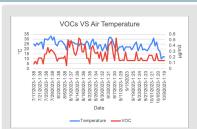
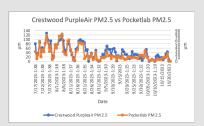
A Longitudinal Study Comparing Select Atmospheric Parameters with Air Pollutant The CLOBE Propriet

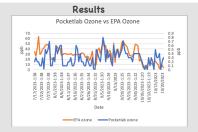
Levels in Southeastern Michigan

Yasmine Ahmad, Jenna Charara, Deanna El-Saghir, and Alaa Selman Crestwood High School- Dearborn Heights. MI

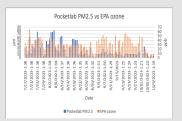


Air temperature recorded from the WeatherBug app in comparison to Crestwood High School's PurpleAir device vs the Pocketlab VOC data collected from the ATMO tube throughout the summer to device displaying positive correlation fall months. The two parameters demonstrate a close relationship

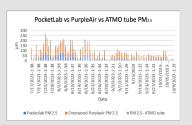




The Pocketlab ozone data compared to the EPA ozone data from the AirNow site showed significant correlation.



Particulate Matter data from the Pocketlab compared to EPA ozone conclude significant correlation



PocketLab, PurpleAir, and ATMO Tube PM2.5 data compared throughout four months at or near solar noon. The three devices show positive correlation to one another

Introduction

The Researchers collected daily atmospheric data on Crestwood High School's hand practice field in Dearborn Heights, MI, where multiple students engaged in various activities. Increased outdoor activity during the summer and fall led to rising levels of VOCs, PM2.5, and ground-level ozone, raising concerns. PM2.5 particles pose a significant health risk as they can penetrate deep into the lungs. The Summer of 2023 saw numerous Ozone Action Days due to high temperatures and pollutants from sources like Marathon Oil. Despite the inability to measure nitrogen oxides due to cost constraints, high levels of VOCs were detected, attributed to local oil refineries. Dr. Ali Abazeed highlighted Dearborn's industrial nature, emphasizing air quality concerns. Local agencies aided researchers in data collection and interpretation within air quality initiatives. The school's PurpleAir device provided near-professional grade PM2.5 data, while PocketLab Air and ATMO Tube data, though less accurate, reflected trends observed with professional instruments. High summer temperatures led to elevated ground-level ozone readings, exacerbated by nitrogen oxides and VOCs from vehicles and industries. Proximity to Ford Motor Company factories and steel mills contributed to pollutant levels, exacerbated by prevailing winds. Ground-level ozone and particulate matter, both EPA criteria pollutants, pose significant health risks, with VOCs playing a key role in ozone formation. The Dearborn-Detroit-Warren area ranks 13th in air pollution, highlighting the urgent need for action (Laster).

Null Hypothesis

- 1. There is no significant correlation between PM2.5 data collected from the Pocketlab Air device and data collected from the PurpleAir instrument.
- 2. There is no significant correlation between the ground-level ozone, PM2.5, and 3. There is no significant difference between VOC data collected from the ATMO
- tube and air temperature. 4. There is no significant difference between the variety of PM2.5 data collected
- from the ATMO tube. Pocketlab Air, and the Purple Air instrument.
- 5. There is no significant correlation between EPA reported ozone levels and the Pocketlab Air ground-level ozone readings.

Research Questions

1.How do PM2.5 levels taken from a Pocketlab Air correlate to the measurements of PM2.5 taken from a permanently installed PurpleAir device?

- 2.To what extent does ground-level ozone correlate with PM25 and VOC levels? 3.What effect does air temperature have on VOC data collected with the ATMO Tube
- 4.How does PM25 data taken from the ATMO Tube vary with values obtained from the Pocketlab Air device and PurpleAir?
- 5. How does locally reported ground-level ozone data from the EPA and Pocketlab Air device vary?

Methodology



A satellite image of the location where the data was taken.



A student researcher submitting data for GLOBE verification.



The ATMO Tube collecting data on PM25 and VOCs.

researcher's phone

An image of Purple Air PM25 measurements after hazardous wildfires,

Data from the ATMO Tube displayed on the

The ozone levels displayed on the mobile ATMO Tube app.

The PocketLab Air gathering

measurements on ozone and PM25

The student researchers collecting ground level ozone data.

Abstract

Researchers compared their GLOBE data with ground-level ozone, particulate matter (PM25), and Volatile Organic Compounds (VOCs) measured using consumer-grade instruments known as PurpleAir, PocketLab Air, and ATMO Tube. All measurements were taken at or near solar noon to maintain reporting consistency. The data collected and analyzed in this research showed that high PM2s levels do appear to correlate with high ozone levels and high air temperatures. Researchers found that the PocketLab Air and ATMO Tube had measurements typically below locally reported data, but they constantly varied with professional devices. Reducing the intense long-term effects of ground-level ozone, particulate matter (PM25), and Volatile Organic Compounds (VOCs) is crucial for student health and safety during recess and when practicing and performing athletic outdoor-based sporting activities. This longitudinal research extended a project conducted previously to include data taken during two different seasons and years. Air quality data collected at schools is vital as atmospheric conditions can vary considerably on a microscale level.

Conclusion

Researchers have found a positive correlation between air temperature and VOC levels throughout the summer and fall. The PurpleAir, handheld PocketLab Air, and ATMO tube devices showed significant similarities in their measurement, allowing for accurate data collection. The PocketLab and ATMO devices were user-friendly and portable. while the PurpleAir was a research-grade device in a stable location, allowing for accurate comparisons. The data collected also revealed a positive correlation between VOC and ground-level ozone, as VOCs in sunlight cause ozone formation, which accounts for VOC rise with higher temperatures. The study is essential for addressing the health risks associated with VOCs, PM2.5, and ozone, which are known to cause cardiovascular disease, asthma, and heart attacks. The researchers hope to access higherquality devices like the PurpleAir to collect substantial ground-level ozone and VOC data and develop a NOx research-grade protocol for further research. The study aims to study regulated pollutants and install more PurpleAir devices in Southeastern Michigan to protect citizens' health. The Crestwood School district has been granted a grant to purchase four more PurpleAir devices to install at other district schools.

Acknowledgements

Thank you to Dr. Czaikowski and his staff at NASA Globe Mission Farth (University of Toledo) along with Mr. Bydlowski of the GLOBE AREN for providing some of the instruments utilized in this research. Extended gratitude to Dr. Margaret Pippin of NASA Langley for providing Laster, Luke, "Air Quality Monitors insight on the devices the researchers utilized in the project through email communication with the GLOBE advisor. Thank you also to Mrs. Diana Johns GLOBE teacher at Crestwood High School for her consistent availability and support throughout, answering questions, and providing additional resources.

Bibliography

Discussion

The study found that the PurpleAir device and PocketLab Air measured PM2.5 values consistently higher than the PocketLab Air, indicating a more accurate measurement. Ozone levels were positively correlated with higher PM2.5 levels, suggesting that ozone levels depend on weather conditions. The study also found that higher air temperatures increase PM and ozone levels, likely due to groundlevel ozone and PM2.5 counts. The researchers' study was influenced by climate change, such as the Canadian wildfires in 2023, which led to sudden changes in PM and ozone levels in their community.

Researchers aim to obtain higher-quality equipment for their research, aiming to collect more accurate data and meaningful results. Data was collected from July to October, including seasonal temperature changes. One possible source of error is the relatively new ATMO Tube device, which took time to achieve accurate results. The researchers have experience using other devices and have experience using other devices. Another possible source of error is the unknown time the ozone was taken on EPA ozone, which may differ from other devices. The PurpleAir device is located within Crestwood's courtyards, but the researchers couldn't access them due to summer closures. The hand practice field was used to measure near the courtward

