



# **Ozone Modeling Platform Development: Choosing a Modeling Episode**

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Cara Scalpone  
Air Quality Modeler  
Air Quality Division

Houston-Galveston-Brazoria Air Quality Technical Information Meeting  
June 23, 2021



# Topics

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- What is a modeling platform?
- Why is the TCEQ developing a new platform?
- What are the criteria for choosing a modeling episode?
- How was the new episode selected?
- What is the chosen episode for the new platform?



# What is a modeling platform?

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- The TCEQ uses photochemical modeling to estimate ozone concentrations for certain regulatory applications.
- A modeling platform is the foundation of all modeling applications, consisting of the various components that are used together to estimate ozone concentrations.
- The Environmental Protection Agency's Modeling Guidance (EPA Modeling Guidance)<sup>1</sup> provides a blueprint for the development of modeling platforms.

<sup>1</sup> "Modeling Guidance for Demonstrating Air Quality Goals for Ozone, PM2.5, and Regional Haze", available at [https://www.epa.gov/sites/production/files/2020-10/documents/o3-pm-rh-modeling\\_guidance-2018.pdf](https://www.epa.gov/sites/production/files/2020-10/documents/o3-pm-rh-modeling_guidance-2018.pdf)



# What are the components of a modeling platform?

## Domains

The **geographical bounds** of the area to be modeled.

## Episode

A **time period in the recent past** with observed high ozone concentrations. The calendar year the episode is from is referred to as the **base year**.

## Inputs

Modeling inputs including **meteorology, emissions inventories,** and **initial and boundary conditions.**

## Testing

Testing of **modeling software** to select appropriate versions, run options, determine run times, and estimate storage needs.

## MPE

**Model performance evaluation (MPE)** to compare modeled ozone concentration to monitored observations for the episode.

## Documentation

Details of the development of the modeling platform are documented in a **Technical Support Document (TSD).**



# Why is the TCEQ developing a new modeling platform?

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- Potential future applications of the ozone modeling platform include:
  - Modeling for attainment demonstration (AD) State Implementation Plan (SIP) revisions for ozone nonattainment areas with moderate and higher classifications, and
  - Scenario analyses to help with policy decisions.
- The last TCEQ ozone modeling platform used a 2012 base year, which is over 10 years prior to potential AD SIP revision future years.
- The most recent EPA platform is 2016, which is not an appropriate year to model ozone in Texas.



# How is a modeling episode selected?

- EPA Modeling Guidance recommends choosing a time period that:
  - Has a sufficient number of exceedance days;
  - Follows historically observed temporal patterns;
  - Includes a variety of meteorological conditions that frequently correspond to high ozone;
  - Has at least five days in the episode for each regulatory monitor in each nonattainment area with a monitored maximum daily average eight-hour (MDA8) value greater than or equal to 60 ppb;
  - Is in the recent past, preferably close to a National Emissions Inventory (NEI) year.
- Timelines, resources, and data availability must also be considered.



# Why is 2016 not appropriate for ozone modeling in Texas?

- There weren't sufficient exceedance days.

## Number of exceedance days (counted at each regulatory monitor)

Area	2015 Eight-Hour Ozone NAAQS in the 2012 Episode (May - September)	2015 Eight-Hour Ozone NAAQS in the 2016 Episode (April - October)	2008 Eight-Hour Ozone NAAQS in the 2012 Episode (May - September)	2008 Eight-Hour Ozone NAAQS in the 2016 Episode (April - October)
Dallas-Forth Worth (DFW)		43	145	21
Houston-Galveston-Brazoria (HGB)		44	88	19
San Antonio (SAN)	26	7		
El Paso (ELP)		10		
Beaumont-Port Arthur (BPA)		3		

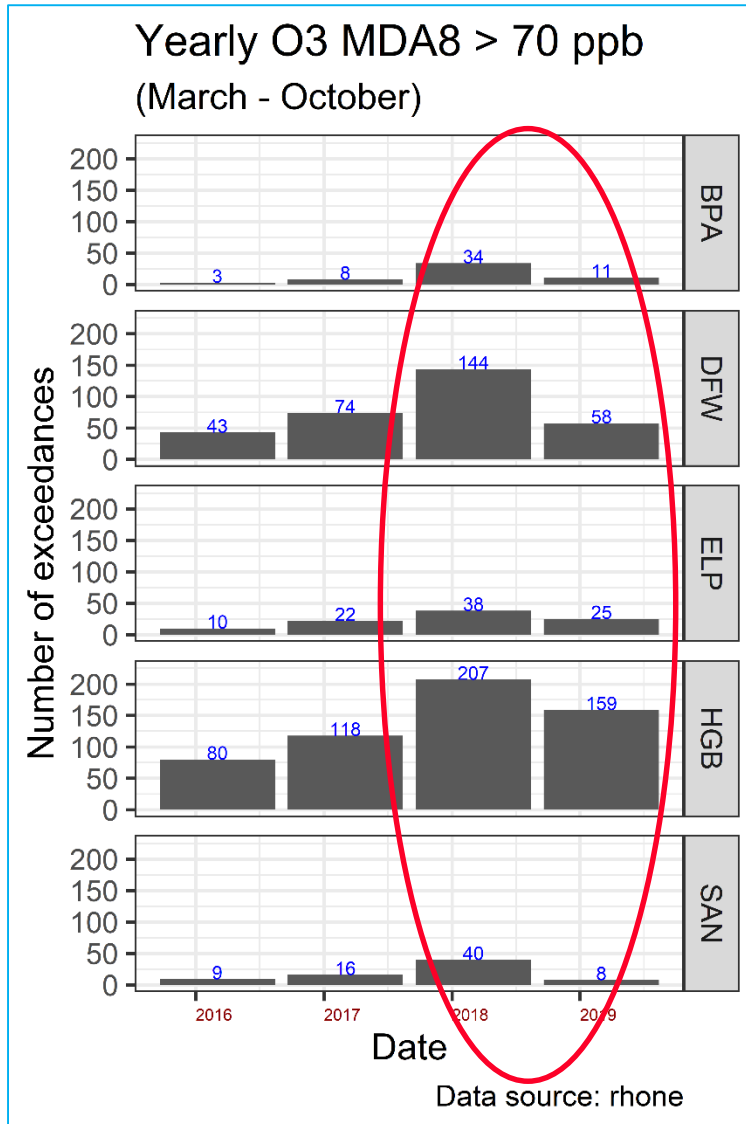
- Numerous monitors in many areas did not have the number of days required for the modeled attainment test.

## Number of monitors without at least five days with MDA8 value $\geq$ 60 ppb

Area	2012 Episode (May - September)	2016 Episode (April - October)
DFW	0	4
HGB	0	2
SAN	0	0
ELP		1
BPA		3



# Which recent years have the most exceedance days?



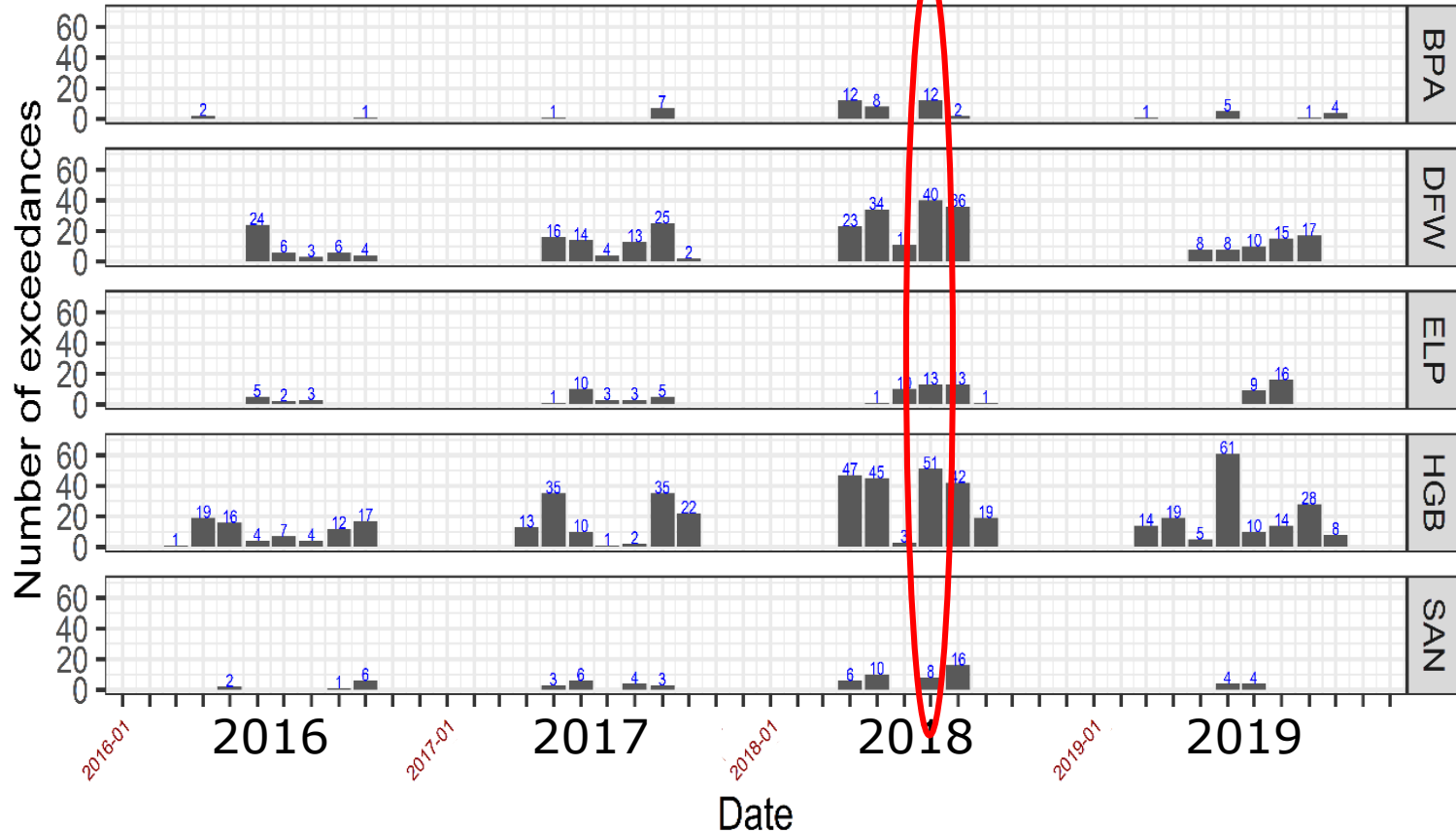
**Conclusion: 2018 has the greatest number of exceedance days during the March to October ozone season, followed by 2019.**





# Did 2018 follow the expected temporal pattern in exceedances?

Number of monthly O3 MDA8 > 70 ppb (March - October)

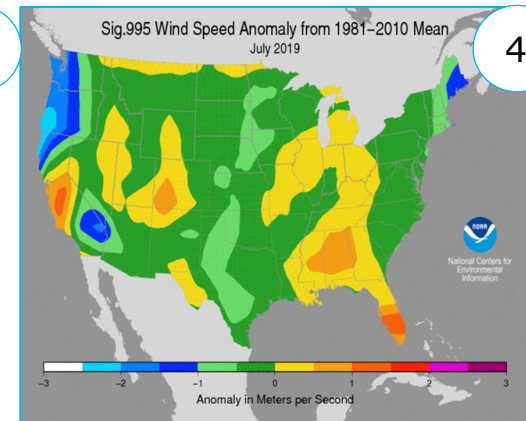
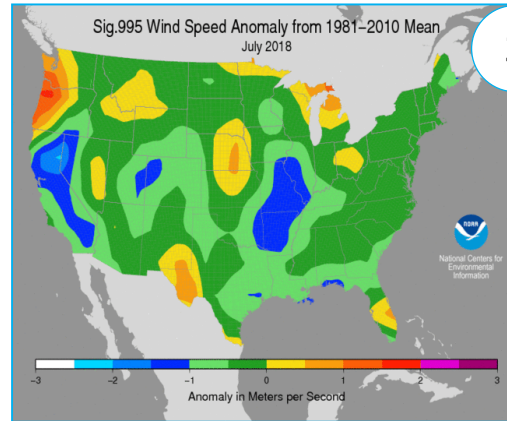
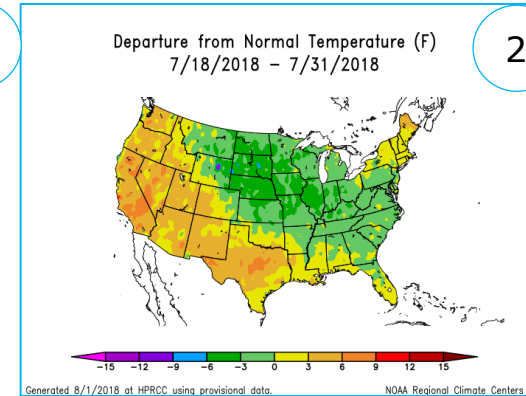
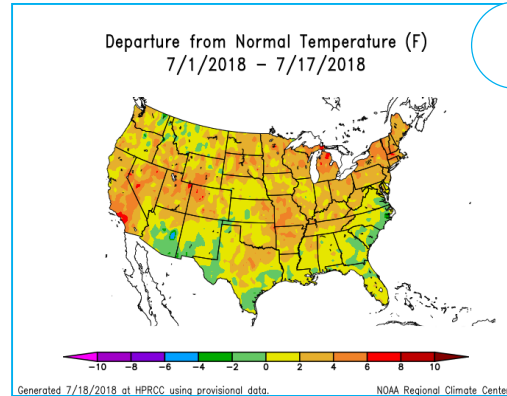
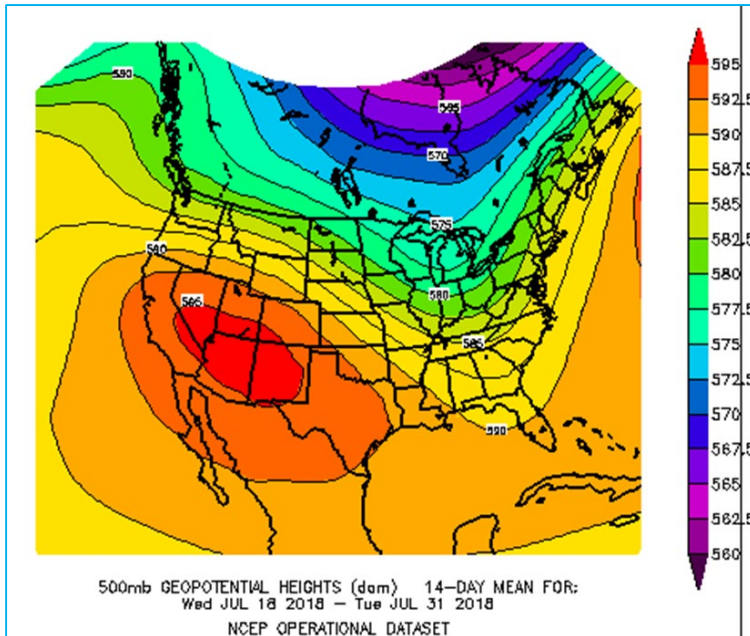


**Observation: July 2018 looks different than the other years with a higher number of exceedance days than usual.**



# Do the July 2018 exceedances correlate to an unusual jet stream event?

A jet stream event in July 2018 was identified as a potential factor in the unusual exceedances.

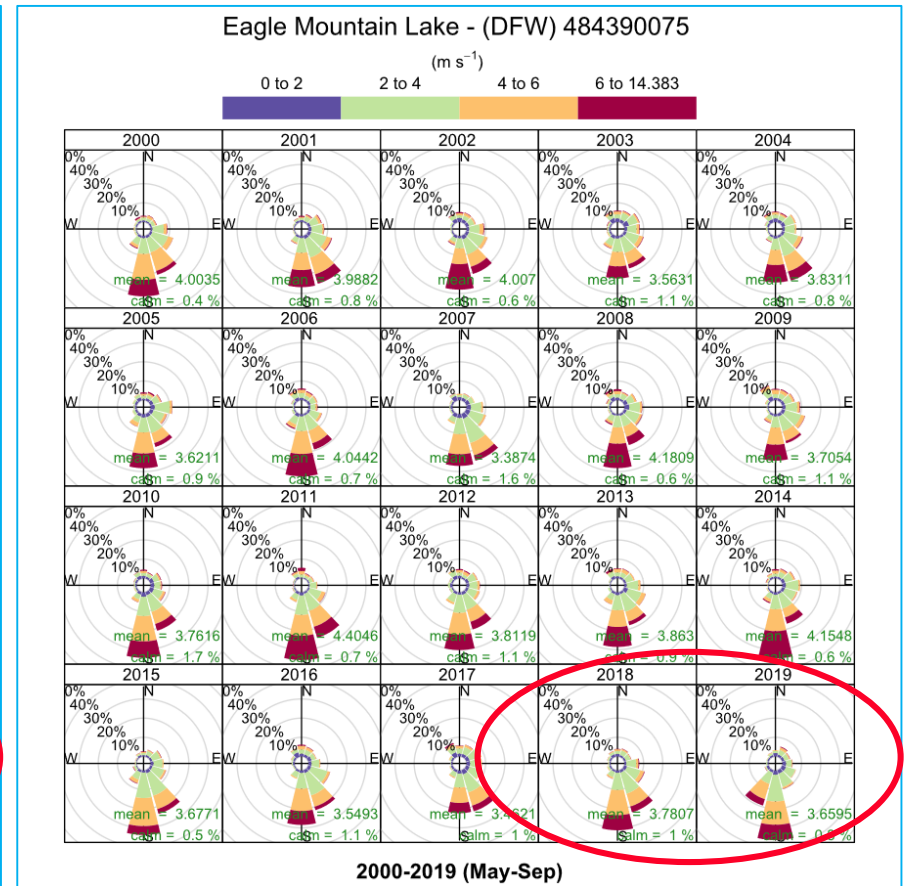
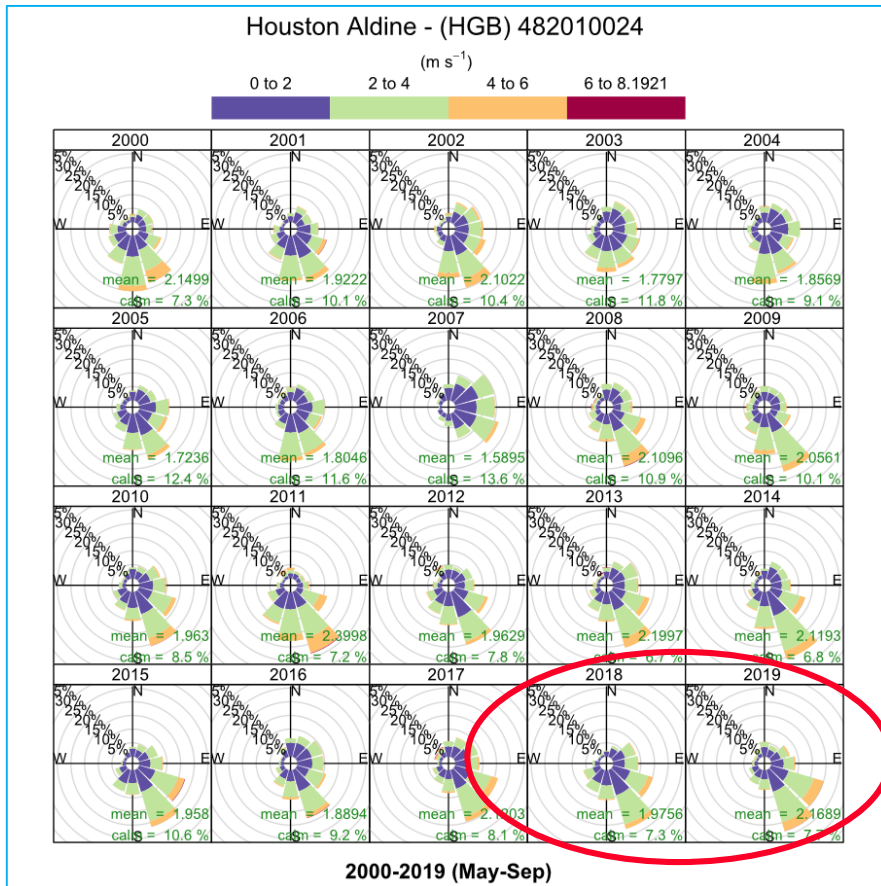


**Conclusion:** Meteorological analysis could not definitively tie the unusual number of ozone exceedances in July 2018 to the jet stream event.



# Was Texas meteorology typical in 2018 and 2019?

Analyses focused on meteorological variables such as temperature, wind direction, stagnation, relative humidity, and precipitation to compare 2018 and 2019 to historical trends and averages.







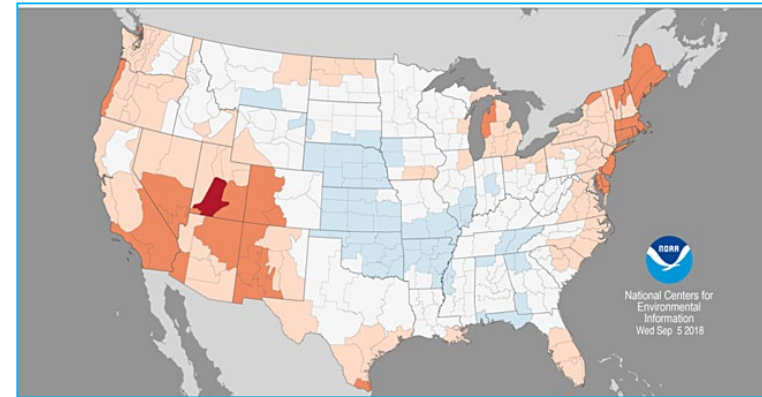
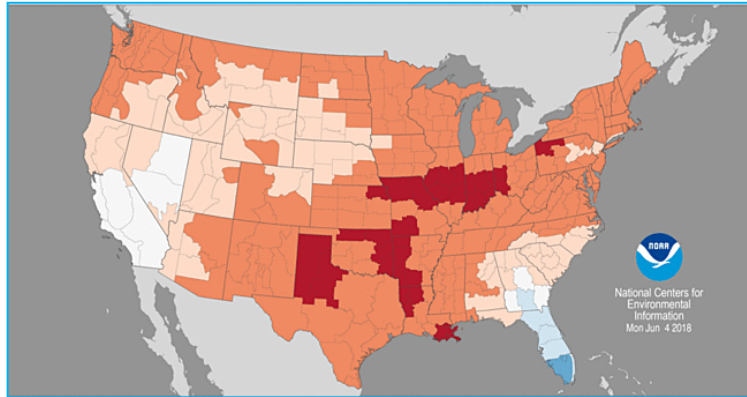
# Was Texas meteorology typical in 2018 and 2019? (cont.)

## Divisional Maximum Temperature Ranks from 1895-2019

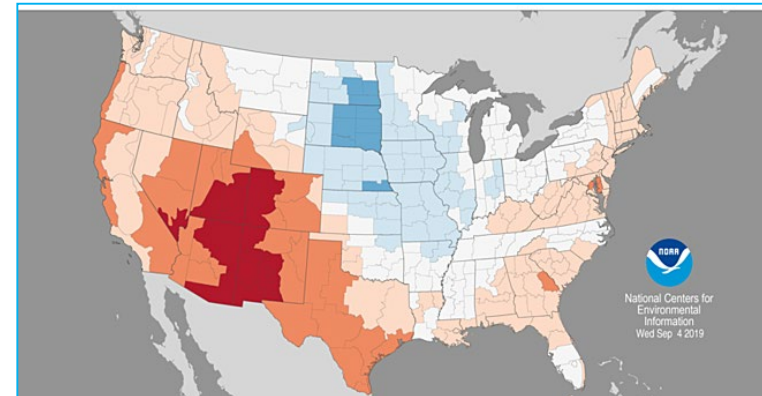
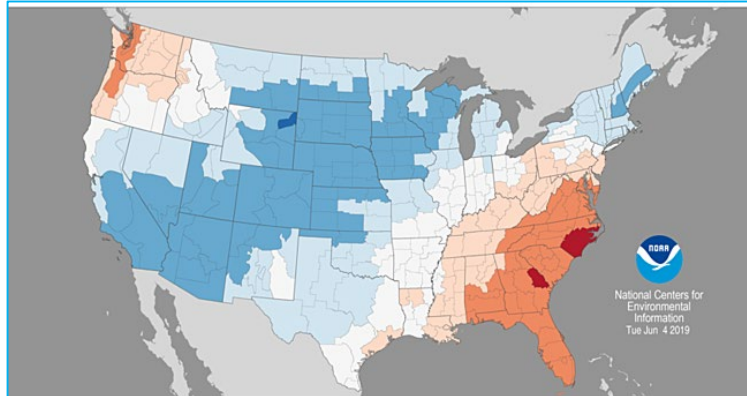
May

August

2018



2019



**Conclusion: Meteorology in 2018 and 2019 are both reasonable for ozone modeling.**

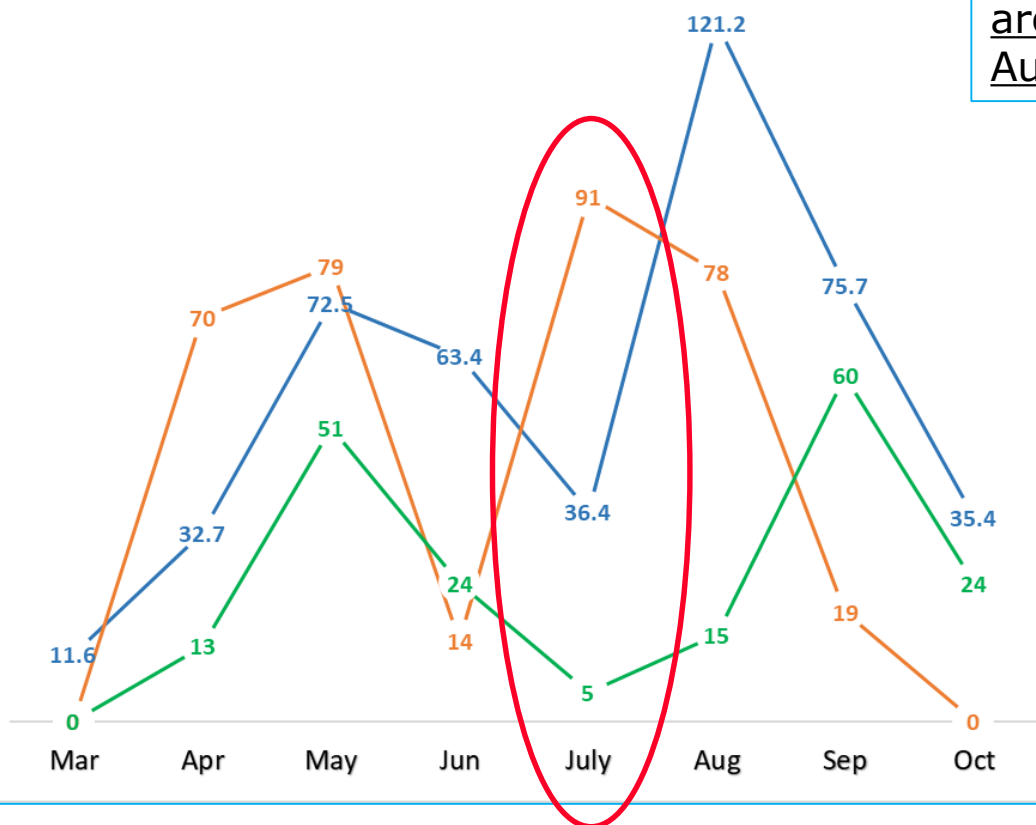


# Was July 2018 ozone really *that* anomalous?

## TEMPORAL PROFILE OF NUMBER OF EXCEEDANCE DAYS

(Maximum Daily Eight-Hour Average > 70 ppb)

— Ten-Year Average (2010-2019) — 2018 — 2019



Typical temporal pattern during the ozone season months in DFW and HGB consists of a bi-modal peak centered around May/June and August/September with a low in July.

**Conclusion: July 2018 is unusual with more exceedance days than seen in the past ten years. June and September of 2018 are unusual with very low exceedances.**



# Why is April through October the best available episode?

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- ✓ This seven-month episode has sufficient exceedance days for both the 2015 and 2008 eight-hour ozone NAAQS (223 and 82 days, respectively).
- ✓ Exceedances in HGB and DFW nonattainment areas follow the expected temporal pattern.
- ✓ 2019 meteorology is representative of typical ozone forming conditions.
- ✓ All but one monitor in DFW have at least five days with a monitored MDA8 value greater than 60 ppb.
- ✓ 2019 is the latest year with complete data, and the modeling platform will remain representative in terms of emissions and fleet characteristics for longer.



# Conclusion

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- April through October 2019 is the episode for the new modeling platform.
- TCEQ is currently developing 2019 model inputs for meteorology and emissions inventories.
- Base and future year emissions inventories will be made available to the public in the fall of 2021.



# Questions?

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Cara Scalpone

[cara.scalpone@tceq.texas.gov](mailto:cara.scalpone@tceq.texas.gov)