USING LOW-COST SENSORS TO MONITOR OZONE POLLUTION IN COLORADO'S CENTRAL MOUNTAIN VALLEYS

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PROJECT INTRODUCTION

- Ambient ground level ozone pollution (O_3) is classified as a criteria pollutant via the EPA's National Ambient Air Quality Standards (NAAQS).
- Adverse health effects range from minor respiratory irritation to severe asthma and potentially premature death in individuals with preexisting conditions.
- Effective exposure mitigation requires a monitoring network to track real-time concentrations and learn about O_3 behavior over time.
- Reference monitors (from EPA) are expensive and can only be used at controlled sites.
- Limited O_3 monitoring in rural and/or underserved communities that don't have the resources for EPA monitors
- This necessitates the development of reliable, autonomous, low-cost O_3 sensors that can be deployed in rural areas to expand upon current monitoring infrastructure for both public health and environmental justice reasons.

INTERNSHIP GOALS

- Develop and deploy version 2 of the low-cost O_3 sensors developed by Dylan Giardina in his Master's thesis work: MOOS2A.
- Test MOOS2A as a reliable and accurate low-cost O_3 sensor .
- Deploy a small fleet (3) of MOOS2A in CO's Central Mountain Valleys.
- Monitor O_3 across the continental divide: track pollution in a new region and under different conditions than normally observed (high altitude, different weather, less sources of O_3 precursors).

COLLECTED FIELD DATA SAMPLE

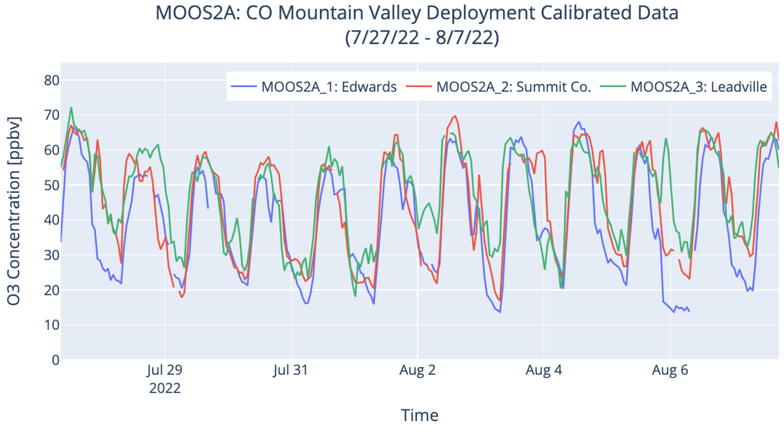

Figure 1: Calibrated MOOS2A field data from all three deployment locations.

DEVELOPING MOOS2A

There were several main modifications made to MOOS1 for the development of MOOS2A:

- Addition of particulate matter (PM) sensors (PMS3005 & SPS30)
- User friendly wiring scheme
- Guy wires and weatherproofing

The benefits from these modifications include:

- Thoroughly characterize air quality at a site (O_3 and PM)
- Increased user-friendliness and ease of deployment

Figure 2: MOOS2A_1 on the Powerhouse rooftop. Pictured are the guy wiring and weatherproofing modifications.

CALIBRATION AND TESTING

- MOOS2A units were deployed on Powerhouse rooftop before and after the mountain valley deployment.
- Provided reference data for pre-field calibration.
- Post-field data will help quantify how the sensors accuracy has changed over time.

DEPLOYMENT LOCATIONS

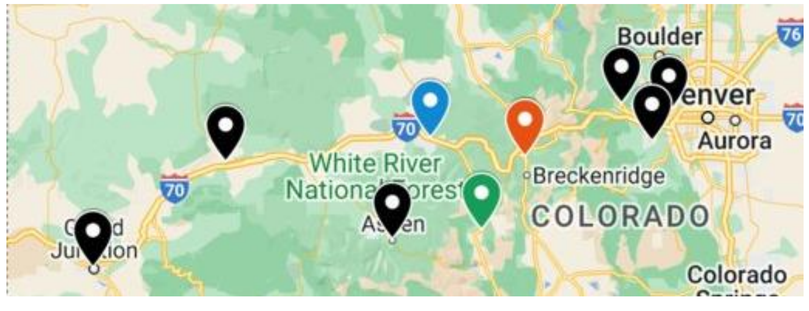

Figure 3: Map of mountain valley deployment locations. EPA reference monitors elsewhere along the I-70 corridor are denoted by black pins.

MOUNTAIN VALLEY DEPLOYMENT

Three MOOS2A units were brought to towns in Colorado's Central Mountain valleys in late July for a four-week deployment. Sensors were deployed at the following locations:

- Town of Edwards
- Summit County High School
- CMC Leadville Campus

These locations were selected for several reasons.

- Separated in different valleys for distinct pollution sampling.
- Different proximities to major roadways (I-70)
- Central locations connect gaps between EPA monitoring networks on Western Slopes and the Front Range.

It was found that O_3 concentrations were similar between all three locations, which was slightly surprising given the above location characteristics.

Figure 4: MOOS2A_3 at CMC Leadville on the morning of 8/23/22

ONGOING AND FUTURE WORK

- Continued data analysis with an emphasis on sensor calibration and evaluation.
- Collaborating with Central California Environmental Justice Network to send 10-15 sensors for their use to monitor O_3 exposure of agricultural workers in California's Central Valley.
- Community outreach for involvement with using low-cost sensor technology and public health awareness.

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