

Surface Ozone in the Northern Front Range and the Influence of Oil and Gas Development on Ozone Production During FRAPPÉ/DISCOVER-AQ

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The results of this study demonstrate that high concentrations of ozone (O_3) in the northern Front Range of Colorado are not limited to the urban Denver area; high O_3 is observed in rural areas where oil and gas activity is the primary source of O_3 precursors. On individual days, oil and gas precursors can contribute in excess of 30 ppb to O_3 growth and could lead to exceedances of the Environmental Protection Agency (EPA) standards. Data used in this study was gathered from continuous surface O_3 monitors as well as additional flask measurements and mobile laboratories that were part of the Front Range Air Pollution and Photochemistry Experiment (FRAPPÉ) and Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality (DISCOVER-AQ) field campaign of July and August, 2014. Overall O_3 levels during the summer of 2014 were lower than in 2013, likely due to cooler and damper weather than an average summer. This study determined the average O_3 mixing ratio on summer days with limited photochemical production within the boundary layer to be approximately 45 ppb. Mobile laboratory and flask data collected on July 23, August 3, and August 13, 2014 provide representative case studies of different O_3 formation environments in and around Greeley. Observations of a number of gases (including methane, ethane, carbon monoxide, nitrous oxide (NO_x)) measured along with O_3 are used to identify possible sources of O_3 precursor emissions that could contribute to O_3 formation. The July 23 survey demonstrated low O_3 enhancement while the August 3 and August 13 surveys recorded O_3 at 30 ppb or more above concentrations on days with limited photochemical production. August 3 is an example of both high oil and gas emissions and high agricultural emissions. August 13 demonstrates high oil and gas emissions, low agricultural emissions, and carbon monoxide measurements that were well correlated with ethane from oil and gas, suggesting an oil and gas related activity as a potential NO_x and O_3 precursor source.

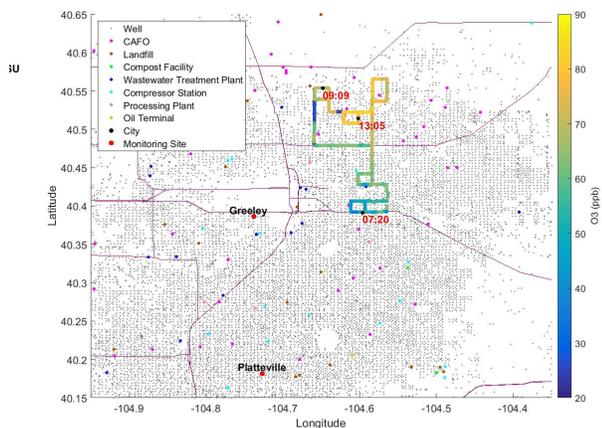


Figure 1. Map of mobile laboratory O_3 measurements on August 13, 2014.

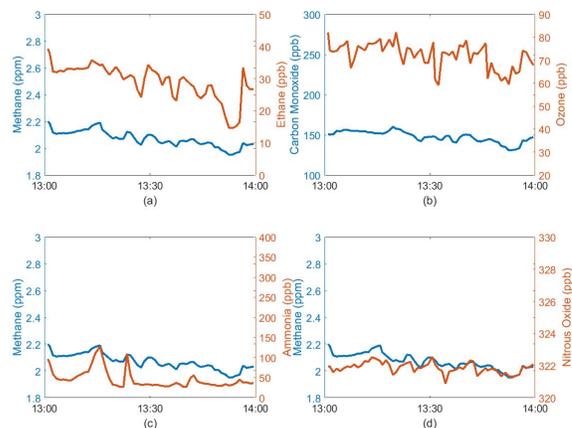


Figure 2. Time series of gaseous species from mobile laboratory on August 13, 2014.