SOURCE APPORTIONMENT OF SUMMERTIME OZONE IN UTAH'S SALT LAKE VALLEY: SOURCE CONTRIBUTIONS & POLICY IMPLICATIONS

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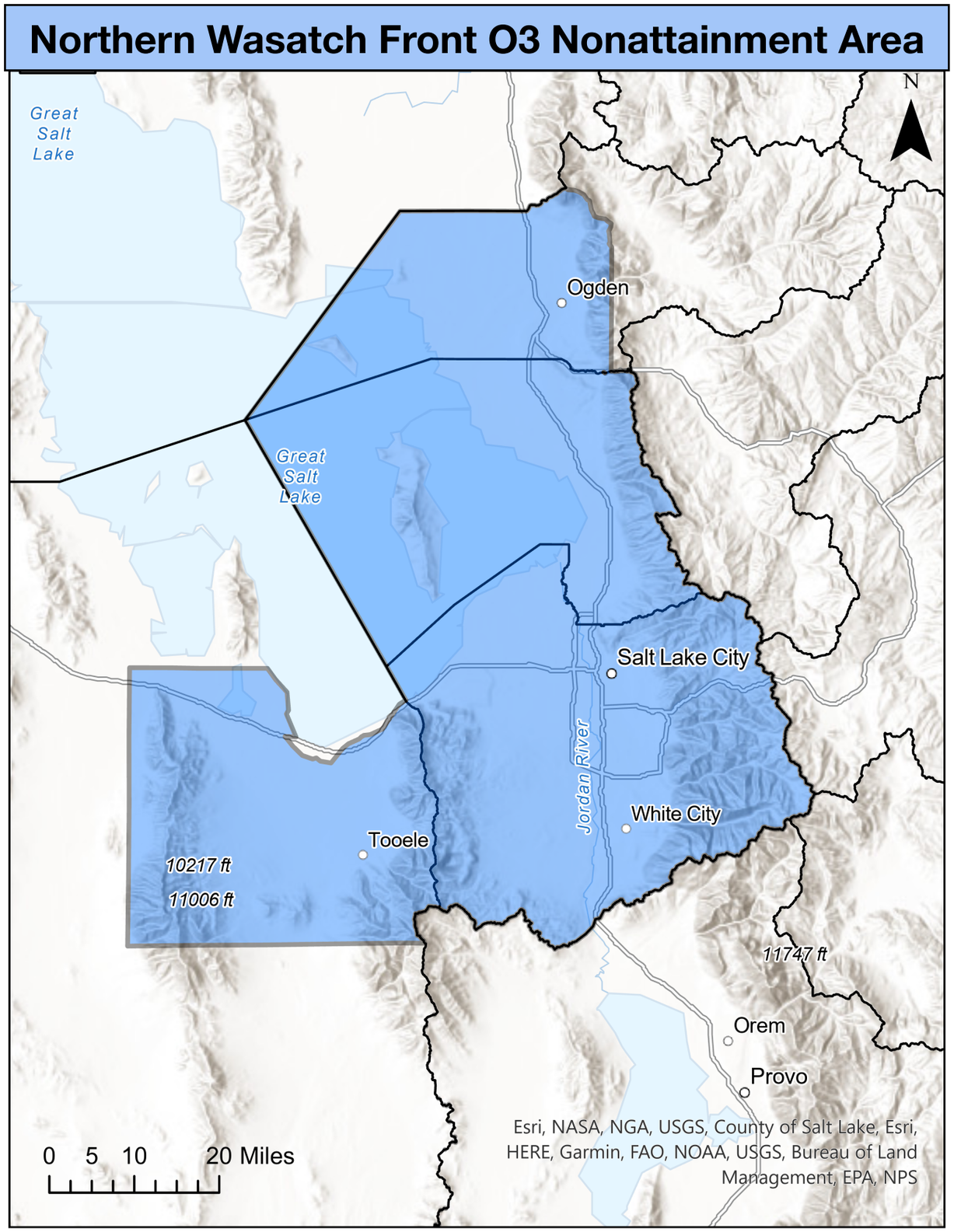
MOTIVATION



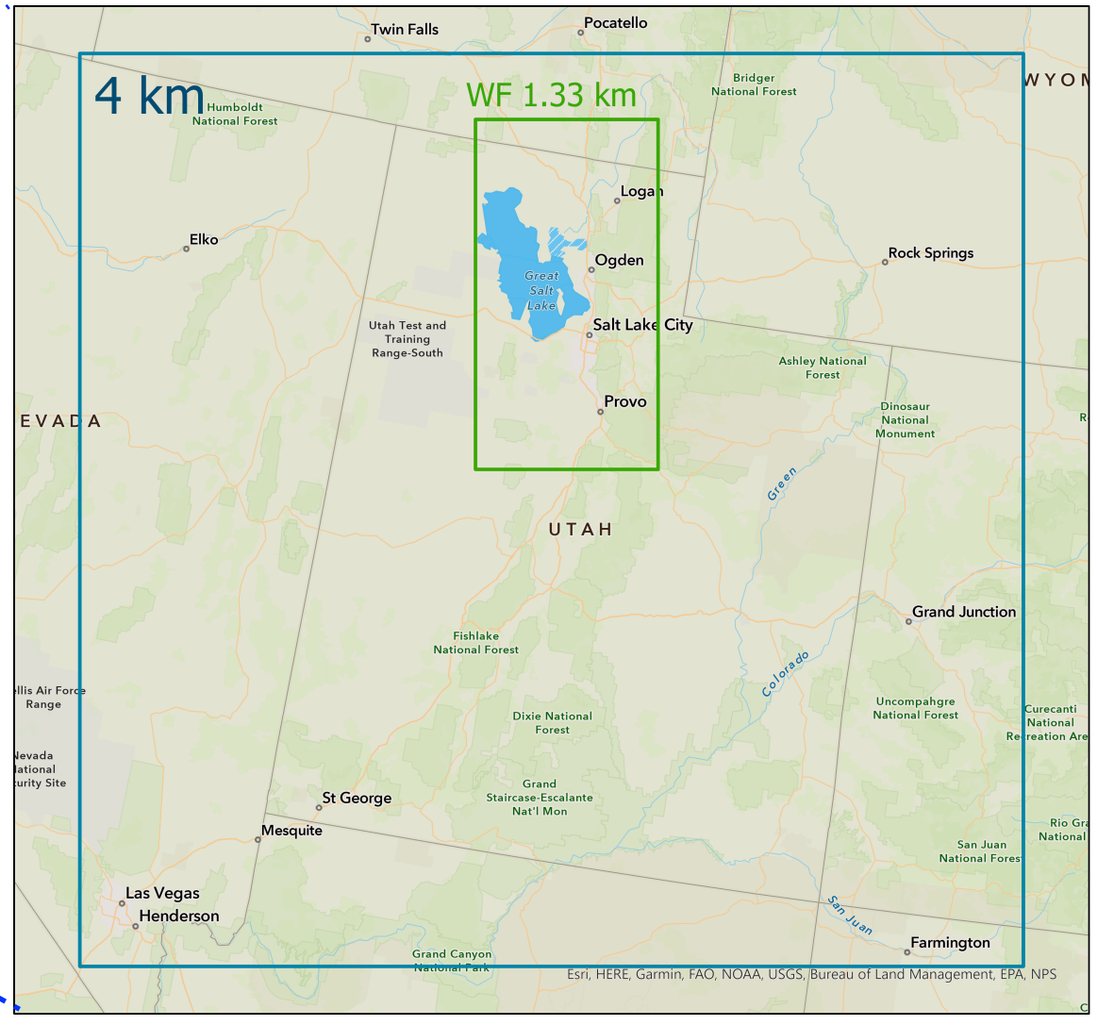
Objectives

- Determine source contributions to O3
- Determine pollutants limiting O3 formation
- Inform controls

Approach

- A base-year O3 simulation
- A future-year O3 source apportionment simulation

MODELING DOMAINS



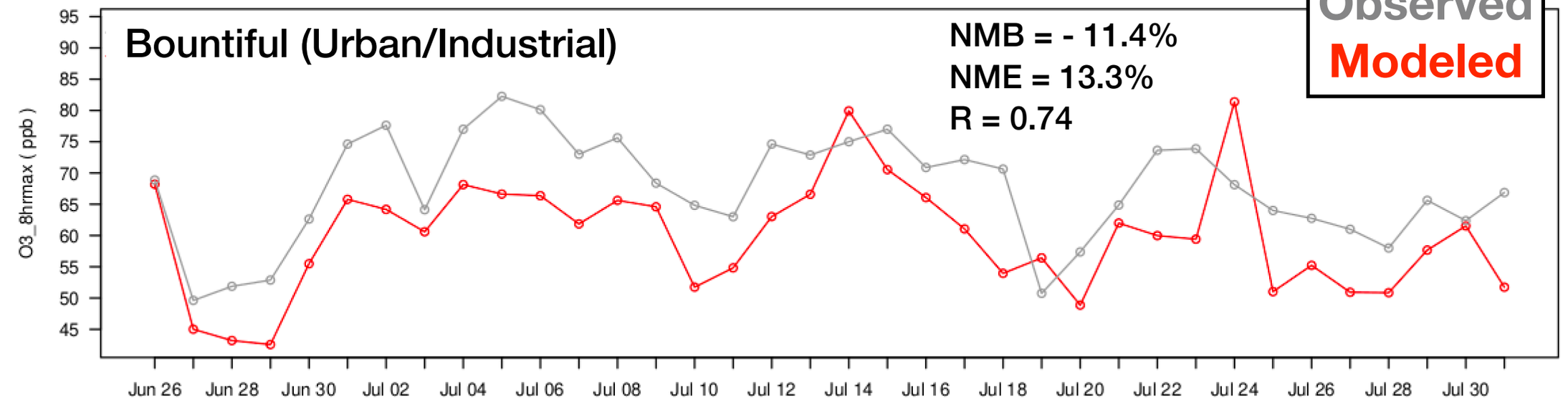
Episode: Jun. 15 - Aug. 1 2017
Base Year Simulation: 2017
Future Year Simulation: 2023

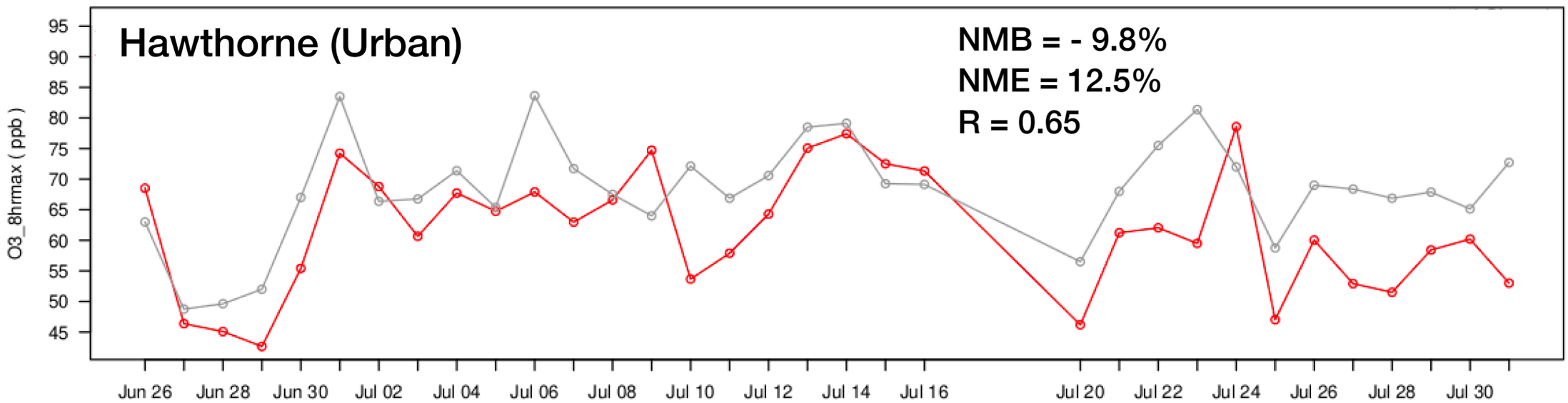
MODEL CONFIGURATION

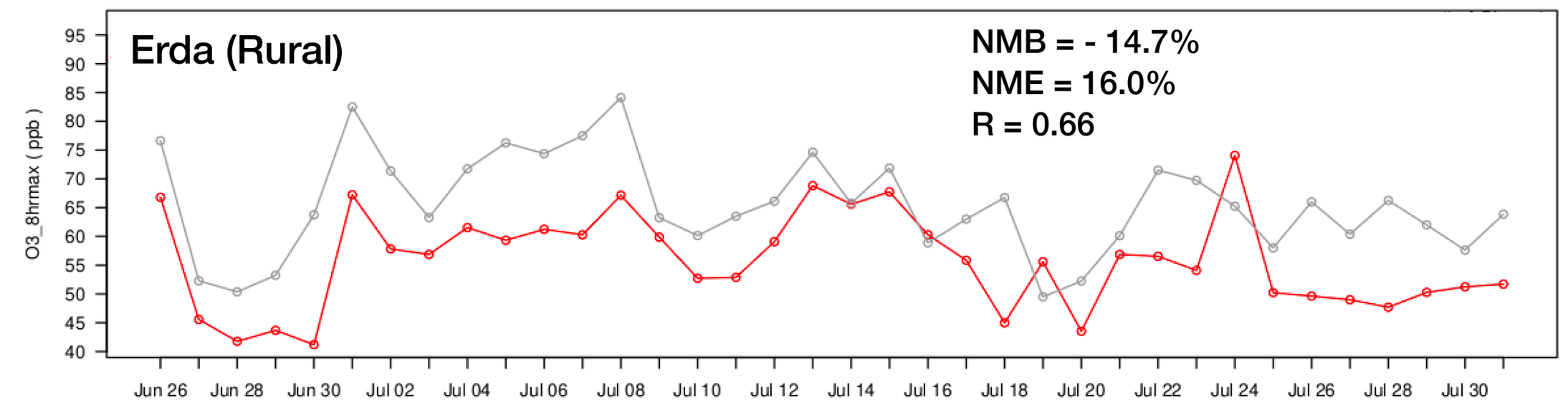
Model	CAMxv7.1
Grid Resolution/Interaction	12 km one-way nesting 4/1.33 km two-way nesting
Meteorology	WRF4.2 Hybrid Vertical Coordinate System
Great Salt Lake Modifications	- Lake-Specific Land Use Modifications - UV Surface Albedo: Salt Crust (69%), Playa (34%)
Emission Inventories	VCPy, beis3.6/beld4.1*, etc.
Gas-Phase Chemistry	cb6r5h** (inc. halogens chemistry)

*Based on sensitivity simulations using beis3.6/beld4.1, beis3.7/beld 5 and beis4/beld 6
**Developed by Ramboll for Utah DAQ

MODEL PERFORMANCE OVERVIEW







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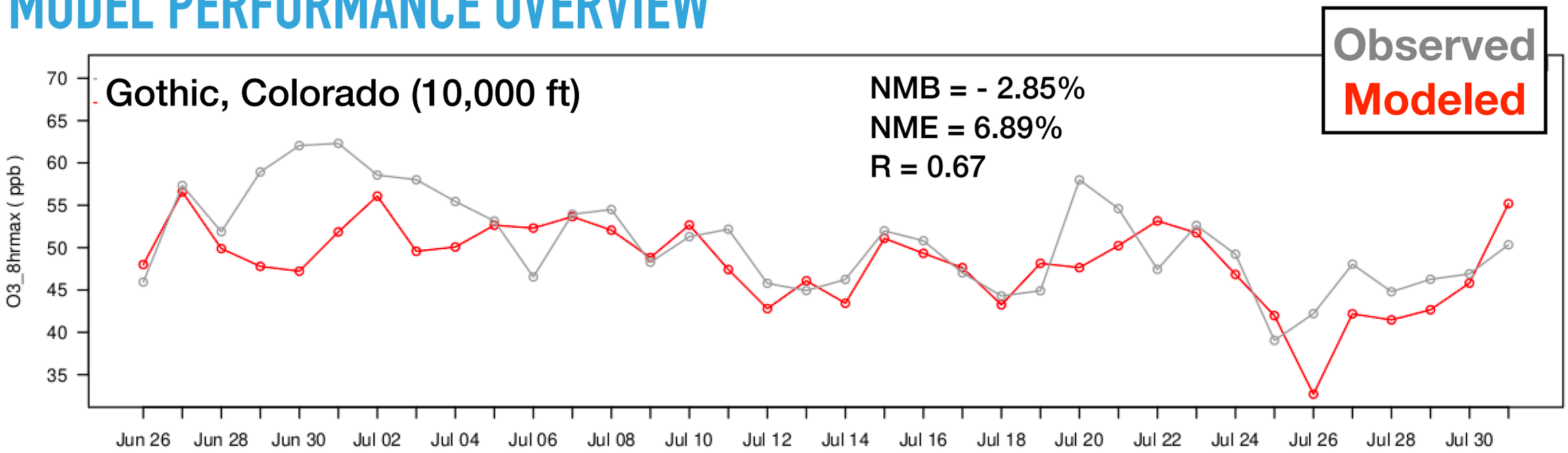
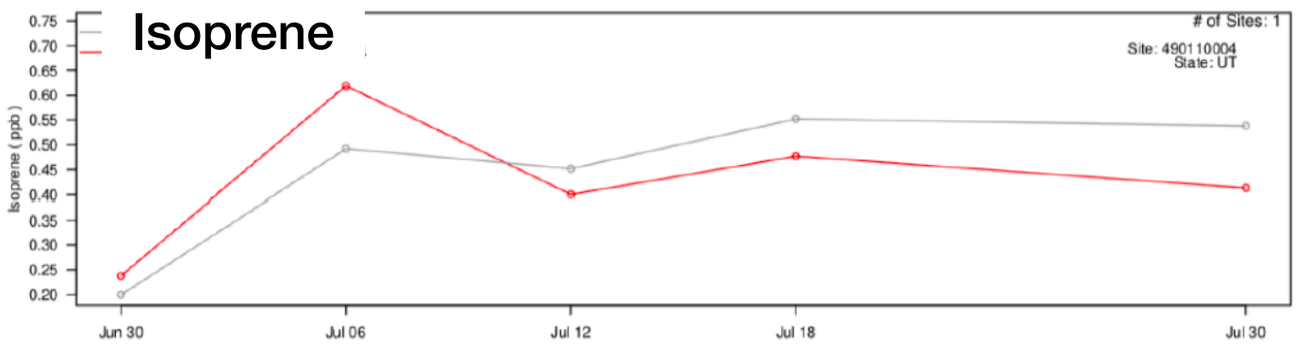
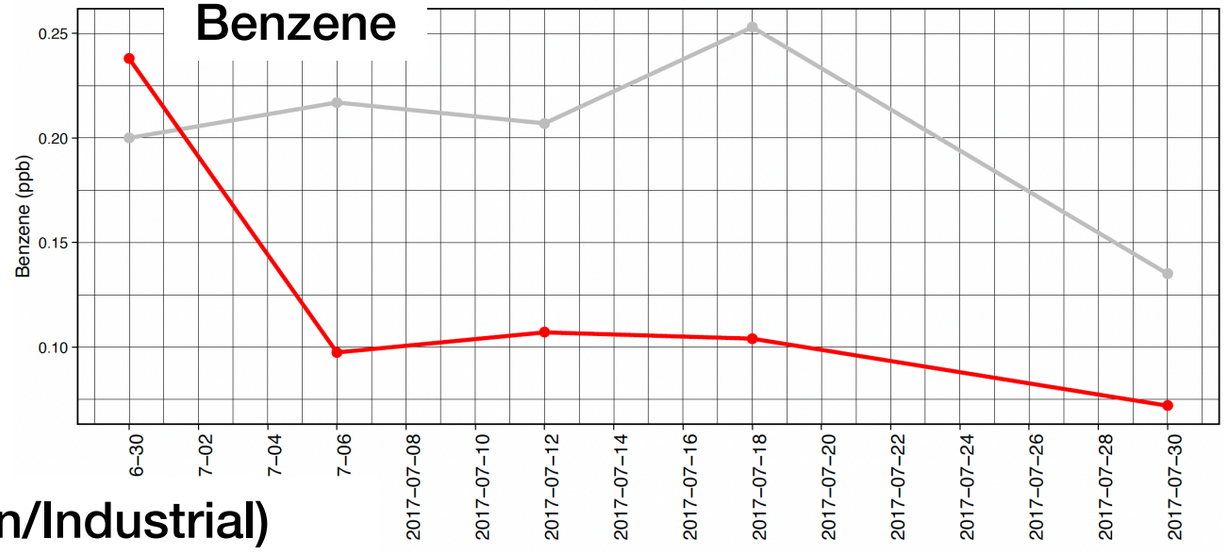
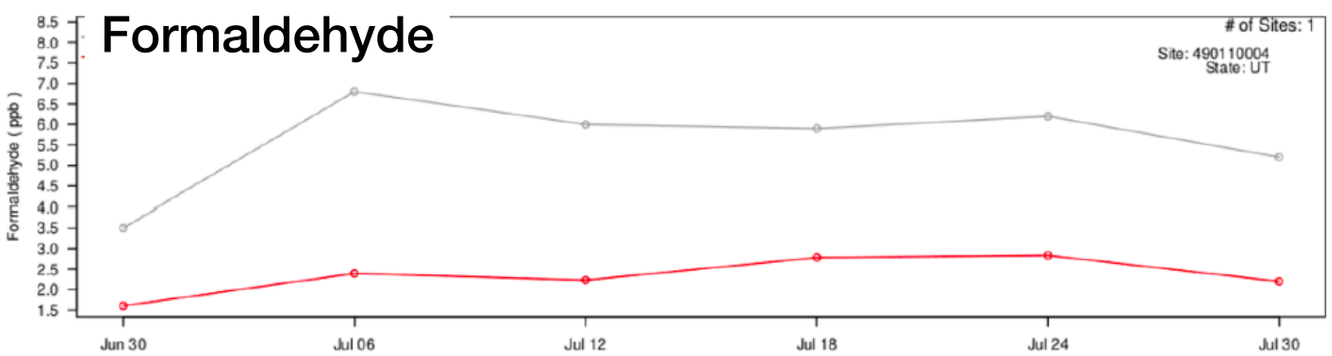
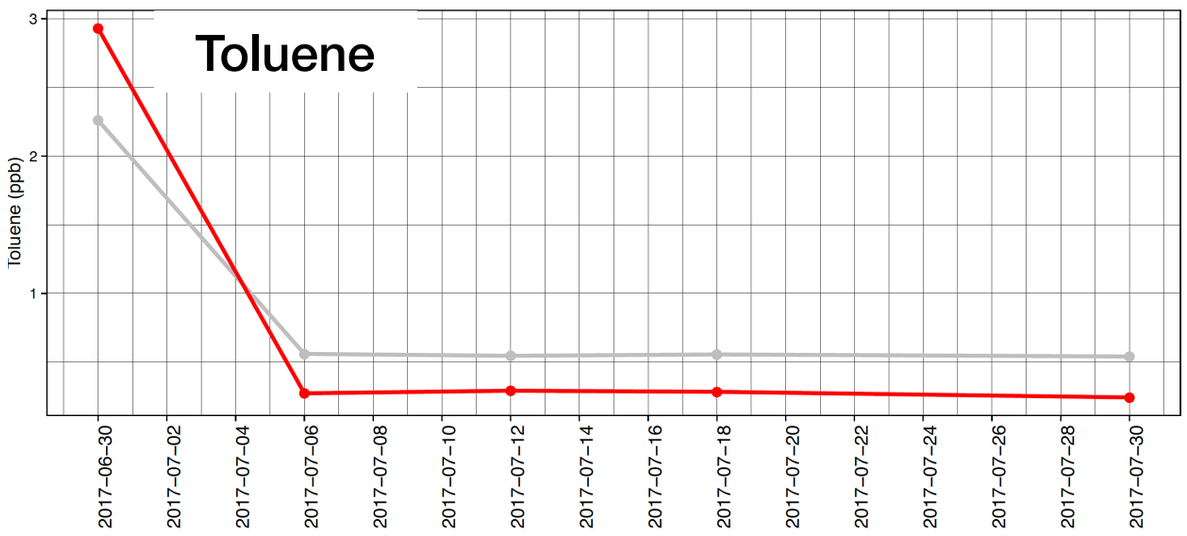






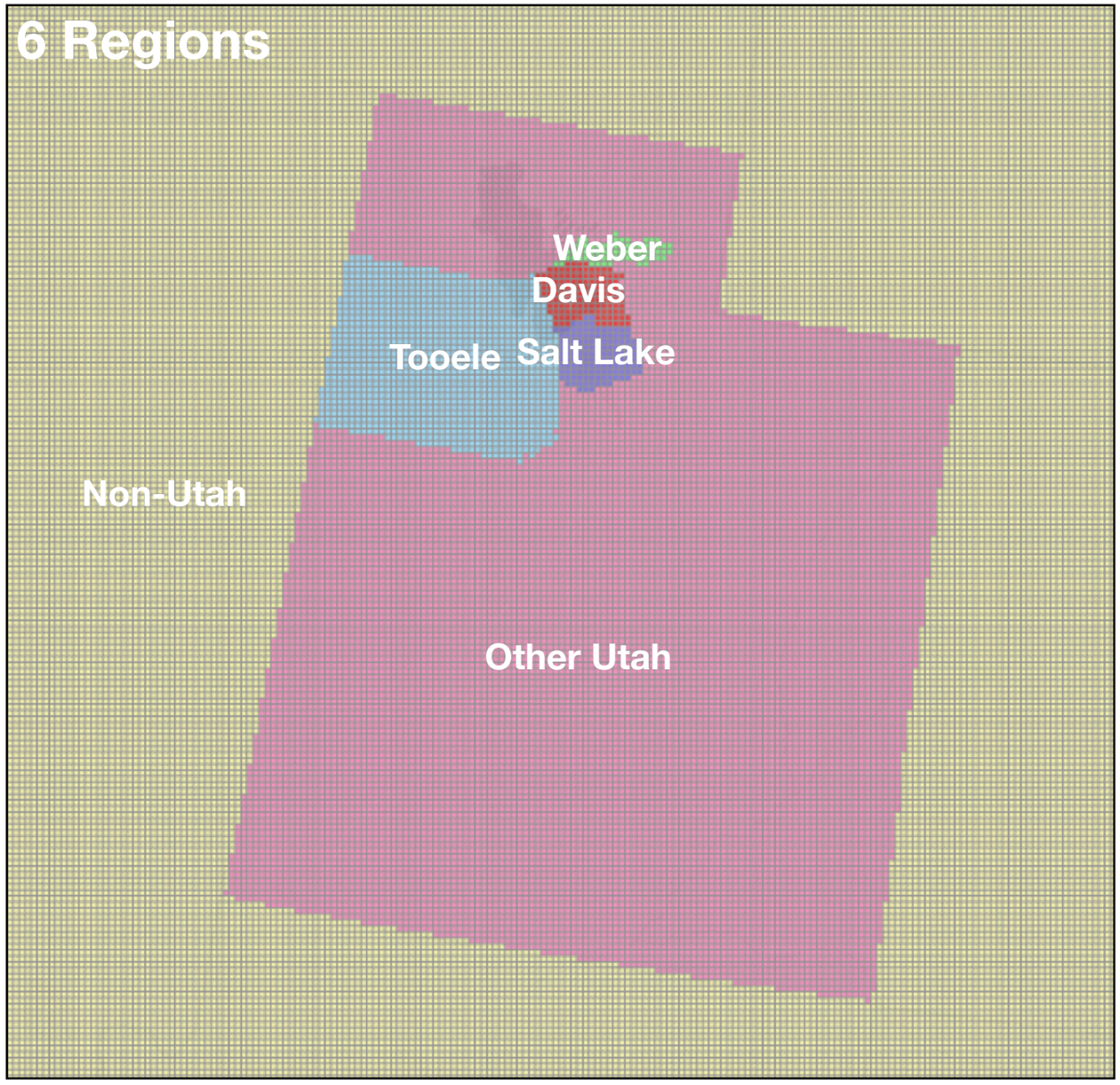
Bountiful (Urban/Industrial)





O3 SOURCE APPORTIONMENT

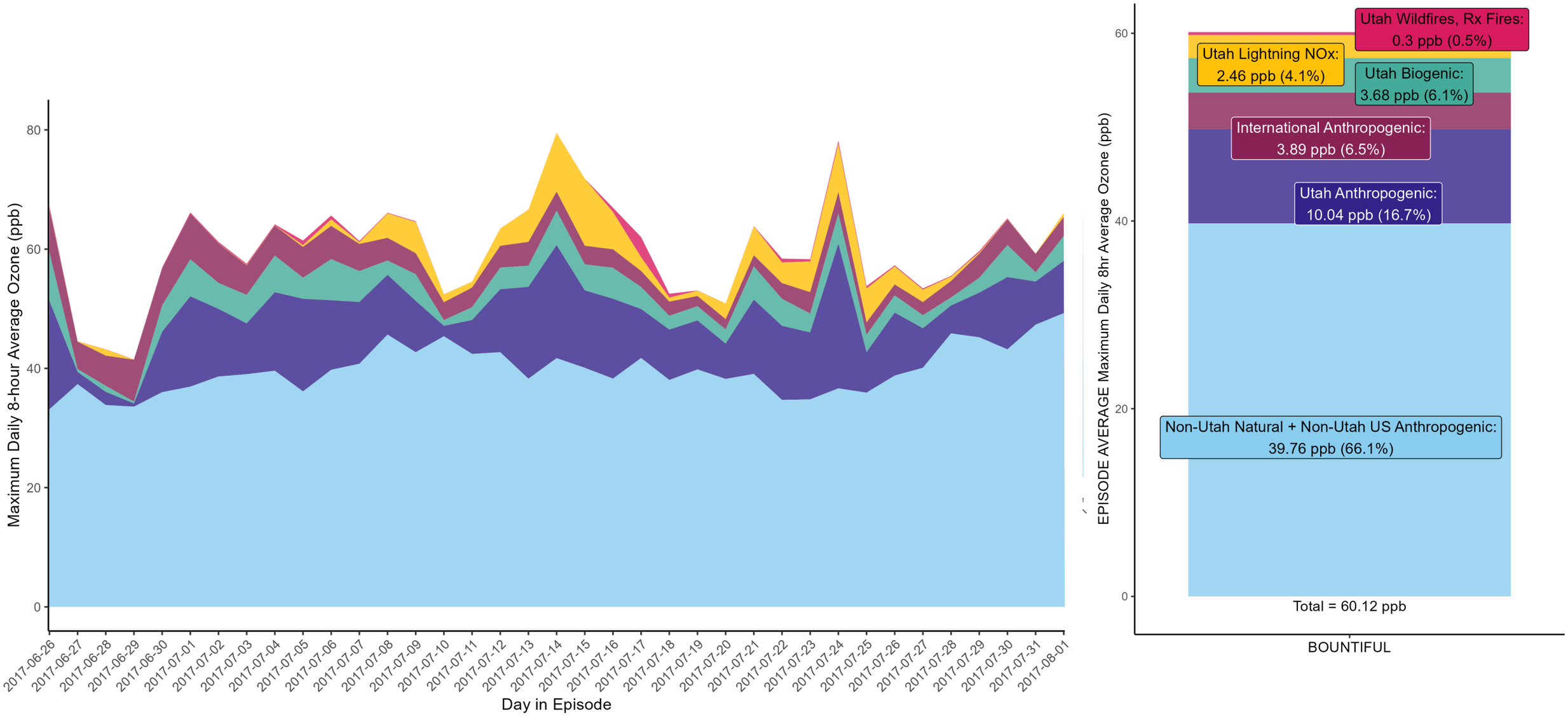
- Applied to 2023 Emissions Year & 4/1.33 km domains
- Determine source contributions to O3 & their origin
- Understand impact of controllable vs. non-controllable sources



Source Emission Groups
Solvents: Consumer Products
Solvents: Other
Nonroad: Lawn and Garden
Nonroad: Other
Onroad: Light Duty
Onroad: Heavy Duty
Rail
EGUs
Point: Oil &Gas
Point: Other
Point: Mine Trucks
Nonpoint
Wildfires, Prescribed Fires
Agricultural Fires
Lightning NOx
Airports
ERC Bank
Fertilizer
Livestock
Other
International Anthropogenic Emissions
Global Natural + non-Utah US Anthropogenic

CONTRIBUTIONS FROM ALL SOURCE GROUPS/REGIONS

Bountiful, Episode Average



Wildfires & Prescribed Burns in UT

Lightning NOx & Agricultural Fires in UT

International Anthropogenic Emissions

Biogenics in UT

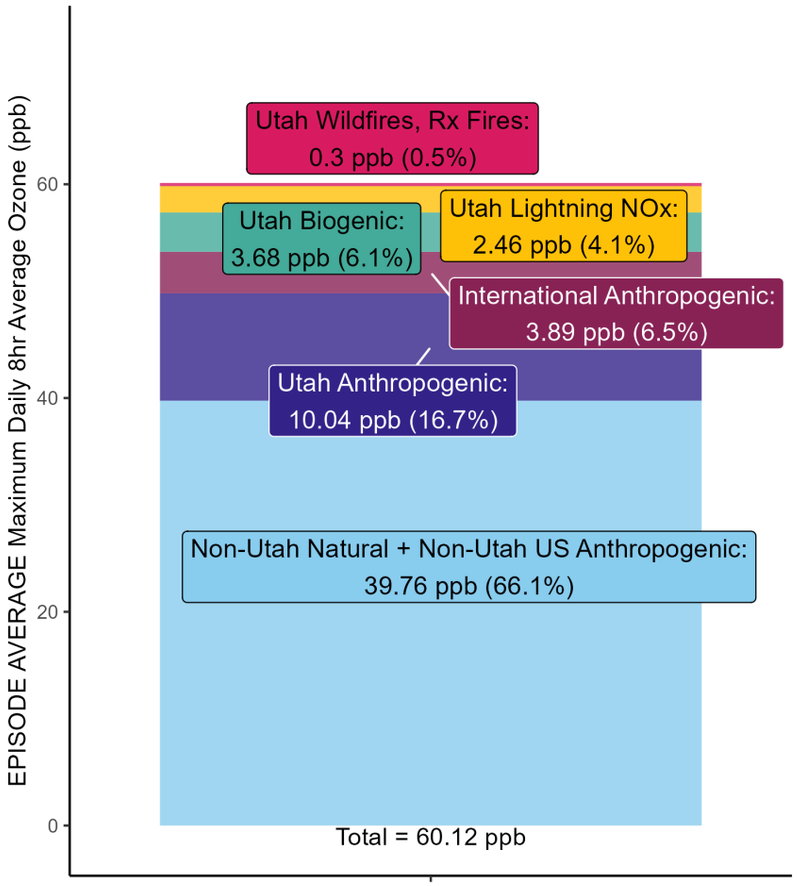
UT Anthropogenic (solvents, nonroad, onroad, rail, point, airports, fertilizer, ERC bank, O&G, nonpoint, livestock, dust)

Natural (biogenic, fires, etc.) & Anthropogenic Outside UT

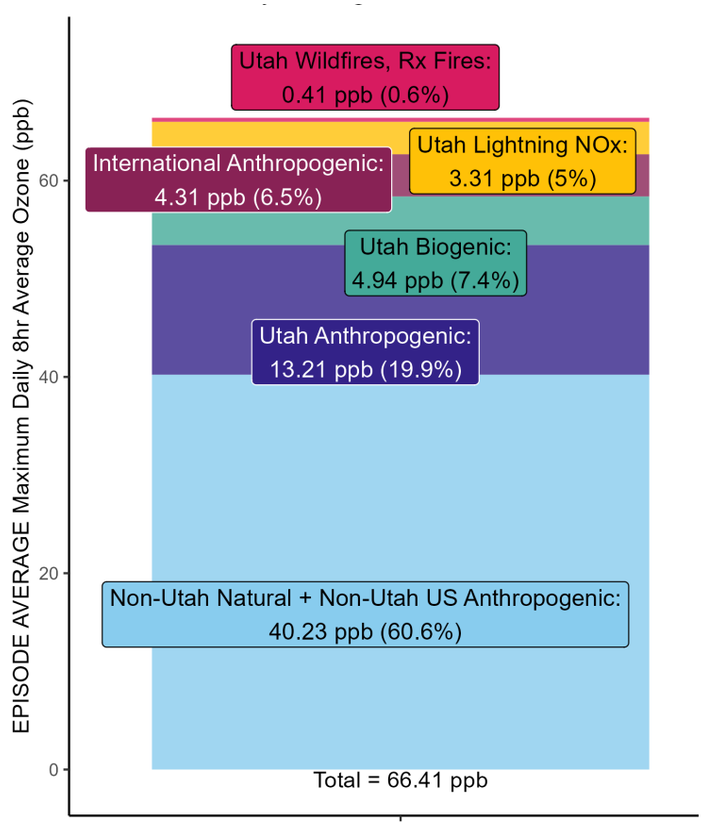
CONTRIBUTIONS FROM ALL SOURCE GROUPS/REGIONS

Bountiful

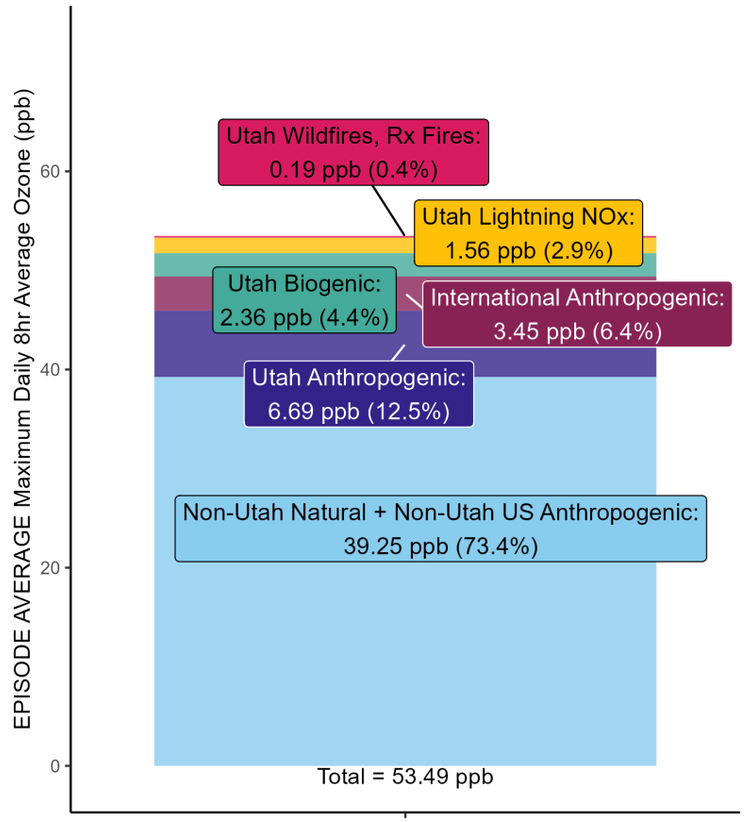
Episode Average



Exceedance Day Average



Non-Exceedance Day Average



Wildfires & Prescribed Burns in UT

Lightning NOx & Agricultural Fires in UT

International Anthropogenic Emissions

Biogenics in UT

UT Anthropogenic (solvents, nonroad, onroad, rail, point, airports, fertilizer, ERC bank, O&G, nonpoint, livestock, dust)

Natural (biogenic, fires, etc.) & Anthropogenic Outside UT

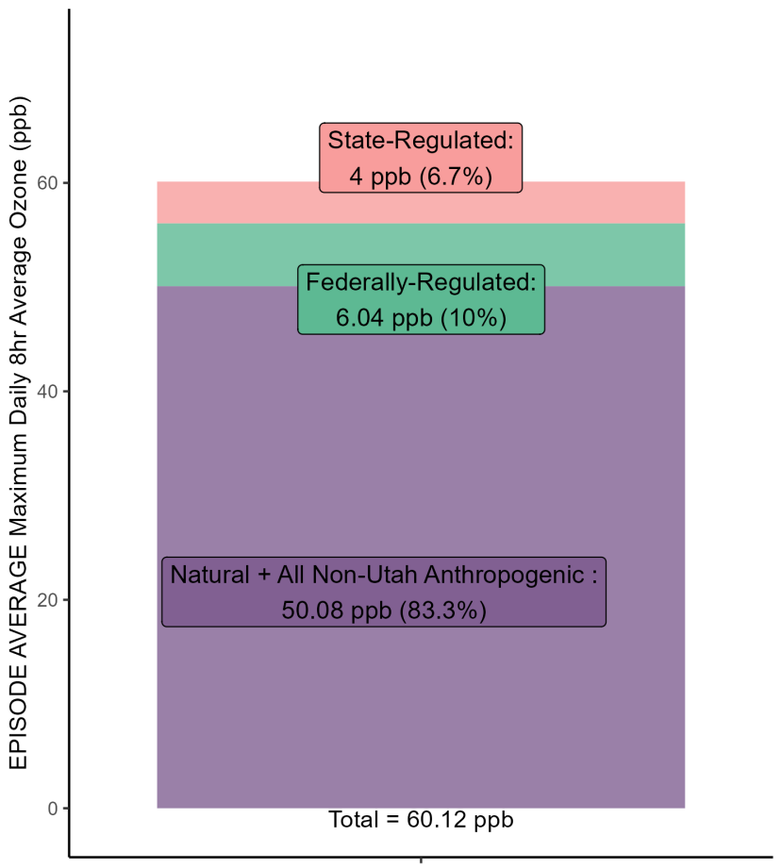
CONTRIBUTIONS FROM ALL SOURCE GROUPS/REGIONS BY JURISDICTION

State-Regulated (solvents, point, nonpoint, fertilizer, livestock, dust, other from within Utah)

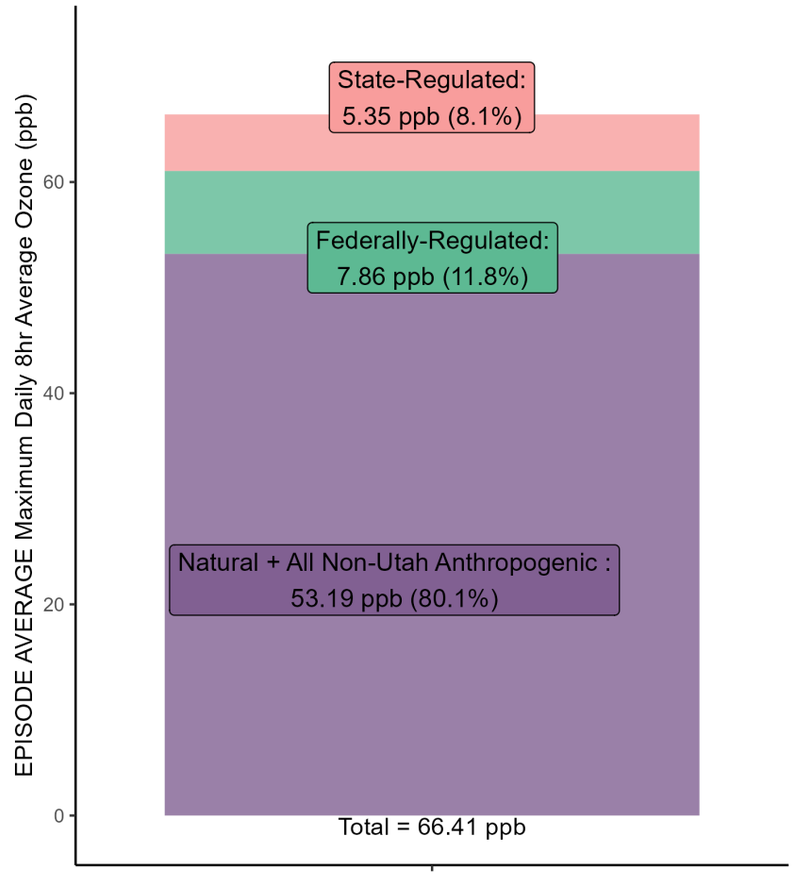
Federally-Regulated (nonroad, onroad, rail, airports from within Utah)

Natural & non-Utah Anthropogenic (biogenic, wildfires, prescribed fires, agricultural fires, lightning NOx, anthropogenic emissions from other states, global natural and anthropogenic emissions)

Episode Average



Exceedance Day Average



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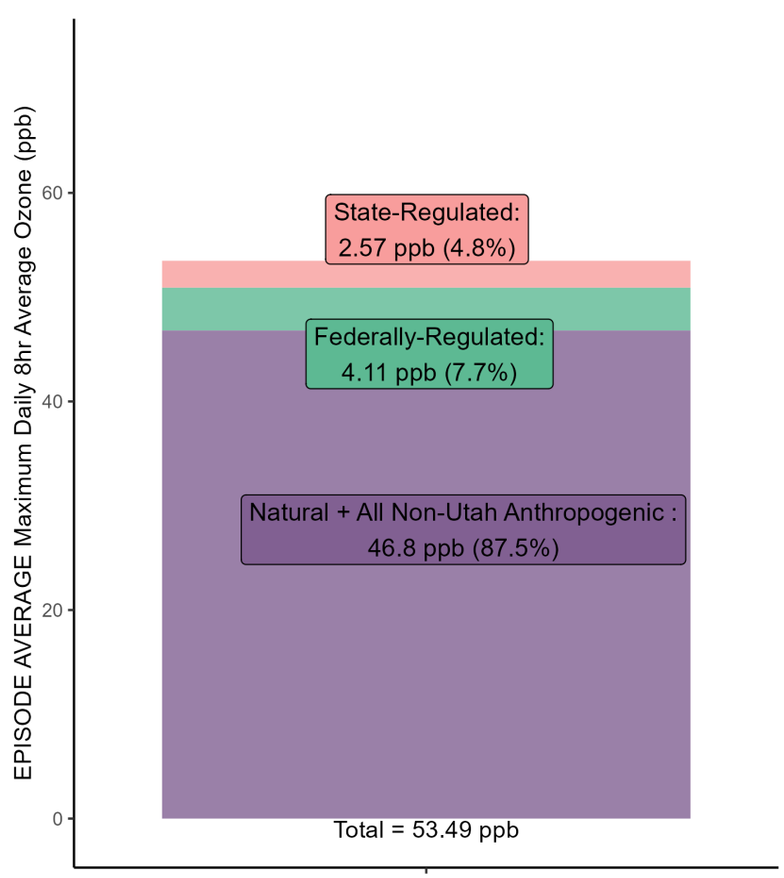
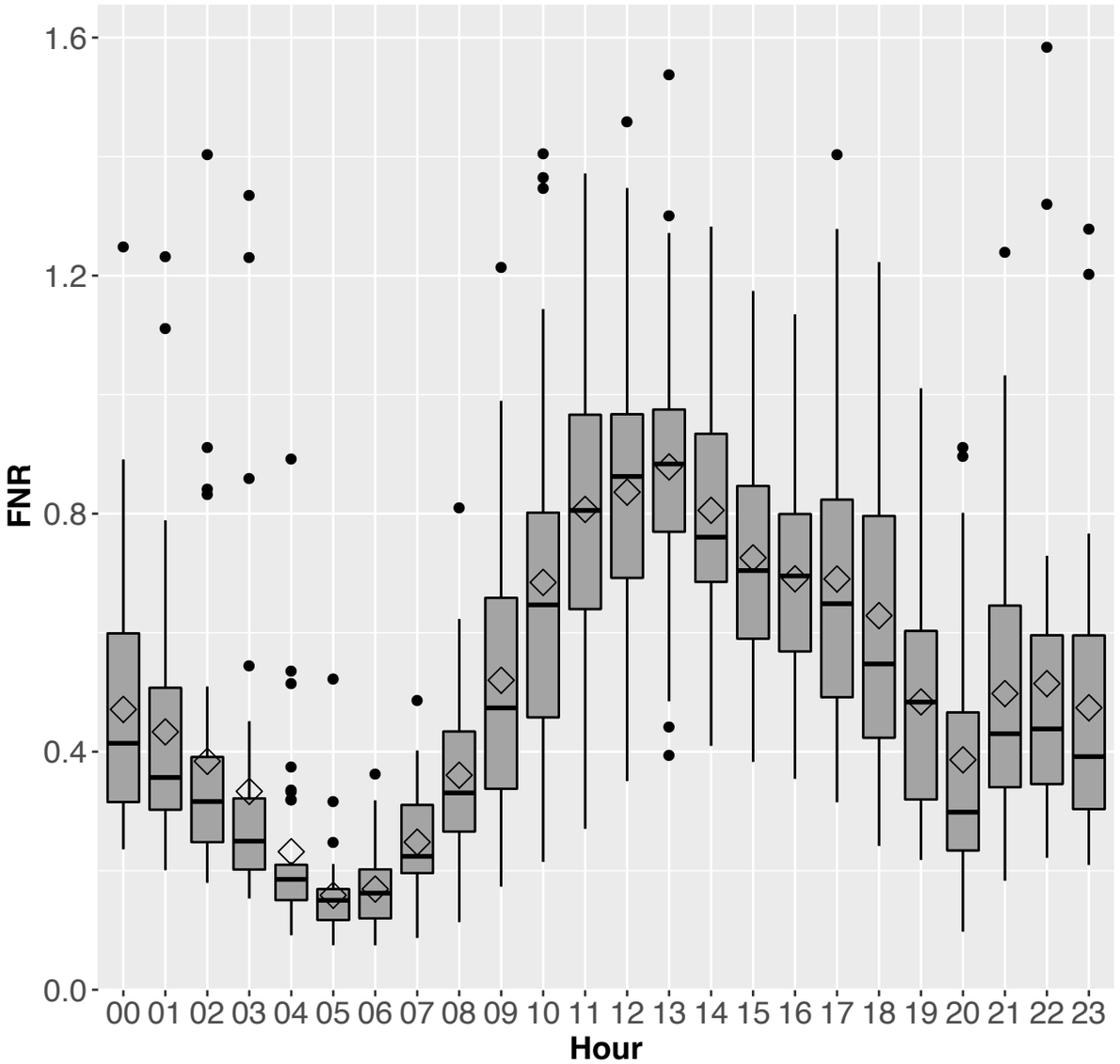


Bountiful

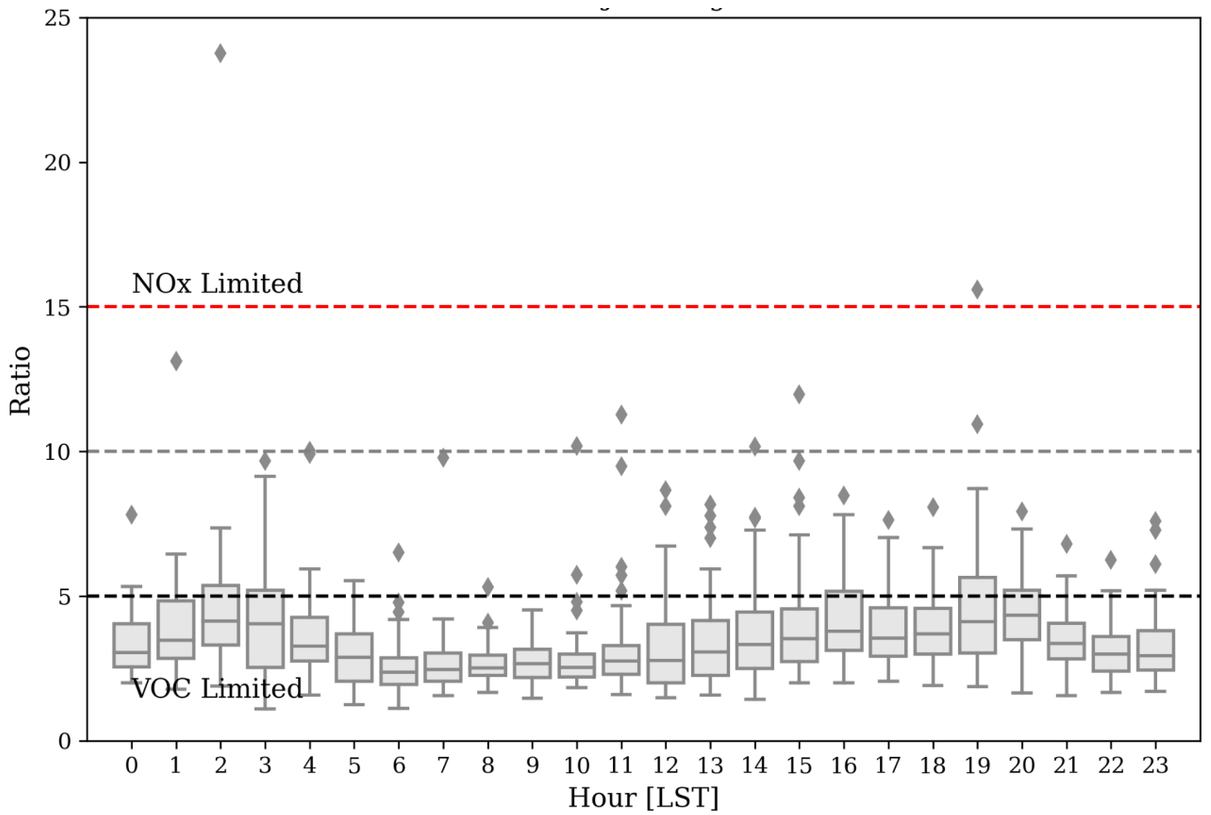
O3 SENSITIVITY

Hawthorne

Modeled
2023 Formaldehyde to NO2 Ratio (June-July)



Measured
2022 VOC/NOx Ratio (June-Aug.)



FINDINGS & IMPLICATIONS

- Background natural & anthropogenic sources contribute to most of the O3 within the NAA, during both O3 exceedance & non-exceedance days
- While there is uncertainty in local ozone production, contribution from local state-regulated sources remains minor
    - This presents challenges to reduce a substantial portion of the emissions contributing to O3 within the NAA
- At Hawthorne, O3 formation is VOC-limited

NEXT STEPS

- Continue Improving Model Performance, mainly:
  - Biogenic emissions (see **Lexie Wilson's Presentation**)
  - Speciation of VOCs from Refineries
  - PBL and Urban Land Use Representation (see **Mark Sghiatti's Poster**)
  - O3 Sensitivity to NOx and VOCs
  - Emissions from the Lake
  - Valley Transport

THANK YOU

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