METEOROLOGICAL EFFECT ON CRITERIA AIR POLLUTANTS

SOUTHEAST TEXAS
URBAN INTEGRATED FIELD LAB

Interrelation between Pollutants Species in Southeast Texas

WHY NOW?

Air pollutants are very common in industrial urban landscapes such as in the Southeast Texas region. To effectively study air quality, we must evaluate the impact of meteorological and weather factors on pollutant spread, as well as the location, pollutant release type and time period, and the concentration ratios of pollutants that can react with each other.

WHAT WE DID

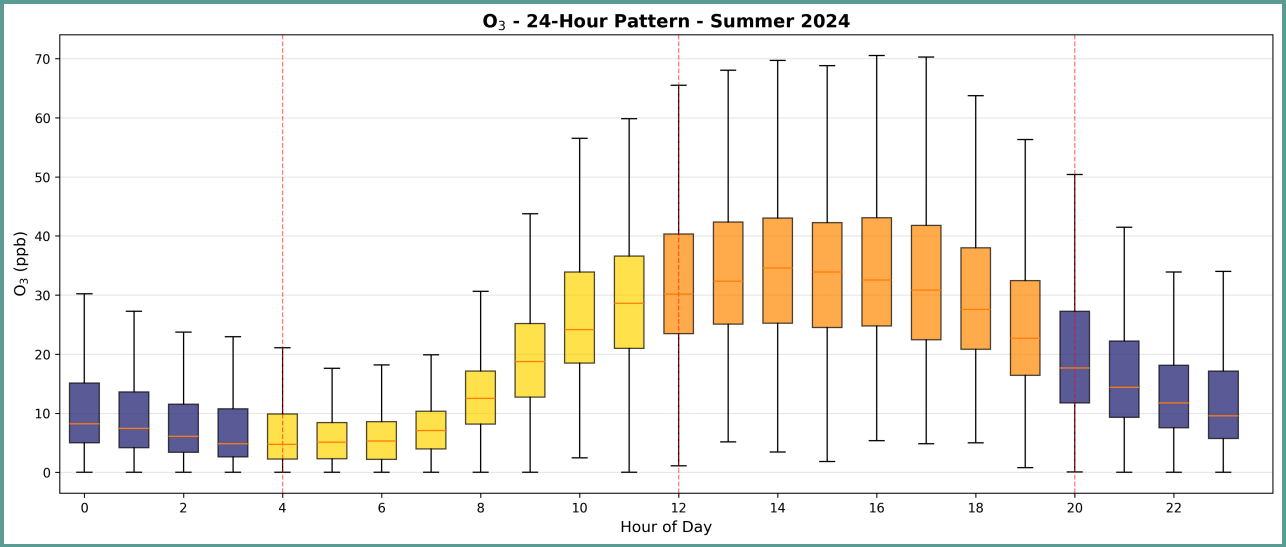
The SETx-UIFL research team monitored the following at different times of day and seasons: Pollutant concentration (PM, NO, NO2, CO, CO2, O3 & total VOC), ambient temperature, Relative humidity, wind speed, and wind direction. Using low-cost sensors deployed outdoors and indoors, the researchers collected real-time data in frequency of 1 min across 3 years. The pattern of pollution by individual compound have been studied in respect of meteorological parameters (wind speed & direction, temperature and relative humidity) for different seasons throughout the year. The research analyzed the correlation between the pollutants to identify complex pollution hours and chemical/physical interactions in the perspective of atmospheric phenomena. The research team also conducted an indoor-outdoor comparative study.

FINDINGS

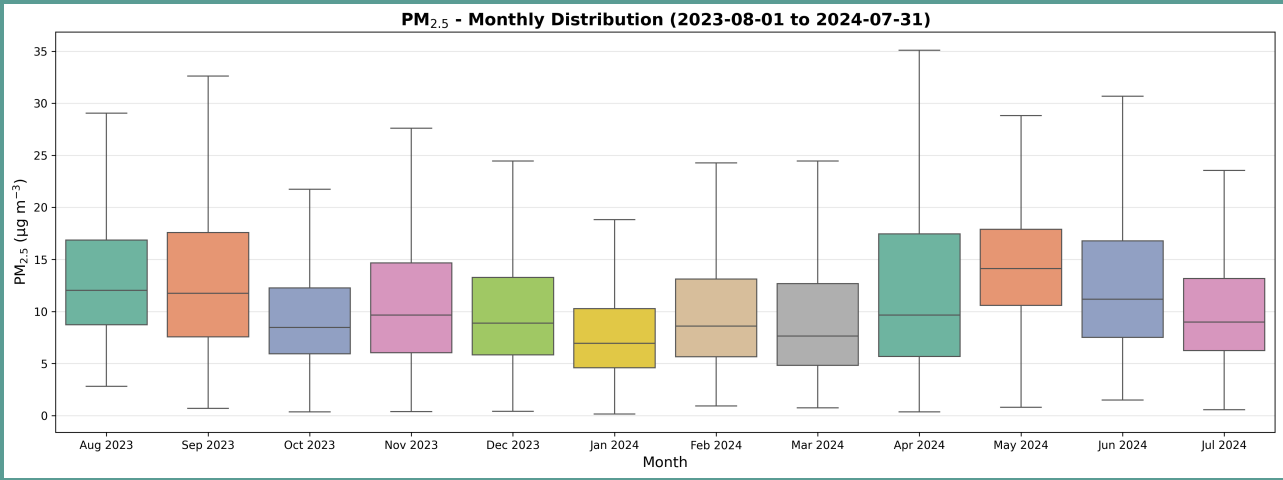
• There are trends showing different air pollutants are more noticeable during certain seasons. For example, O3 pollution is found higher in summer while NO2 pollution is higher in winter.

• Temperature and relative humidity have impacts on the concentration and dispersion rate of several chemicals. Wind speed and direction have the strongest effect on pollutant concentration and movement which will determine the impacted risky zone depending on the weather conditions across the region. Further analysis will identify the specific wind direction that is more concerning.

• The relation between some pair of compounds (those may react with each other or affect the formation of each other) such as NO2 – O3 and PM – O3 have been observed under different ambient conditions and different hours of the day. For example, a higher NO2 is found when O3 is lower in winter. Additionally, data collected in the afternoon shows lower NO2 and higher O3 concentration due to the stronger sunlight. These observations suggest influence of temperature & solar radiation on the reaction kinetics and equilibrium between NO2 and O3. Further analysis is ongoing and although some comparable trends in different seasons have been observed we cannot make any final conclusions as of now.



Daily variation in Ozone Concentrations in the summer



Monthly PM2.5 concentrations.

Sensor picture from Shipping and Receiving Building

MORE ABOUT SETX-UIFL

The Southeast Texas Urban Integrated Field Lab (SETx-UIFL) is one of four projects funded in 2022 by the U.S. Department of Energy to study how climate, environment, and urban changes affect cities. A team of over 80 researchers from UT, Lamar University, Texas A&M, Prairie View A&M, Oak Ridge National Lab, and Los Alamos National Lab has collected data and conducted modeling across hazards including flooding, hurricanes, heat stress, and air quality. Our Why: Southeast Texas faces numerous hazards, yet smaller communities like this one have often felt forgotten compared to larger cities. The SETx-UIFL was designed to explore the complex dynamics of disaster vulnerability for this economically and culturally vibrant region. We believe Southeast Texas is a bellwether for the entire Gulf Coast, and an exemplar for strategies that protect people and places. We hope this effort supports your path toward lasting resilience.

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