.3	0.3	0.056
XYL	0.0975	0.0975	0.0688
ISOP	3.6	0.1	0.001
MEOH	8.5	0.001	0.001
ETOH	1.1	0.001	0.001
Total NOx	1.1	1.1	1.1
Total VOC (ppbC)	50.5	22.3	9.3

CAMx Base Case Evaluation

- **Big Picture Graphics**
 - Spatial distribution of estimated daily maximum 8-hour ozone concentrations with superimposed observations
 - Time series plots
 - Scatter plots
- **Model Performance Statistics**
 - Daily maximum 8-hr ozone (<±20%)
 - 1hr & 8-hr ozone
 - Normalized and Fractional Bias (<±15%)
 - Normalized and Fractional Gross Error (<35%)

2002 Base Case 8-Hour Ozone on July 1, 2002



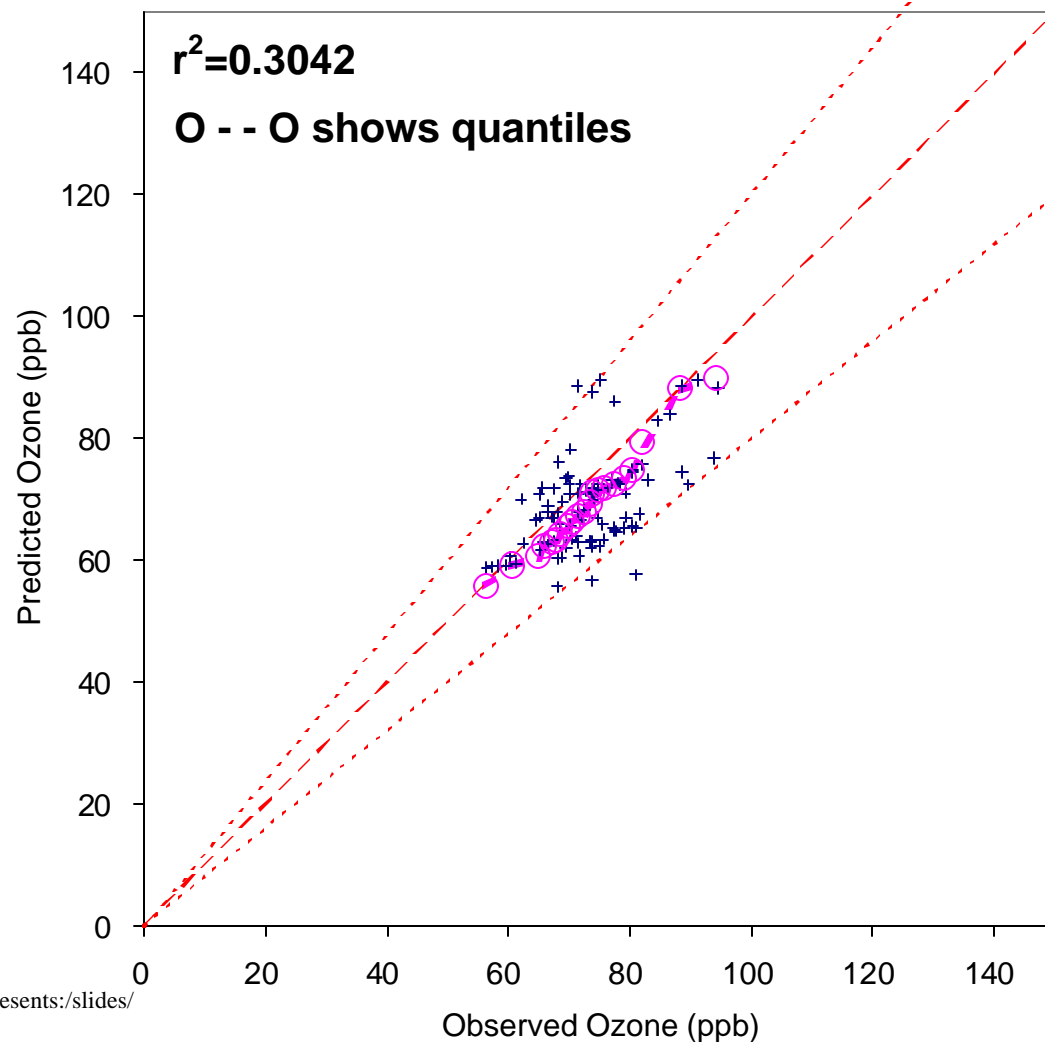
EPA Draft 8-Hour Ozone Guidance Performance Goals (EPA, 1999)

“bias pred/obs mean 8-hr (& 1-hr) daily maxima near each monitor”	“~20% most monitors (8-hr comparisons only)”
“fraction bias pred/obs mean 8-hr (& 1-hr) daily maxima near each monitor”	“~20% most monitors (8-hr comparisons only)”
“correlation coefficients, all data, temporally paired means, spatially paired means”	“moderate to large positive correlations”
“bias (8-hr daily max and 1-hr obs/pred), all monitors”	“~5-15%”
“gross error (8-hr daily max and 1-hr obs/pred), all monitors”	“~30-35%”
“Scatter plots & Q-Q plots of 8-hr and 1-hr metrics”	

EPA 8-Hour Ozone Guidance Ozone Metrics

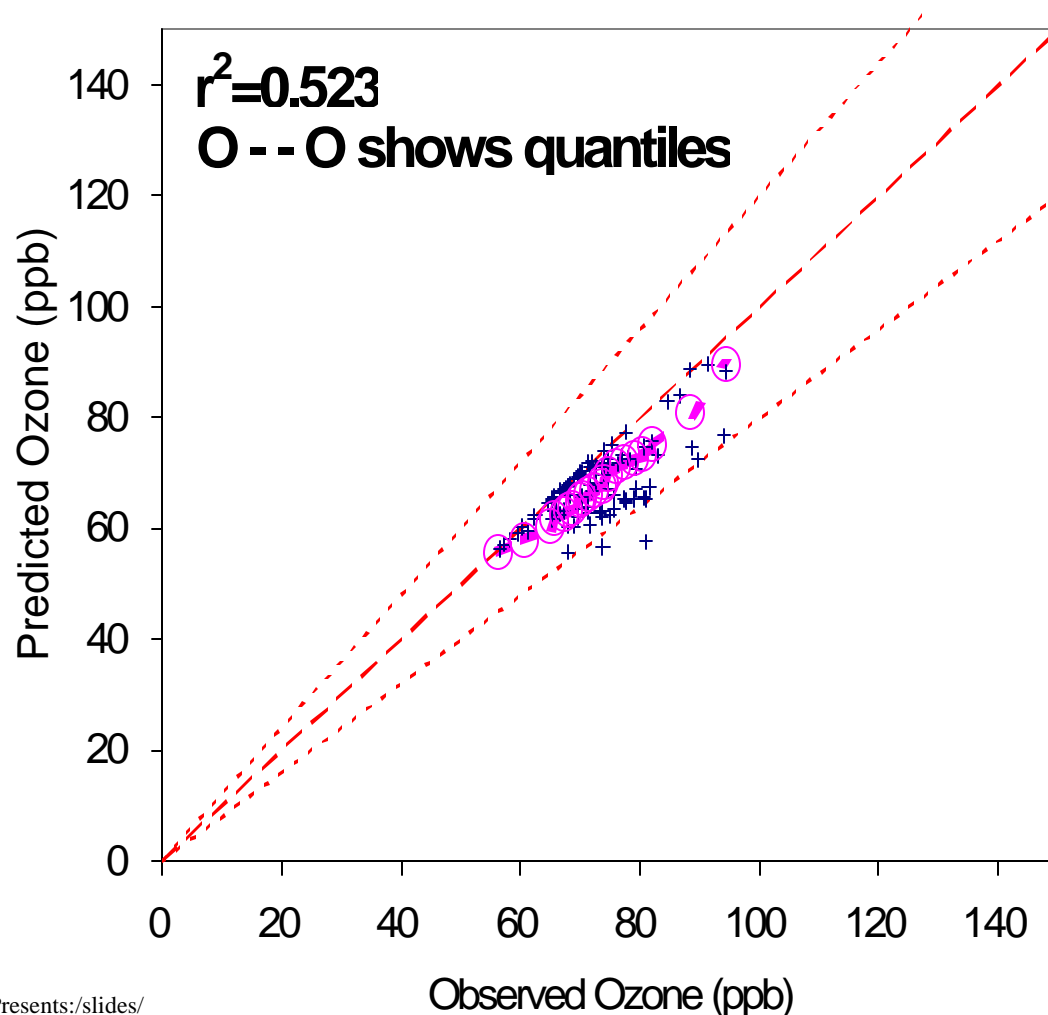
- “bias pred/obs mean 8-hr (& 1-hr) daily maxima near each monitor” (EPA, 1999)
- “~20% most monitors (8-hr comparisons only)” (EPA, 1999)
 - How to define “near”? – Use same NX by NY array of grid cells centered on monitor with 15 km radius as used in the attainment test (e.g., 9 by 9 for 4 km grid)
 - What predicted ozone to select for comparison with observed maxima?
 1. maximum ozone near monitor;
 2. best fit (closest to observed value) near monitor; and
 3. at monitor location (spatially paired).

Max Predicted 8-Hr Ozone Near Monitor – June 2002 Episode and 2002 Base Case – 4 km



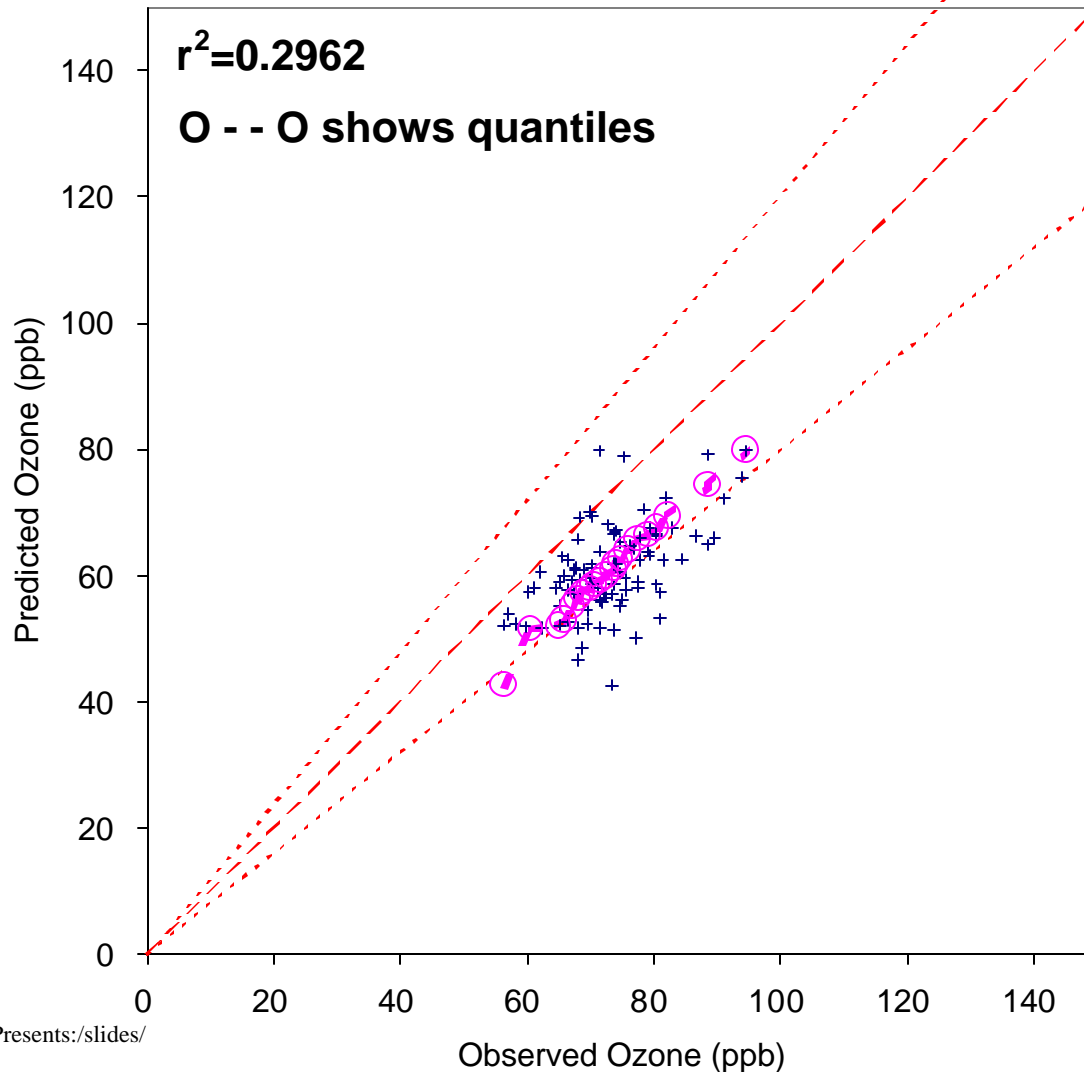
- EPA Performance Goal of within $\pm 20\%$ at “most monitors”
- ~96% of Max Pred near monitor $< \pm 20\%$ of observed value
- 3 pred/obs pairs do not meet $< \pm 20\%$ performance goal (Weld Cnty 6/26; CO Springs 6/28; and Boulder on 7/1)

Best Predicted 8-Hr Ozone Near Monitor – June 2002 Episode and 2002 Base Case – 4 km



- EPA Goal $<\pm 20\%$
- ~98% of pred/obs pairs meet $<\pm 20\%$ goal
- Weld Cnty 6/26
pred/obs of 57/81 ppb
- CO Springs 6/28
pred/obs of 57/74 ppb

Paired Predicted 8-Hr Ozone @ Monitor June 2002 Episode and 2002 Base Case – 4 km



- No applicable EPA Performance Goal as spatially paired Pred/Obs more stringent than “near”
- A majority (~60%) of pred/obs 8-hr ozone pairs are within $\pm 20\%$

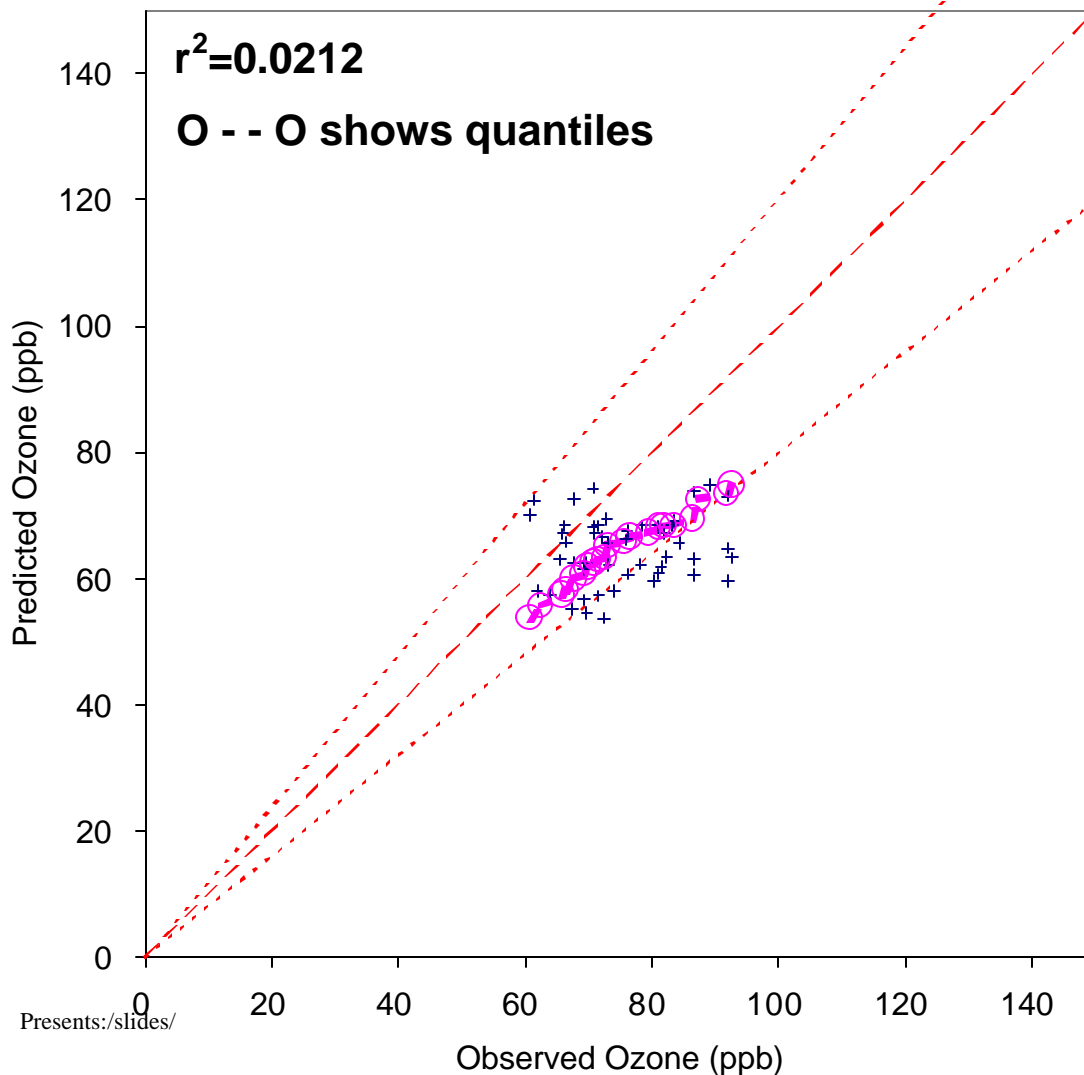
June 2002 Episode 2002 Base Case 8-Hr Ozone Daily Performance Stats

- **EPA performance goal for modeled daily max 8-hr ozone within $< 20\%$ of observed value at most monitors is satisfied**
- **8-hr ozone normalized bias and fractional bias meets $< 15\%$ performance goal using maximum and best fit comparisons (except for -15.4% fractional bias on June 26)**
- **Bias $< 15\%$ performance goal met on June 30 & July 1, 2002 using most stringent spatial paired comparison**
- **Gross error $< 35\%$ performance goal met using maximum, best fit and spatially paired 8-hr ozone estimates**

Summary of 2002 Base Case 8-Hour Ozone EPA Performance Goals for June 2002 Episode

- **Meets EPA performance goals**
 - > 95% of monitor/days meet EPA's performance goal of predicted 8-hr ozone near monitor $< \pm 20\%$ of observed value
 - EPA Bias and Gross Error performance goals (15% & 35%) met using maximum and best fit predicted 8-hr ozone near the monitor
 - Underestimation bias sometimes exceeds $< 15\%$ performance goal but gross error always meets $< 35\%$ performance goal using spatially paired pred/obs 8-hr ozone at the monitor
- **Some ozone spatial alignment issues**
- **Model performance for June 2002 episode performing sufficiently well for ozone attainment demonstration modeling**

Max Predicted 8-Hr Ozone Near Monitor – July 2002 Episode and 2002 Base Case – 4 km



- EPA Performance Goal of within $\pm 20\%$ at “most monitors”
- ~65% Max Pred near monitor $< \pm 20\%$
- 8-hr ozone at DMA sites exceeds $< \pm 20\%$ goal
- Best Fit Similar
- Spatially Paired only ~23% of monitor/days achieve $< \pm 20\%$ goal

Key Conclusions for Denver 2002 Base Case Ozone Performance June/July 2002

- **June 2002 episode reproduces spatial and temporal characteristics of observed ozone and achieves EPA's performance goals**
 - Spatial displacement of estimated ozone cloud slightly further away from the Denver area than observed
 - Overstatement of ozone suppression over Denver
 - Understated regional ozone background on some days
- **July 2002 episode did not perform as well so was dropped from consideration for now**

2007 Emission Scenarios

- **2007 Base Case – CO Data Provided by CDPHE**
- **2007 RVP: Lower RVP in DMA+Weld**
 - 8.1 psi + 1 psi waiver w/ 40% EtOH penetration
 - ~9 tpd reduction in on-road mobile VOC emissions
- **2007 Flash: 37.5% Flash VOC Control**
 - ~55 tpd reduction of VOC emissions in Weld Cnty
- **2007 RICE: Control of RICE nat gas units**
 - ~4 tpd VOC, ~12 tpd NO_x, & 10 tpd CO reductions mainly (80%) in Weld Cnty
- **2007 All Control: Combine RVP, Flash and RICE**

2007 Emissions Scenarios DMA+Weld

VOC Emissions (tons per day)

VOC Category	2007Base (tpd)	2007 RVP (tpd) (%)	2007 Flash (tpd) (%)	2007 RICE (tpd) (%)	2007 All (tpd) (%)
Points	208	208 0.0%	155 -25.4	205 -1.7%	152 -27.1%
Area	102	102 0.0%	102 0.0%	102 0.0%	102 0.0%
Off-Road	57	57 0.0%	57 0.0%	57 0.0%	57 0.0%
On-Road	152	144 -5.5%	152 0.0%	152 0.0%	144 -5.5%
Total	520	511 -1.6	467 -10.2	516 -0.7%	455 -12.4

8.4 tpd

53 tpd
in Weld
Cnty

3.5 tpd 80%
in Weld Cnty

64.9 tpd

DMA+Weld = Adams, Arapahoe, Broomfield, Boulder, Denver, Douglas, Jefferson and Weld Counties. On-road mobile includes extra areas in link based network and should be ~65% for DMA+Weld counties

2007 Emissions Scenarios DMA+Weld

NOx Emissions (tons per day)

NOx Category	2007Base (tpd)	<u>2007 RVP</u> (tpd) (%)		<u>2007 Flash</u> (tpd) (%)		<u>2007 RICE</u> (tpd) (%)		<u>2007 All</u> (tpd) (%)	
Points	103	103	0.0%	103	0.0%	91	-11.9%	91	-11.9%
Area	6	6	0.0%	6	0.0%	6	0.0%	6	0.0%
Non-Road	111	111	0.0%	111	0.0%	111	0.0%	111	0.0%
On-Road	176	176	-0.4%	176	0.0%	176	0.0%	176	-0.4%
Total	396	396	-0.2%	396	0.0%	396	0.0%	396	-0.2%
		0.7 tpd		0.0 td		12.2 tpd		12.9 tpd	

DMA+Weld = Adams, Arapahoe, Broomfield, Boulder, Denver, Douglas, Jefferson and Weld Counties. On-road mobile includes extra areas in link based network and should be ~67% for DMA+Weld counties

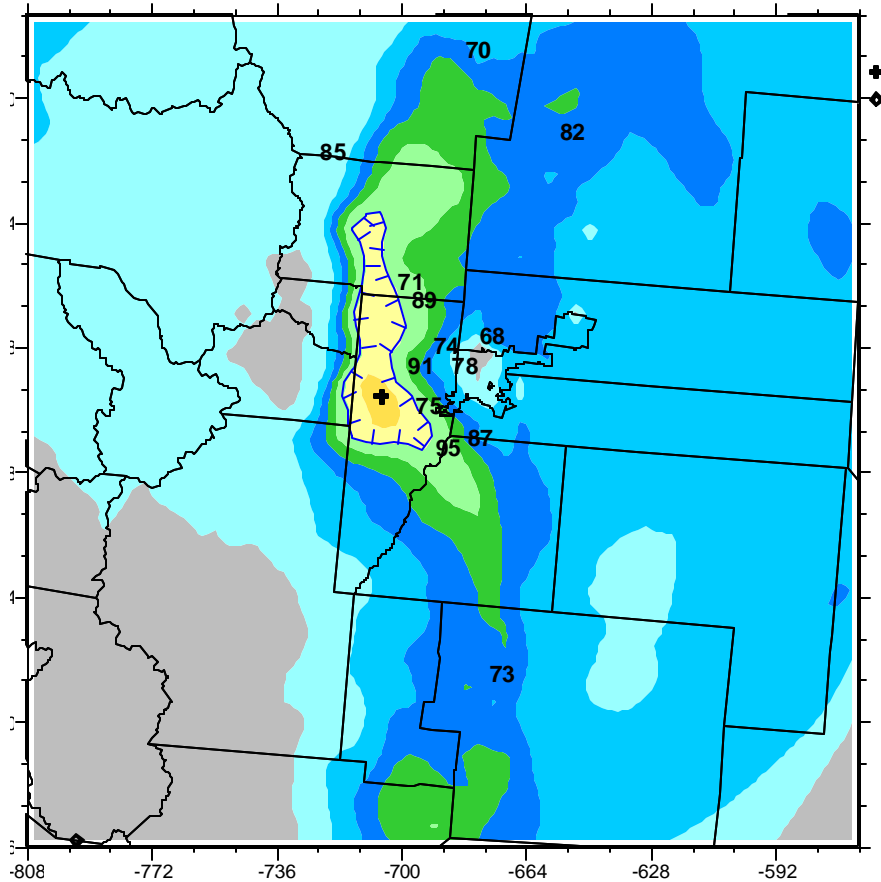
2007 Emissions Scenarios DMA+Weld

CO Emissions (tons per day)

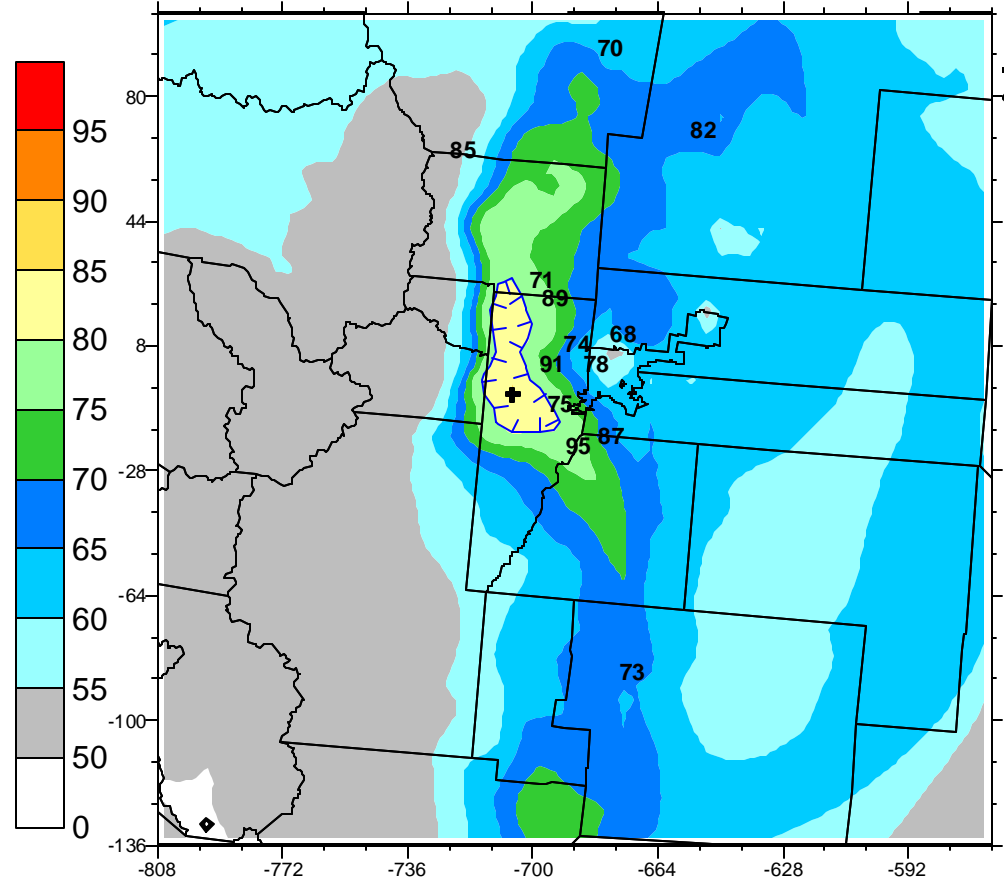
CO Category	2007Base (tpd)	<u>2007 RVP</u>		<u>2007 Flash</u>		<u>2007 RICE</u>		<u>2007 All</u>	
		(tpd)	(%)	(tpd)	(%)	(tpd)	(%)	(tpd)	(%)
Points	41	41	0.0%	41	0.0%	30	-26.2%	30	-26.2%
Area	2	2	0.0%	2	0.0%	2	0.0%	2	0.0%
Off-Road	1312	1312	0.0%	1312	0.0%	1312	0.0%	1312	0.0%
On-Road	1284	1193	-7.1%	1284	0.0%	1284	0.0%	1193	-7.1%
Total	2639	2547	-3.5%	2639	0.0%	2628	-0.4%	2537	-3.9%
		91 tpd		0 tpd		11 tpd		102 tpd	

DMA+Weld = Adams, Arapahoe, Broomfield, Boulder, Denver, Douglas, Jefferson and Weld Counties. On-road mobile includes extra areas in link based network and should be ~65% for DMA+Weld

Daily Max 8-Hr Ozone (ppb) (July 1, 2002 Met Conditions)



2002 Base Case

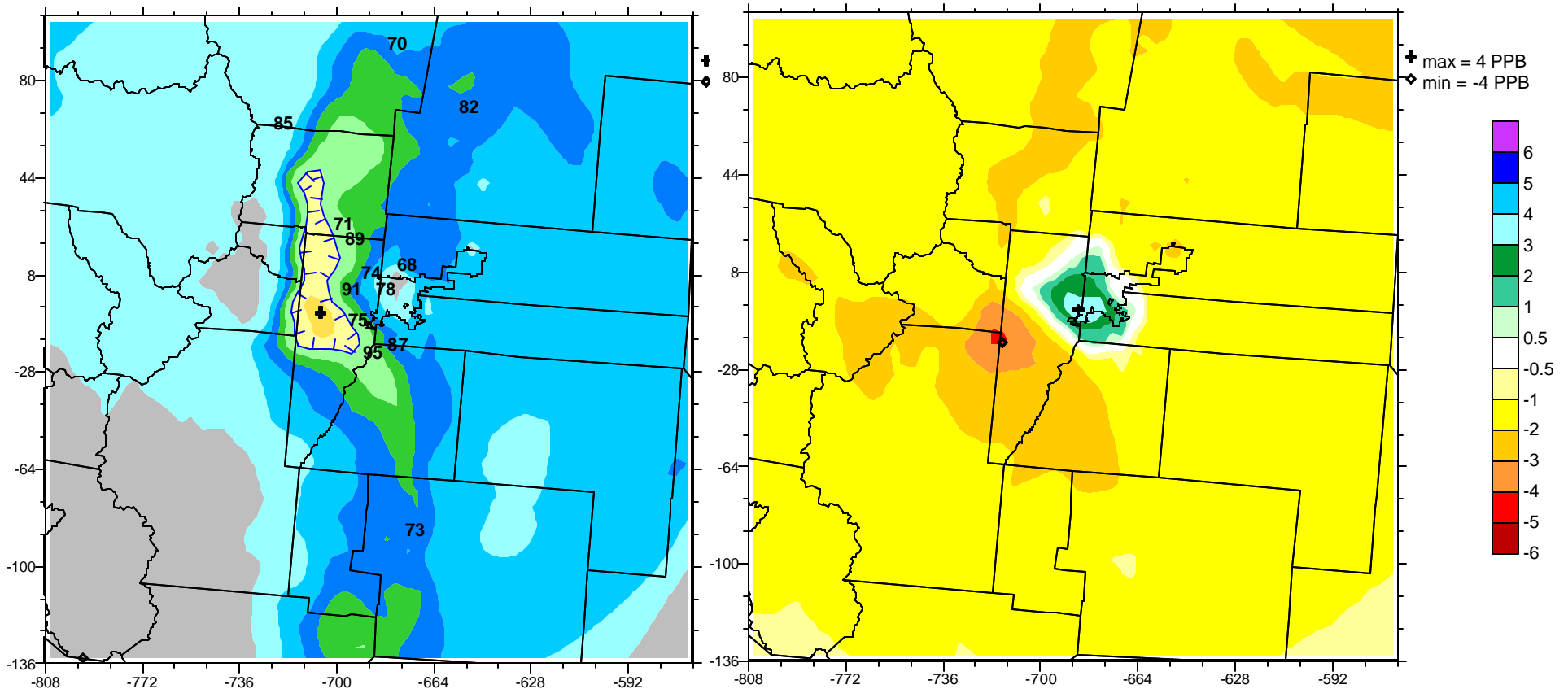


2007 Base Case

Presents:/slides/ **Model Peak = 87 ppb**

Model Peak = 85 ppb

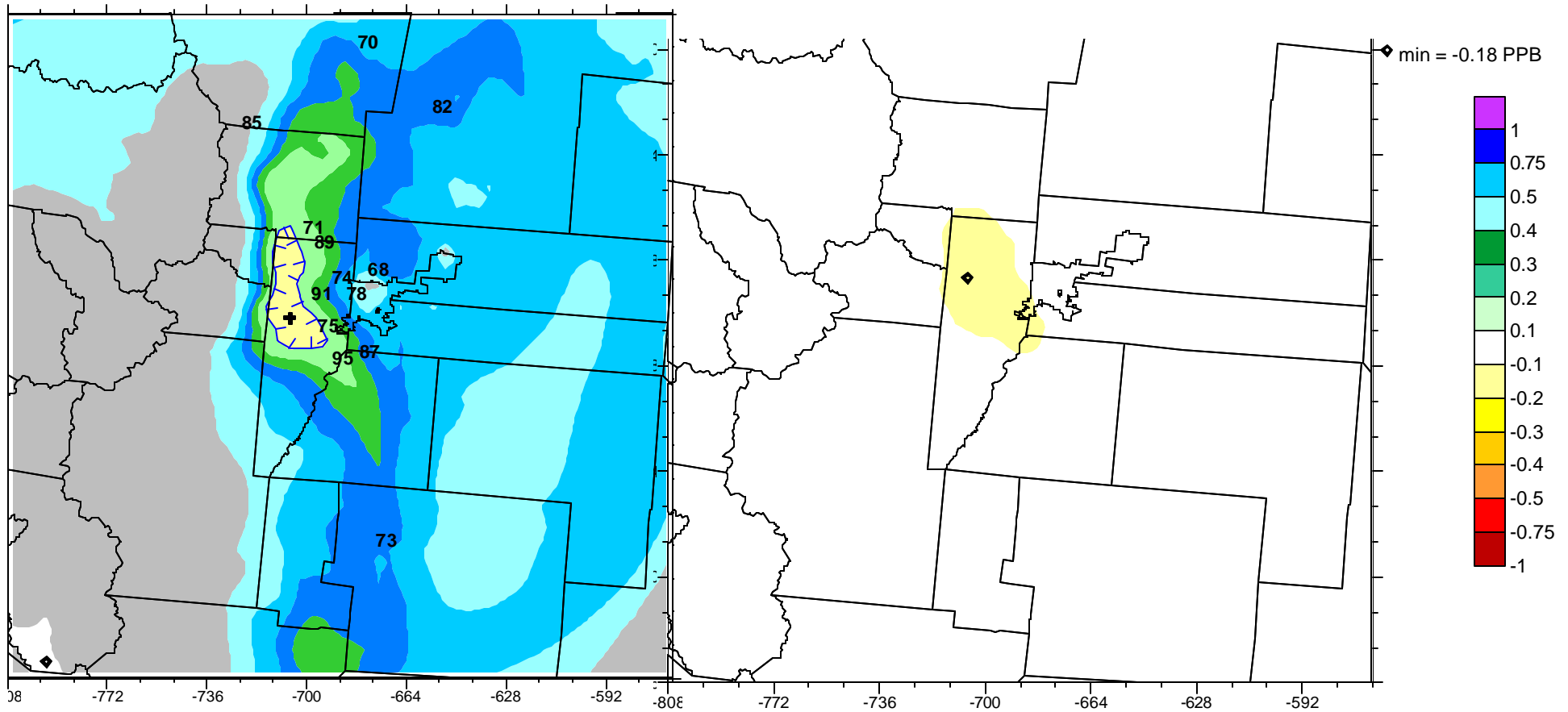
Difference in 8-hr Ozone, 2007 Base – 2002 Base (July 1, 2002 Met Conditions)



2002 Base Case

2007 Base – 2002 Base

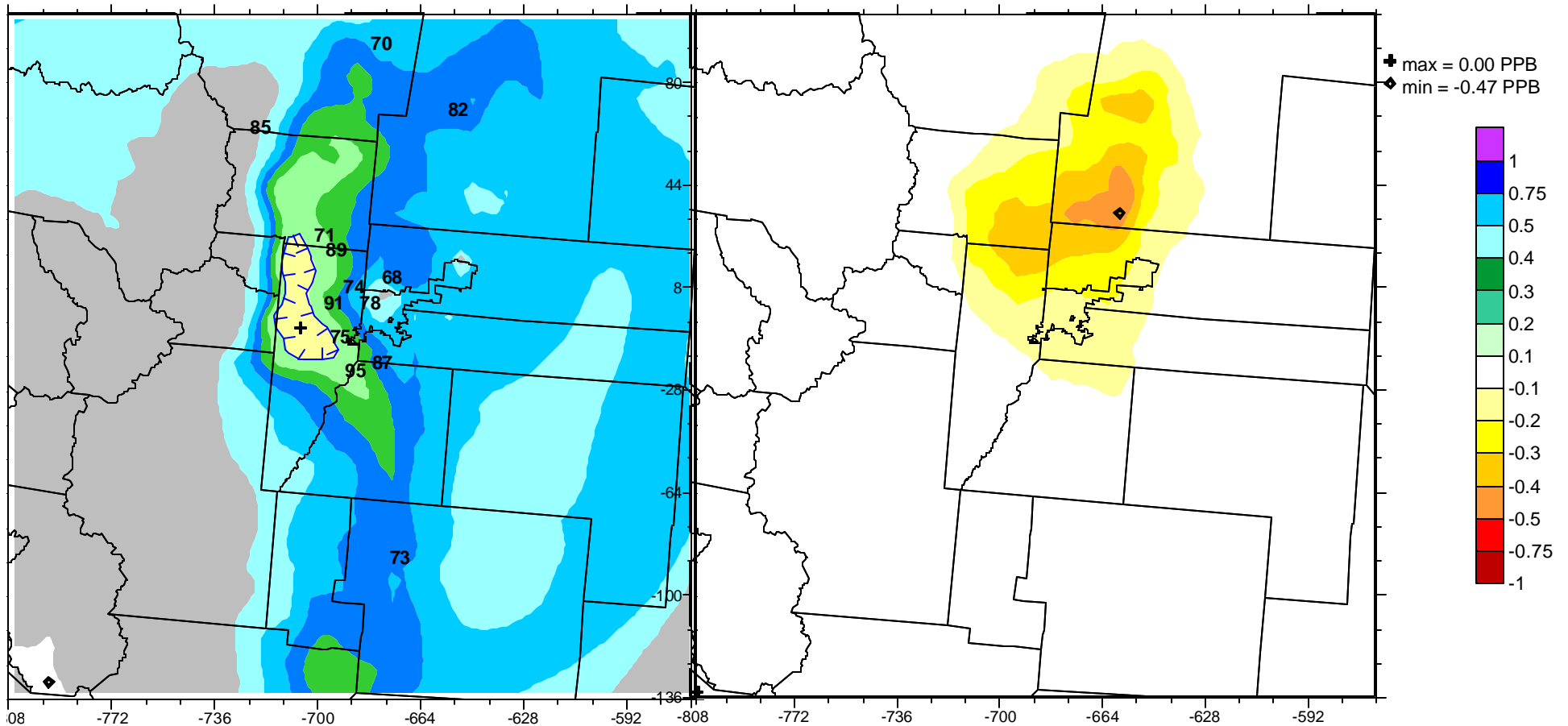
Differences in 8-hr Ozone, 2007 RVP – 2007 Base (July 1, 2002 Met Conditions)



2007 Base Case

2007 Cnt11 (RVP) – 2007 Base

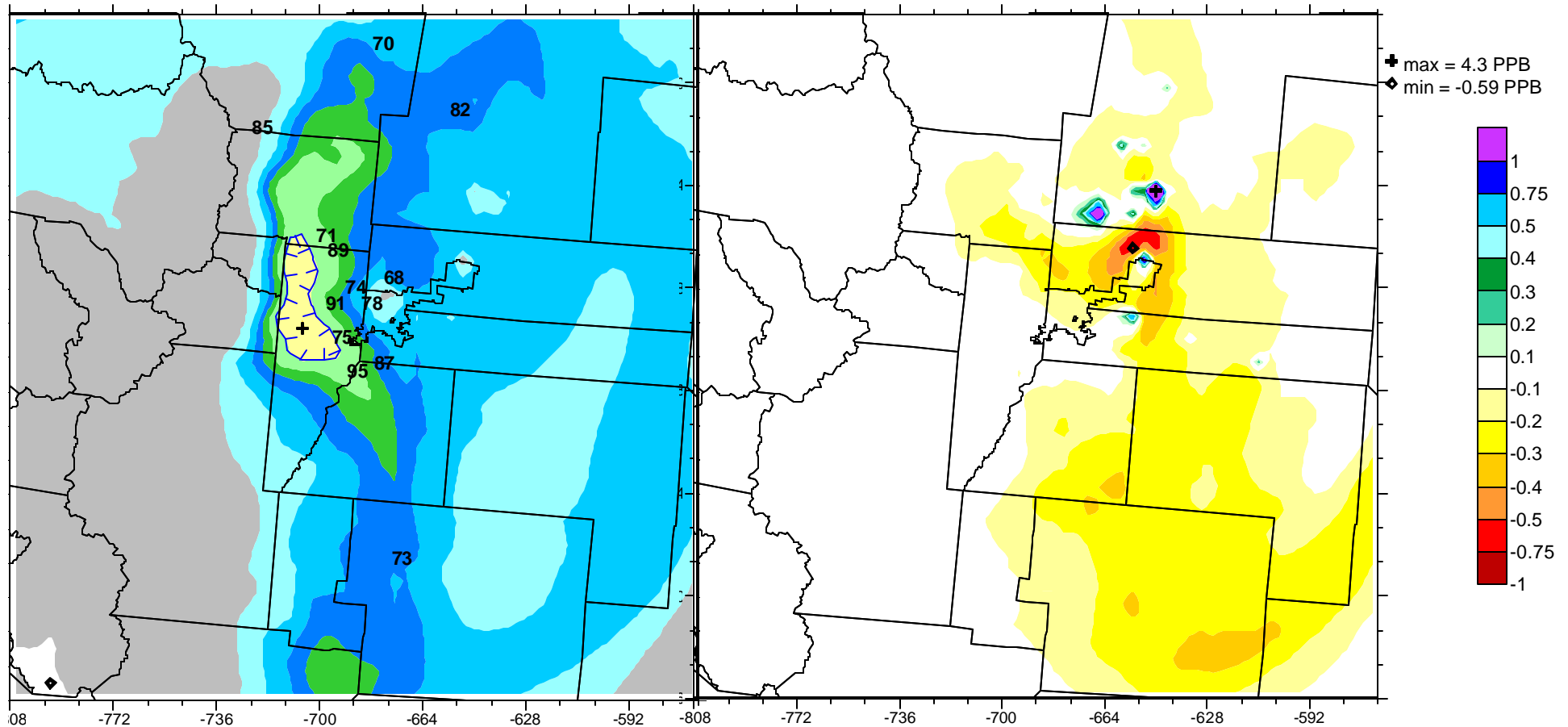
Differences in 8-hr Ozone, 2007 Flash – 2007 Base (July 1, 2002 Met Conditions)



2007 Base Case

2007 Flash – 2007 Base

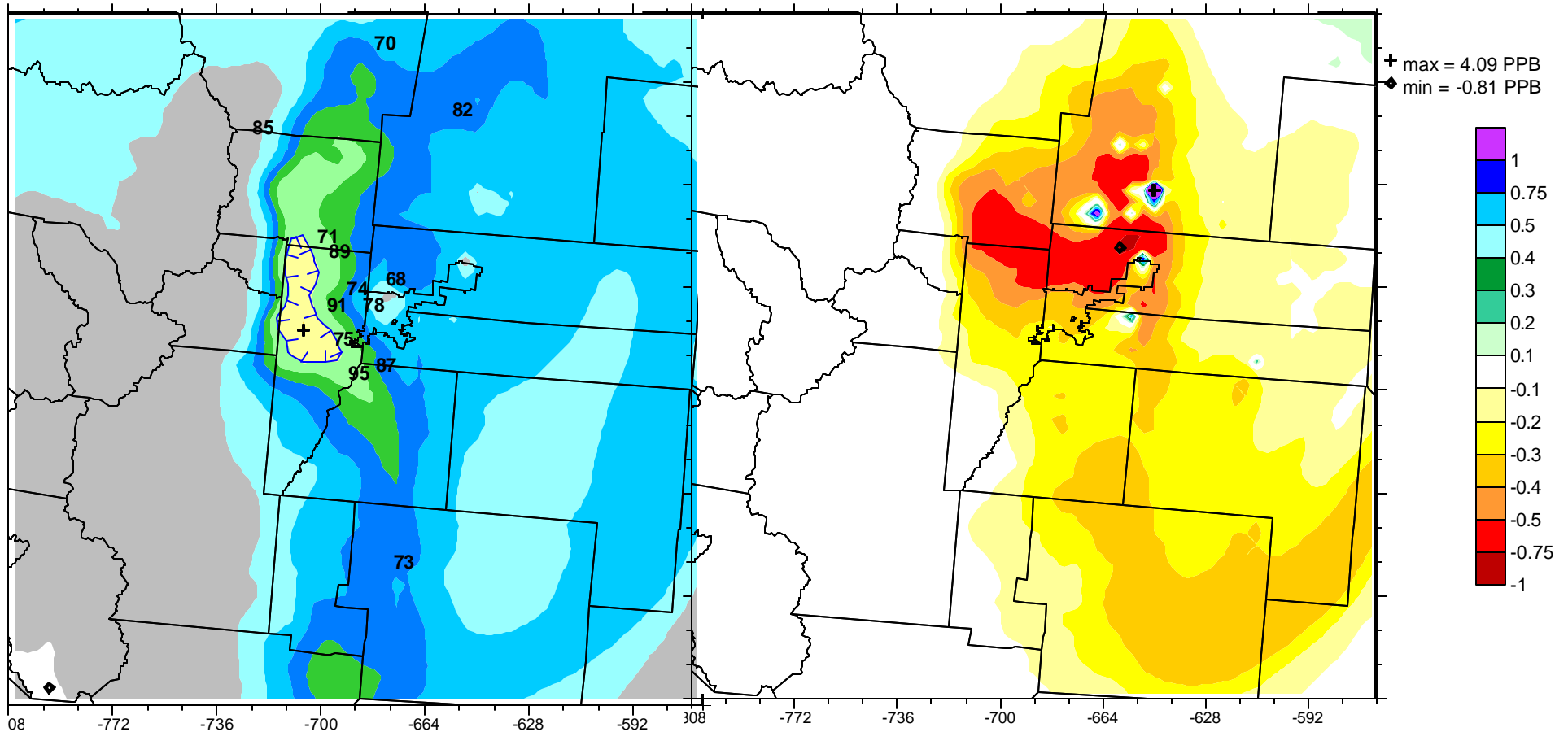
Differences in 8-hr Ozone, 2007 RICE – 2007 Base (July 1, 2002 Met Conditions)



2007 Base Case

2007 RICE – 2007 Base

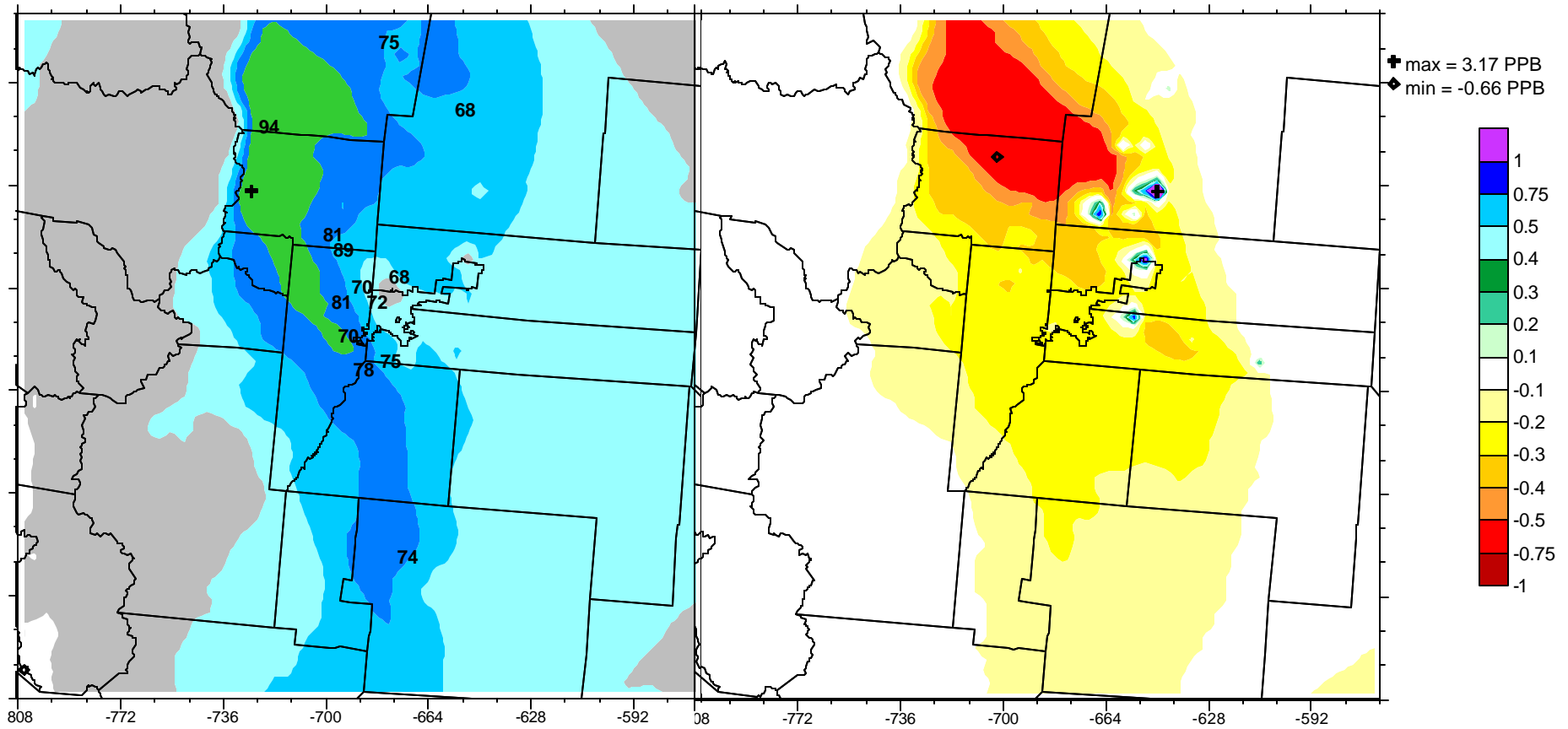
Differences in 8-hr Ozone, 2007 All Cntl – 2007 Base (July 1, 2002 Met Conditions)



2007 Base Case

2007 All Control – 2007 Base Case

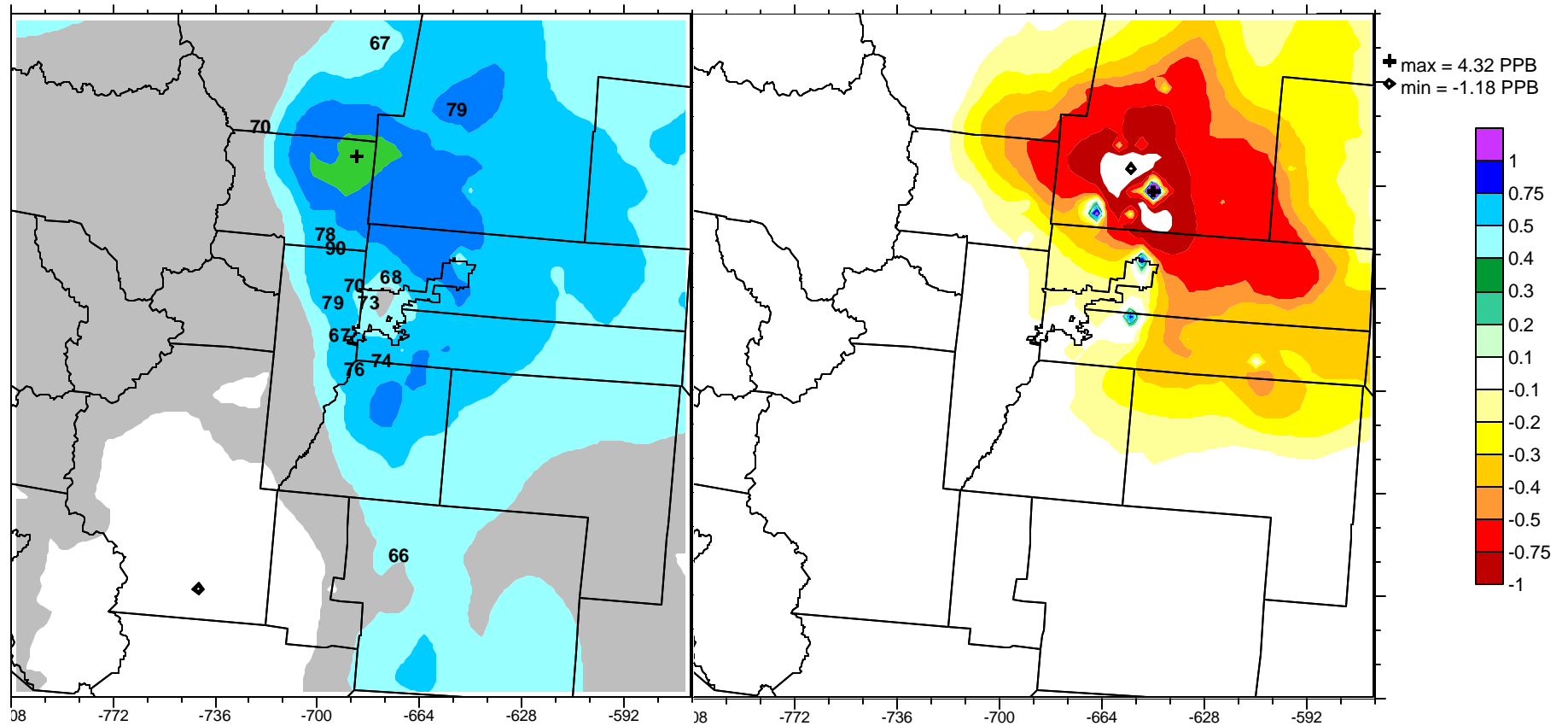
Differences in 8-hr Ozone, 2007 All Cntl – 2007 Base (June 30, 2002 Met Conditions)



2007 Base Case

2007 All Control – 2007 Base

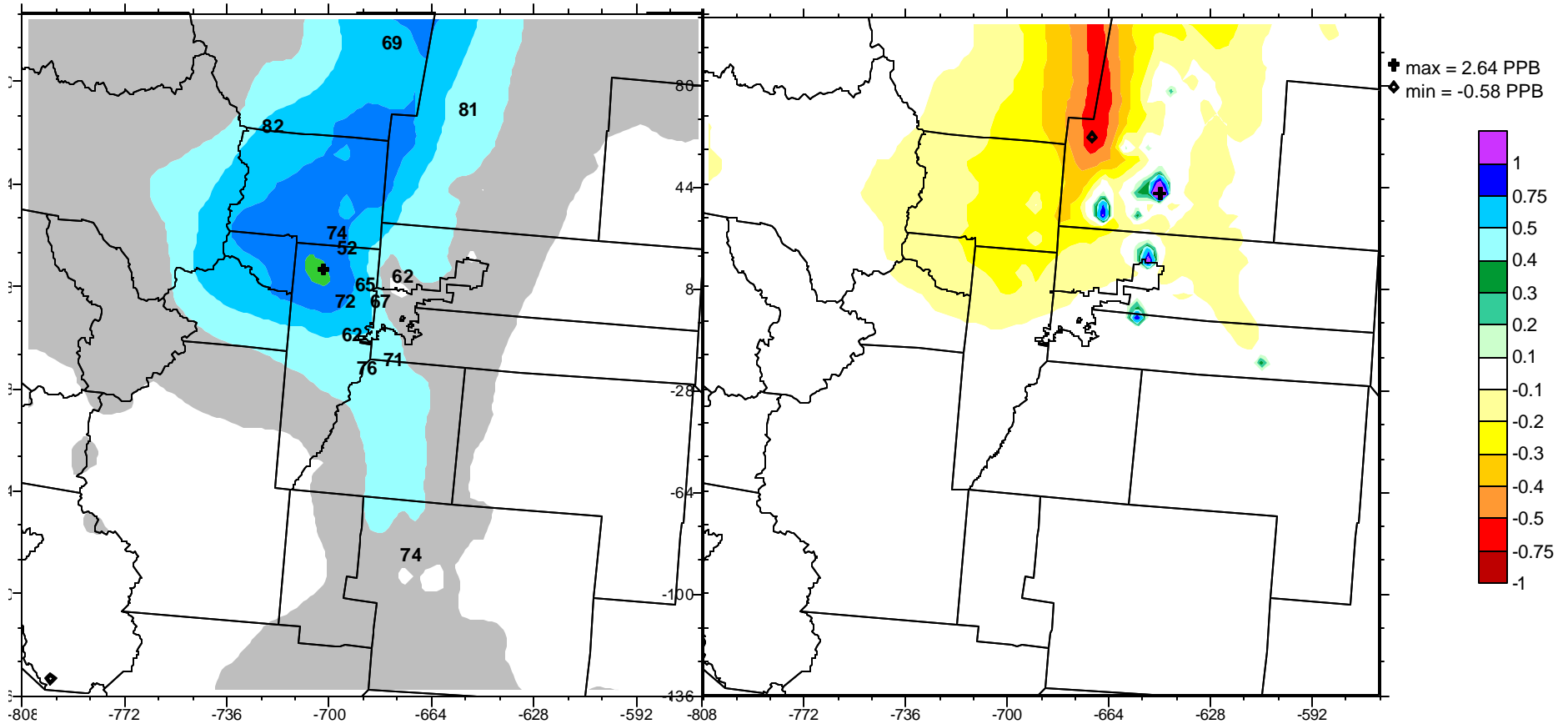
Differences in 8-hr Ozone, 2007 All Cntl – 2007 Base (June 29, 2002 Met Conditions)



2007 Base Case

2007 All Control – 2007 Base

Differences in 8-hr Ozone, 2007 All Cntl – 2007 Base (June 27, 2002 Met Conditions)



2007 Base Case

2007 All Control – 2007 Base

How Are Modeling Results Used to Demonstrate Attainment of the 8-Hour Ozone NAAQS

- **EPA Draft Guidance uses model in a relative sense to project current-year observed 8-hour ozone Design Values (DVC) to the future-year (DVF)**
- **This is done using monitor specific Relative Reduction Factor (RRF_i) that is the ratio of the future-year to current-year 8-hour ozone estimates near the monitor**

$$DVF_i = RRF_i \times DVC_i$$

How Are Modeling Results Used to Demonstrate Attainment of the 8-Hour Ozone NAAQS

- For each monitor (i) and modeling day (j) the maximum 8-hour ozone “near” the the monitor is selected for the current ($O3C_{ij}$) and future-year ($O3F_{ij}$)
- The RRF_i for monitor i is the ratio of the average 8-hour ozone concentrations

$$RRF_i = \left[\sum_j O3F_{ij} \right] / \left[\sum_j O3C_{ij} \right]$$

How Are Modeling Results Used to Demonstrate Attainment of the 8-Hour Ozone NAAQS

- **Selecting maximum estimated ozone “near” the monitor**
 - Near defined by NX x NY array of cells centered on monitor that encompasses 15 km radius
 - 5 km 7 x 7; 4 km 9 x 9; etc.
- **Exclude days in which 2002 Base Case estimated 8-hr ozone near monitor is < 70 ppb**
 - Eliminates low ozone (background) days with low emissions contributions

**2007 Projected 8-Hour Ozone Design Values
2007 Base, RVP, Flash, RICE and All Control Strategies**

Ozone Monitor	Observed 2001-03	2007 Proj 8-Hr Ozone Design Value				
		Base	Cntl1	Cntl2	Cntl3	Cntl4
Weld County	81	79.0	78.9	78.6	78.9	78.5
Rocky Mtn. NP	81	79.3	79.3	79.2	79.2	78.9
Fort Collins	71	70.1	70.0	69.9	69.8	69.7
USAF Acad	73	70.9	70.8	70.8	70.6	70.6
Welch	70	68.8	68.7	68.7	68.7	68.5
Rocky Flats	87	86.2	86.1	86.1	86.2	85.9
NREL	85	84.2	84.1	84.1	84.1	83.9
Arvada	76	75.4	75.3	75.3	75.4	75.2
Welby	66	66.1	66.0	66.0	66.1	65.8
S. Boulder	77	76.3	76.2	76.2	76.3	76.0
Carriage	76	74.6	74.5	74.5	74.6	74.4
Highland	81	79.6	79.5	79.5	79.5	79.3
Chatfield Res.	85	83.2	83.1	83.1	83.1	82.9

Details on 2007 All Control Projected 8-hr Ozone Design Value Projections

- **Detailed example for 2007 All Control strategy (combined RVP, Flash and RICE)**
- **2001-2003 Observed 8-hr Ozone Design Values**
- **June 25 – July 1, 2002 Episode**
- **2002 Base Case Simulation – Consider all days with maximum estimated daily maximum 8-hr ozone “near” the monitor > 70 ppb**
- **2007 All Control – Use maximum estimated daily maximum ozone “near” (9 x 9 array of 4 km cells) the monitor**

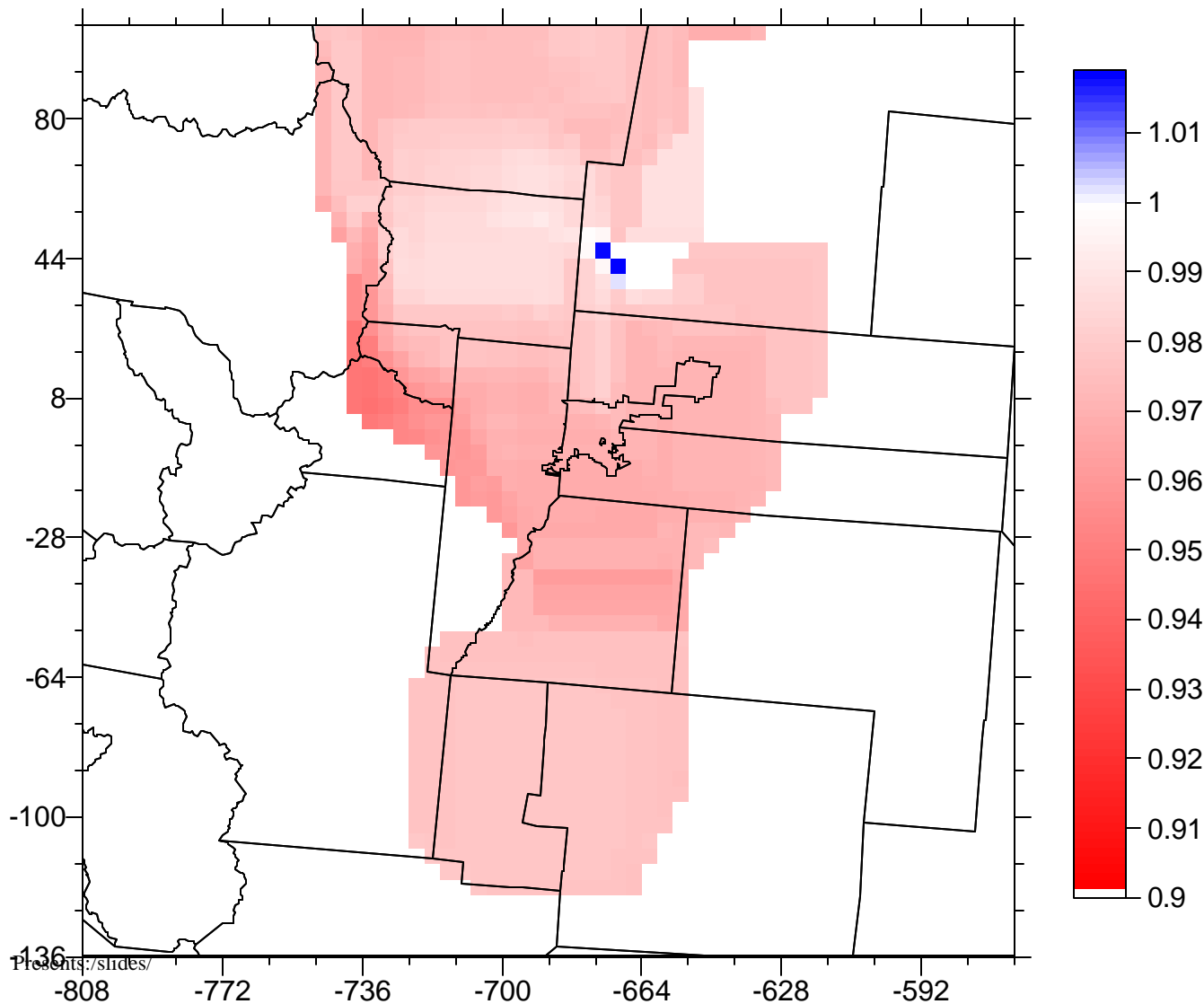
Projected 2007 All Cntl 8-Hr Ozone Design Value

Site	2001-03 Obs DV	Jun 25	Jun 26	Jun 27	Jun 28	Jun 29	Jun 30	Jul 1	# Days	
2002 Modeled 8-Hr Ozone (ppb)										
Weld County	81	61.0	57.2	65.2	60.6	69.4	66.9	70.9	1	
Rocky Mtn. NP	81	63.1	64.3	67.4	62.0	71.4	76.0	79.1	3	
Rocky Flats	87	62.8	62.7	70.9	62.1	70.5	73.8	84.5	4	
NREL	85	60.4	64.6	70.9	64.9	63.1	73.8	87.2	3	
Arvada	76	59.8	60.0	70.8	63.1	69.1	71.8	85.1	3	
Welby	66	56.6	55.2	62.6	66.5	70.0	66.2	72.7	2	
S. Boulder	77	63.0	62.8	70.9	63.0	70.9	74.1	84.5	4	
Carriage	76	58.4	62.3	68.8	67.9	66.6	71.9	83.8	2	
Highland	81	57.4	66.3	62.7	73.0	69.7	71.9	81.6	3	
Chatfield Res.	85	57.9	66.5	63.4	73.0	69.7	71.9	85.9	3	
	2001-03 Obs DV	2007 Cntl4 Modeled 8-Hr Ozone (ppb)							RRF	2007 DV
Weld County	81	59.9	56.3	64.3	59.5	67.9	65.5	68.7	0.969	78.5
Rocky Mtn. NP	81	62.8	62.8	66.0	61.0	70.1	74.2	76.5	0.974	78.9
Rocky Flats	87	63.1	61.7	70.5	61.3	69.6	73.4	82.6	0.988	85.9
NREL	85	60.3	65.4	70.5	65.4	62.5	73.4	85.0	0.987	83.9
Arvada	76	60.0	60.8	70.5	62.3	68.1	70.9	83.8	0.989	75.2
Welby	66	55.9	54.6	64.3	65.2	69.1	67.6	73.2	0.997	65.8
S. Boulder	77	63.3	61.9	70.5	62.1	70.1	73.4	82.6	0.987	76.0
Carriage	76	59.0	64.1	69.3	68.3	65.9	70.4	81.9	0.979	74.4
Highland	81	57.0	66.7	63.2	71.0	67.5	70.4	80.5	0.980	79.3
Chatfield Res.	85	57.9	66.7	61.6	71.0	67.5	70.4	83.8	0.976	82.9 ⁴¹

How Are Modeling Results Used to Demonstrate Attainment of the 8-Hour Ozone NAAQS

- **EPA Screening Test – Attainment Test at Grid Cells w/o Monitor where Estimated Ozone is Consistently Greater than Near a Monitor**
 - Associate grid cells with monitors
 - Look at # days estimated daily 8-hr ozone at a grid cell is >5% higher than at associated monitor and > 70 ppb
 - If # days is 50% or more of modeled days, then treat grid cell like a monitoring site with maximum 8-hr ozone Design value from associated monitors
- **For Denver June 2002 episode, there were no grid cells that met EPA's screening test criteria**

Spatial Distribution of 2007 All Cntl RRF



- Clear/white area RRFs not calculated because ozone always < 70 ppb
- RRFs > 1.0 in downtown Denver due to NO_x reductions
- RRFs “stiffer” west of DMA (e.g., Rocky Flats)

2007 Control Strategy Conclusions

- **2007 All Control Strategy sufficient to model 8-Hour ozone attainment at the Chatfield and NREL monitors, Rocky Flats Monitor still estimated to exceed the standard**

Site	2001-2003 DV	2007 All Cntl DV
Chatfield	85	82.9
NREL	85	83.9
Rocky Flats	87	85.9

8-hr ozone standard = 84 ppb

2007 Control Strategy Conclusions

- **Most benefits from 2002 Base to 2007 Base**
- **RVP Control has reduces 8-hr ozone DVs ~0.1 ppb**
- **Flash Control reduces 8-hr ozone DVs ~0.1 ppb except at Weld County site (~0.4 ppb reduction)**
- **RICE Control reduces 8-hr ozone DVs by 0.0-0.1 ppb**
- **All Control results in 8-hour ozone DV reductions of ~0.3 ppb**

Weight of Evidence Attainment Demonstration

- **EPA Draft 8-hr Ozone Guidance (EPA, 1999)**
 - Modeled max 8-hr ozone Design Value < 90 ppb
 - Air Quality Modeling Analysis
 - Change in grid-hours with ozone > 84 ppb
 - Number grid cells > 84 ppb
 - Change in ppb-hr with ozone > 84 ppb
 - Air Quality and Emission Trends
 - Extrapolation of DV to attainment year
 - Emission Trends
 - Observation Based Models (OBM)
 - Not quantitative, support VOC/NO_x selection

Weight of Evidence Attainment Demonstration

- Other corroborative analysis
 - Quantifying model uncertainties
 - Other year Design Values
 - e.g., 2000-2002
 - Examine basis for excluding days
 - e.g., just July 1, 2002
 - Additional data collection
 - e.g., 2003 VOC sampling study
 - Other?

ENVIRON/Alpine Denver EAC Project Status

- **Performed 15 sensitivity and control strategy simulations**
- **Tasks 1-6 Completed**
- **Task 7: Control Strategy Modeling**
 - Task 7 Report to do
- **Task 8: Technical Support Document (TSD)**
 - Task 8 TSD to do
- **Task 9: Assistance and Training**
 - Task 9 on-site training seminar to do