Motivation

The South Coast Air Basin of California (SoCAB) is well-known for its historically poor air quality. In recent years, the Basin has seen tremendous progress due to the implementation of effective emissions mitigation strategies. In the past five decades, the level of air pollutants (particulate matter (PM), NOx, ozone) has been reduced. However, in the last five years, the ozone concentrations in the SoCAB shows the inverse trend despite the continuous reduction of emissions. To answer the question, we need to investigate not only how ozone responds to emissions, but also how concentrations are impacted by meteorological factors (i.e., wind speed, temperature, relative humidity, pressure). It is difficult given the complexities of accurately tracking emission changes, characterizing all meteorological variables that can impact ozone, simulating the complexities of the formation and fate of ozone and PM, and isolating the role of long-range transport of pollutants impacting the region.

Objectives

Overall Objective: To understand the relationship of ozone and meteorology over the past 30 years.

1. Determine a set of meteorological factors which contribute to high ozone and PM2.5 episodes, respectively.
2. Analyze the recent meteorological and air quality trends
3. Project directions of recent air quality trends

UCR Tasks

1. Task 3: Machine learning to determine air quality, meteorology, and regional drivers of high ozone
2. Task 4: Chemical transport modeling and sensitivity analyses to quantify VOC and NOx contributions to high ozone and PM2.5

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Results

Machine learning using the RFR algorithm well describes the trends of ozone due to the variations of other features.

- Meteorology significantly affects ozone exceedances
- Slightly lower NO2 and NO concentrations promote the exceedance hours of ozone
- Empphasis was given to the role of meteorology that has adversely influenced the observed trends of ozone and PM2.5 in the SoCAB in recent years and the projection of such trends to the near-term

Conclusion

- Apply machine learning to test the sensitivity of ozone to changes in meteorology. We will use similar methods to build the regression models for particulate matter mass and species, CO, NOx, and SO2
- Use machine learning to predict future ozone concentrations for different cases (i.e., increasing temperature, decreasing NOx)
- Use CMAQ to simulate the summer 2017 and 2023 cases

Future Work

Ozone Meteorology Study: Quarter 1 Report, 2019

Evaluation of Meteorological Factors and Trends Contributing to Recent Poor Air Quality in the South Coast Air Basin

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University of California, Riverside • Center for Environmental Research and Technology

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