



# ***Update on Planning Activities for the Bexar County Ozone Nonattainment Area***

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Presented at San Antonio Outreach Meeting  
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# Presentation Overview

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- Bexar County Update
- Introduction to Air Quality Modeling
- International Transport Analysis



# 2015 Eight-Hour Ozone NAAQS

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- On July 25, 2018, the Environmental Protection Agency (EPA) published air quality designations for the San Antonio area regarding the 2015 Ozone National Ambient Air Quality Standard (NAAQS).
- Based on air monitoring data from 2015-2017, Bexar County was designated as nonattainment with a classification of marginal.
- All other counties in the Core Based Statistical Area were classified as attainment/unclassifiable.



# San Antonio 4<sup>th</sup> High Values

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2015 4 <sup>th</sup> high	2016 4 <sup>th</sup> high	2017 4 <sup>th</sup> high	2017 Design Value
79	71	73	74

2016 4 <sup>th</sup> high	2017 4 <sup>th</sup> high	2018 4 <sup>th</sup> high	2018 Design Value
71	73	72	72

2017 4 <sup>th</sup> high	2018 4 <sup>th</sup> high	2019 4 <sup>th</sup> high	Preliminary 2019 Design Value *
73	72	74	73

All readings are in parts per billion (ppb)

\* As of September 25, 2019

# SIP Requirements for Ozone Nonattainment Areas

**MARGINAL**

(3 Years)

**MODERATE**

(6 Years)

**SERIOUS**

(9 Years)

**SEVERE**

(15-17 Years)

**EXTREME**

(20 Years)

## **MARGINAL**

- Nonattainment New Source Review (NNSR) Permitting
  - 100 Tons Per Year Threshold
  - 1.1:1 Offset Ratio
- Emissions Inventory State Implementation Plan (SIP) Revision
  - Emissions Statement
- Transportation and General Conformity

Major Source Threshold  
(TPY)

100

100

50

25

10

**1.1 : 1**

**1.15 : 1**

**1.2 : 1**

**1.3 : 1**

**1.5 : 1**

NSR Offset Ratios

Nonattainment requirements compound as classification increases.



# Emissions Inventory SIP Revision

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- Required for all nonattainment areas regardless of classification
- Inventory of actual emissions from all source categories for tracking progress in emissions reductions
- Establishes a Base-Year Inventory for the nonattainment area
- All stationary sources above the threshold required to submit certified emissions annually (Emissions Statements)



# Emissions Inventory SIP Revision

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- 2017 established as the base year
- Due two years after the effective date of a nonattainment designation
- Tentative proposal date: November 20, 2019
- Tentative adoption date: June 10, 2020



# Timeline

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October 2015	New Primary Ozone Standard: 70 ppb; Secondary standard same as primary
September 24, 2018	Effective date of Bexar County nonattainment designation
November 2018	EPA finalized 2015 Ozone SIP Requirements Rule
September 24, 2019	Transportation Conformity: deadline for approval
September 24, 2020	Emissions Inventory SIP due
2020	Attainment year
September 24, 2021	Attainment date (no later than)





# What Happens After 2020?

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- If the three-year design value is at or below 70 ppb, the area is eligible for redesignation to attainment.
  - SIP revision with public notice and comment
  - Describes how SIP obligations have been met
  - Demonstrates maintenance for 10 years after EPA approval (sets motor vehicle emissions budget)
  - Includes contingency plan
- Redesignation lifts requirement for NNSR.
- Redesignation does not lift any SIP-approved regulations.
- A second 10-year maintenance plan would be required.



# What Happens After 2020?

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- If the three-year design value is 71 ppb or greater, the area is reclassified to moderate.
  - By operation of law – no action from the state
  - Federal notice and comment rulemaking
- Reclassification would likely occur in late 2021 or early 2022.
- States usually have one year after reclassification to submit federally required SIP revisions.
- Attainment would be required by the end of 2023.

# SIP Requirements for Ozone Nonattainment Areas

## MARGINAL

(3 Years)

## MODERATE

(6 Years)

## SERIOUS

(9 Years)

## SEVERE

(15-17 Years)

## EXTREME

(20 Years)

### MODERATE

- Nonattainment New Source Review Permitting
  - 100 Tons Per Year Threshold
  - 1.15:1 Offset Ratio
- Attainment Demonstration SIP Revision
  - Photochemical Modeling
  - Reasonably Available Control Technology
  - Reasonably Available Control Measures
- Reasonable Further Progress
  - 15% Reduction in Volatile Organic Compound (VOC) emissions within first six years
- Vehicle Inspection and Maintenance

NSR Offset Ratios

Nonattainment requirements compound as classification increases.



# International Transport

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- In the 1990 Clean Air Act Amendments, Congress recognized that in some areas, the ability to attain the NAAQS may be impacted by emission sources from outside of the U.S.
- §179B was established to provide the EPA with the authority to address the impact of international emissions in areas designated nonattainment.
- Under this provision, the EPA could approve plans for areas that could attain the NAAQS by the attainment date “but for” emissions emanating from outside the U.S.



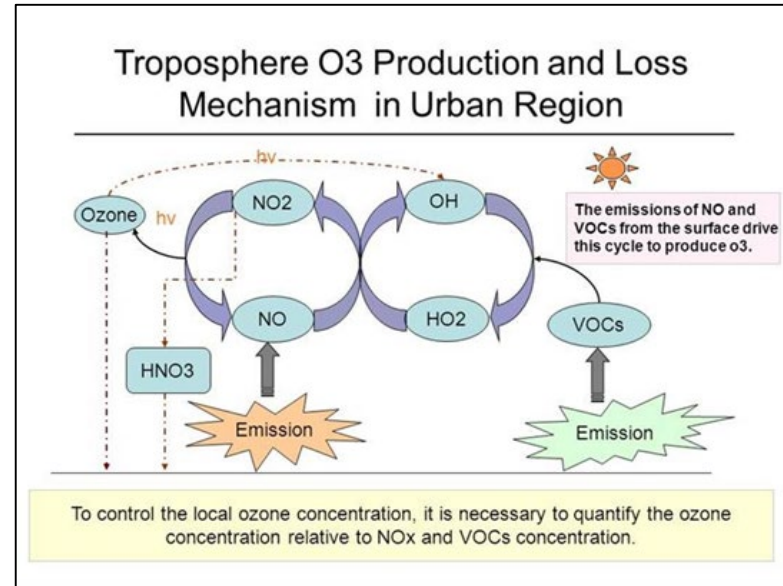
# International Transport

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- §179B Demonstration
  - Optional submittal
  - Not restricted to areas adjoining international borders
- EPA approval of a §179B Demonstration for a marginal area that fails to attain:
  - Area would remain nonattainment but would not be bumped-up to moderate
    - No increase in permitting threshold or offset ratios
    - No additional SIP requirements associated with a moderate classification
  - Marginal nonattainment area requirements would apply until the area is redesignated to attainment

# Basic Principles of Ozone Formation

- Ozone ( $O_3$ ) is a secondary pollutant.
  - Not emitted directly into atmosphere
  - Forms via a complex chemical process
  - Human (anthropogenic) emissions
- Formed due to a complex nonlinear reaction between precursors.
  - $NO_x$  - Nitrogen Oxides ( $NO$ ,  $NO_2$ )
  - VOC - Volatile Organic Compounds
- Ozone formation is a photochemical process.
  - Requires ultraviolet energy from sunlight
  - Can be destroyed at night





# Uses for Air Quality Modeling

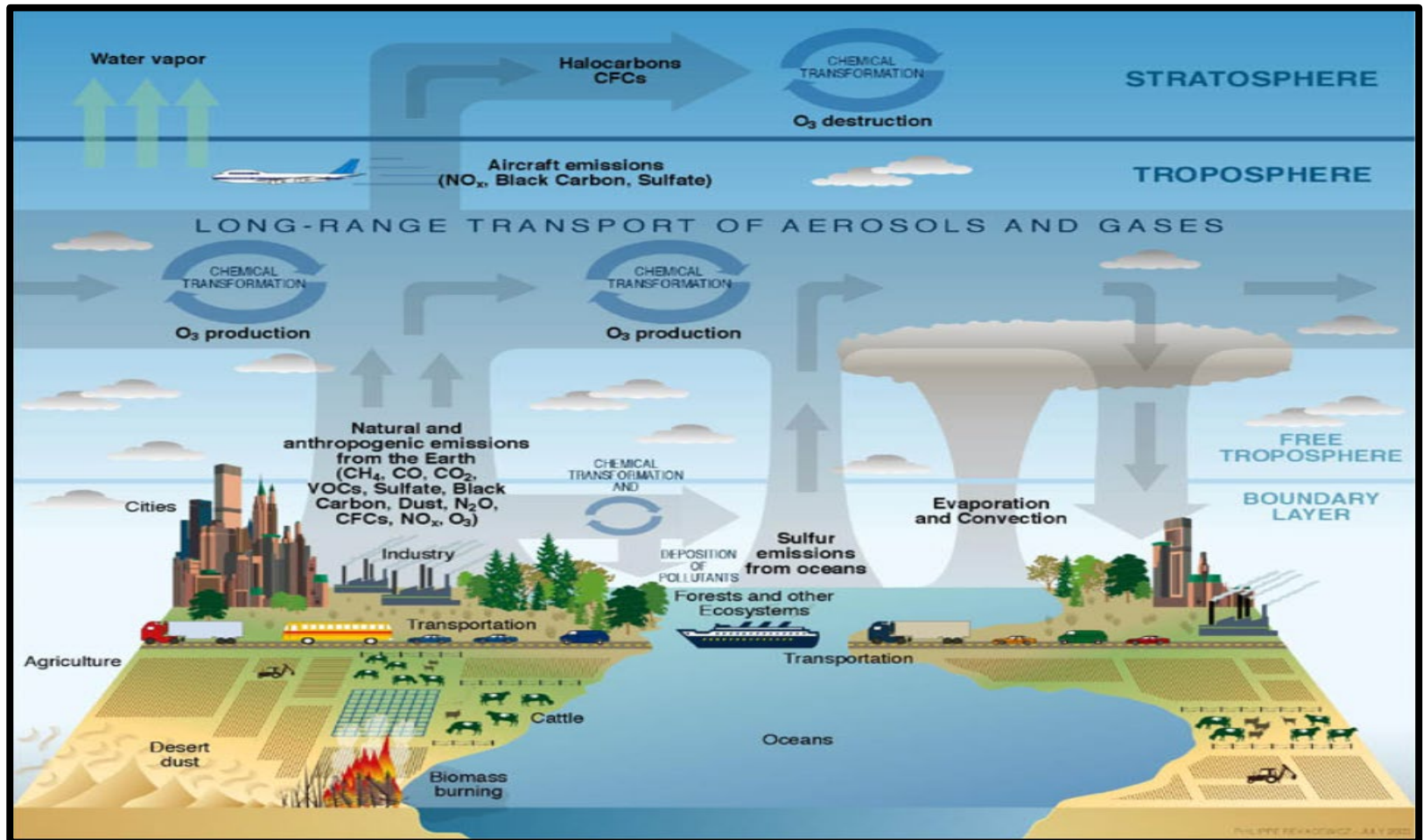
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- Federal Clean Air Act requires photochemical modeling for ozone nonattainment areas classified as **moderate** or above.
  - Will an area attain the ozone NAAQS?
    - *The Attainment Test*
  - What would happen if...? i.e., test scenarios
    - *Model results help study effectiveness of plans and control measures*
    - *Demonstrate whether the proposed control strategies will achieve the standard by the attainment date*
- Enhances understanding of air pollution
  - What emission sources contribute most to air pollution?
  - Formed locally, or transported in?

*For the International Transport Analysis, we will be using regional and global scale photochemical “grid” models.*

# Photochemical Modeling

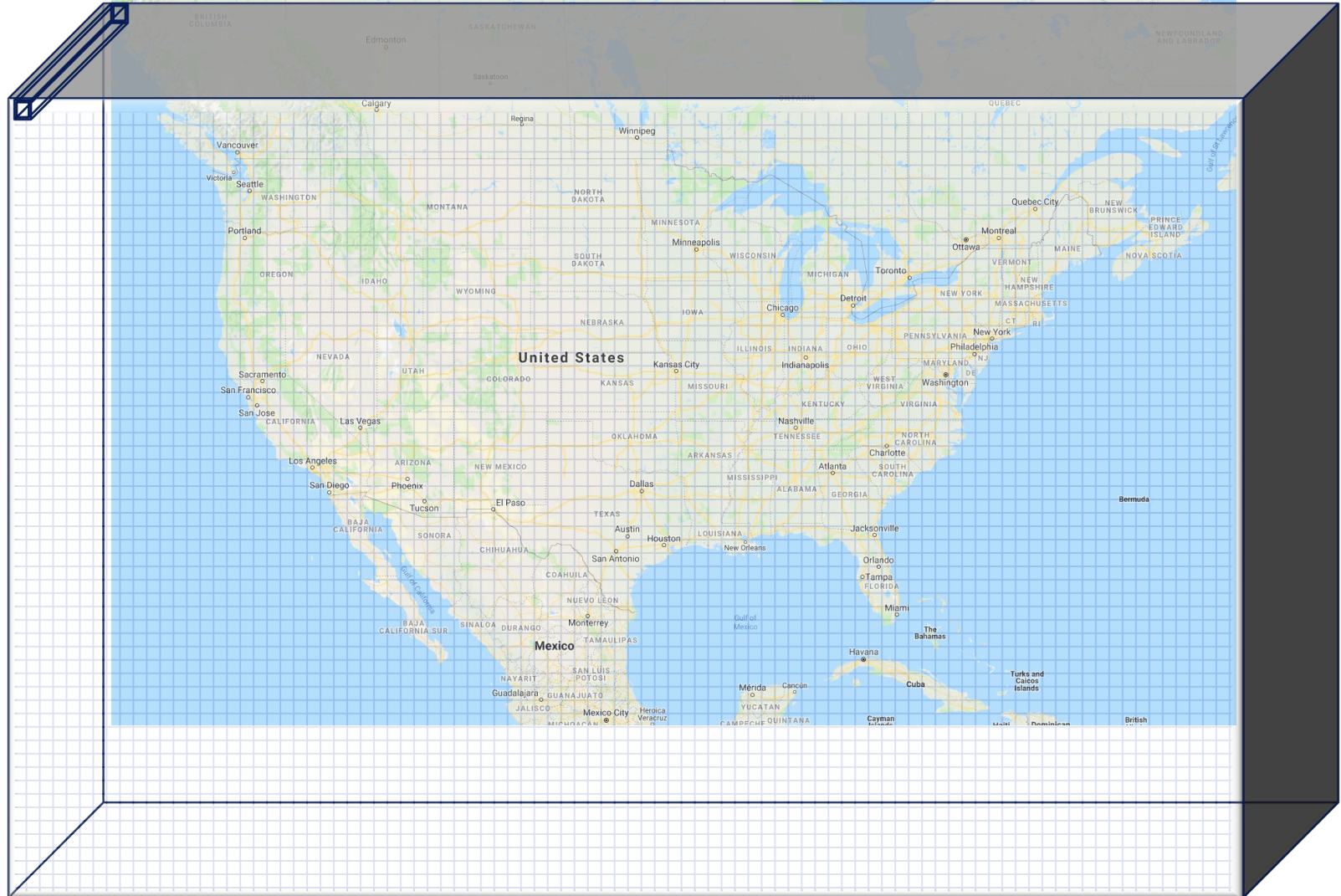
Photochemical models or Chemical Transport Models (CTM) are computer models designed for simulating the various chemical and physical atmospheric processes.





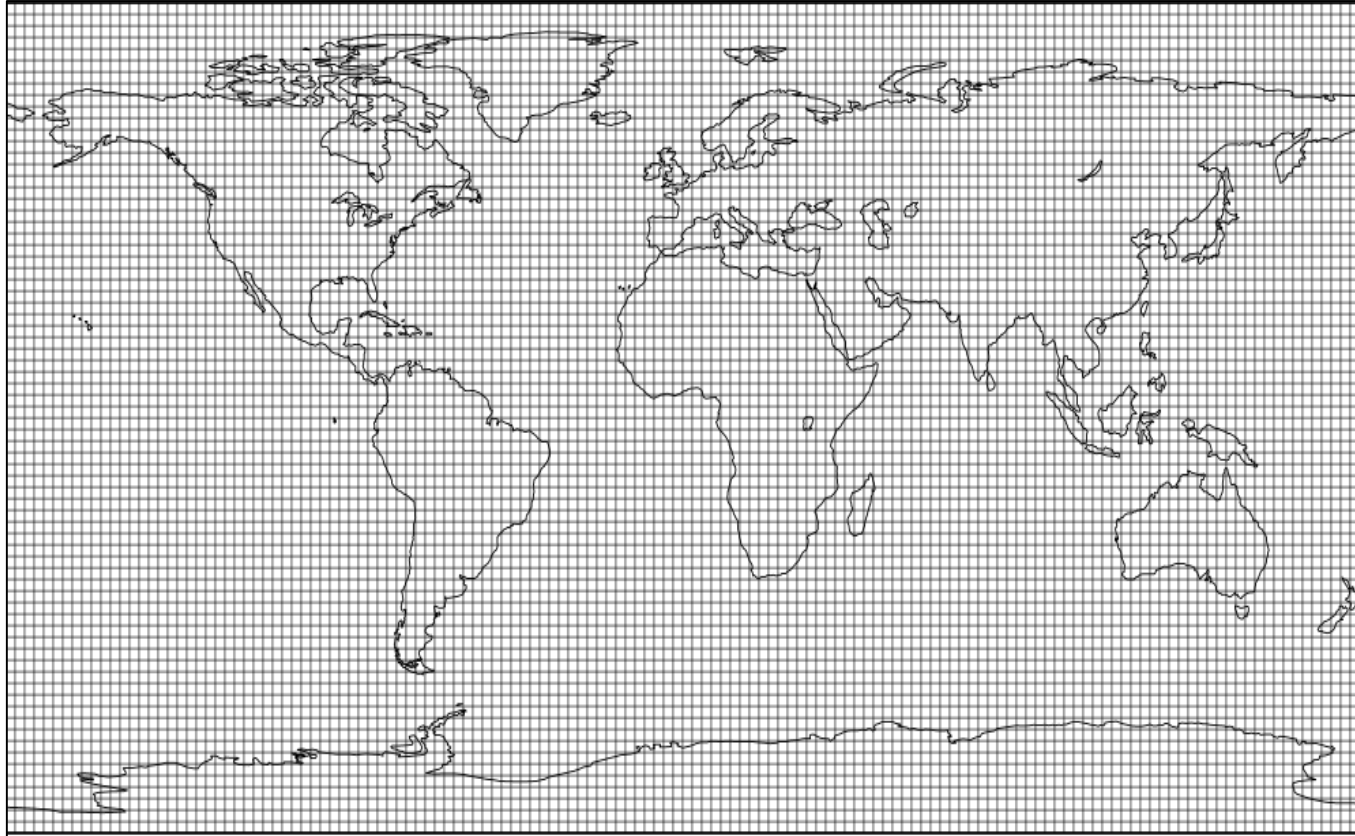


# What is a “grid”?





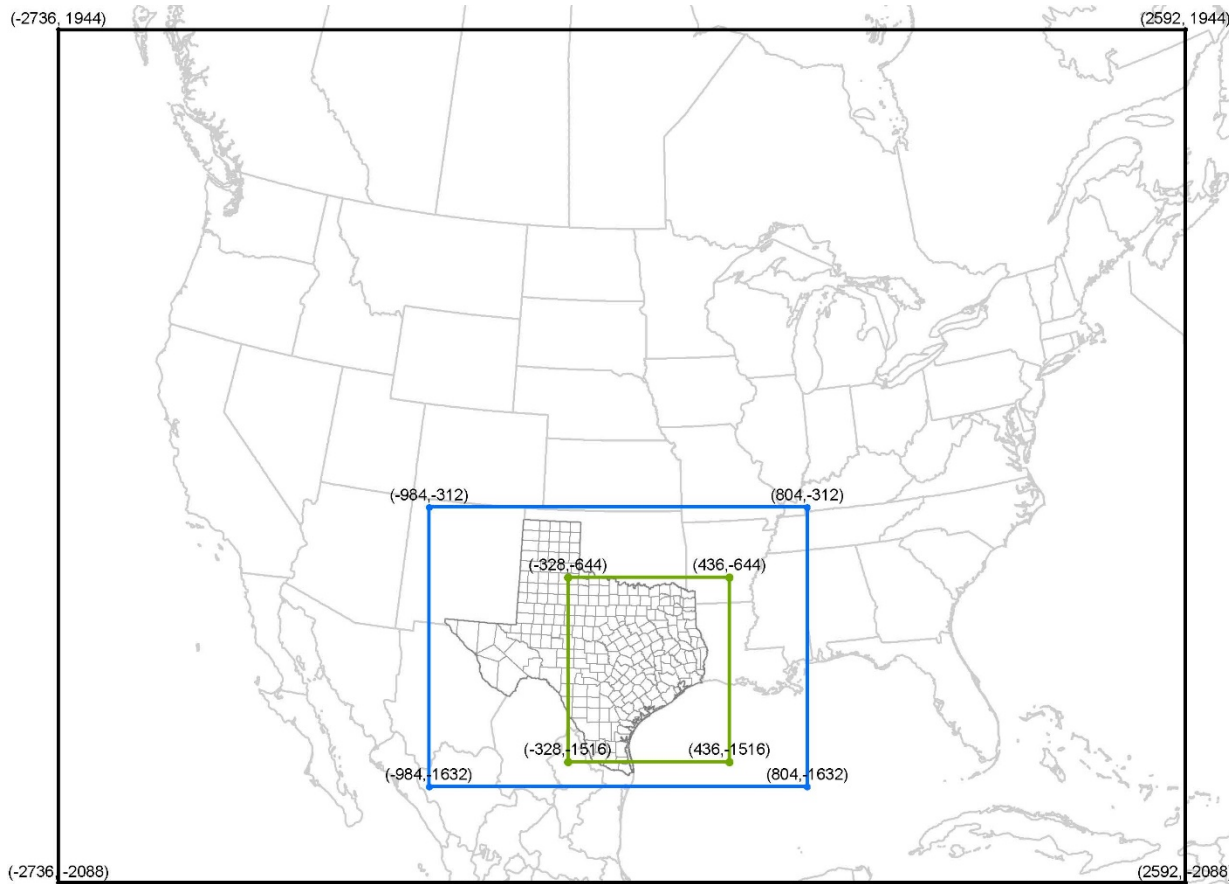
# Global Domain for Texas Air Modeling Efforts



Grid Size	No. of vertical layers
2° x 2.5°	79



# North American Regional Domains for Texas Air Quality Modeling Efforts



Grid Size in Kilometer	No. of Vertical Layers
4	29
12	29
36	29



# Modeling Process: A System of Computer Simulations

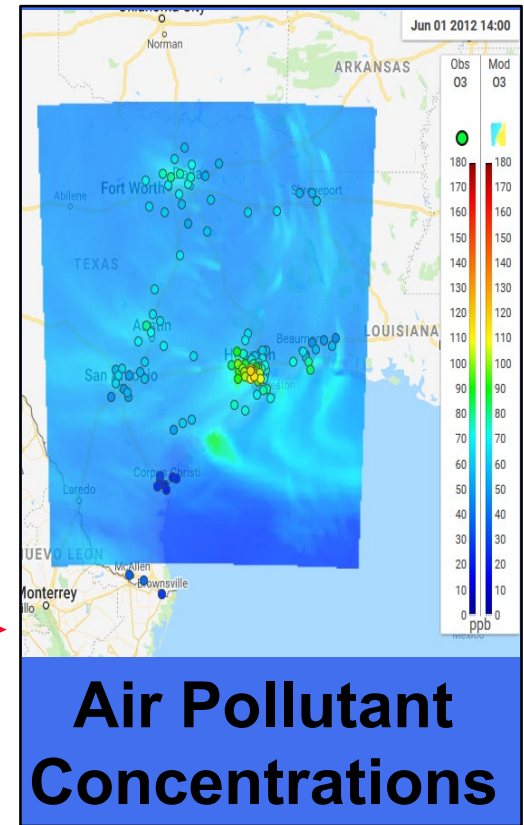
**Meteorology**

**Emissions**

**Chemistry:**

- Close to 100 chemical species
- More than 200 chemical reactions
- Every grid cell, every hour

**CTM**





# Future Design Value and Ozone Standard Attainment

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- A key component of the attainment demonstration is the future year design value ( $DV_F$ ).
- $DV_F$  is the modeled design value at all regulatory monitors in the attainment year.

Basic steps:

- 1. Episode:** Select a representative historical ozone episode.
- 2. Base Case:** Develop modeling inputs for this episode.
- 3. Performance:** Evaluate performance of the episode by comparing with historically monitored data.
- 4. Future Case:** Develop anthropogenic emission inputs for the future year.
- 5. Attainment Test:** Calculate the  $DV_F$  for each monitor. The  $DV_F$  is calculated by applying the future/base modeled ozone ratio to a baseline monitored design value ( $DV_B$ ).





# Definitions: Background and International Transport

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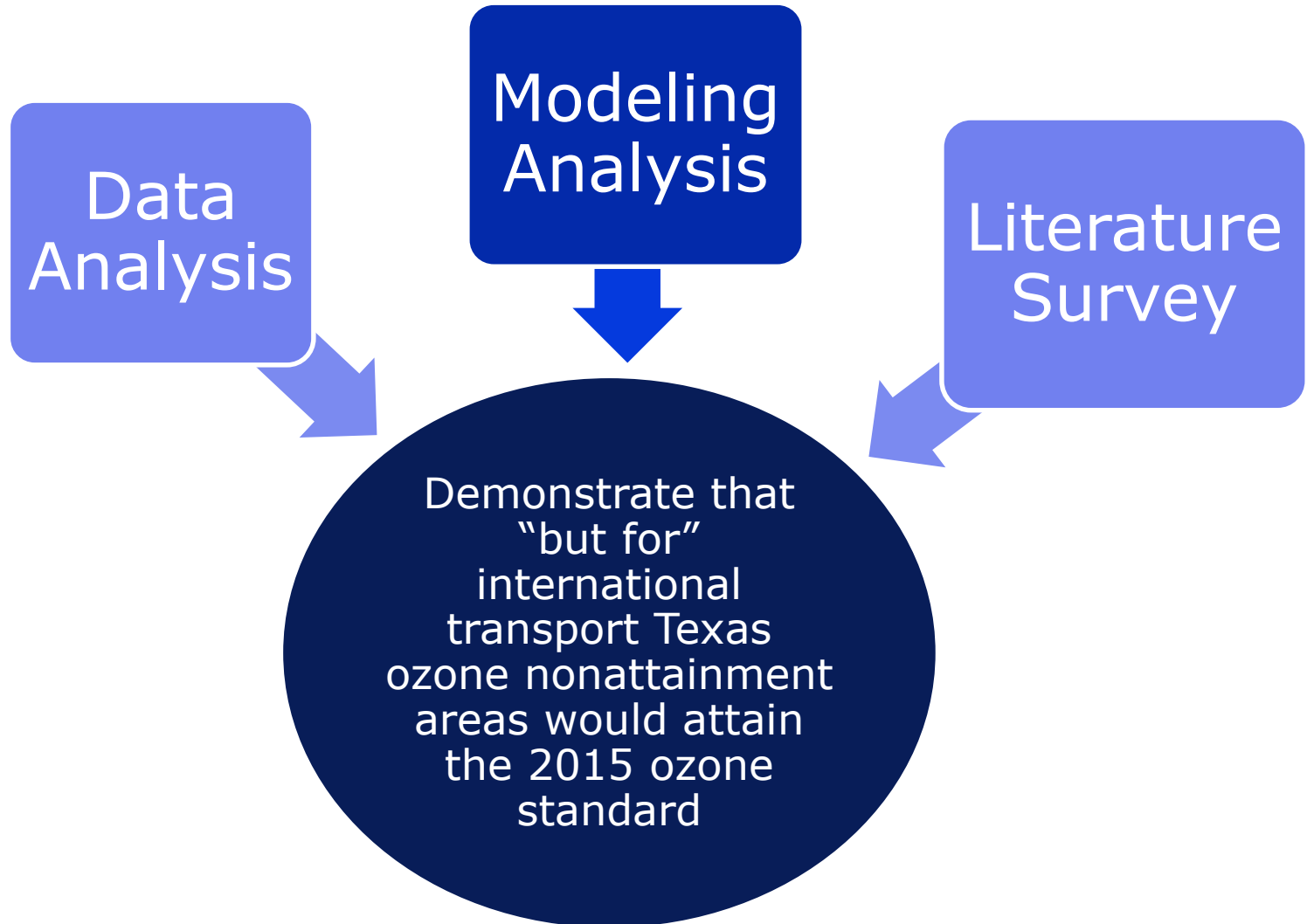
- **Background Ozone:** Ozone formed from sources or processes *other than* U.S. anthropogenic emissions of  $\text{NO}_x$ , VOC, methane ( $\text{CH}_4$ ), and carbon monoxide ( $\text{CO}$ )<sup>1</sup>
  - Includes ozone due to natural events such as stratospheric intrusions, wildfires, and ozone from non-U.S. anthropogenic sources.
- **International Transport:** Ozone formed from international anthropogenic sources, transported and mixed down to the surface and contributing to local ozone concentrations within the U.S.

<sup>1</sup>From EPA Whitepaper available at <https://www.epa.gov/sites/production/files/2016-03/documents/whitepaper-bgo3-final.pdf>



# Main Components of International Transport Analysis

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# Technical Analysis Framework

## Modeling Analysis

- Estimate the contribution of international anthropogenic emissions to future year design value ( $DV_F$ )
- Conduct source apportionment
- Determine the responsiveness of  $DV_F$  at Texas monitors

## Data Analysis

- Conduct trajectory analysis to characterize international transport/meteorology patterns into Texas

## Literature Survey

- EPA memos, whitepapers, etc.
- Academic studies and papers





# International Anthropogenic Emissions Contribution to $DV_F$

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- International anthropogenic emissions contribution is estimated using a combination of global and regional Chemical Transport Model (CTM).
- Difference between two future year design values:

$$DV_F^{Ref} - DV_F^{ZROW},$$

where Ref = Reference and ZROW = "Zero out Rest Of the World"



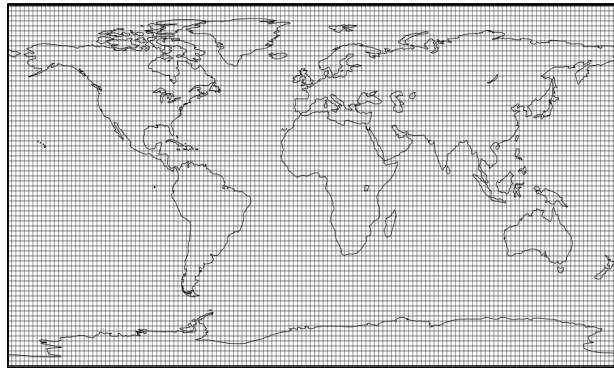
# International Anthropogenic Emissions Contribution to $DV_F$ (cont.)

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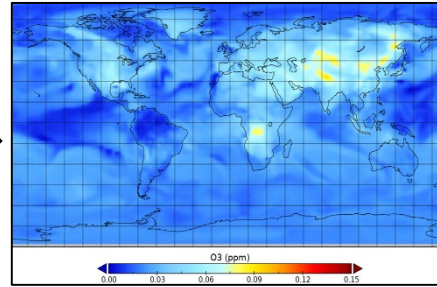
- $DV_F^{Ref}$  is the Reference  $DV_F$ 
  - Calculated from regional model simulations.
  - Boundary conditions derived from global model simulations that have all emissions sources (natural and anthropogenic).
- $DV_F^{ZROW}$  is the “Zero-out Rest Of the World”  $DV_F$ 
  - Calculated from regional model simulations that have all non-US anthropogenic emissions within the regional model domain zeroed-out.
  - Boundary conditions derived from global model simulations that have all non-US anthropogenic emissions in the global model domain zeroed out.



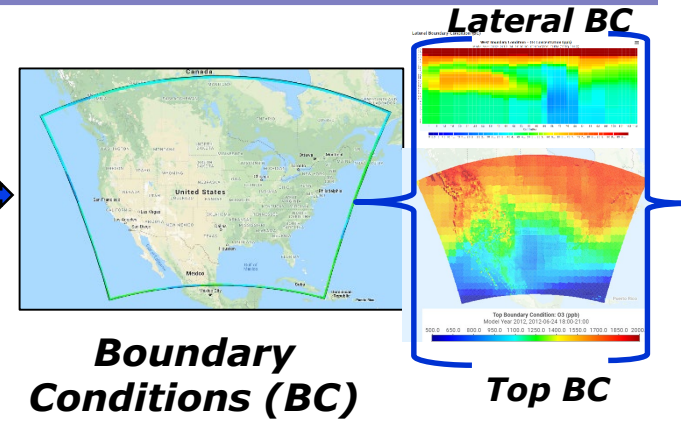
# $DV_F$ Calculation Process and Boundary Conditions



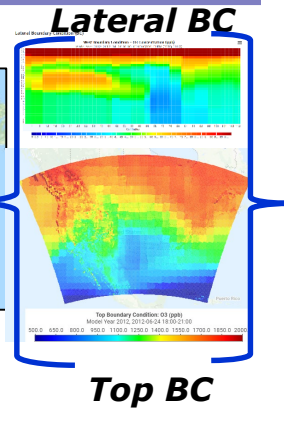
**Global CTM Simulation Domain**



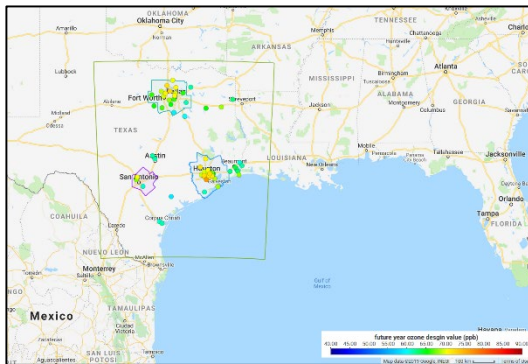
**Global CTM Output Concentrations**



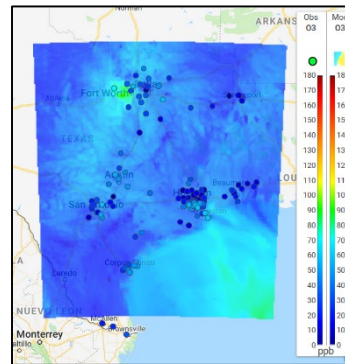
**Boundary Conditions (BC)**



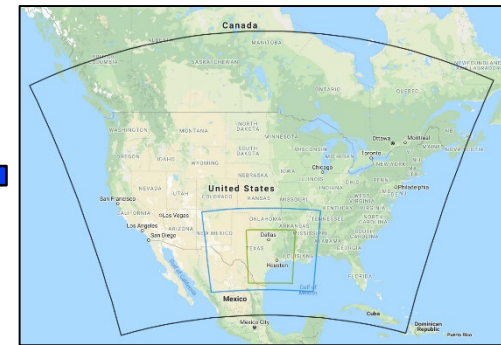
**Top BC**



**$DV_F$**



**Regional CTM Output Concentrations**



**Regional CTM Simulation Domain**

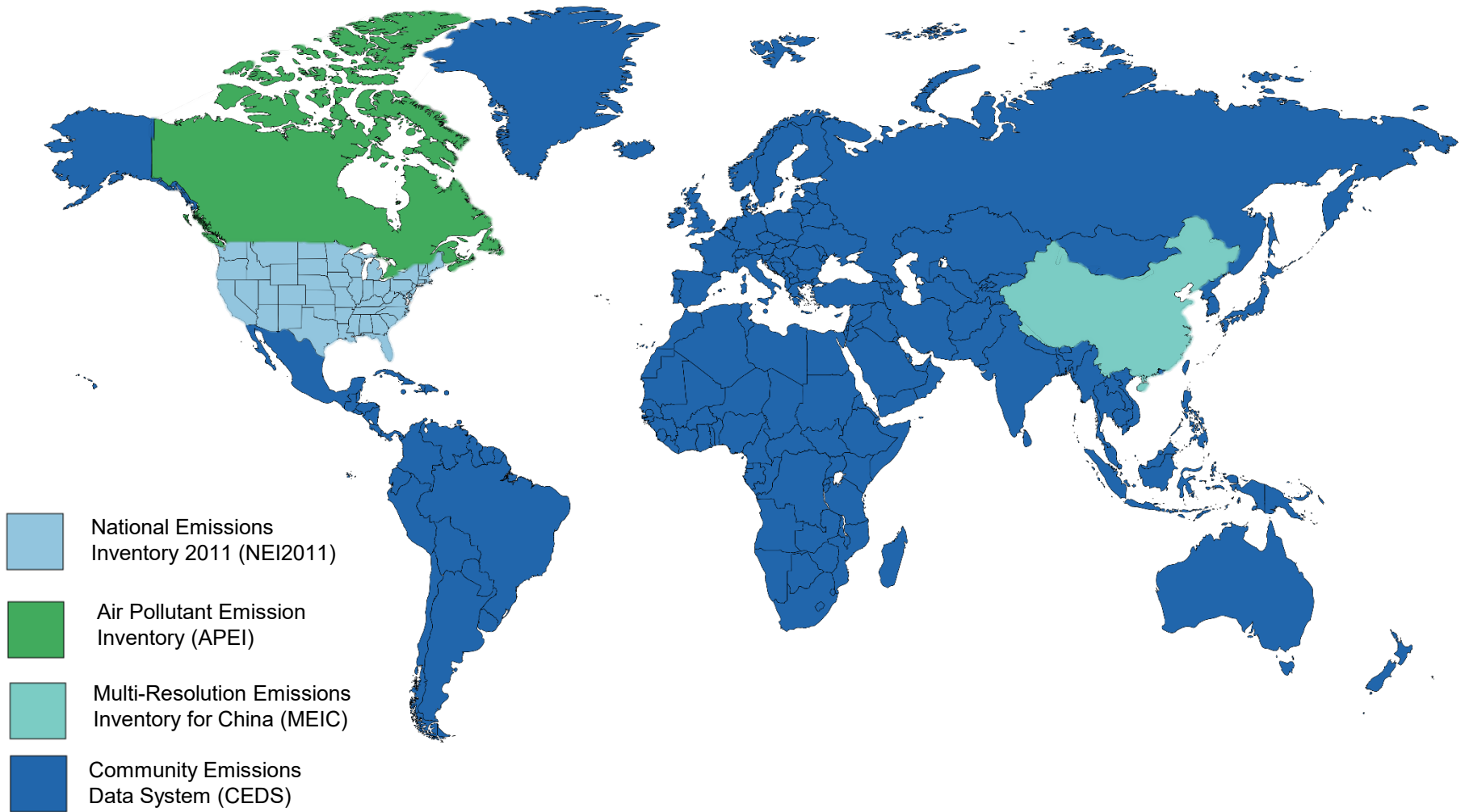


# Modeling Platform Details

	Global CTM	Regional CTM
Base Year	2012	
Future Year	2020 (Attainment year for marginal nonattainment areas)	
Episode	May 1 through September 30	
Model	GEOS-Chem, version 12	Comprehensive Air Quality Model with Extensions (CAMx), version 6.5

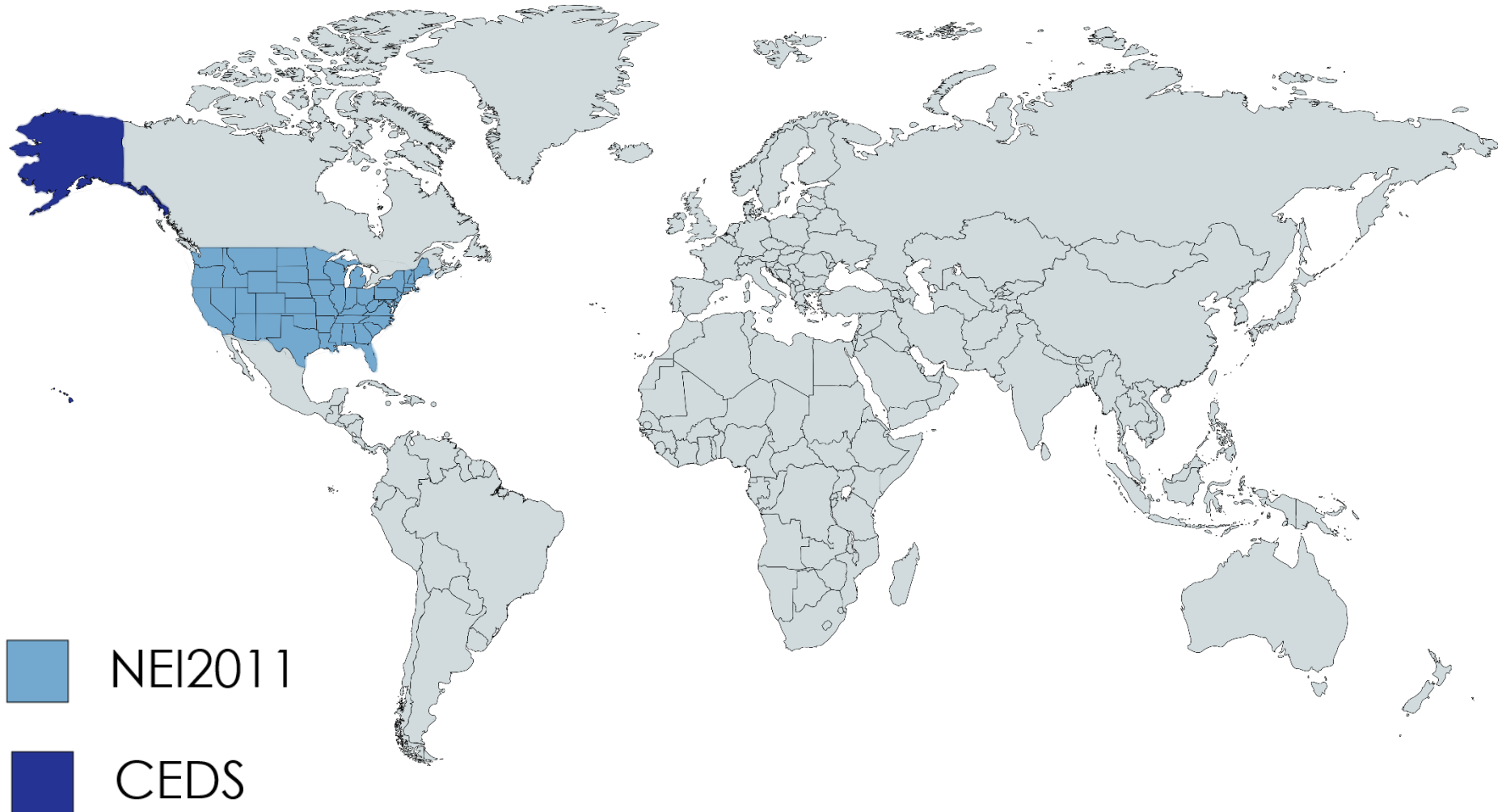


# GEOS-Chem Anthropogenic Emissions Inventories (*Reference Simulation*)



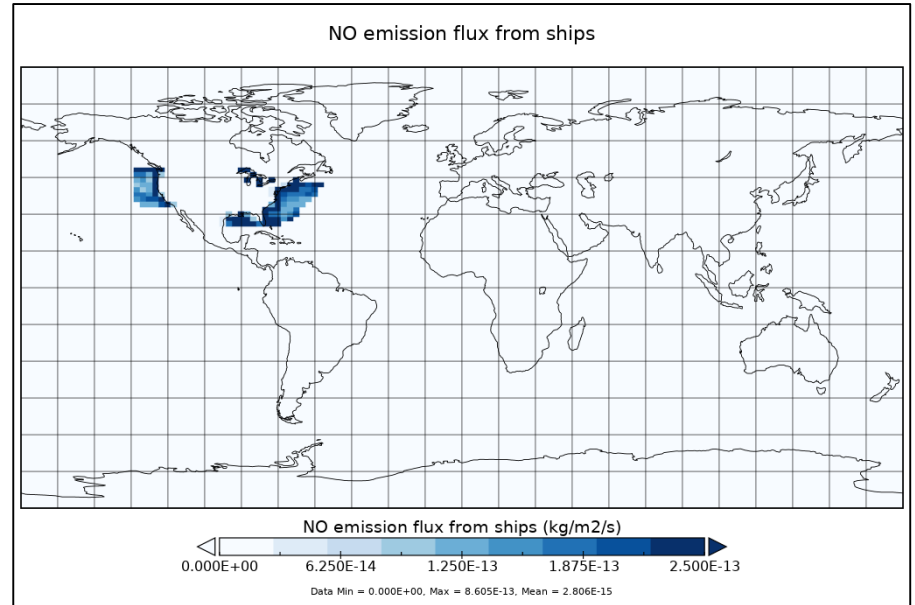
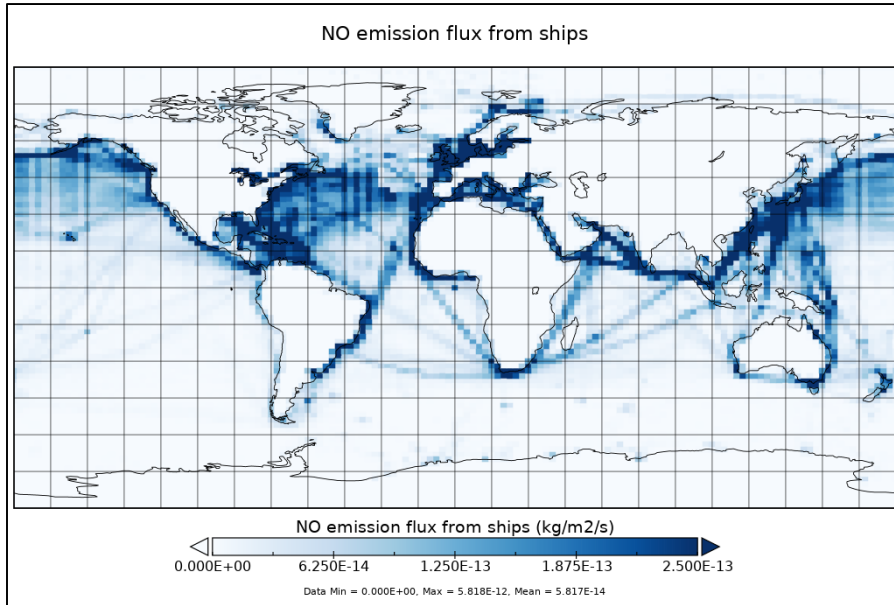


# GEOS-Chem Anthropogenic Emissions Inventories (*ZROW Simulation*)



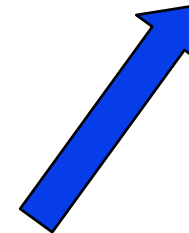
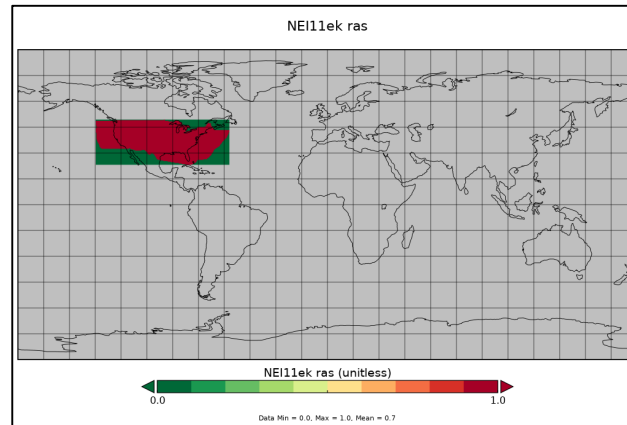
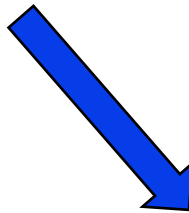


# Global Shipping Inventory



## Reference Global Simulation

## ZROW Global Simulation





# Preliminary Results – International Anthropogenic Contribution

Monitoring Site Name	Modeling Site Code	2020 DV <sub>F</sub> (ppb) <sup>a</sup>	International Anthropogenic Contribution Estimation (ppb) <sup>b</sup>
Camp Bullis	BOER	70	3
Calaveras Lake	CALA	59	2
San Antonio Northwest	SAWC	67	2

<sup>a</sup>Rounded and truncated per EPA guidance and without removing the estimated international anthropogenic contribution

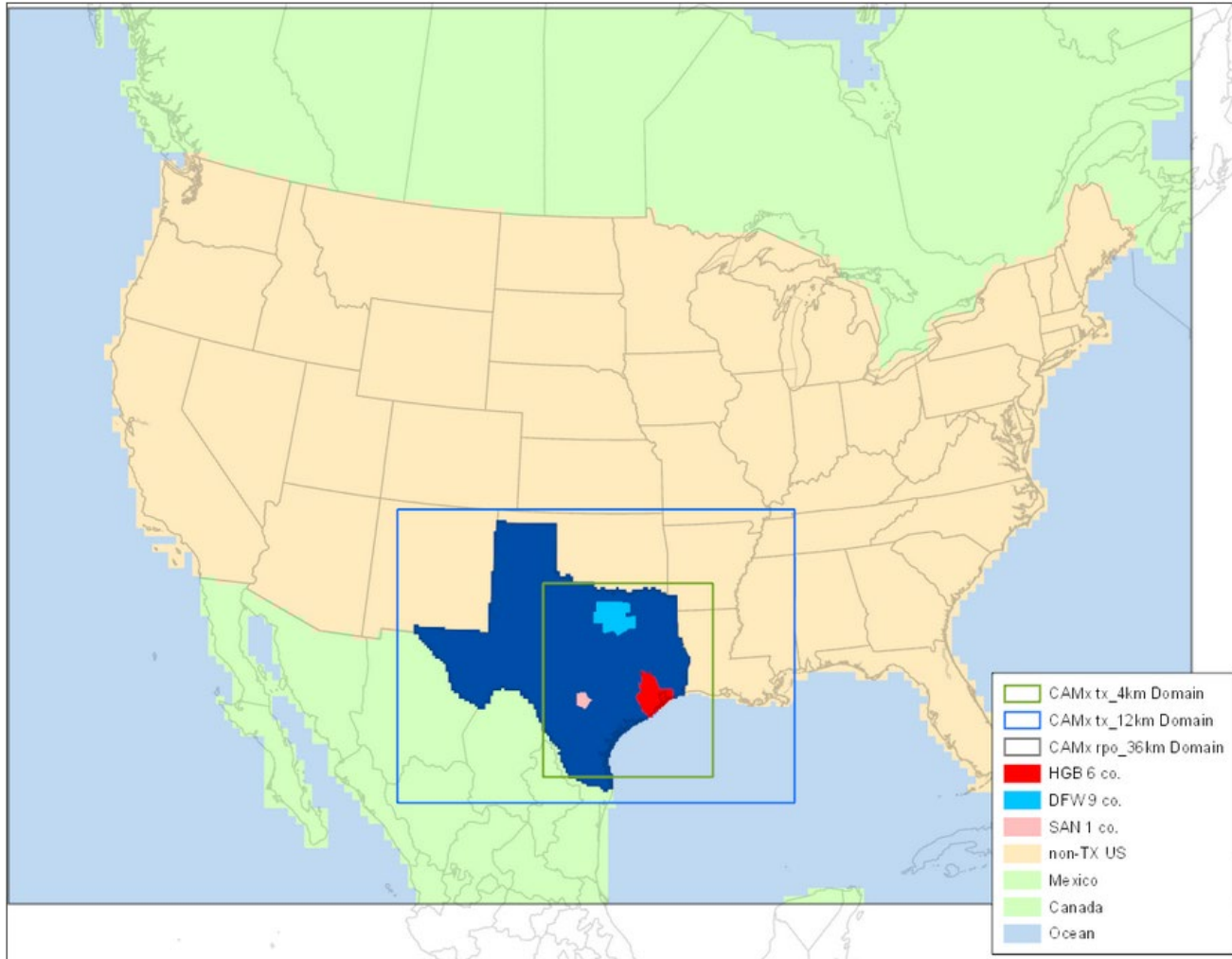
<sup>b</sup>Rounded and truncated similar to modeled design value





# Source Apportionment

Source apportionment tools estimate the ozone contribution of a defined source to a location by tracking its precursors (NO<sub>x</sub> and VOC).



## Emission source categories

1. Biogenic
2. Fires
3. Anthropogenic

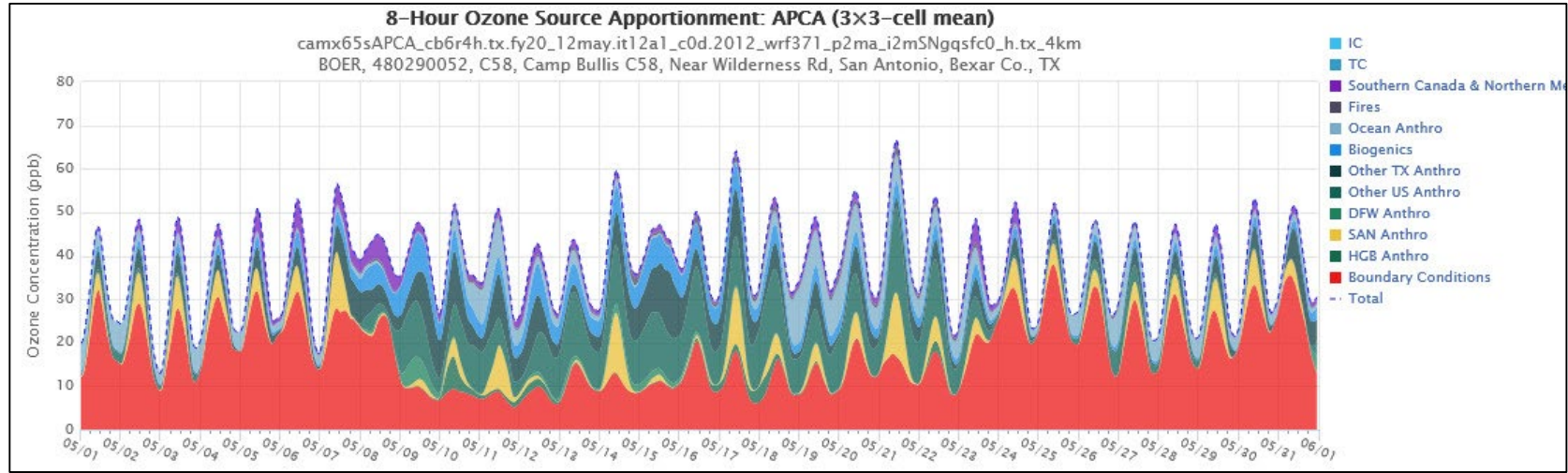
## Emission source regions

1. HGB
2. DFW
3. Bexar County (SAN)
4. Texas outside HGB, DFW, and SAN
5. USA outside Texas
6. Mexico and Canada
7. Oceans

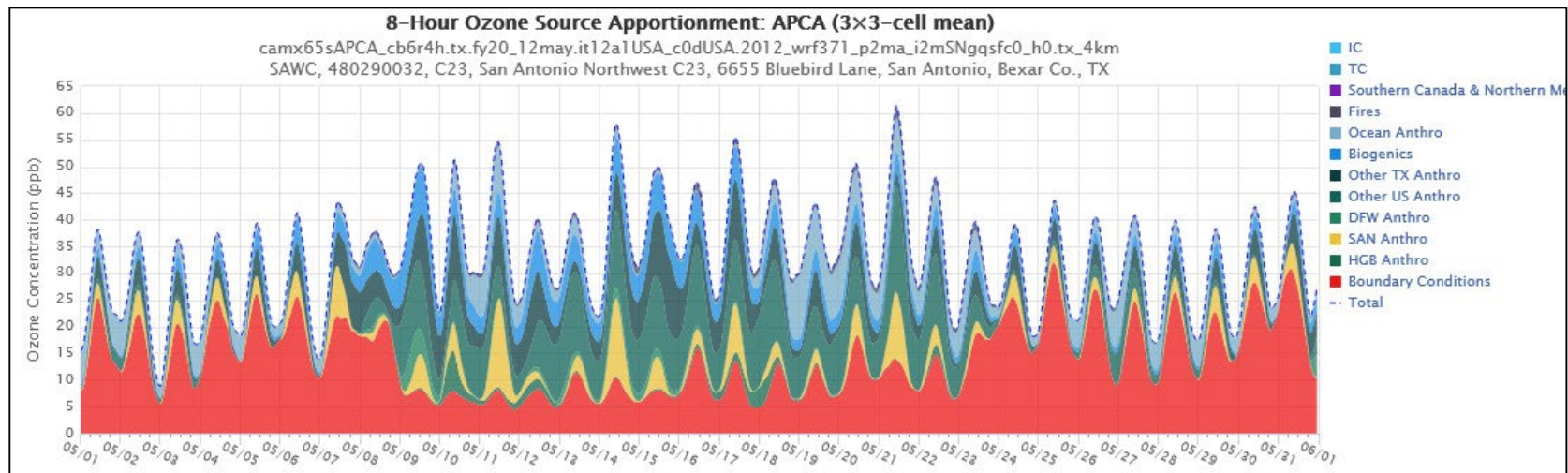


# Source Apportionment Preliminary Results – Future Year May Episode

## Camp Bullis – Reference Simulation

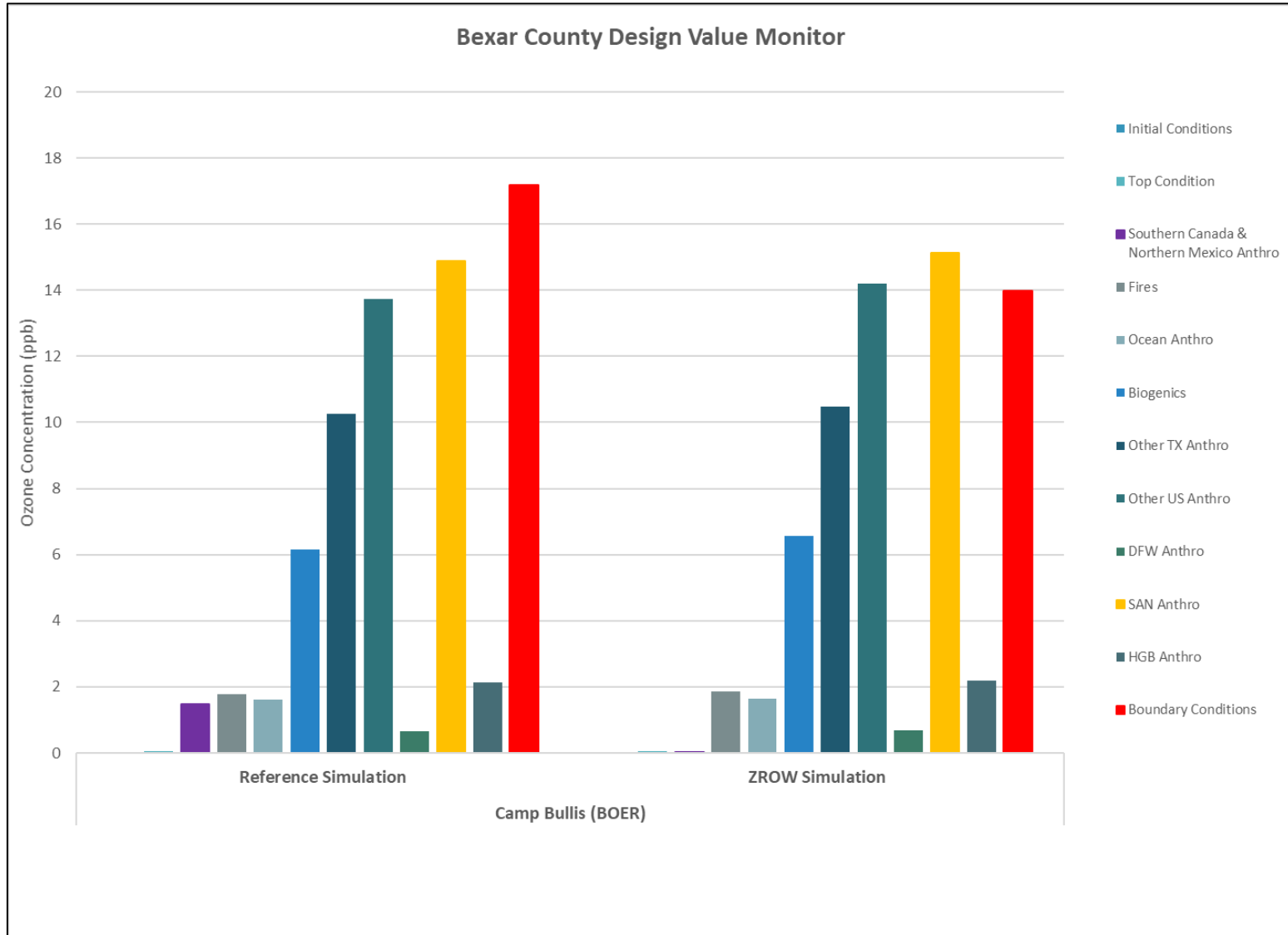


## San Antonio Northwest – Reference Simulation





# Preliminary Results – Source Apportionment of 2020 DV<sub>F</sub>





# San Antonio Photochemical Modeling Technical Committee

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- Participate in the San Antonio Photochemical Modeling Technical Committee (SA PMTC):
  - E-mail [amda@tceq.texas.gov](mailto:amda@tceq.texas.gov) with "SA PMTC" in the subject line to join our meeting notification list or request more information
- For updates on modeling activities in Texas
  - Sign up for the "TCEQ Photochemical Modeling Data" ListServ at the following link:  
<https://public.govdelivery.com/accounts/TXTCEQ/subscriber/new>



# Questions?

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