



# 2019 Modeling Platform Updates

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Presented at the HGB Air Quality Technical Information Meeting on July 28, 2022

# Today's Presentation

- Modeling Platform Set-up
- Emission Databases and Updates
- Model Performance Evaluation
- Preliminary Future Design Values
- Ozone Sensitivities
- Modeling Resources

# Modeling Platform Set-up

- Episode: April 1 – October 31
- Modeling years: 2019, 2023, 2026
- Emission processing - EPS3
- Meteorological modeling - WRF v. 4.1.5
  - Hybrid Vertical Coordinate,
  - Noah Land-surface model (LSM)
  - Yonsei University (YSU) PBL scheme
  - WRF Double-Moment 6-Class Microphysics
- Air quality modeling - CAMx version 7.10
  - CB6r5 chemical mechanism
  - K-theory for vertical diffusion
  - Wesely89 dry deposition scheme

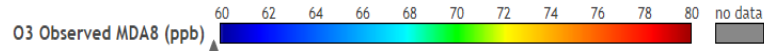


# Emission Data and Planned Updates

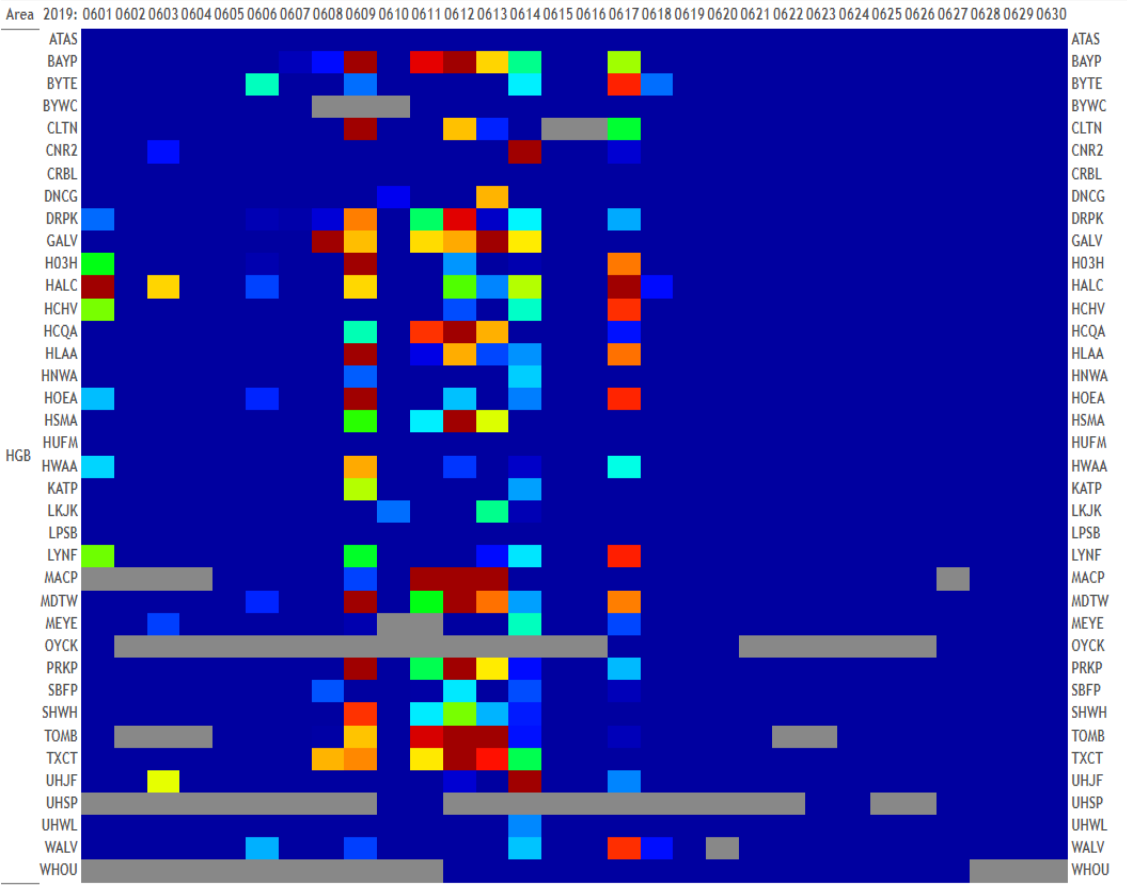
Sector	Sector/Geographic area	Datasets/Model
Point	EGU	2019 Air Market Program Data (AMPD)
	Non-EGU TX	2019 State of Texas Air Reporting System (STARS)
	Non-EGU Non-TX	EPA 2016v1 Modeling Platform
Non-Point	Oil & Gas TX	2019 Railroad Commission of Texas (RRC)
	Oil & Gas Non-TX	EPA 2017 Modeling Platform
	Off-shore	2017 Bureau of Ocean Energy Management (BOEM)
Mobile	On-Road	<b>TX NAA: MOVES3 - link based</b> ; outside NAA: MOVES3 - county based
	Non-Road	TexN2.2 (TX); MOVES3 (non-TX)
	Off-road Shipping	4km: 2019 Automatic Identification System (AIS); vessel characteristic IHS 2020 MARINER v1; 12km: version 1 of the 2016 EPA modeling platform
	Off-road Airports	<b>TX NAA: TTI 2020 data; Other: EPA 2016 platform</b>
	Off-road Locomotives	<b>TX NAA: TTI 2019 data, Other: EPA 2016 platform</b>
Area	Area TX	<b>2020 Air Emissions Reporting Requirements (AERR)</b>
	Area Non-TX	EPA 2017 Modeling Platform
Natural	Biogenic	Biogenic Emissions Land-use Database (BELD5); BEIS v3.7 and SMOKEv4.8
	Fires	2019 MODIS and VIIRS; FINN v2.2
Other	International Els	2019 Community Emission Data System (CEDS); SMOKEv4.7_CEDS



# High Ozone Days in June



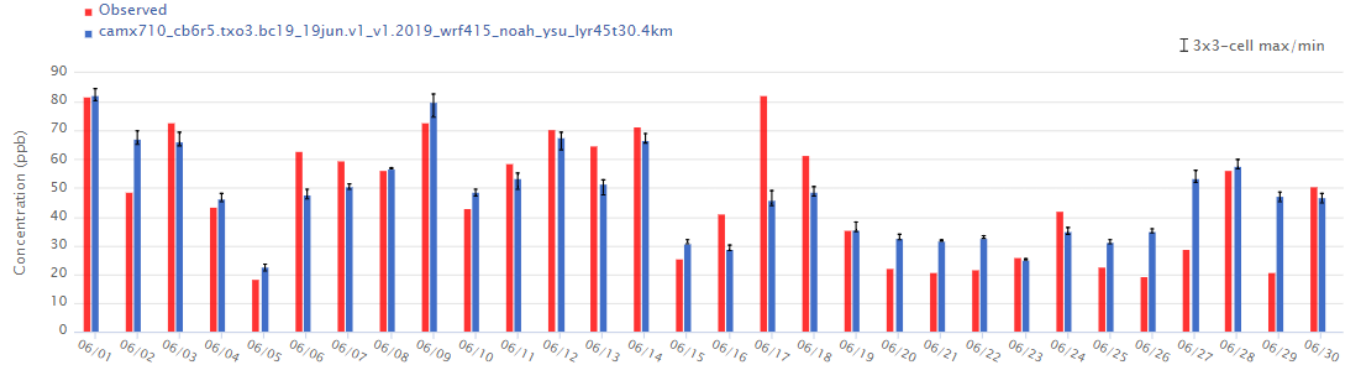
Month: 201906 Area: HGB - Houston-Galveston-Br Show data: Show tooltip: Change data range: min 60 max 80 redraw



Area 2019: 0601 0602 0603 0604 0605 0606 0607 0608 0609 0610 0611 0612 0613 0614 0615 0616 0617 0618 0619 0620 0621 0622 0623 0624 0625 0626 0627 0628 0629 0630

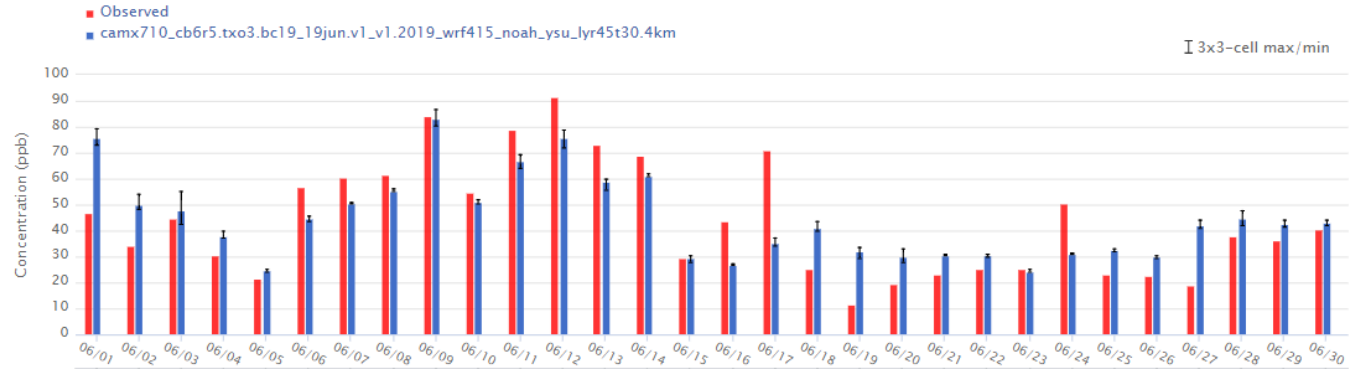
O3 Daily Maximum 8-Hour Concentration (2x2 bi-linear interpolated value)

HALC, 482010024, Houston Aldine C8/AF108/X150, Houston, Harris, TX

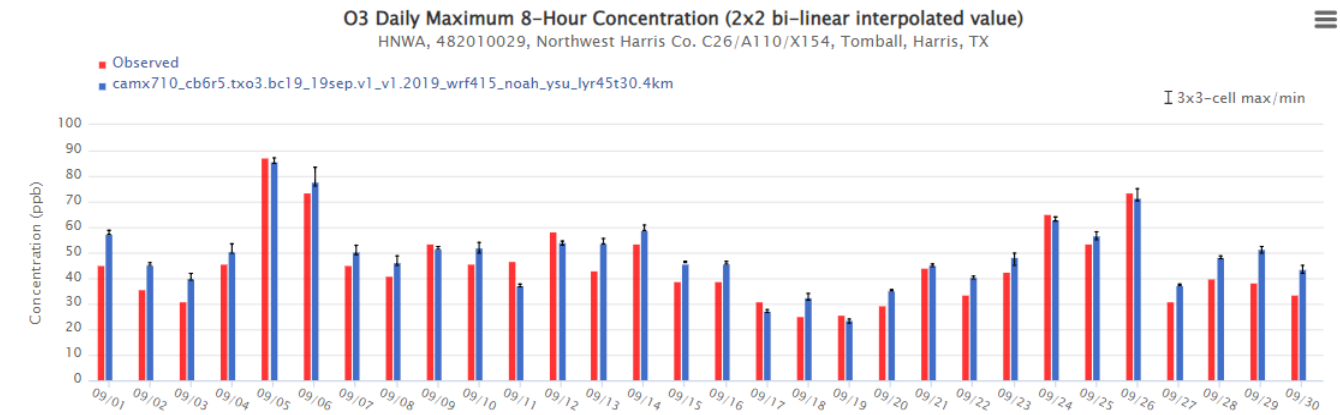
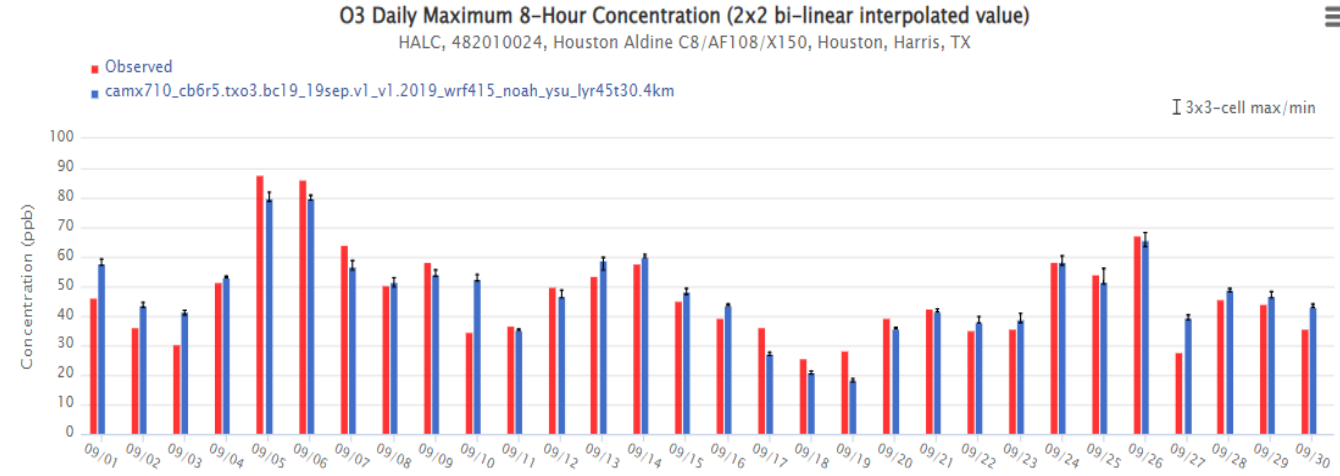
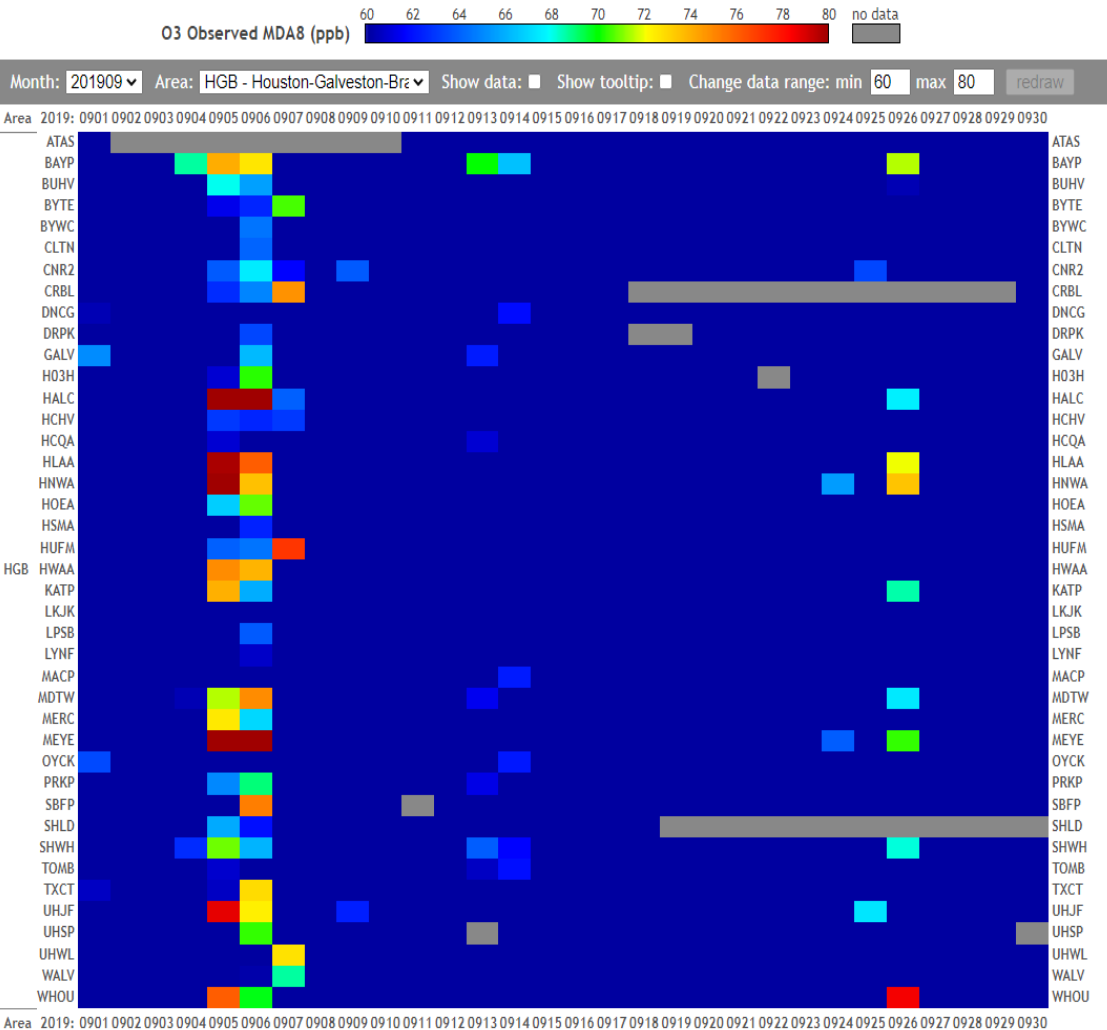


O3 Daily Maximum 8-Hour Concentration (2x2 bi-linear interpolated value)

BAYP, 482010055, Houston Bayland Park C53/A146, Houston, Harris, TX



# High Ozone Days in September



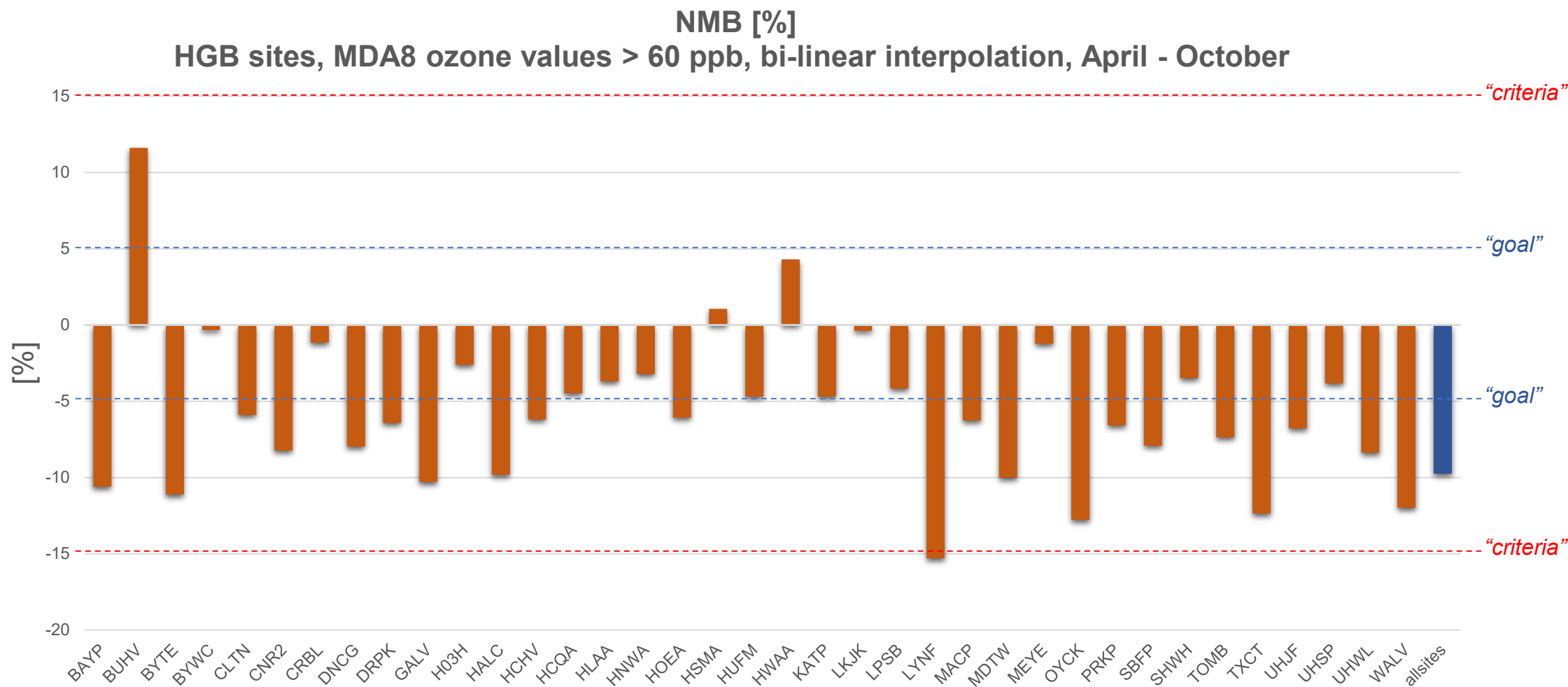
# Statistic Benchmarks for Model Performance Evaluation (MPE)

**Recommended  
by Emery et al. (2017)**

	<b>NMB</b>	<b>NME</b>
Goal	< $\pm 5\%$	< 15%
Criteria	< $\pm 15\%$	< 25%

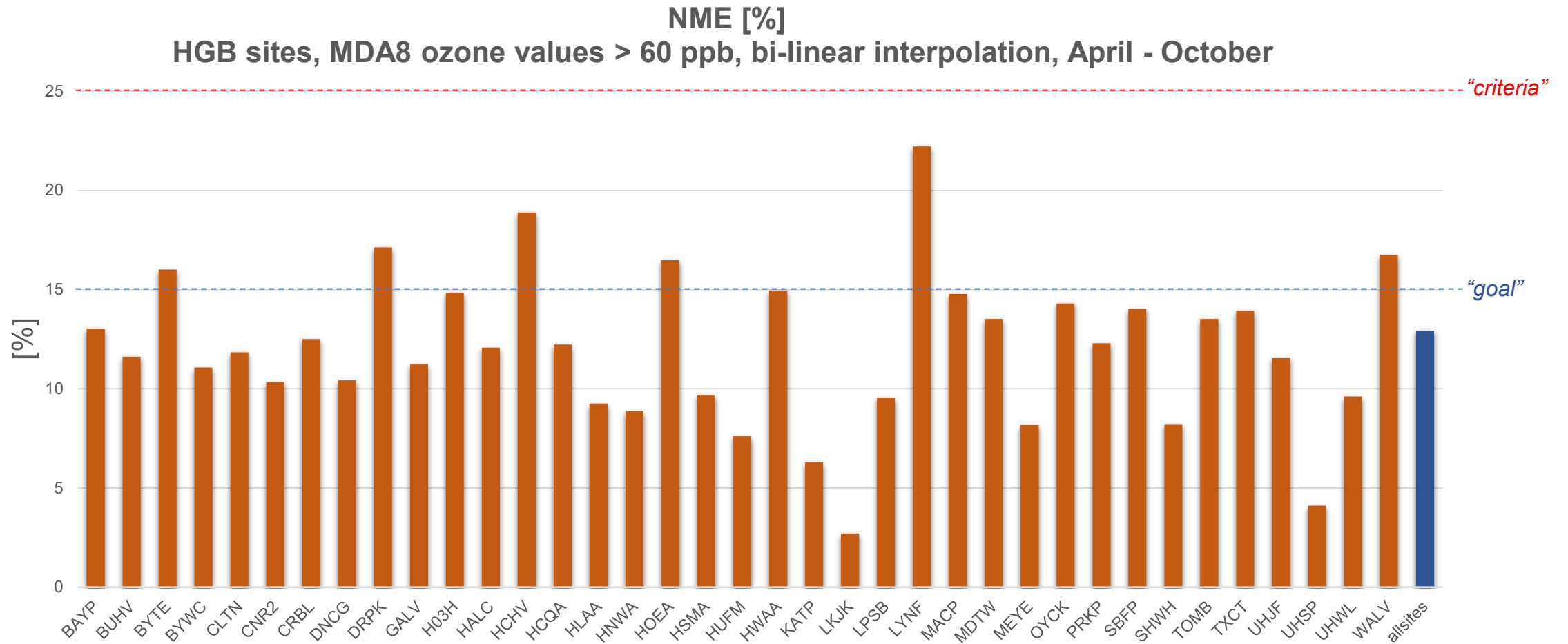
- Goal
  - statistical values met by about a third of top performing past applications
  - considered as the best a model can be expected to achieve
- Criteria
  - statistical values met by about two thirds of past applications
  - viewed as what majority of models have achieved
  - one third of past applications that do not meet criteria are considered poor performers

# Normalized Mean Bias for MDA8 Ozone



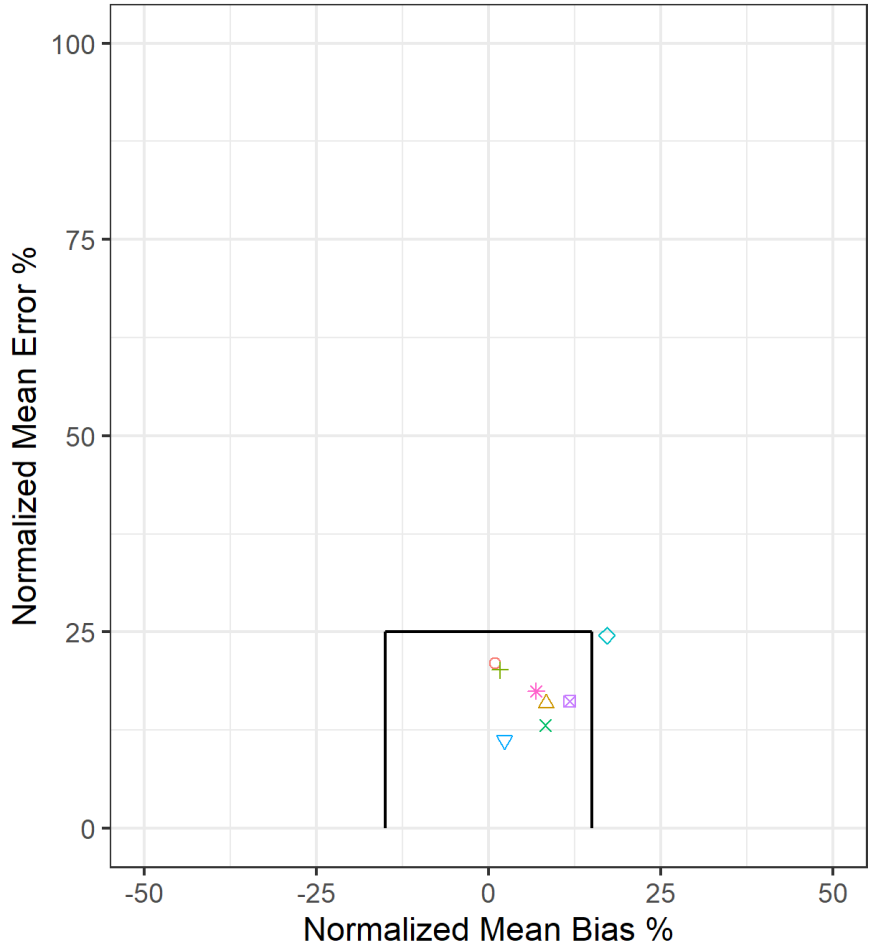


# Normalized Mean Error for MDA8 Ozone



# Soccer Plots for Aldine

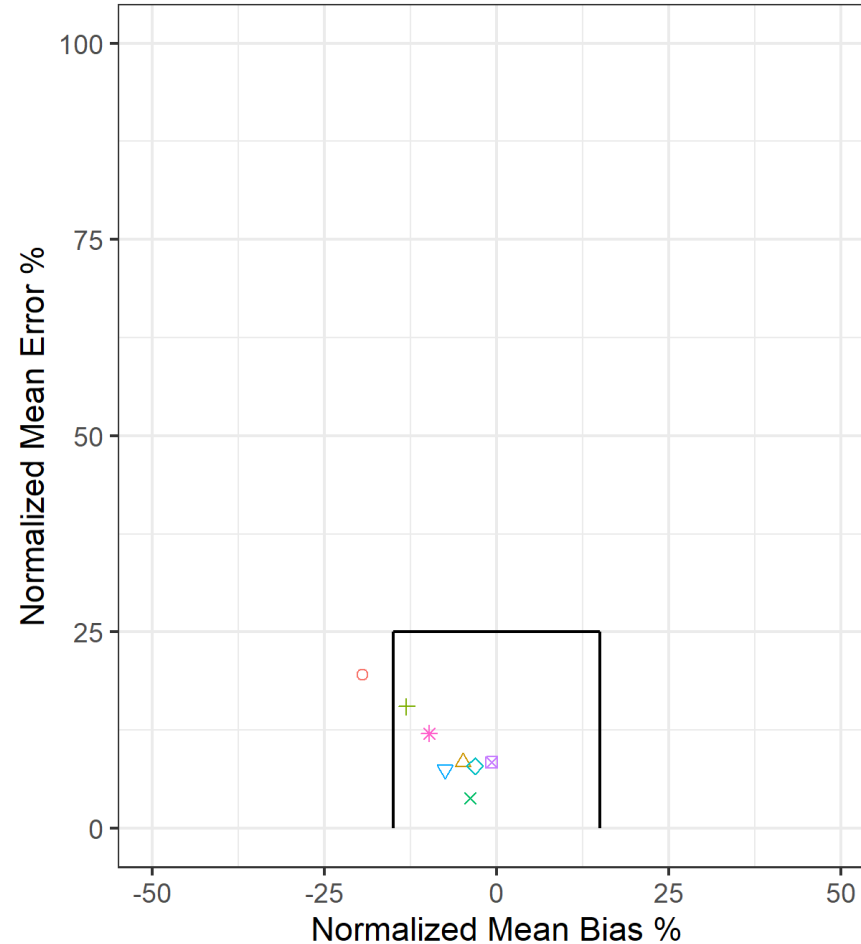
Soccer Plot: Site Daily Max 8h  
Houston Aldine C8/AF108/X150 (HALC)



Legend

- Apr
- △ May
- + Jun
- × Jul
- ◇ Aug
- ▽ Sep
- ⊠ Oct
- \* A20

Soccer Plot: Daily Max, Observed  $\geq$  60 ppb 8h  
Houston Aldine C8/AF108/X150 (HALC)

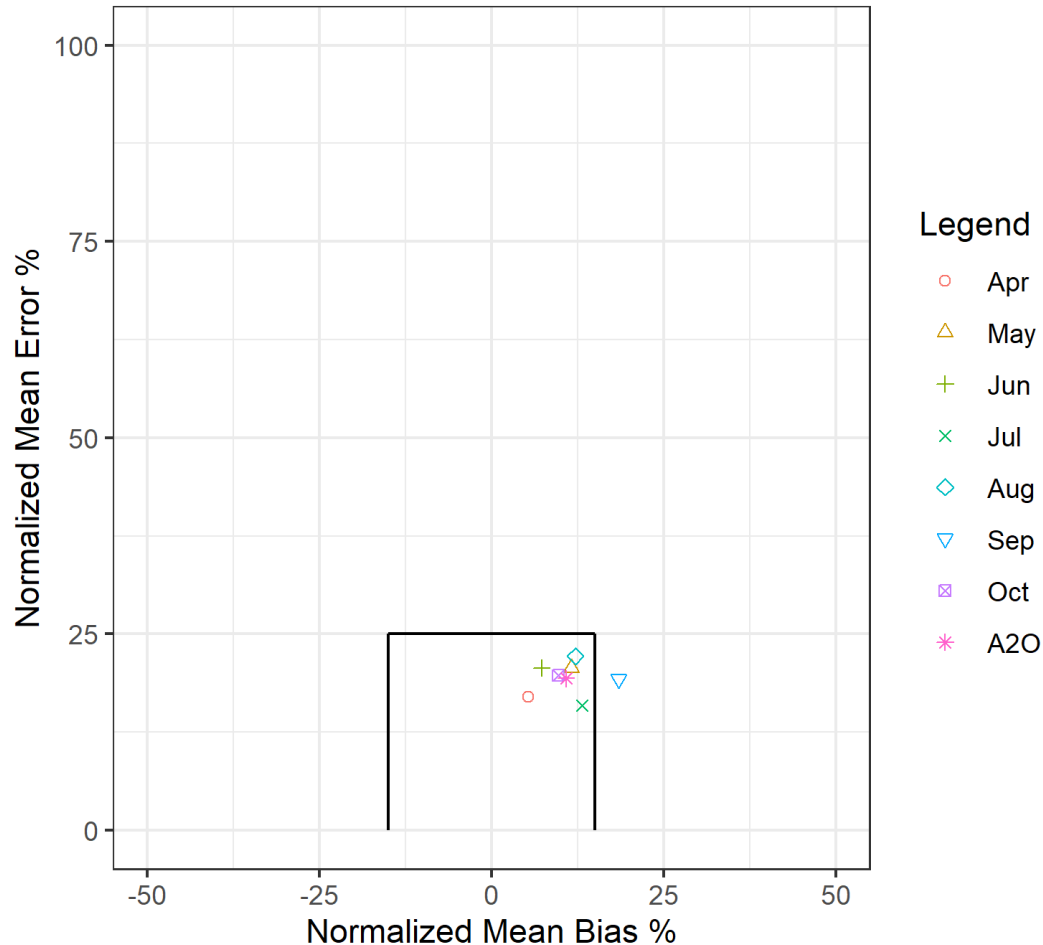


Legend

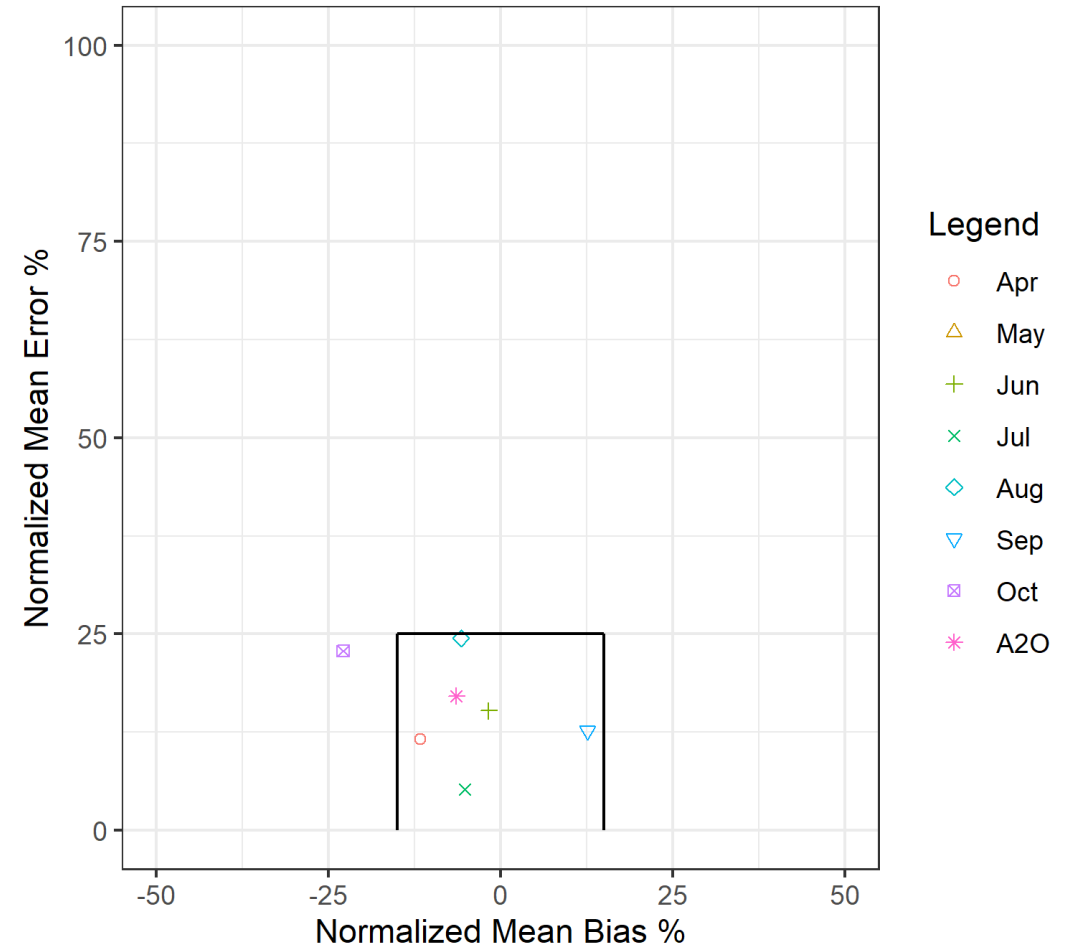
- Apr
- △ May
- + Jun
- × Jul
- ◇ Aug
- ▽ Sep
- ⊠ Oct
- \* A20

# Soccer Plots for Deer Park

Soccer Plot: Site Daily Max 8h  
Hou.DeerPrk2 C35/235/1001/AFH139FP239 (DRPK)

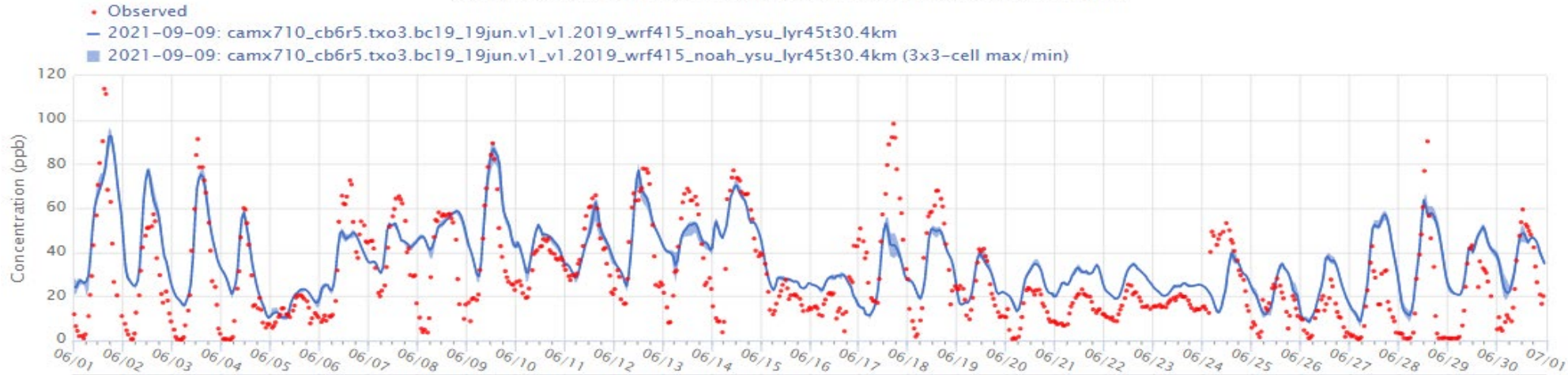


Soccer Plot: Daily Max, Observed  $\geq$  60 ppb 8h  
Hou.DeerPrk2 C35/235/1001/AFH139FP239 (DRPK)

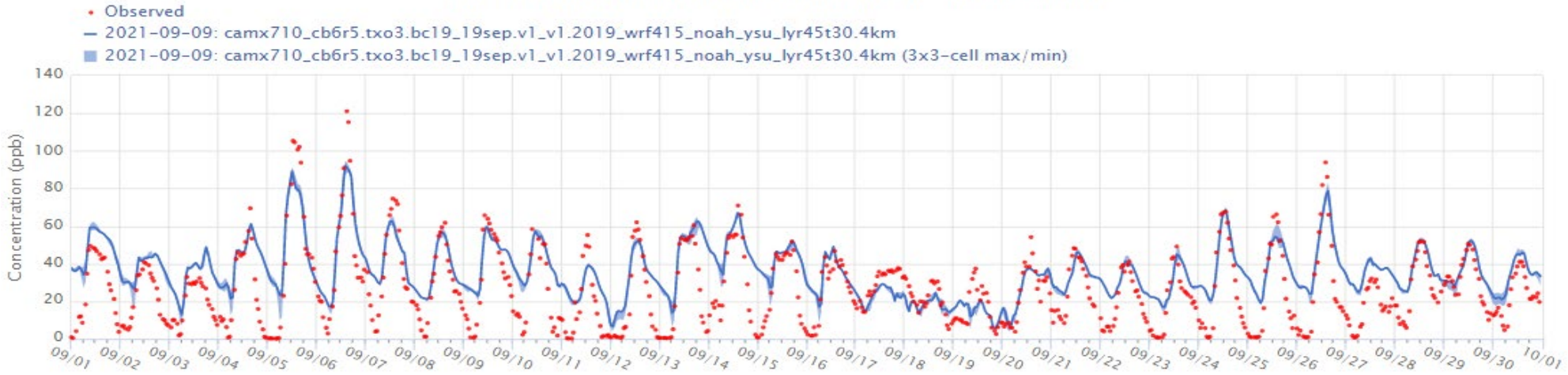


# Daily 1-hr Averaged Ozone for Aldine

O3 Hourly Concentration (2x2 bi-linear interpolated value)  
HALC, 482010024, Houston Aldine C8/AF108/X150, Houston, Harris, TX

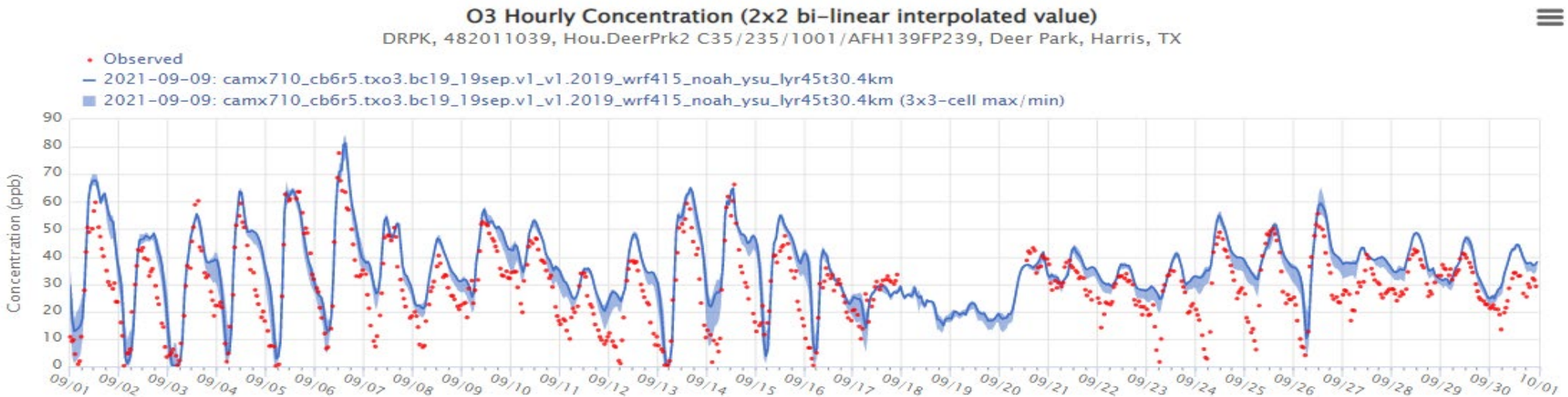
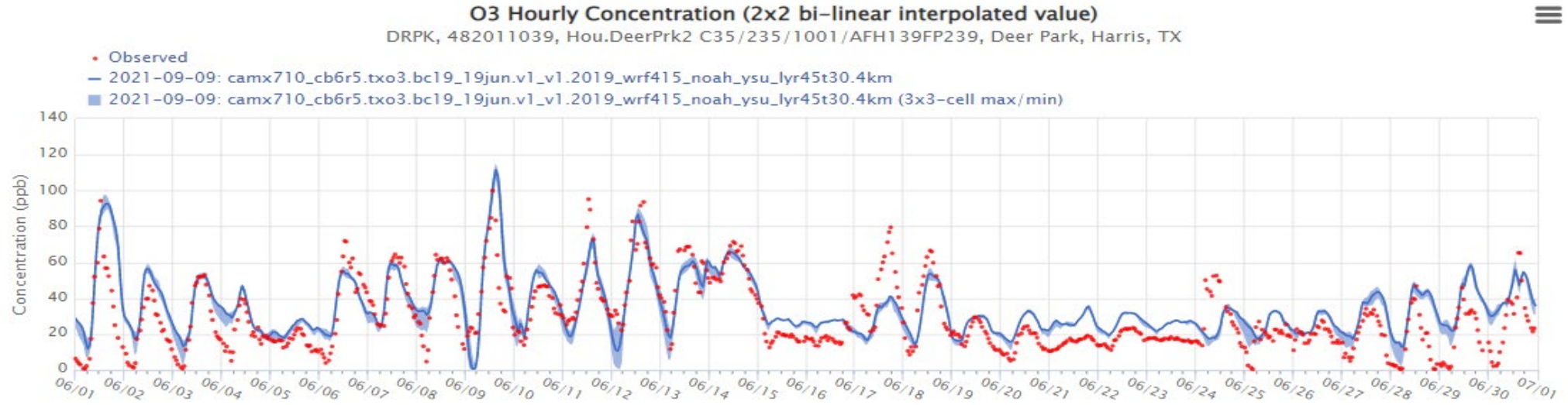


O3 Hourly Concentration (2x2 bi-linear interpolated value)  
HALC, 482010024, Houston Aldine C8/AF108/X150, Houston, Harris, TX





# Daily 1-hr Averaged Ozone for Deer Park





# CAMx Configurations Tested

- **Wesely86 (Default)**
  - Dry deposition scheme: Wesely89
  - Vertical diffusion: K-theory
- **Zhang03**
  - Dry deposition scheme: Zhang03
  - Vertical diffusion: K-theory
- **Wesely89/Acm2**
  - Dry deposition scheme: Wesely89
  - Vertical diffusion: ACM2
- **Zhang03/Acm2**
  - Dry deposition scheme: Zhang03
  - Vertical diffusion: ACM2

# MPE for CAMx Configurations

- Evaluated maximum daily 8-hr average ozone (MDA8)
- Included all HGB sites

CAMx Configuration	June		September	
	MDA8 ≥ 60 ppb		MDA8 ≥ 60 ppb	
	NMB %	NME %	NMB %	NME %
<b>Wesely89/K-theory</b>	-8.80	15.33	-0.06	7.14
<b>Zhang03/K-theory</b>	-4.29	14.83	3.18	7.64
<b>Wesely89/acm2</b>	-7.09	15.23	0.01	7.03
<b>Zhang03/acm2</b>	-2.42	15.30	3.35	7.64

# Model Attainment Test

- How to calculate Future Design Value (DV)?

$$\text{Future DV} = \text{DVB} * \text{RRF}$$

Base Design Value  
Anchor point for future DV

Relative Response Factor

RRF =

$$\frac{\text{Future Year Modeled Ozone Values}}{\text{Base Year Modeled Ozone Values}}$$

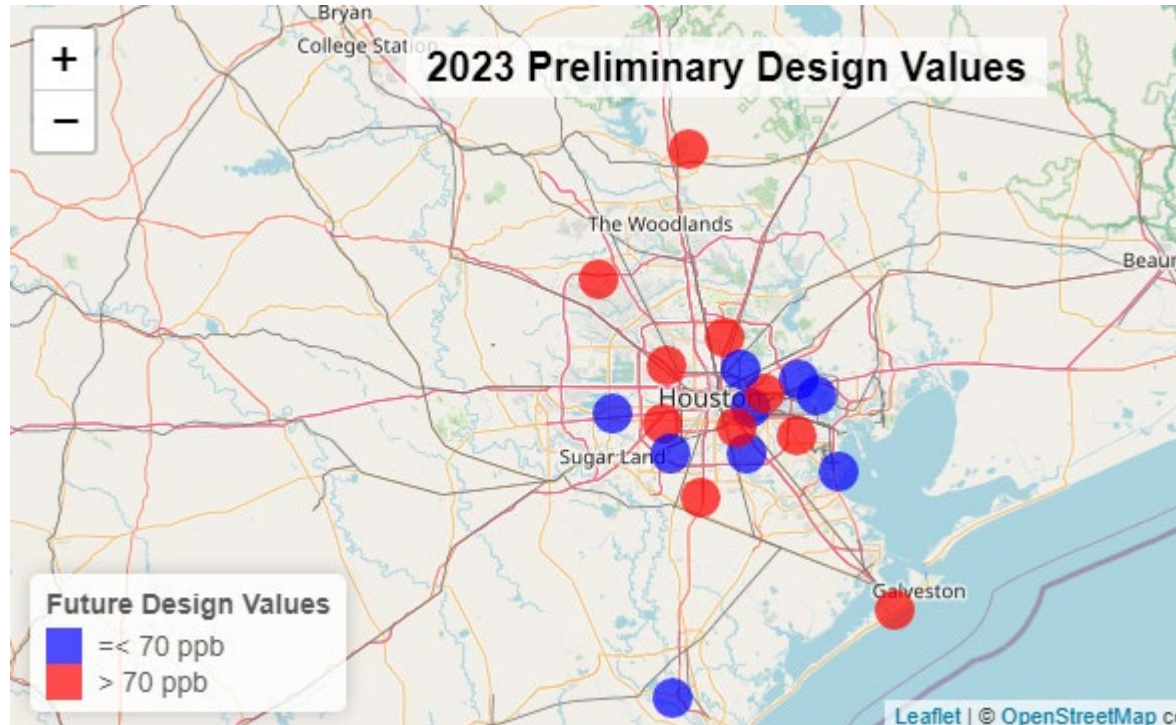
2019 DVB	2017	2018	2019	2020	2021
2019 DV					
2020 DV					
2021 DV					

# Preliminary Future Data Calculation

- Based on 10 days of highest modeled 2019 MDA8 > 60 ppb
- Based on 3 by 3 cell maximum values

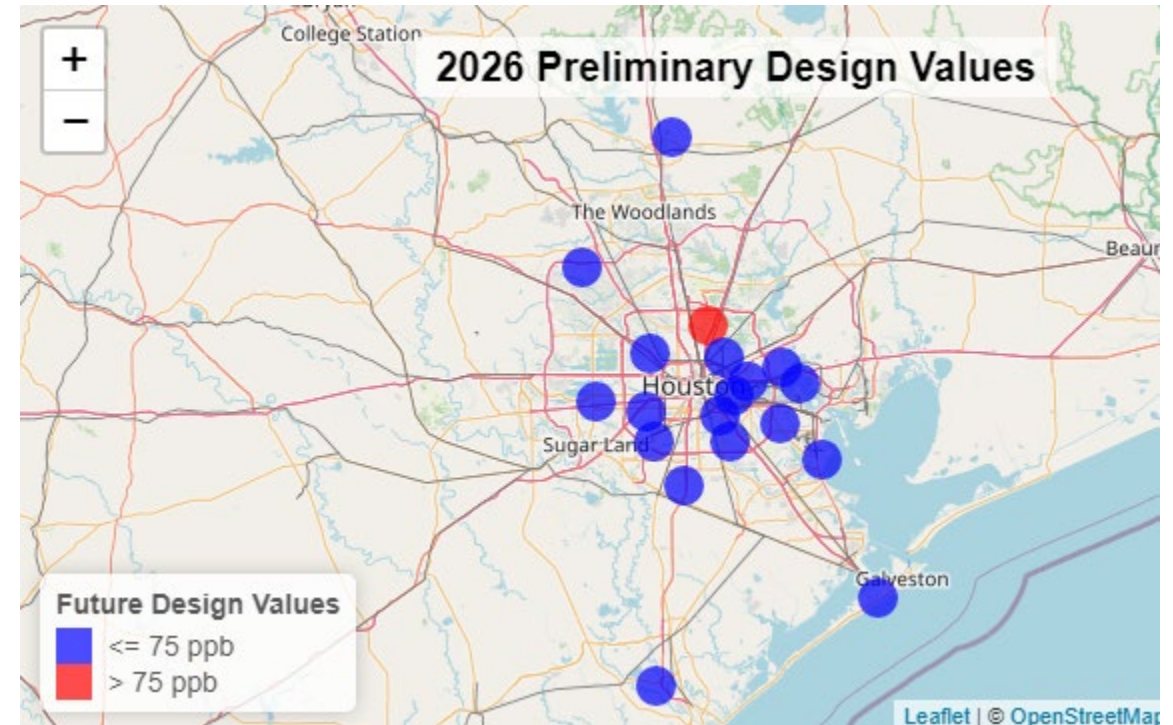
Site	BAYP	CLTN	CNR2	DRPK	GALV	HALC	HCHV	HCQA	HLAA	HNWA	HOEA	HSMA	HWAA	LKJK	LYNF	MACP	PRKP	SBFP	SHWH
2019 DVb	76.67	71.00	74.33	75.67	74.00	78.00	68.00	71.33	72.00	72.67	72.67	66.67	65.00	65.00	64.33	74.33	73.00	67.67	70.00
2023 RRF	0.977	0.995	0.996	<b>1.001</b>	0.992	0.991	0.996	0.983	0.986	0.992	0.997	0.991	0.993	0.993	<b>1.000</b>	0.984	0.995	<b>1.003</b>	0.979
2023 DVf	74	70	74	75	73	77	67	70	71	72	72	66	64	64	64	73	72	67	68
2026 RRF	0.954	0.983	0.980	0.989	0.977	0.976	0.984	0.964	0.969	0.974	0.986	0.980	0.979	0.976	0.989	0.968	0.984	0.992	0.953
2026 DVf	73	69	72	74	72	76	66	68	69	70	71	65	63	63	63	72	71	67	66

# Preliminary Future Ozone Design Values



10 monitors with **2023** DV above standard

- BAYP
- HALC
- MACP
- CNR2
- HLAA
- PRKP
- DRPK
- HNWA
- GALV
- HOEA



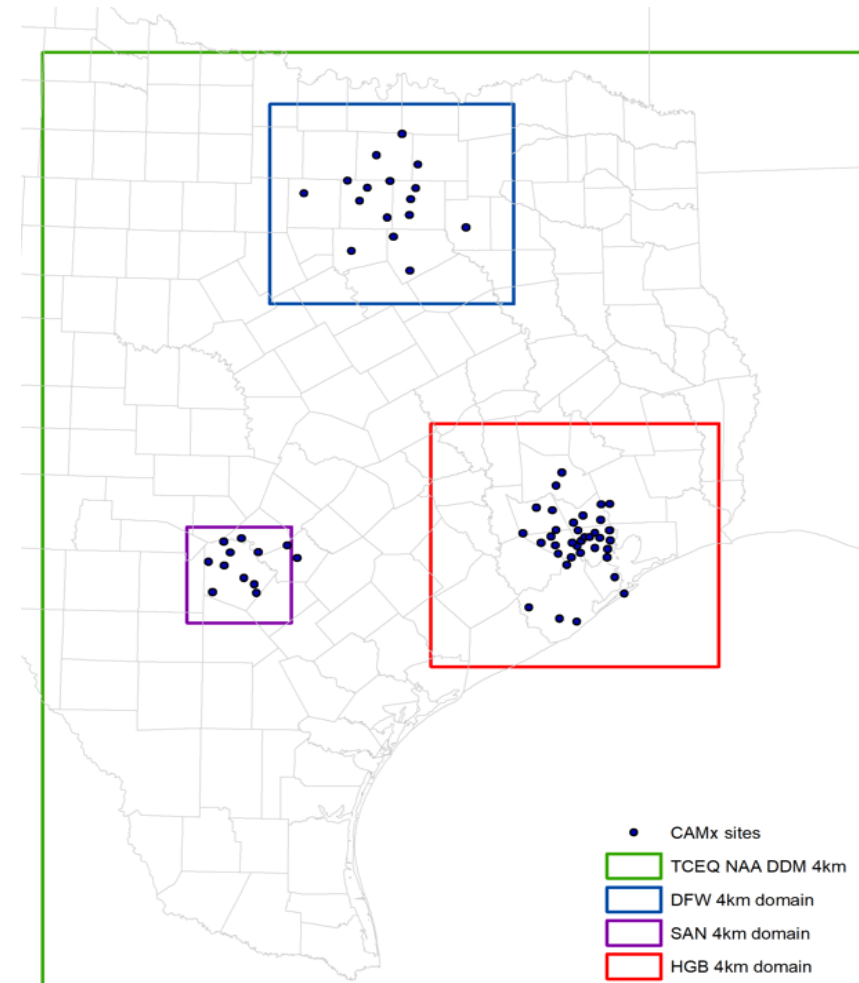
1 monitor with **2026** DV above standard

- HALC - C08 - Houston Aldine

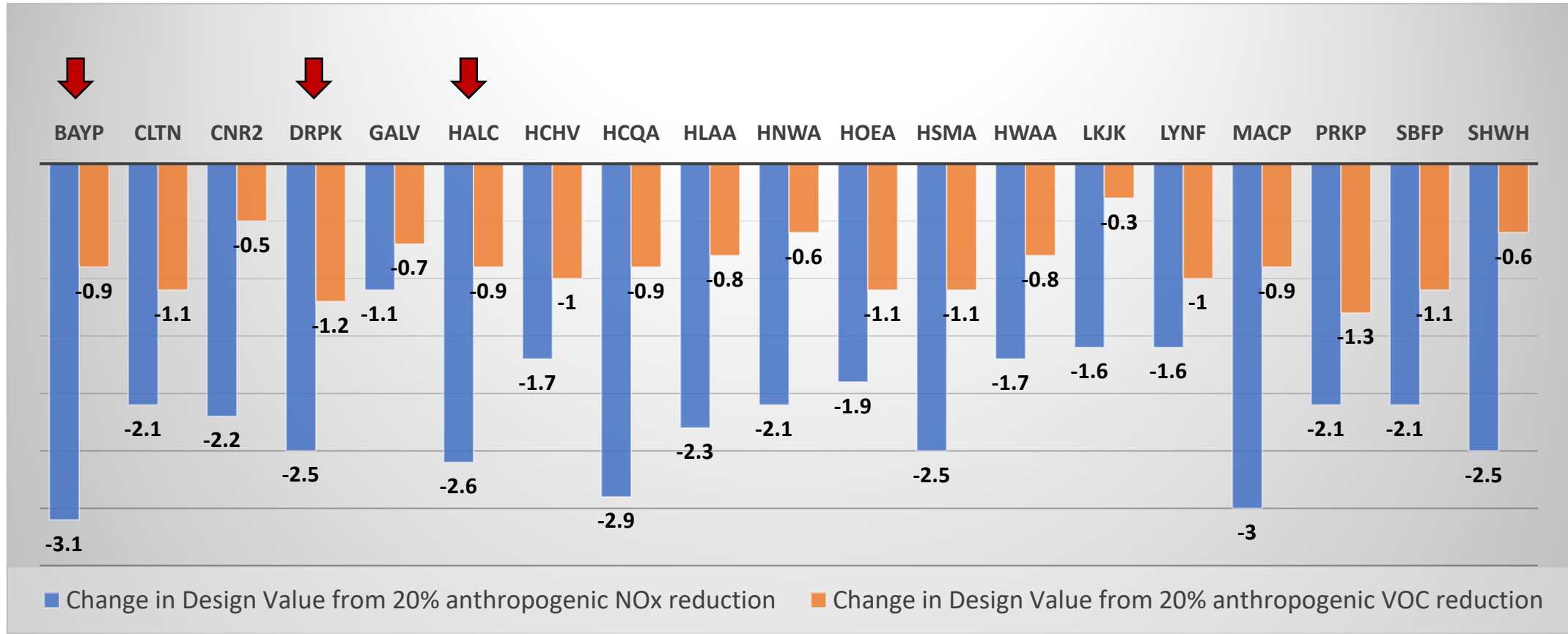


# Ozone Sensitivities – Set up

- Modeling for 2019 base case
- Three subdomains covering ozone nonattainment areas
- 20% reductions in anthropogenic NO<sub>x</sub> and VOC emissions in each subdomain



# Change in Ozone DVb in HGB (ppb)



- NO<sub>x</sub> reductions more impactful than VOC

# On-line Modeling Resources

- Air Quality Modeling information
  - Air Quality Technical Information Meetings
  - Air Quality Research

<https://www.tceq.texas.gov/airquality/airmod/am>

- Preliminary 2019 Modeling Platform Files


FTP Host: amdaftp.tceq.texas.gov

FTP Username: anonymous

FTP Password : user's email address

FTP directory : /TX\_O3/camx

# Questions?

-  **air modeling data analysis**  
Contact: [amda@tceq.texas.gov](mailto:amda@tceq.texas.gov)
- HGB Modeling Project Managers  
[beata.czader@tceq.texas.gov](mailto:beata.czader@tceq.texas.gov)  
[sushil.gautam@tceq.texas.gov](mailto:sushil.gautam@tceq.texas.gov)