

Evaluating the Influence of Wildfires on Observed High Ozone in the Colorado Front Range with Model Verification of Sources

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The Colorado Front Range (CFR) is a region of intricate interactions between pollution sources and complex meteorological conditions which can result in exceedances of the National Ambient Air Quality Standards for Ozone. Surface ozone is a secondary pollutant formed from reactions with other atmospheric constituents and plays a critical role in regulating the oxidation capacity and photochemical properties of the atmosphere. At high levels ozone is a primary contributor to local smog and can result in public health complications and altered ecosystem functioning. When evaluating high ozone episodes in the CFR, co-located in-situ measurements, satellite imagery, HYSPLIT back trajectory analysis, and atmospheric models help to confirm and understand the contribution of different sources and processes on observed local ozone conditions. Precursor emissions from pollution, wildfires, and gas and oil production; along with stratosphere-troposphere exchange, can all result in high ozone episodes over this region.

Emissions from wildfires and biomass burning contain particulate matter, carbon dioxide, carbon monoxide, nitrogen oxides, volatile organic carbon compounds and more. These compounds are a source of primary and secondary pollutants which can influence the production and accumulation of ozone and emissions can be transported long distances from the source. Wildfire season occurs in the summer months (May-September) and varies in severity from year to year. However, it has been reported that the wildfire season is getting worse with climate change in the Western United States. 2018 was documented as one of the worse wildfire seasons on record, and the air quality impacts were noticeable across the United States, including the CFR. The use of additional measurements and models allow for in depth investigation into the air parcel origin, chemistry, and transport which lead to the observed high ozone conditions. The Whole Atmosphere Community Climate Model (WACCM) is a comprehensive climate-chemistry model which provides valuable information on the spatial and temporal distribution of precursor compounds which cannot be fully understood from measurements alone. The 2018 surface ozone measurements from NOAA GMD long-term monitoring sites and mobile van station in the region are evaluated for the influence of wildfires on the observed conditions. Model output is compared to observations of ozone to understand the models ability to capture ozone conditions in the region. Further, the additional species in the model are used to perform analysis of the contributing sources to the high ozone conditions.