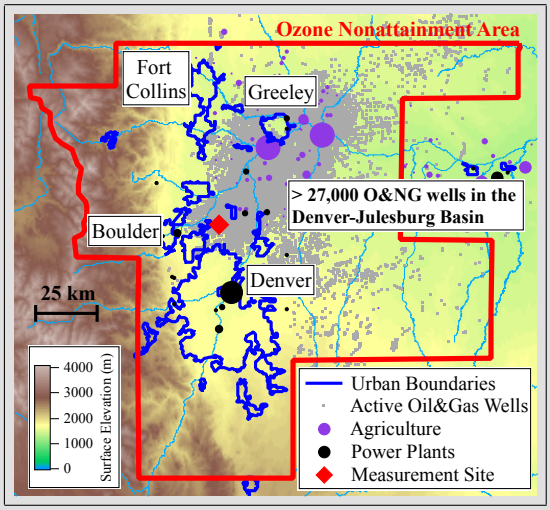
Deciphering Denver's Ozone Problem: What's the Role of Oil & Gas Development?

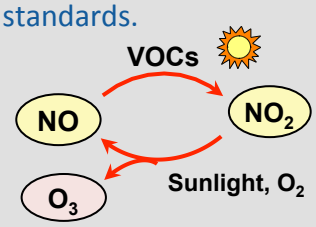
The Issue for Denver: Ozone Nonattainment

- The Denver urban area is often out of compliance with the National Ambient Air Quality Standards (NAAQS) for ozone (O_3) in the summer.
- At least a fifth of Denver's ozone is produced locally from the region's emissions of nitrogen oxides (NO_X) and volatile organic compounds (VOCs).
- Quantifying the most important regional sources of NO_X and VOCs is key to Denver's efforts to comply with federal ozone standards.



Ozone Basics

- Regulated pollutant that is harmful to human health, ecosystems, and crops
- Formed in the atmosphere from other starting ingredients: nitrogen oxides (NO_X) reacting with volatile organic compounds (VOCs)
- NO_X and VOCs come from human activities such as the use of fossil fuels (motor vehicles, power plants) and from natural sources



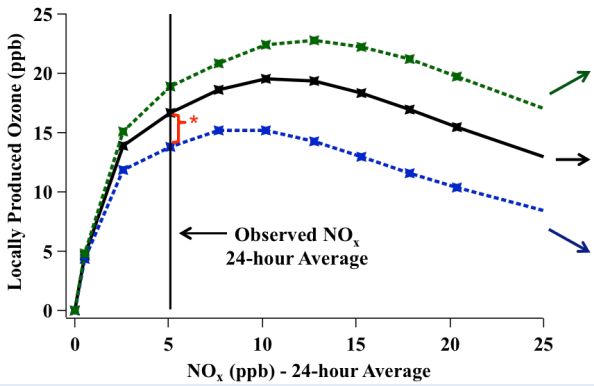
What's Unique about Denver's Ozone?

- Denver's locally produced ozone is fueled by large sources of NO_X and VOC pollution that are in close proximity:
  - NO_X from urban activity (fossil fuel combustion)
  - VOCs from oil and natural gas (O&NG) activity, urban activity, agriculture
- Natural emissions of NO_X and VOCs are low in the region

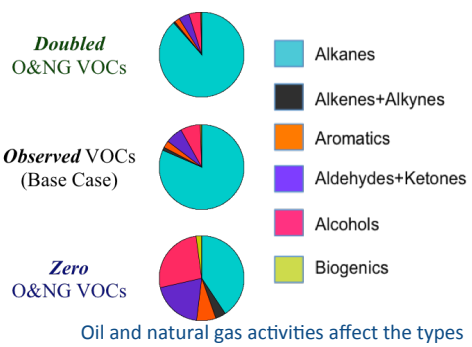
NOAA Findings: How Do Local Emissions Influence Denver's Ozone Pollution?

Method: Detailed measurements of NO_X and VOCs near the center of Denver's nonattainment area
Atmospheric chemical model of ozone's response to changes in NO_X and VOCs

Modeled Locally Produced Ozone (ppb)



VOC Distribution (ppb of Carbon)



Oil and natural gas activities affect the types of VOCs in the atmosphere

- At current levels of NO_X, oil and natural gas (O&NG) VOC emissions contribute to ~19% (~3 ppb) of the ozone produced in the north Denver metro region (see red bracket)
- For any given level of NO_X, increases in O&NG emissions will increase ozone (compare black curve to green curve), but:
  - The ozone increase would be larger if NO_X increases from its current level
  - The ozone increase would be smaller if NO_X decreases from its current level

In the Denver region, a few parts per billion (ppb) of ozone can affect compliance with the Federal ozone standards.

Bottom Line: Ozone produced locally in the northern Front Range metropolitan area of Colorado is sensitive to NO_X, as well as to VOCs from oil and natural gas activities

Payoffs of this Research

- Quantifies the roles of the Denver region's major emission sources in producing ozone pollution
- Provides the scientific basis for air quality approaches that could bring the region into compliance with NAAQS

CSD 2
Contact: Mackenzie Solomon, NOAA Office of Legislative and Intergovernmental Affairs, 202-482-2497, mackenzie.solomon@noaa.gov