2019 Modeling Platform Updates

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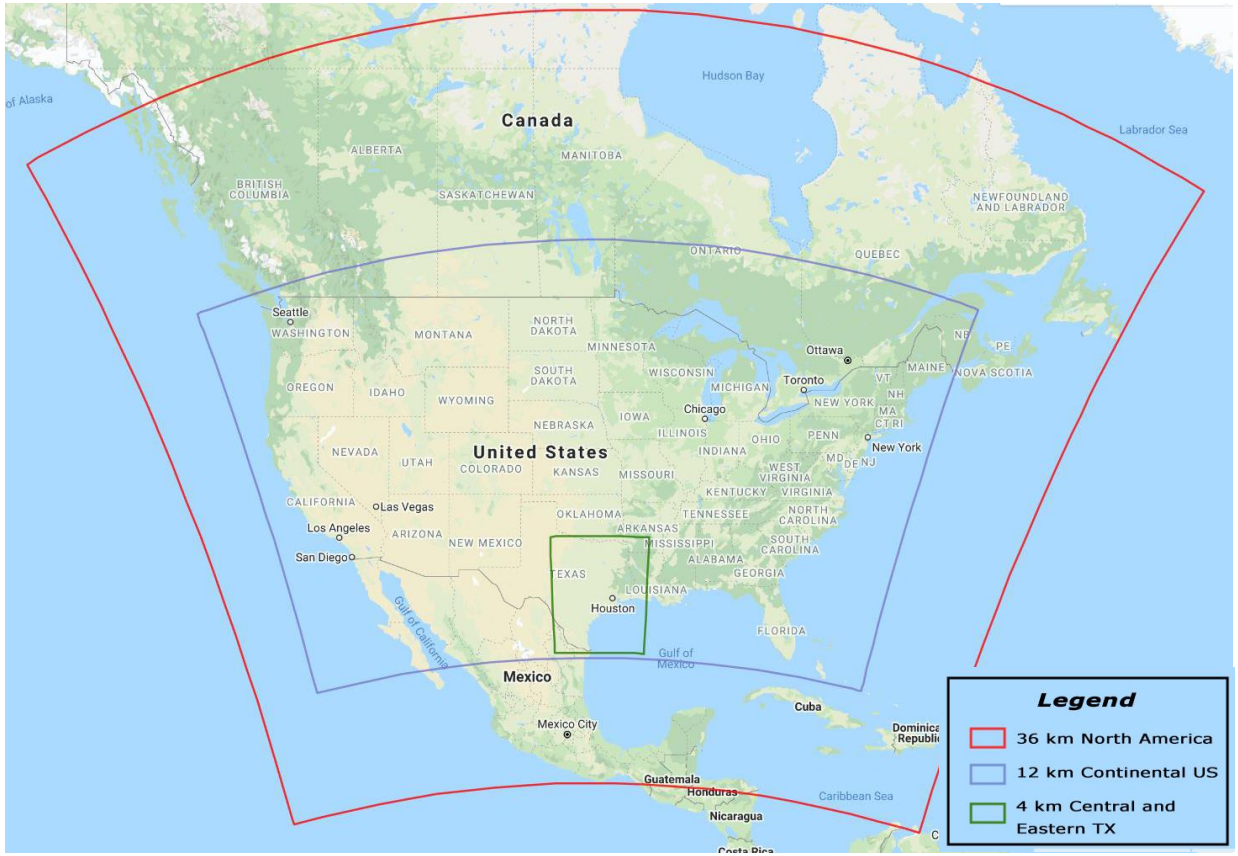
Presented at the DFW Air Quality Technical Information Meeting on August 24, 2022

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	TX NAA: MOVES3 - link based; 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	TX NAA: TTI 2020 data; Other: EPA 2016 platform
	Off-road Locomotives	TX NAA: TTI 2019 data, Other: EPA 2016 platform
Area	Area TX	2020 Air Emissions Reporting Requirements (AERR)
	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 EIs	2019 Community Emission Data System (CEDS); SMOKEv4.7_CEDS

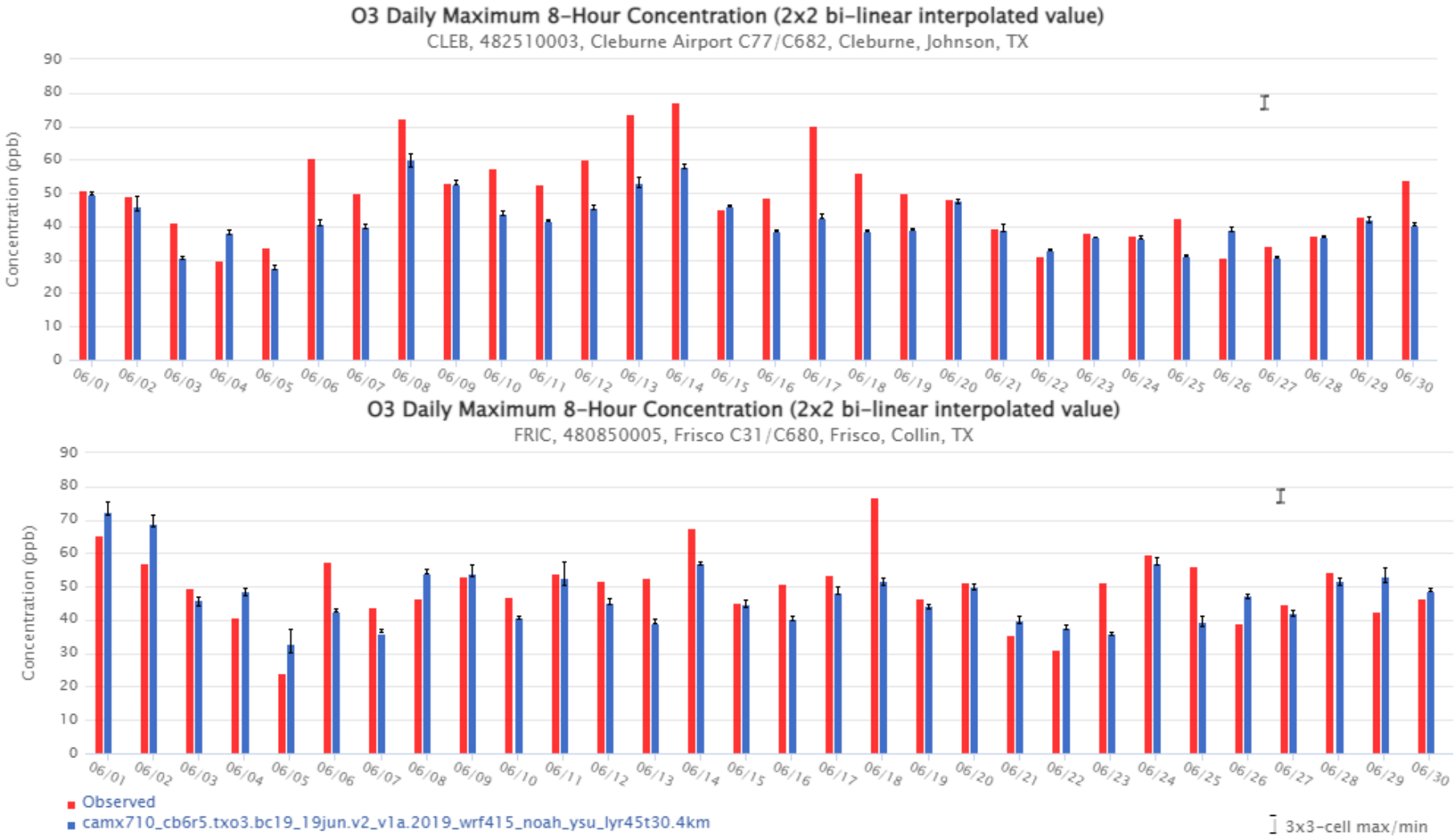
High Ozone Days in June

2019 ozone exceedance days in DFW at regulatory monitors:

- June 8, 13, 14, 17, 18

Highest Regulatory Monitors

- CLEB: Cleburne Airport C77
- FRIC: Frisco C31



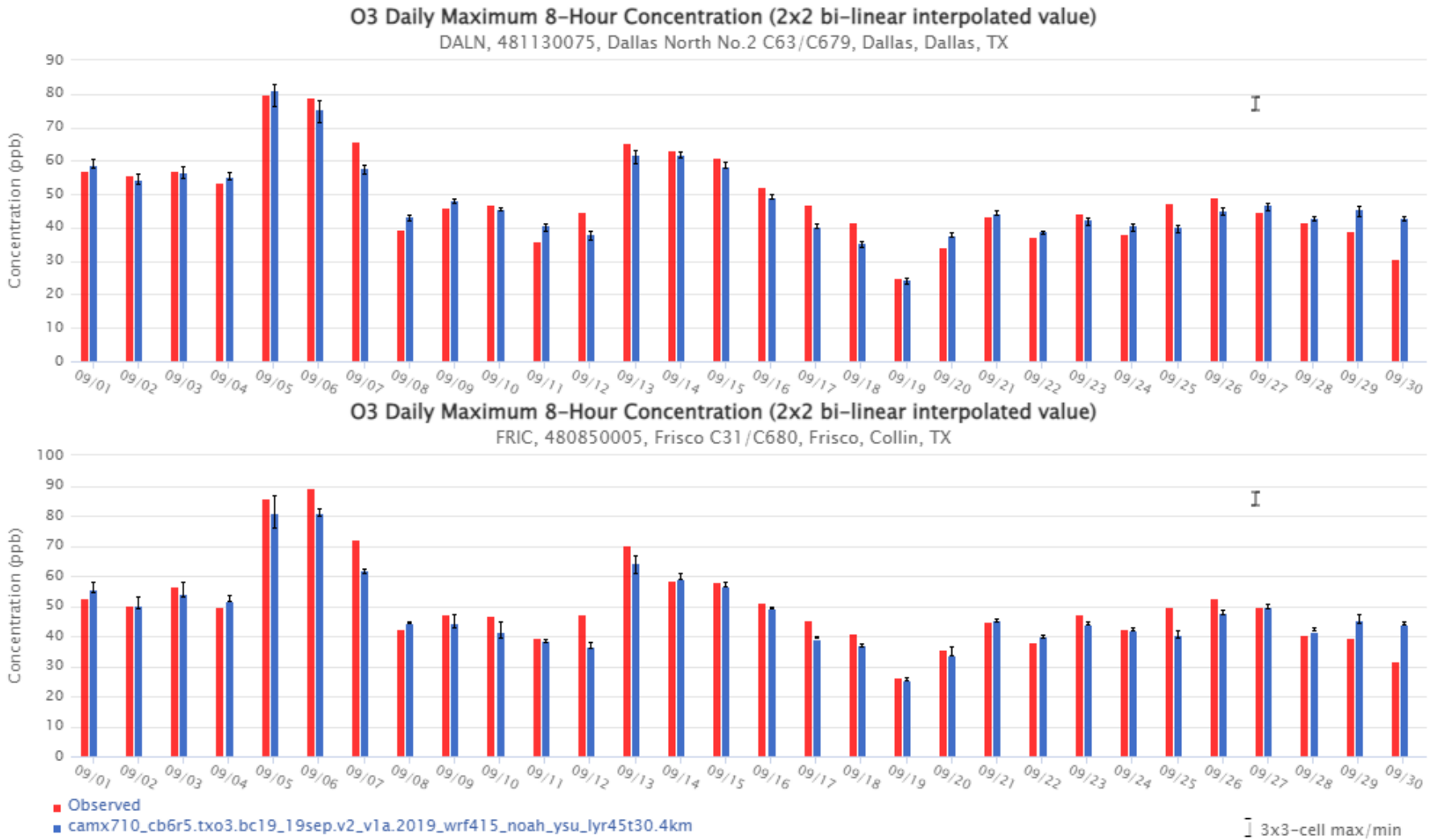
High Ozone Days in September

2019 ozone exceedance days in DFW at regulatory monitors:

- Sept. 3-7, 13-16

Highest Regulatory Monitors:

- DALN: Dallas North No. 2 C63
- FRIC: Frisco C31



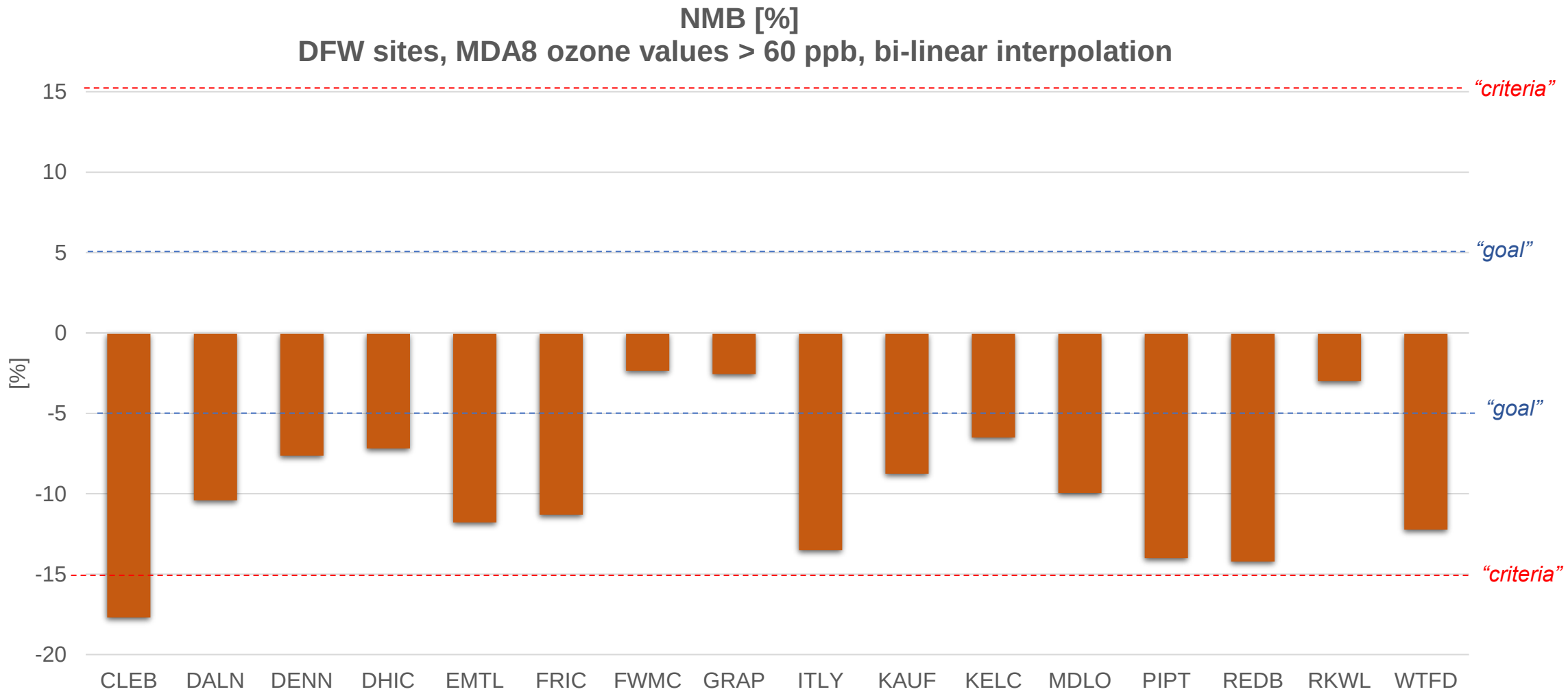
Statistic Benchmarks for Model Performance Evaluation (MPE)

Recommended by Emery et al. (2017)

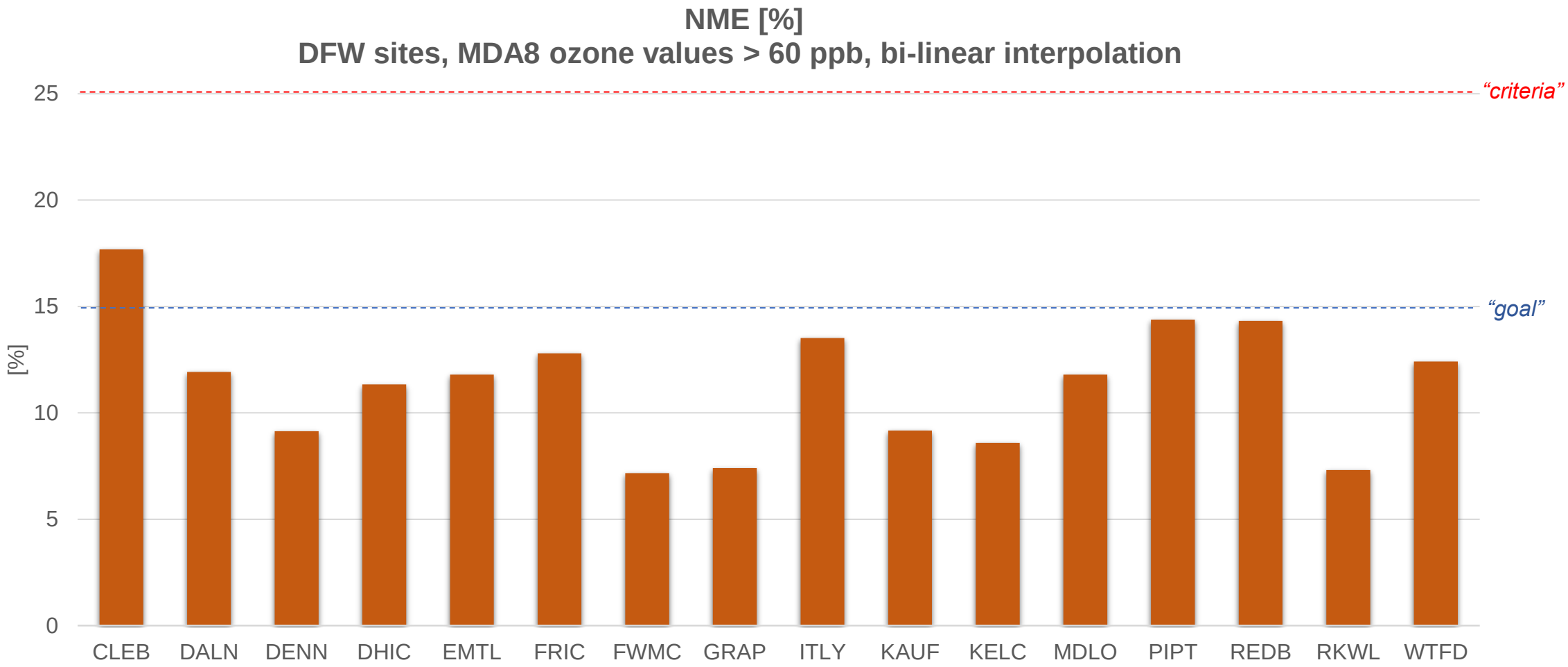
	NMB	NME
Goal	< ± 5%	< 15%
Criteria	< ± 15%	< 25%

- 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

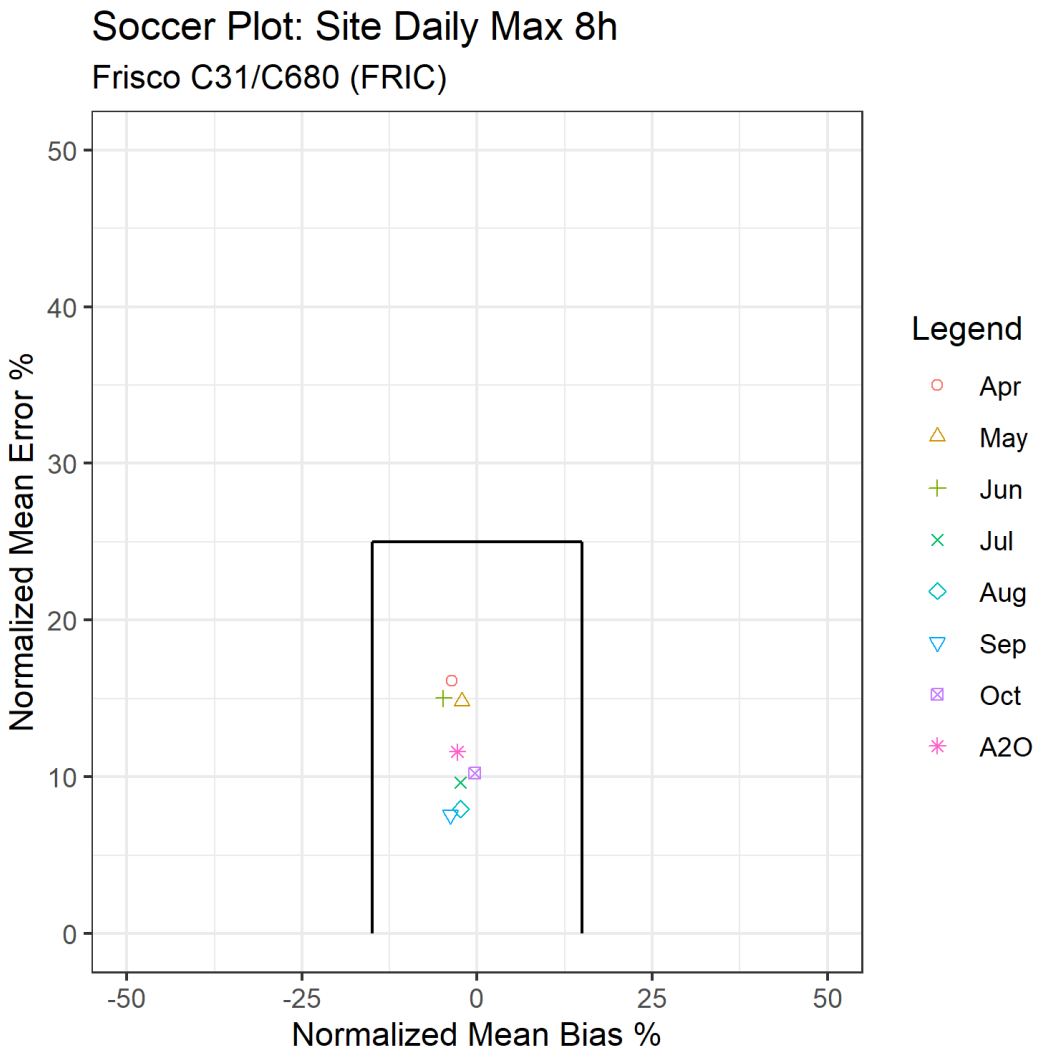
Normalized Mean Bias for MDA8 Ozone

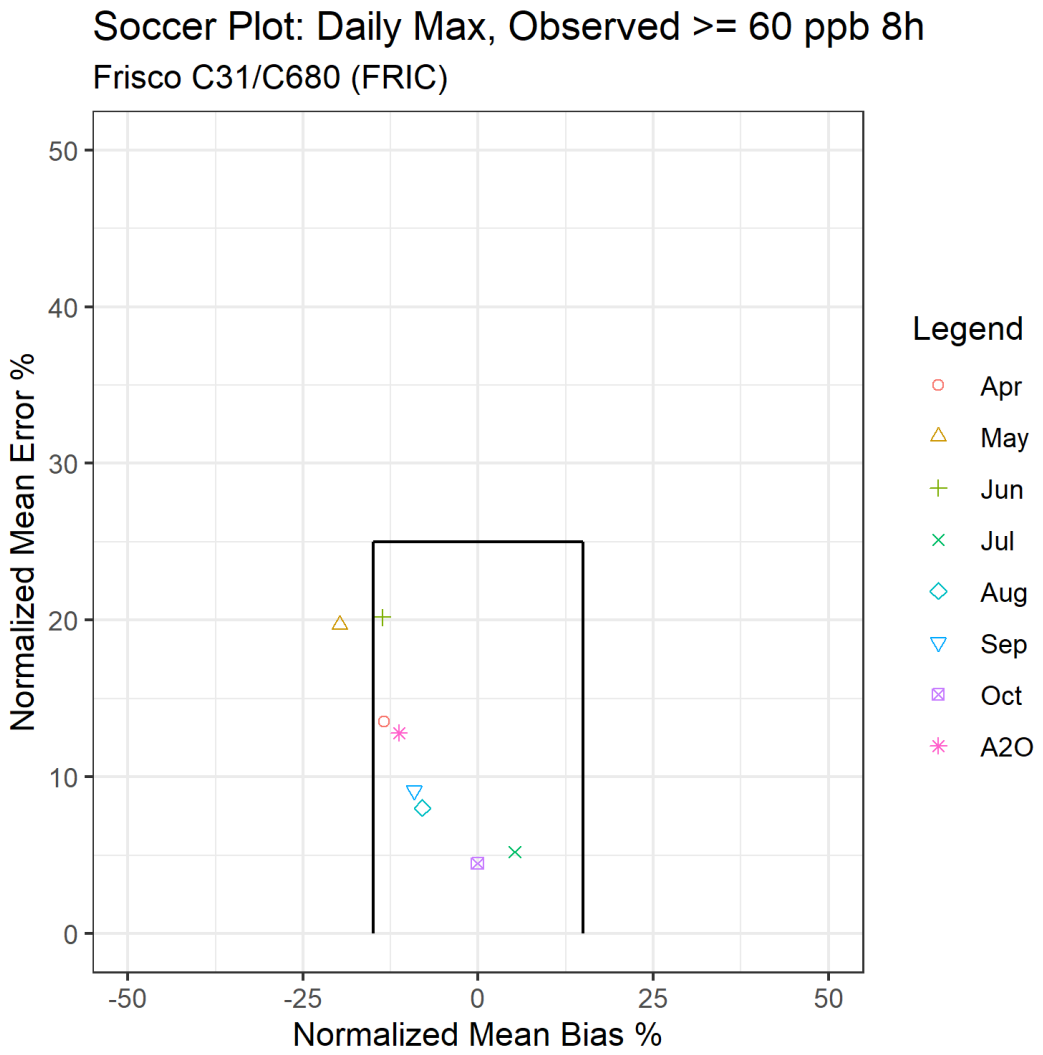


Normalized Mean Error for MDA8 Ozone

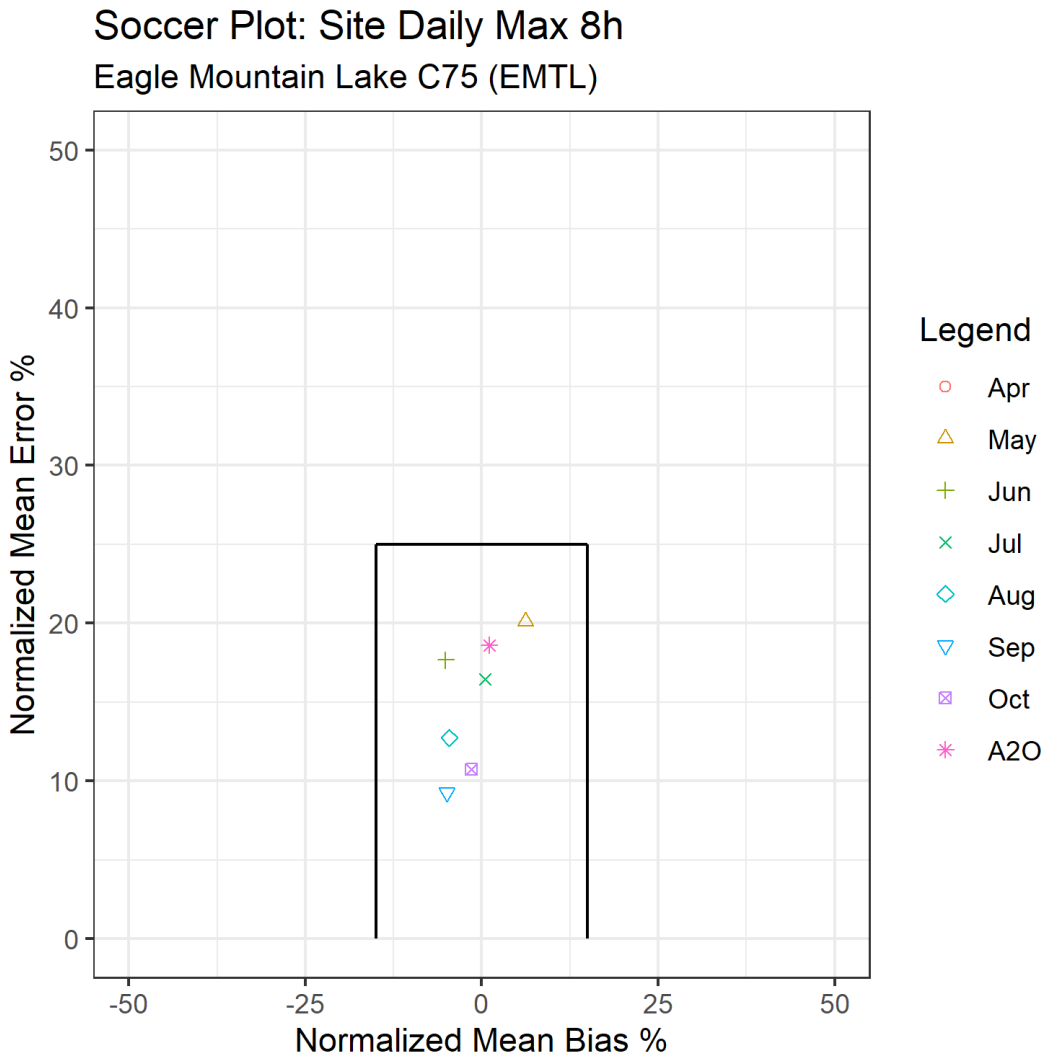


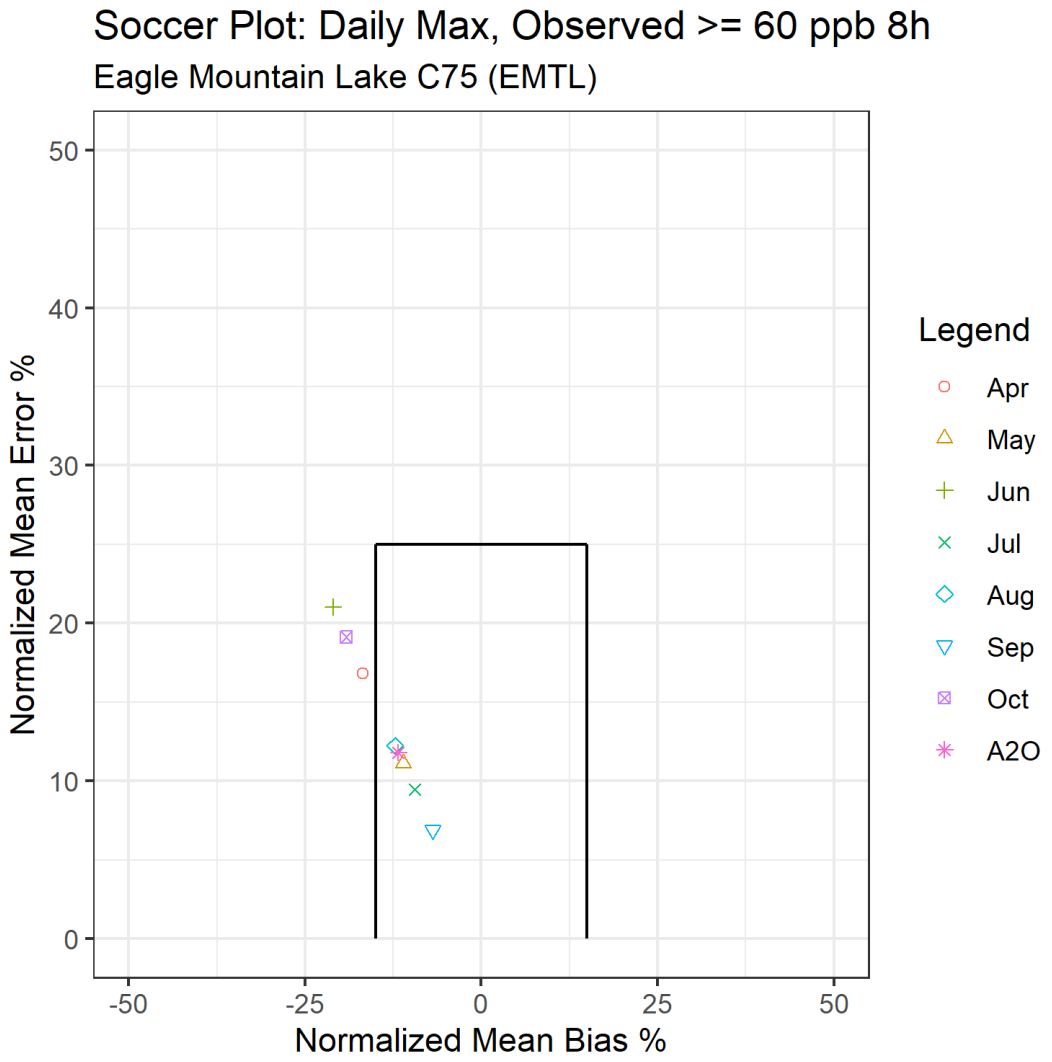
Soccer Plots for Frisco



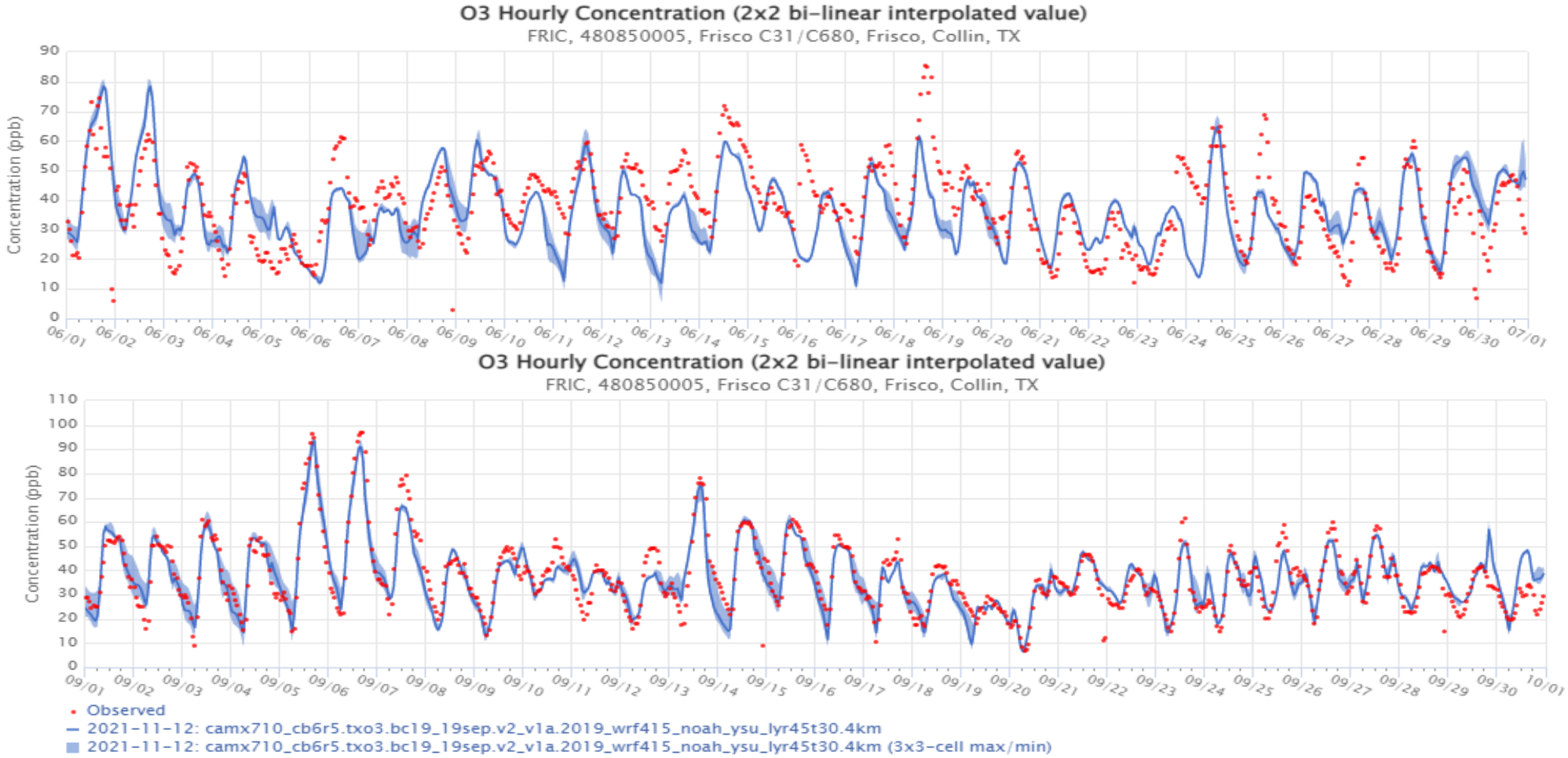


Soccer Plots for Eagle Mountain Lake

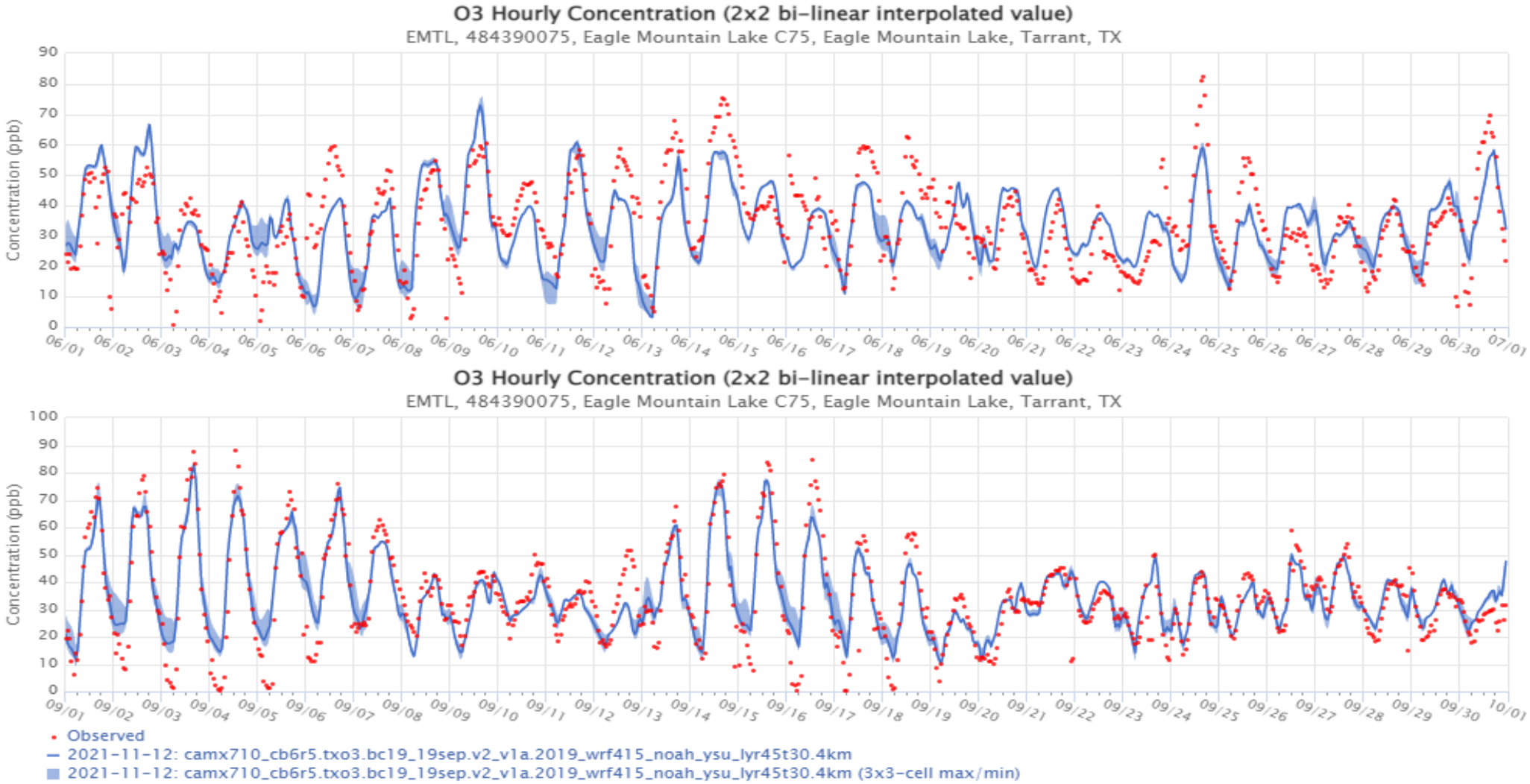




Daily 1-hr Averaged Ozone for FRIC



Daily 1-hr Averaged Ozone for EMTL



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)
- Statistics are for all DFW sites and MDA8 values ≥ 60 ppb

CAMx Configuration	June NMB %	June NME %	September NMB %	September NME %
Wesely89/K-theory	-16.7	18.0	-4.0	6.6
Zhang03/K-theory	-11.8	14.2	1.6	6.5
Wesely89/acm2	-15.7	17.3	-2.8	6.5
Zhang03/acm2	-10.6	13.4	3.0	7.0

Model Attainment Test

How to calculate Future Design Value (DVf)?

Future DV = DVb * RRF

Base Design Value
Anchor point for future DV

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

Relative Response Factor

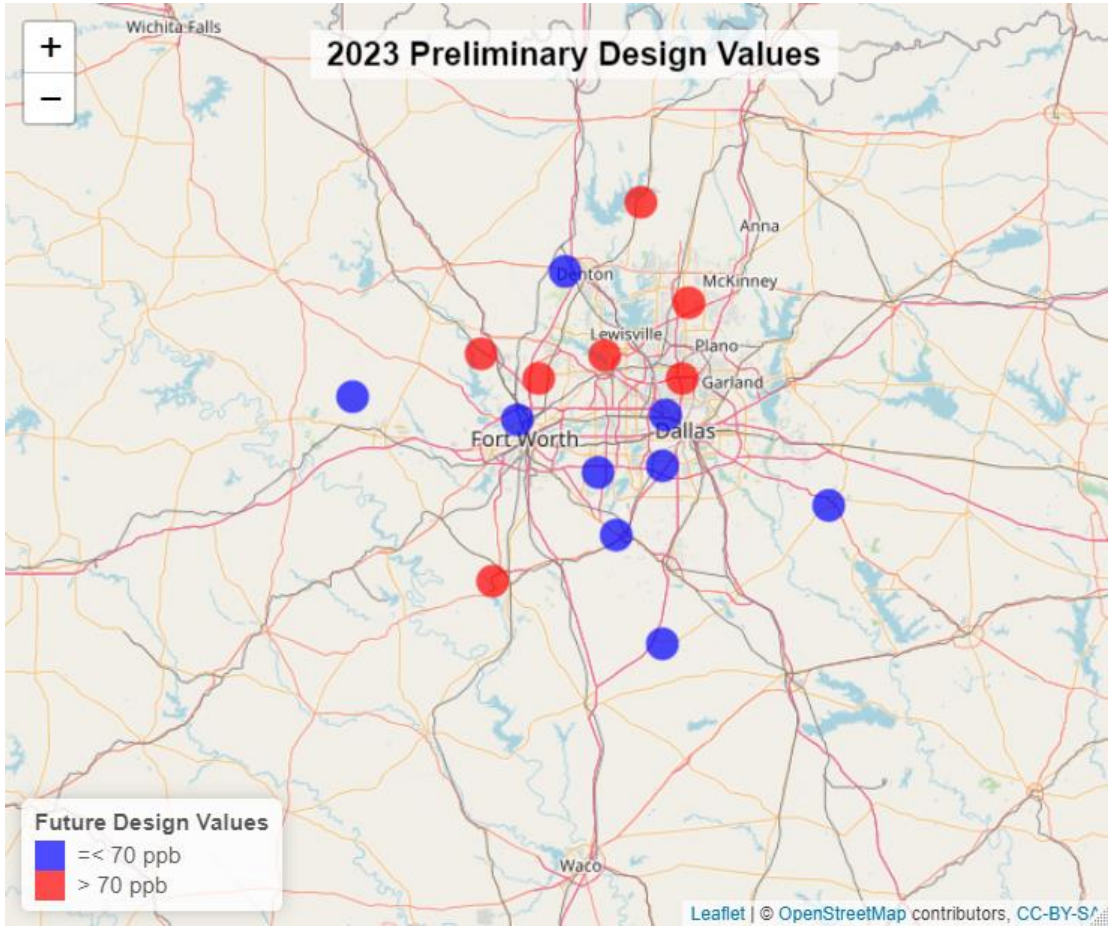
$$RRF = \frac{\text{Future Year Modeled Ozone Values}}{\text{Base Year Modeled Ozone Values}}$$

Preliminary Future Data Calculation

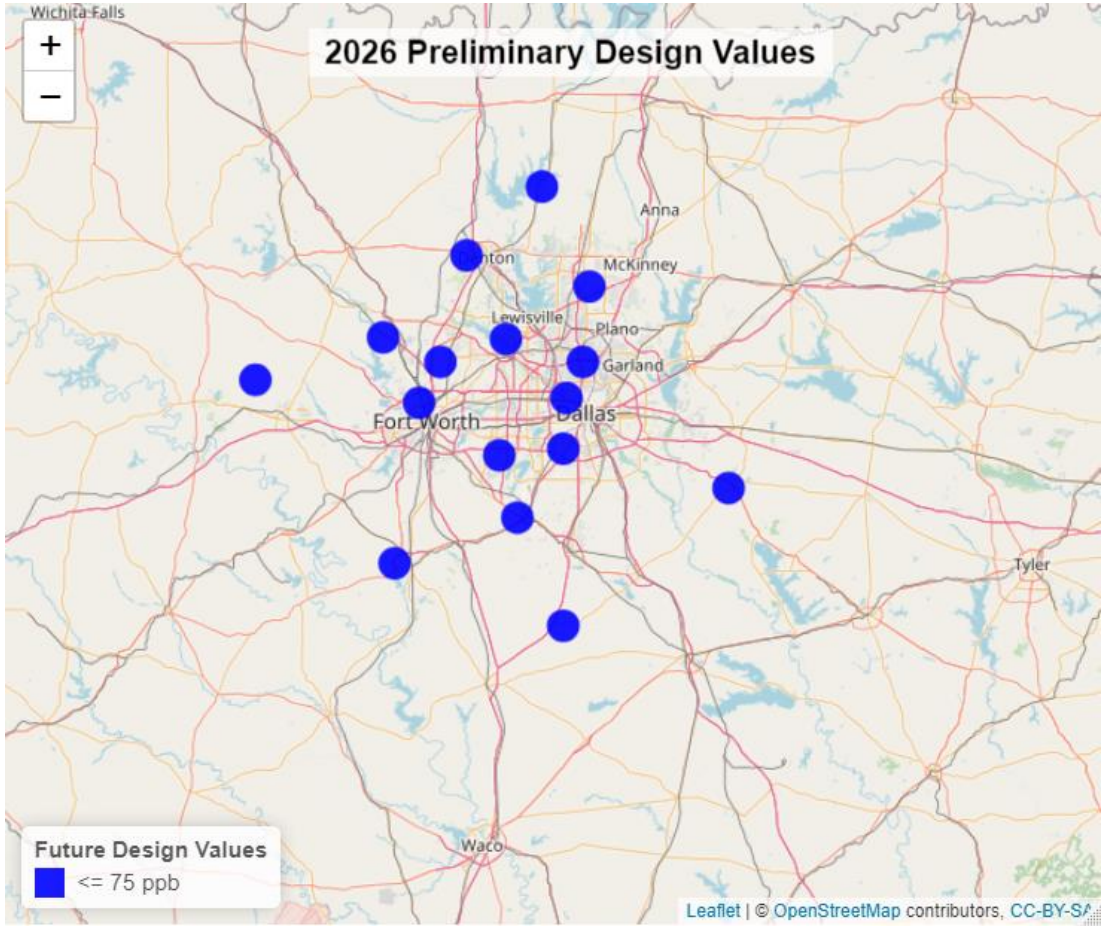
- Based on 10 days of highest modeled 2019 MDA8 > 60 ppb
- Based on 3 by 3 cell maximum values

Site	ARLA	CLEB	DALN	DENN	DHIC	EMTL	FRIC	FWMC	GRAP	ITLY	KAUF	KELC	MDLO	PIPT	REDB	WTFD
2019 DVb	68.50	73.33	74.00	73.00	69.67	74.33	75.33	72.00	75.00	63.00	63.33	73.00	64.00	73.00	68.33	68.67
2023 RRF	0.991	0.987	0.980	0.970	0.985	0.981	0.977	0.983	0.974	**1.014**	**1.010**	0.979	0.997	0.985	0.993	0.987
2023 DVf	67	72	72	70	68	72	73	70	73	63	64	71	63	71	67	67
2026 RRF	0.975	0.970	0.959	0.947	0.966	0.962	0.956	0.964	0.953	**1.001**	0.997	0.960	0.982	0.966	0.976	0.969
2026 DVf	66	71	70	69	67	71	72	69	71	63	63	70	62	70	66	66

Preliminary Future Ozone Design Values



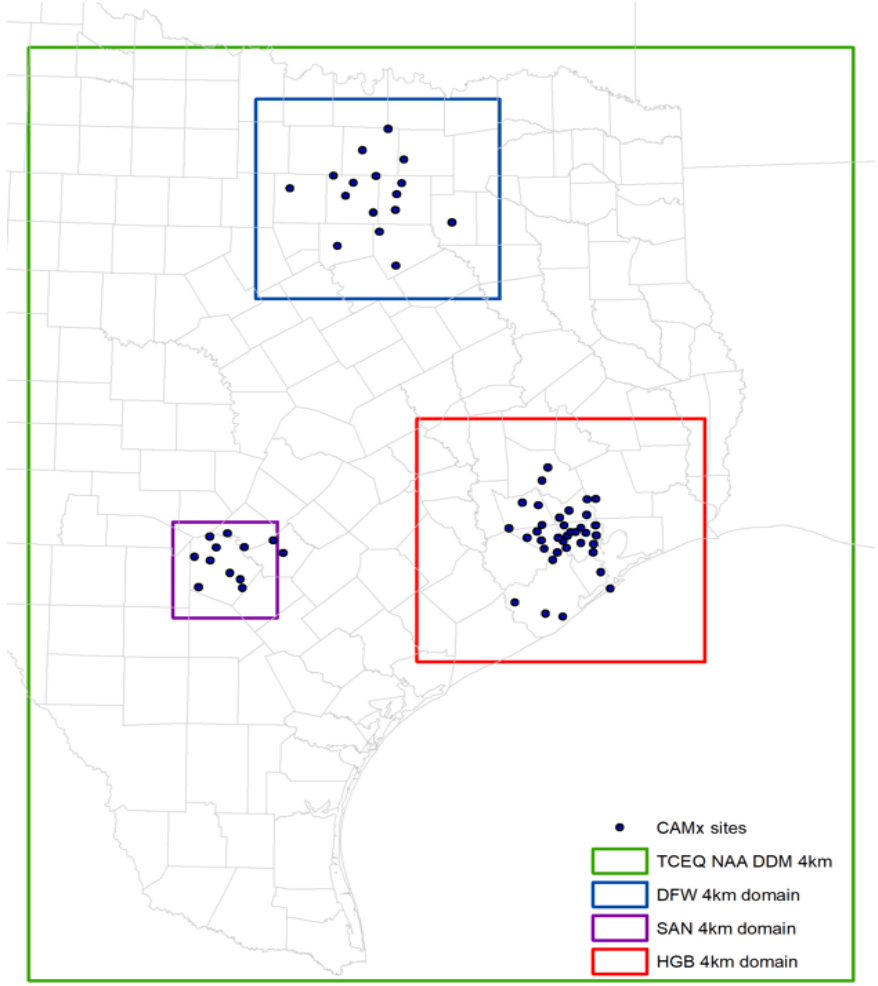
7 monitors with **2023** DV above 70 ppb standard



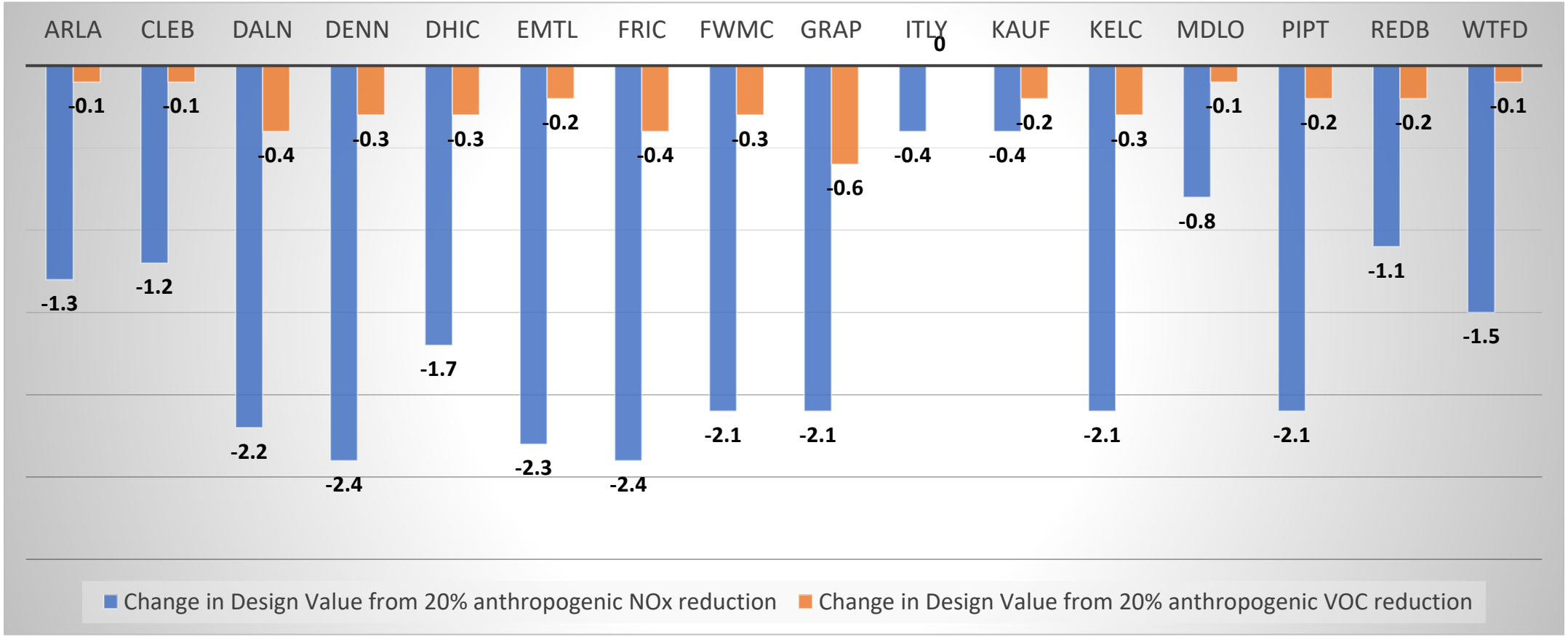
No monitor with **2026** DV above 75 ppb standard

Ozone Sensitivities – Set up

- Modeling for 2019 base case
- Three subdomains covering ozone nonattainment areas
- 20% reductions in anthropogenic NO_x and VOC emissions in each subdomain



Change in Ozone DVb in DFW (ppb)



NO_x reductions more impactful than VOC at all monitors.

Online 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

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