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# Comparison of Chemical Mechanisms: CBIV versus CB05

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**Southeast Texas Photochemical Modeling  
Technical Committee**

**September 11, 2007**



## CAMx Ozone Modeling in SIP Development

# The Big Picture

Base Case

Day-specific emissions; replicate what actually happened

Baseline Case

Typical emissions; used in RRF to predict future design values

Future Base Case

Apply future growth + on-the-books controls to estimate future ozone

Control Strategy Testing

Determine control strategies that will effectively reduce ozone

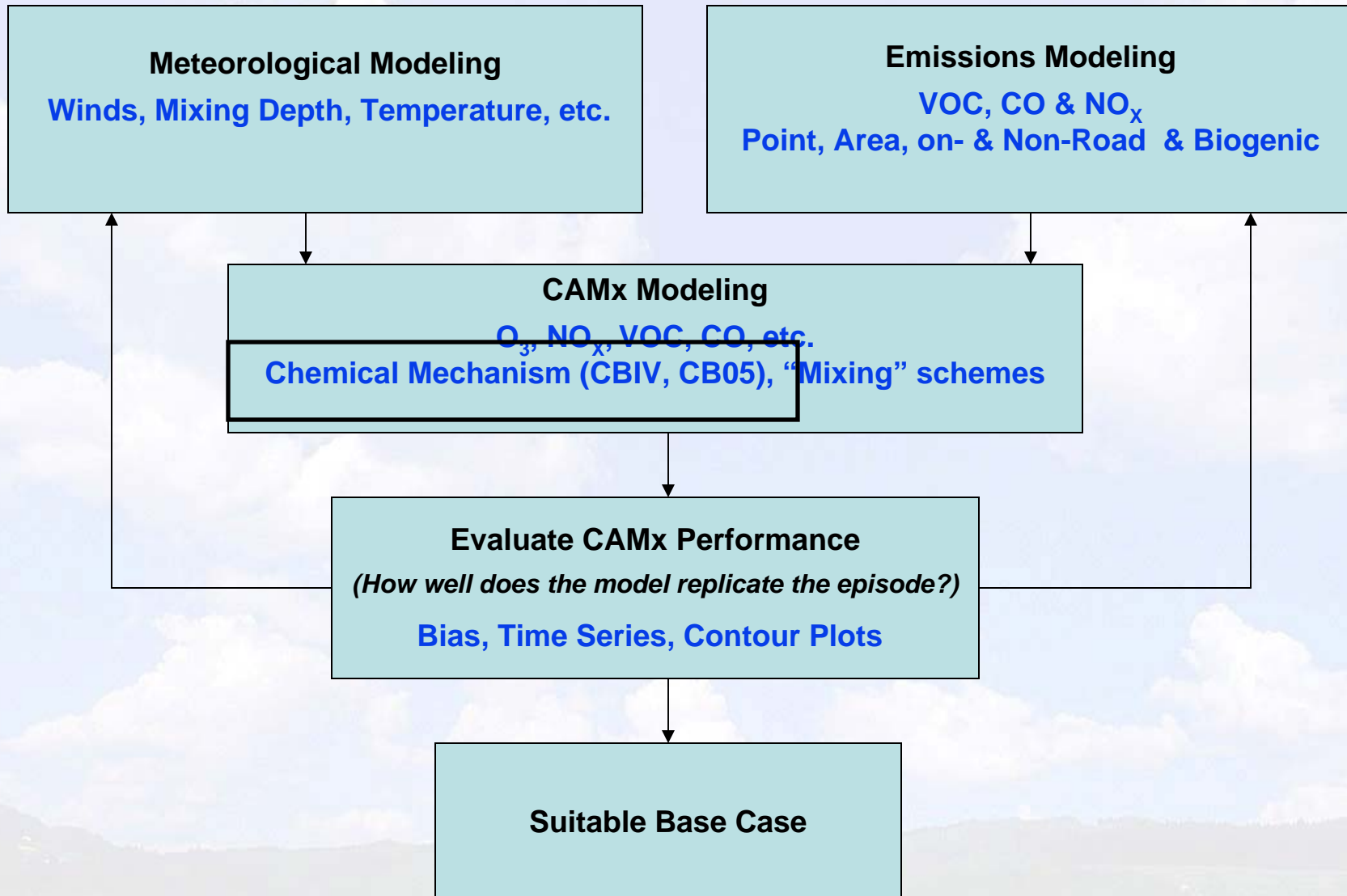
SIP

Document modeling procedures



# CAMx Ozone Modeling in SIP Development

## Base Case – Historical Episode Replication





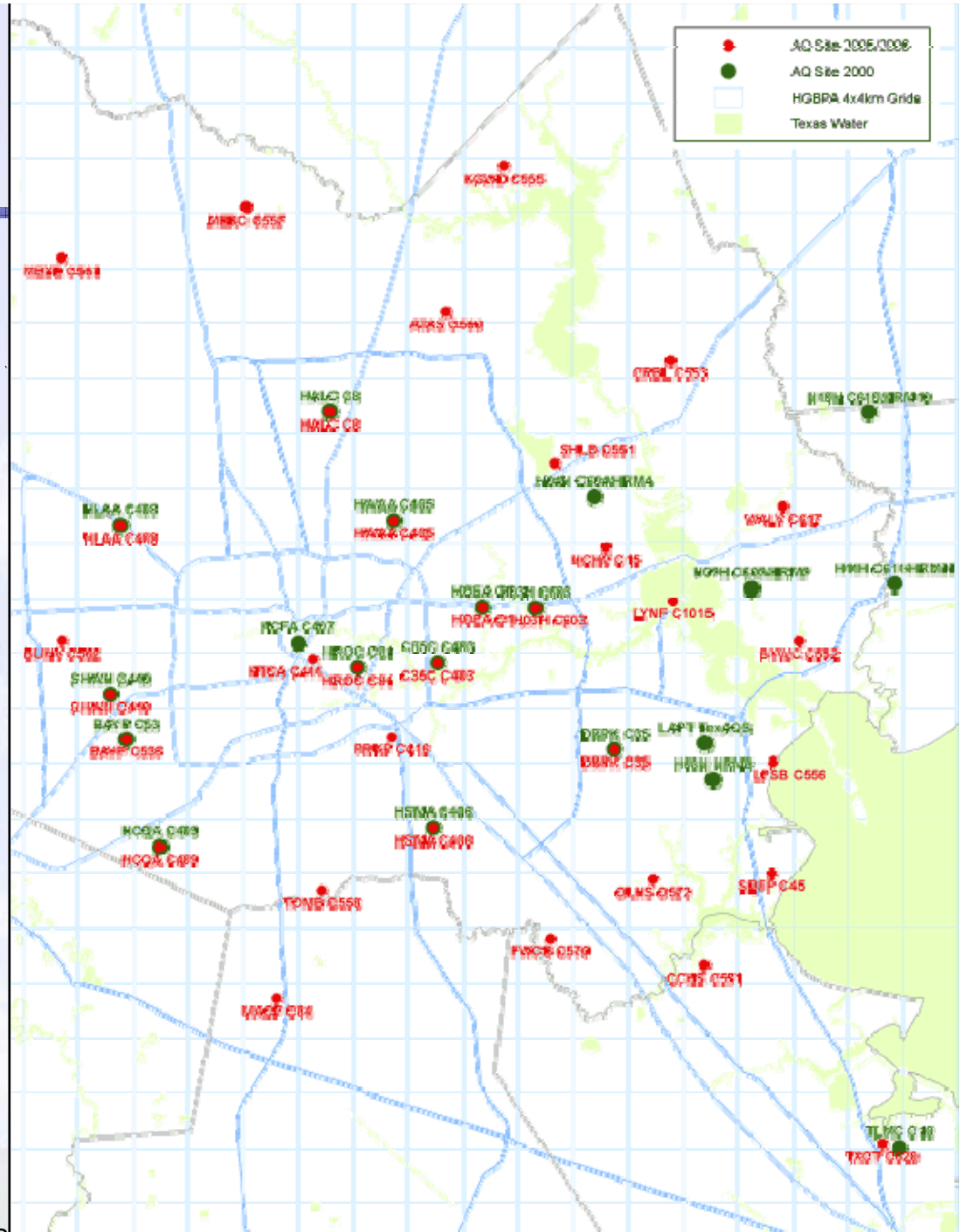
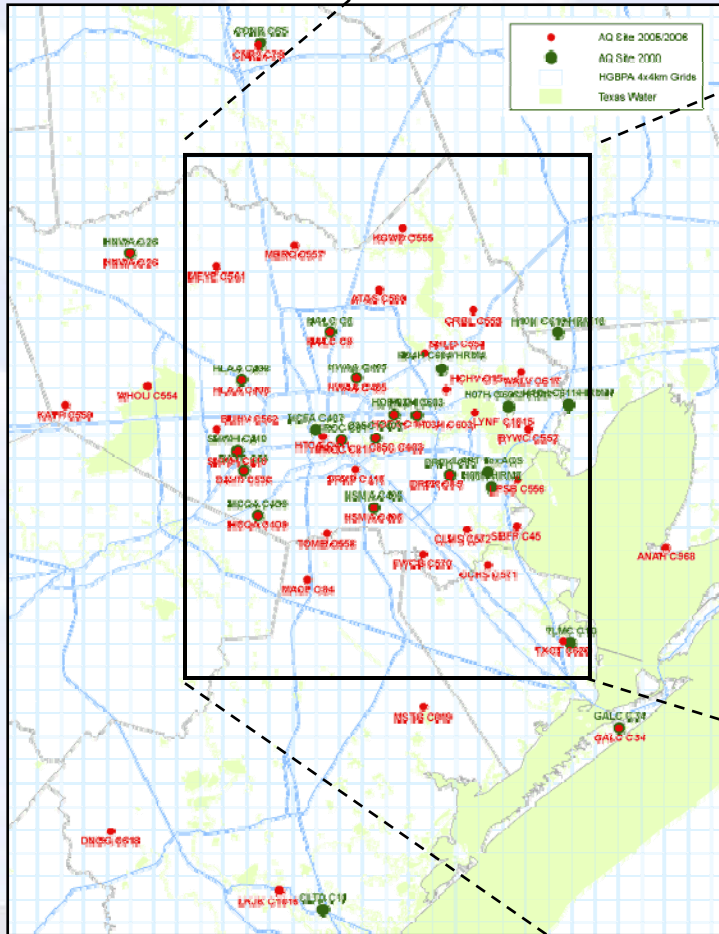
## **CBIV & CB05 Comparison**

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**Air Quality Models (AQMs), such as CAMx, by necessity use simplified photochemical reaction mechanisms.**

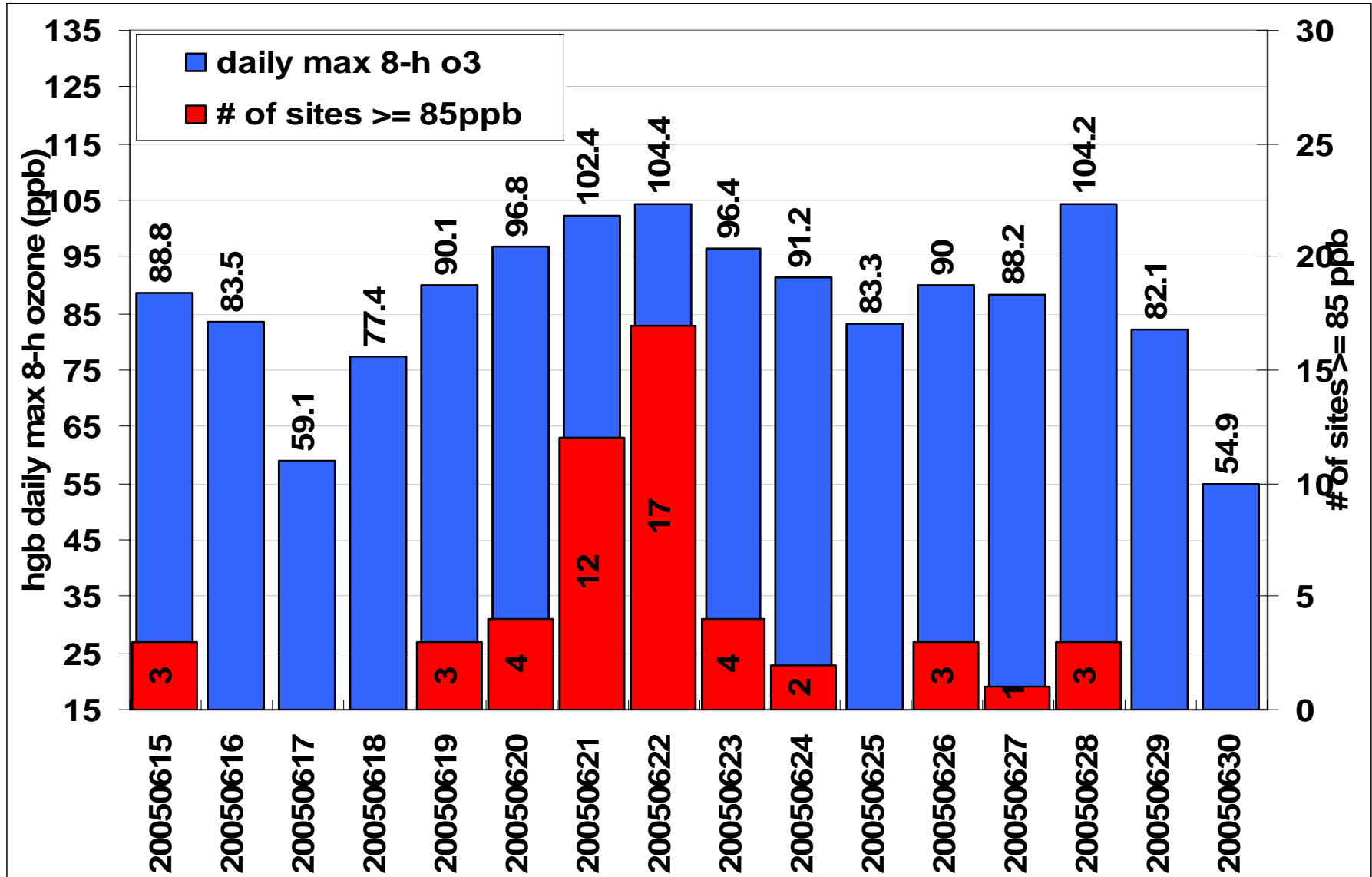
**The CB-05 mechanism, like CBIV, is based upon the molecular structure approach (i.e., carbon bonds). However, CB05 represents a major scientific enhancement over CBIV.**

**EPA plans to use CB05 for future regulatory modeling**



Site	Site Info	Site	Site Info
Code		Code	
ANAH	1850 Hawkins Camp Road, Anahuac, Chambers Co., TX	HLAA	Lang, Houston, Harris Co., TX
ATAS	Atascocita, 2302 Atascocita Rd., Houston, Harris Co., TX	HNWA	NW Harris, Tomball, Harris Co., TX
BAYP	Bayland Park, Harris Co., TX	HOEA	Houston East, Houston, Harris Co., TX
BUHV	Bunker Hill Village, 11977 Memorial Dr., Houston, Harris Co., TX	HROC	TCEQ Houston Regional Office, Houston, Harris Co., TX
BYWC	Baytown Wetlands Center, 1724 Market St., Baytown, Harris Co., TX	HSMA	Swiss and Monroe, Houston, Harris Co., TX
C35C	Clinton, Harris Co., TX	HTCA	Texas Avenue, Houston, Harris Co., TX
CCHS	Clear Creek High School, 2305 East Main St., League City, Galveston Co., TX	HWAA	North Wayside, Houston, Harris Co., TX
CLHS	Clear Lake High School, 2929 Bay Area Blvd., Houston, Harris Co., TX	KATP	Katy Park, 24927 Morton Rd., Houston, Harris Co., TX
CLTA	Clute, Brazoria Co., TX	KGWD	Kingwood Library, 4102 Rustic Woods Dr., Kingwood, Harris Co., TX
CNR2	Conroe Relocated, 9472A Highway 1484, Conroe, Montgomery Co., TX	LKJK	Lake Jackson, 109-B Brazoria Hwy 332-W, Lake Jackson, Brazoria Co., TX
CONR	Conroe, Montgomery Co., TX	LPSB	La Porte Sylvan Beach, 636 Bayshore Dr., La Porte, Harris Co., TX
CRBL	Crosby Library, 135 Hare Rd., Crosby, Harris Co., TX	LYNF	Lynchburg Ferry, 1001 B Lynchburg Road, Baytown, Harris Co., TX
DNCG	Danciger, Danciger, Brazoria Co., TX	MACP	Manvel Croix Park, 4503 Croix Parkway, Manvel, Brazoria Co., TX
DRPK	Deer Park, Harris Co., TX	MERC	Mercer Arboretum, 22306 Aldine Westfield Road, Houston, Harris Co., TX
FWCB	Clear Brook High School, 4607 FM 2351, Friendswood, Harris Co., TX	MEYE	Meyer Park, 7700 Cypresswood Dr., Houston, Harris Co., TX
GALC	Galveston, Galveston Co., TX	MSTG	Mustang Bayou, Liverpool, Brazoria Co., TX
H03H	HRM Site 3, Haden Road, Houston, Harris Co., TX	PRKP	Park Place, 7421 Park Place Blvd., Houston, Harris Co., TX
H04H	HRM Site 4, Sheldon Road, Houston, Harris Co., TX	SBFP	Seabrook Friendship Park, 4522 Park Road, Seabrook, Harris Co., TX
H07H	HRM Site 7, West Baytown, Harris Co., TX	SHLD	Sheldon, 15345 Beaumont Hwy, Houston, Harris Co., TX
H08H	HRM Site 8, La Porte, Houston, Harris Co., TX	SHWH	Westhollow, Houston, Harris Co., TX
H10H	HRM Site 10, Mont Belvieu, Chambers Co., TX	TLMC	Texas City, Galveston Co., TX
H11H	HRM Site 11, East Baytown, Chambers Co., TX	TOMB	Tom Bass, 15108 Cullen Blvd., Houston, Harris Co., TX
HALC	Aldine, Houston, Harris Co., TX	TXCT	2212 North 34th St., Texas City, Galveston Co., TX
HCFA	Crawford, Houston, Harris Co., TX	WALV	Wallisville Road, 4727 Wallisville Rd., Baytown, Harris Co., TX
HCHV	Channelview, Houston, Harris Co., TX	WHOU	West Houston, 16719 Clay Rd., Houston, Harris Co., TX
HCQA	Croquet, Houston, Harris Co., TX	LAPT	La Porte, Harris Co., TX

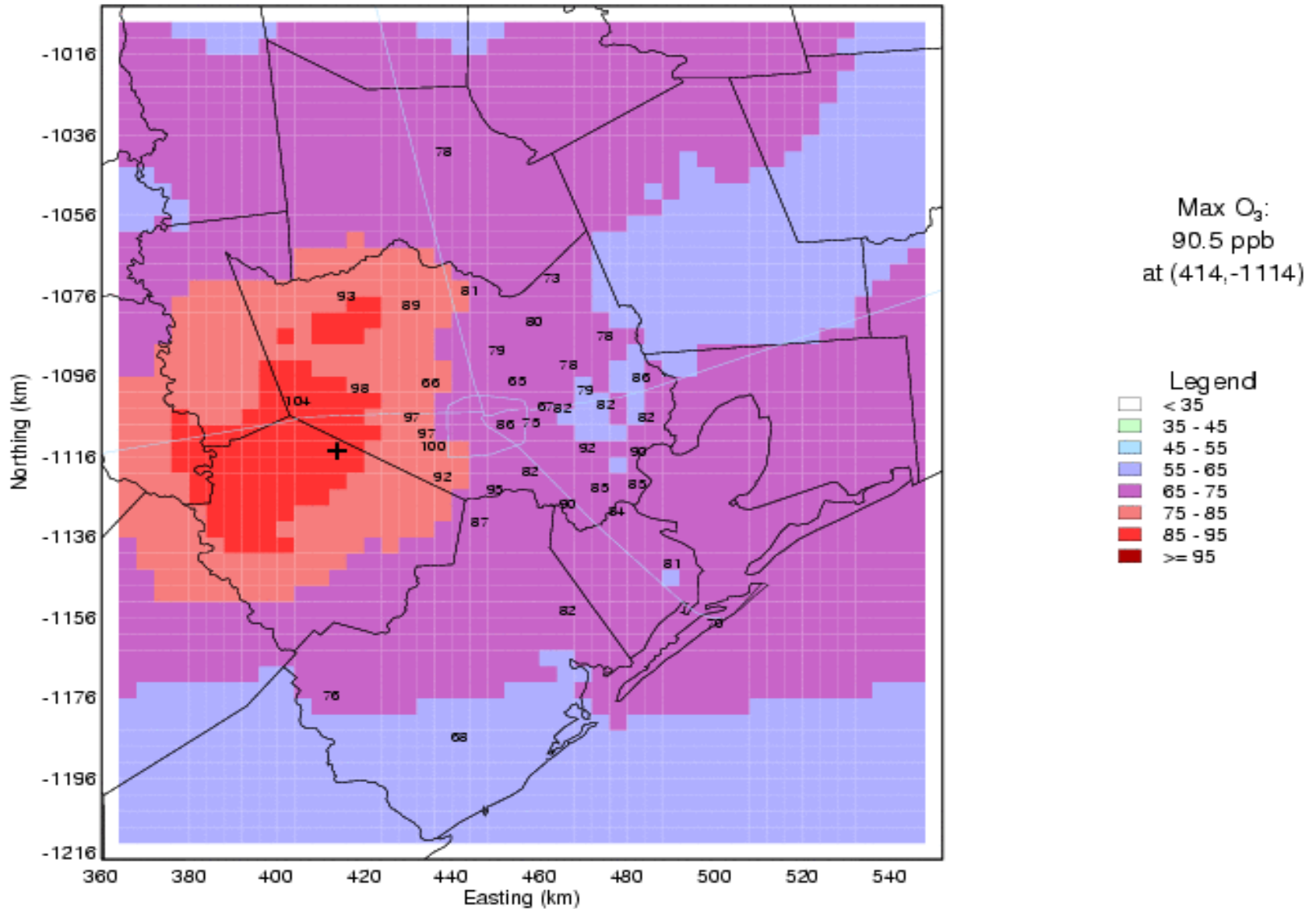
# June 2005 Episode



# Daily Maximum 8-Hour Moving Average O<sub>3</sub> Concentrations (ppb) for 06/22/2005

camx440\_cb4.hgb8h2.bc05jun.regular0.2005ep1\_eta\_fdda

Layer 1

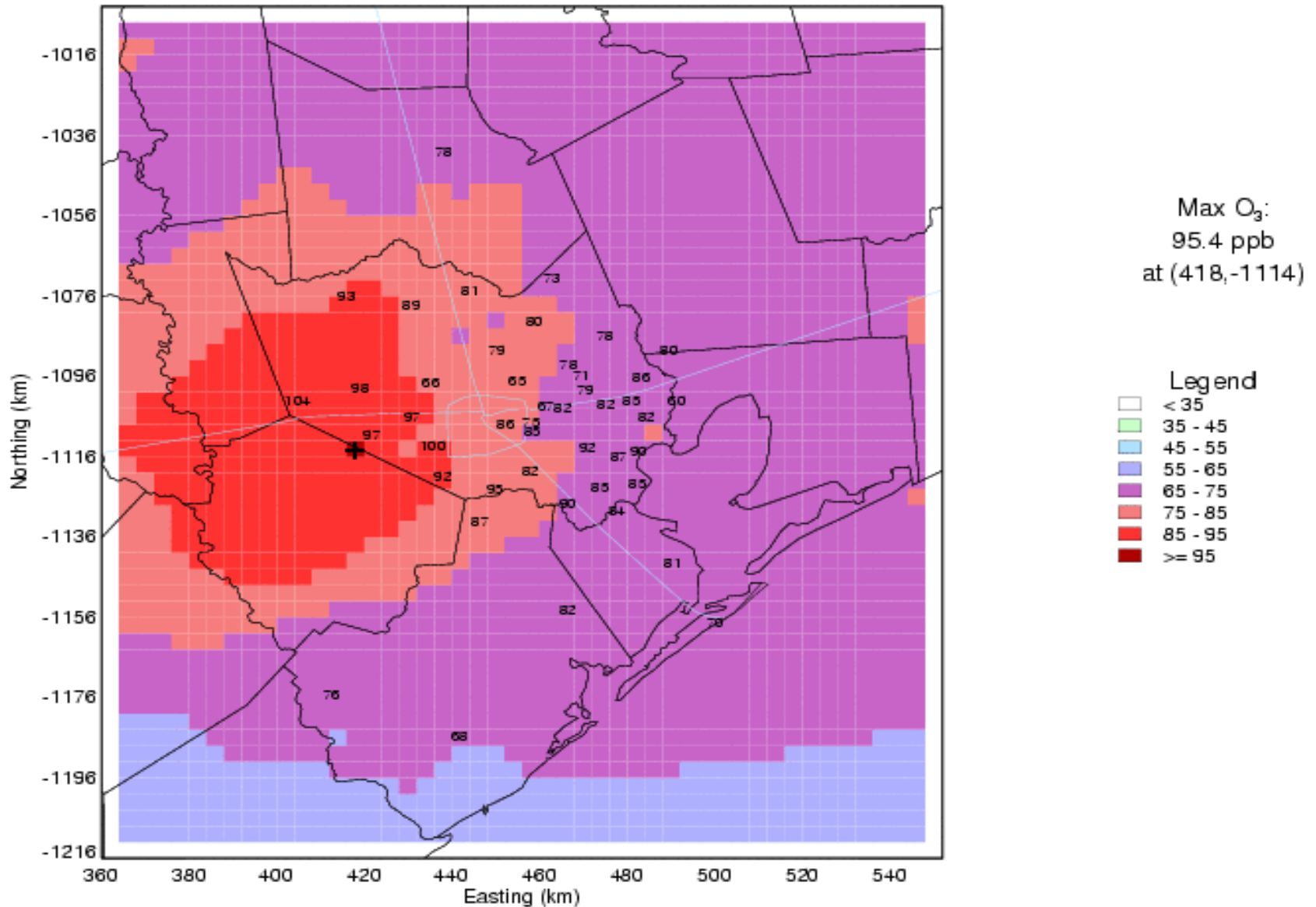




# Daily Maximum 8-Hour Moving Average O<sub>3</sub> Concentrations (ppb) for 06/22/2005

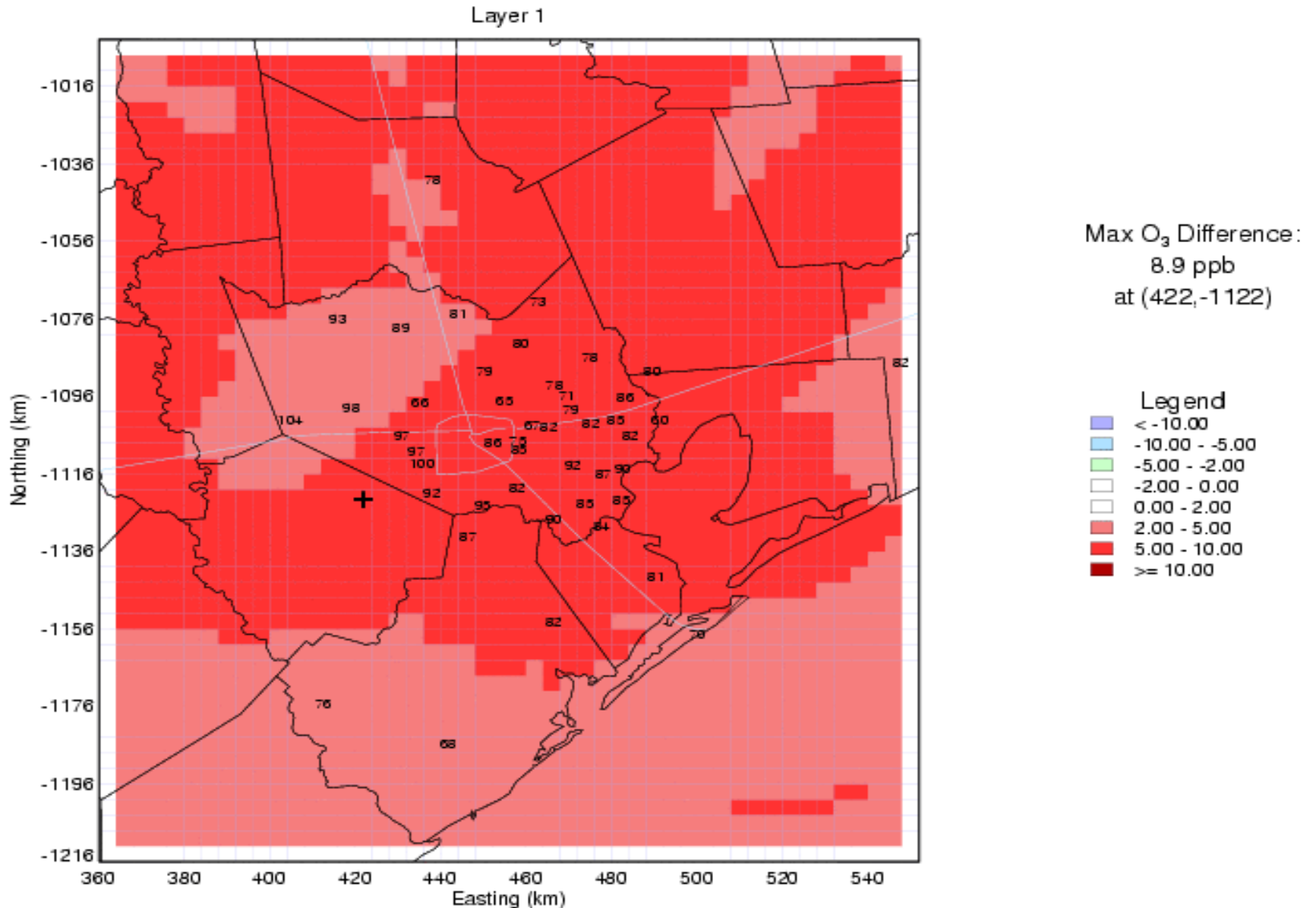
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Layer 1



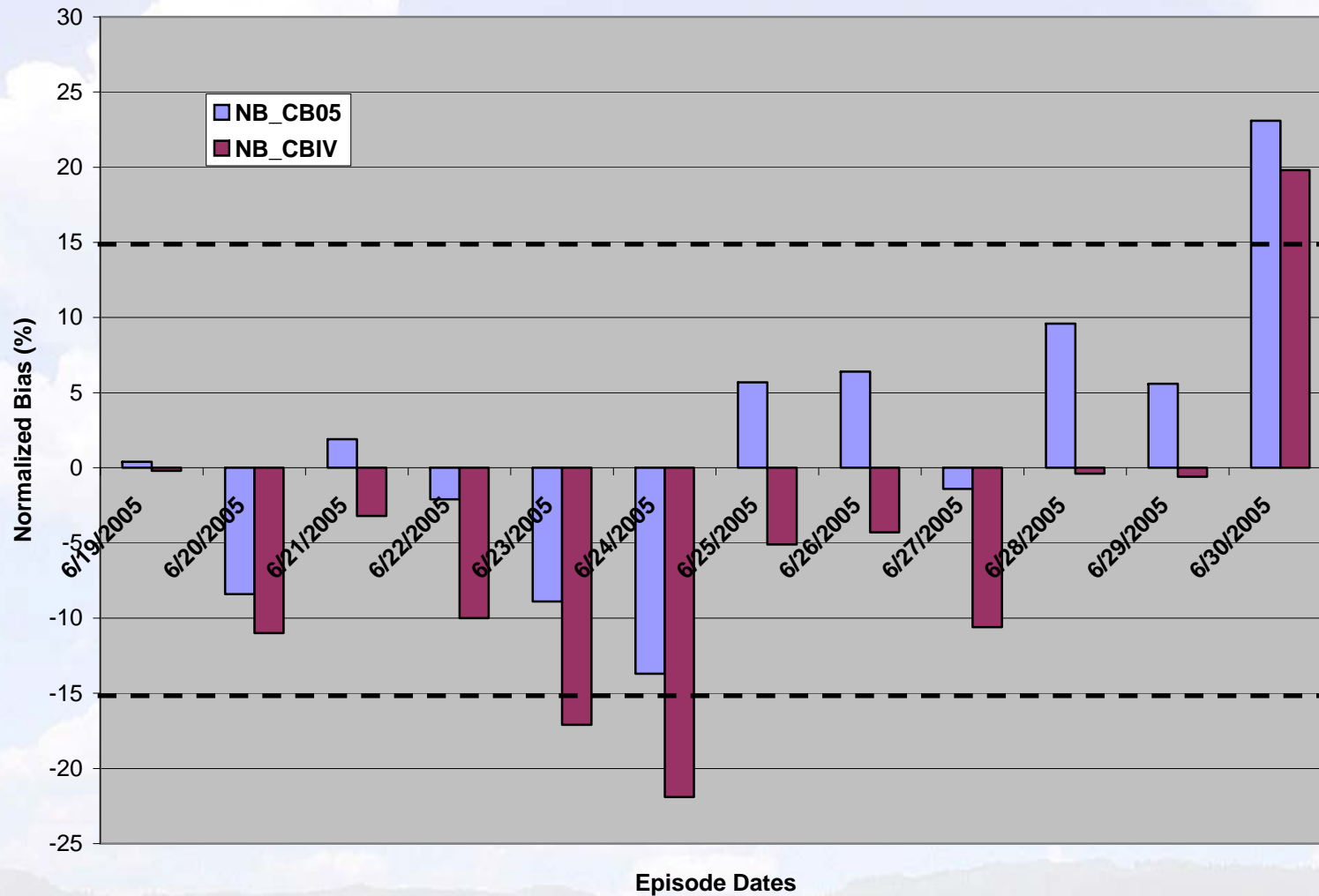
# Difference of Daily Maximum 8-Hour Moving Average O<sub>3</sub> Concentrations (ppb) for 06/22/2005

450\_cb05.hgb8h2.bc05jun.regular1.2005ep1\_eta\_fdda-camx450\_cb4.hgb8h2.bc05jun.regular1.2005ep1\_eta\_fdda



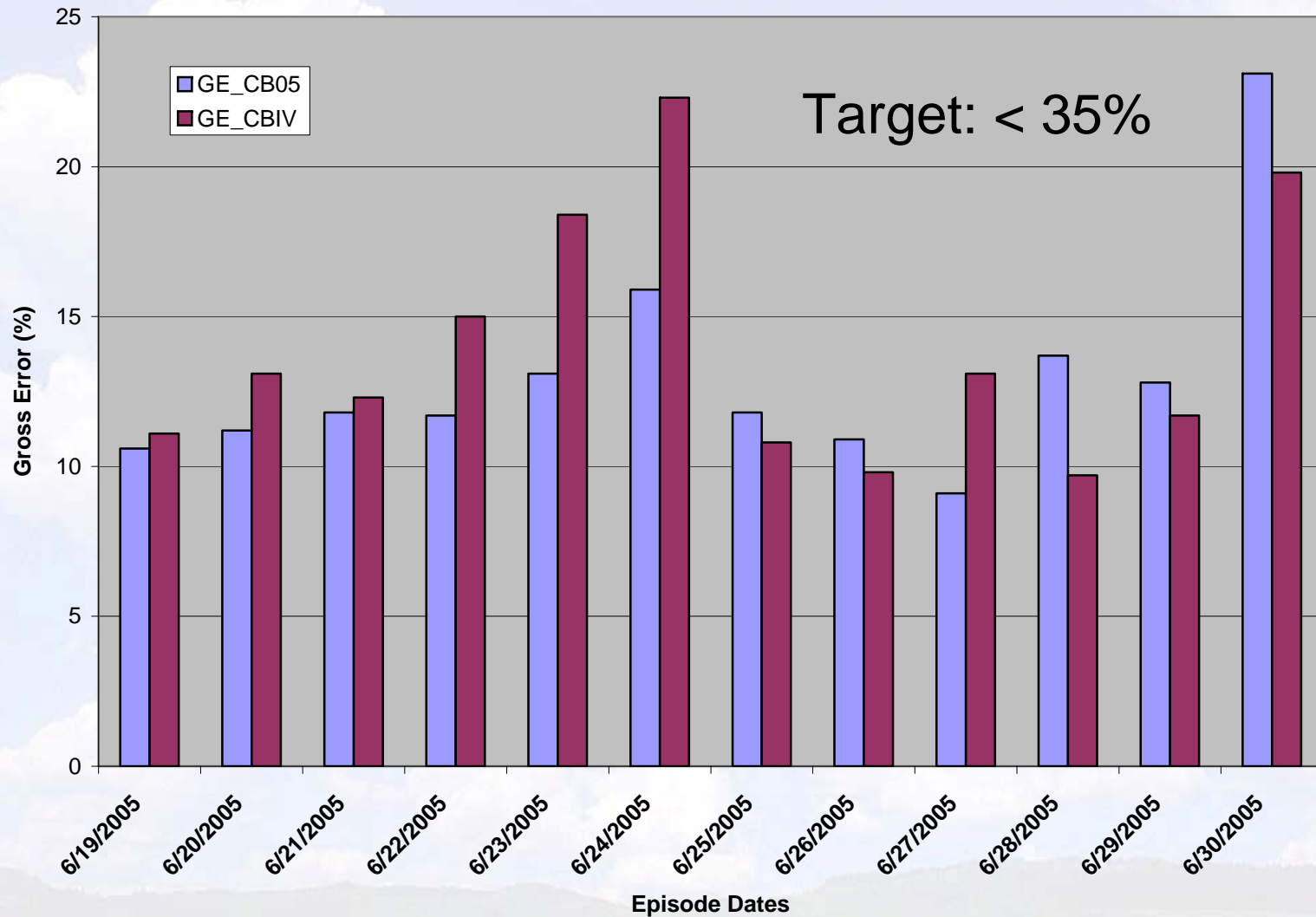


# 8-hour Normalized Bias ( $O_3 > 40$ ppb) June 19 - 30, 2005



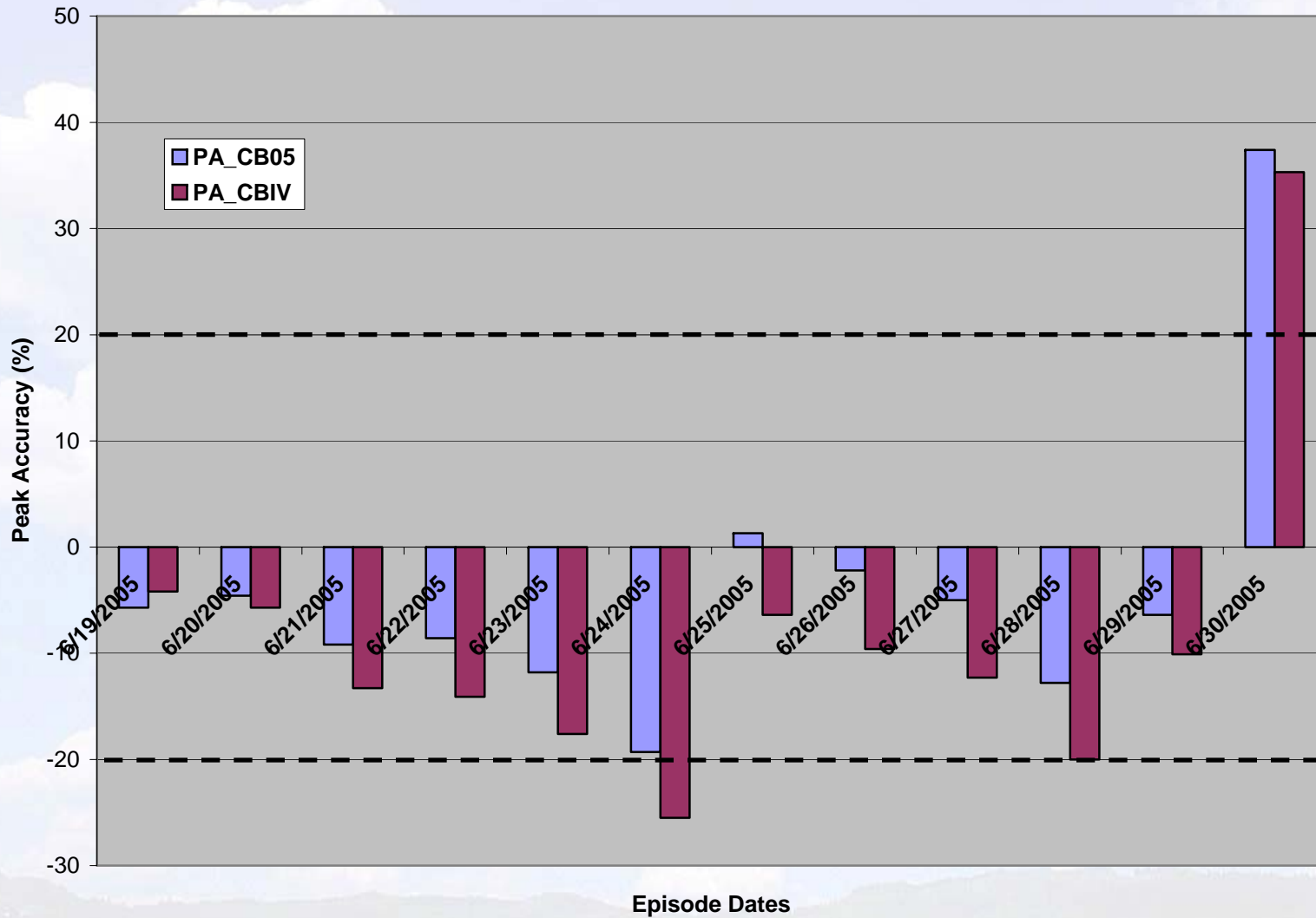


# 8-hour Gross Error (O<sub>3</sub>>40ppb) June 19 - 30, 2005



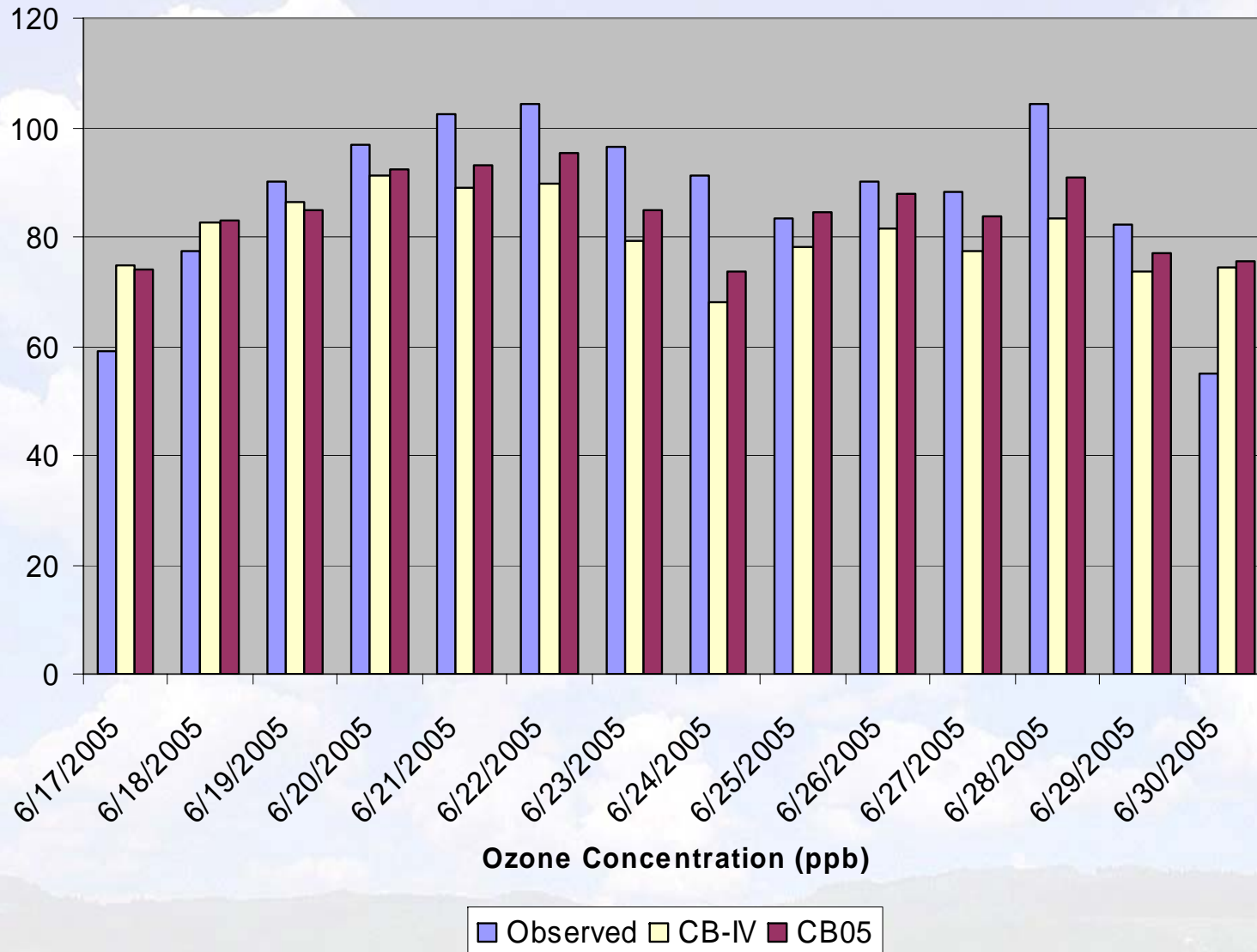


# 8-hour Peak Accuracy June 19 - 30, 2005





# Modeled and Measured Peak Daily 8-Hour Ozone Concentrations



**Table of Observed Versus Modeled (CBIV & CB05) Number of Days  
with Maximum Daily 8-Hour Ozone Concentration  $\geq$  85 & 70 ppb  
for the June 19-30, 2005 Episode**



Station	Designation	CODE	DV-05	OBS Days		CBIV MOD Days		CB05 MOD Days	
				$\geq$ 85 ppb	$\geq$ 70 ppb	$\geq$ 85 ppb	$\geq$ 70 ppb	$\geq$ 85 ppb	$\geq$ 70 ppb
Houston East (C1)	HOEA		87	0	2	0	2	0	4
Aldine (C8)	HALC		92	0	7	0	4	1	5
Channelview (C15)	HCHV		89	0	1	0	1	0	3
NW Harris Co (C26)	HNWA		93	5	11	1	7	2	9
Galveston AP (C34)	GALV		87	0	3	0	3	0	4
Deer Park (C35)	DRPK		100	1	4	0	3	0	4
Seabrook (C45)	SBFP		92	0	2	0	3	0	5
Bayland Park (C53)	BAYP		103	3	8	1	4	2	7
Conroe (C78)	CONR		86	0	3	0	0	0	2
Houston Rg-Off. (C81)	HROC		88	1	5	0	3	0	5
Manvel Croix (C84)	MACP		97	3	5	0	4	1	4
Clinton (C403)	C35C		95	0	1	0	3	0	5
Houston Monroe C406	HSMA		97	1	3	0	4	1	5
Croquet (C409)	HCQA		98	2	5	1	4	2	7
Shell Westhollow C410	SHWH		89	3	7	2	4	2	8
Houston Tx-Av (C411)	HTCA		88	0	5	0	3	0	5
HRM3 (C603)	H03H		92	0	3	0	2	0	4
Wallisville Rd (C617)	WALV		96	1	5	0	1	0	3
Mustang Bayou (C619)	MSTG		93	1	3	0	2	0	4
Tx-City (C620)	TXCT		89	0	3	0	3	0	4
Lynchburg (C1015)	LYNF		96	0	1	0	1	0	2



## CBIV versus CB05 Summary

- **CB05 appears to generate a larger area of elevated 8-hour ozone**
- **CB05 appears to generate higher daily maximum 8-hour ozone**
- **On all exceedance days the Normalized Bias for CB05 is  $\leq \pm 15\%$**
- **On all exceedance days the Gross Error for CB05 is  $< 20\%$**
- **On all exceedance days the Peak Accuracy for CB05 is  $\leq \pm 20\%$**
- **CB05 increases the number of modeled days with daily maximum 8-hour ozone  $\geq 85$  ppb and  $\geq 70$  ppb**
- **CB05 does a better job overall of replicating what actually happened**