Deployment Considerations for Low-cost Air Quality Sensor Networks; a Preliminary Look at Building-Scale Variability

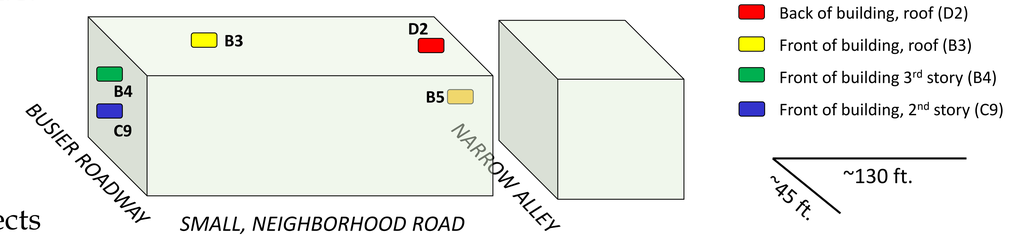
University of Colorado Boulder

Ashley Collier-Oxandale, Michael Hannigan, Joanna Gordon Casey, Evan Coffey, & Jacob Thorson

University of Colorado, Boulder

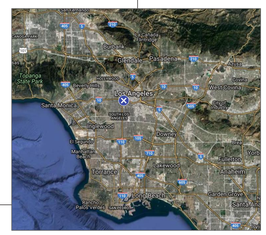
OVERVIEW & OBJECTIVES

- Examine the importance of monitor placement at a site, by comparing data from monitors placed at different heights and on different sides of a building
- OBJECTIVE: recommend best practices for monitor placement, geared toward community-based projects



BACKGROUND

- Lack of 'best-practices' for siting low-cost sensors, typically placement is based on safety, convenience, and logistics
- Study examining spatial variability of several pollutants and estimating exposure in a neighborhood near downtown LA
- For this analysis -> data from one field site



METHODS

Low-cost Sensor System

- Platform: Y-Pods or Pods (continuous, gas-phase, open-source design, next-gen monitors)
- AQ Sensors: CO_2 (non-dispersive infrared sensor), O_3, VOCs (metal oxide semiconductor sensors – 2 different sensors)
- Other: temperature, relative humidity, GPS, & wind speed/direction

Reference Data Available for Future Calibration

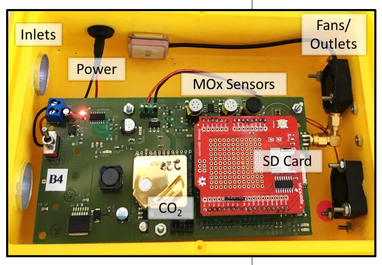
- O_3, CO, CH_4, and TNMHCs

Data Processing & Field Calibration

- Raw data output in voltages, converted using a calibration model developed by co-locating with high-quality reference instruments ("field calibration")
- Multiple linear regression used to develop predictive models, for example: $Concentration\ (ppm) = (Voltage - p_1 - p_3 * Temp - p_4 * RH)/p_2$

For this Analysis

- **Preliminary analysis - only raw sensor signals are used (all sensor data units – ADC values)**
- However, different time averaging is applied (e.g., sub-minute, minute, and hourly)
- Correlation between 1 week co-located and 1 week separated sensors is used to study the impact of siting at a single building

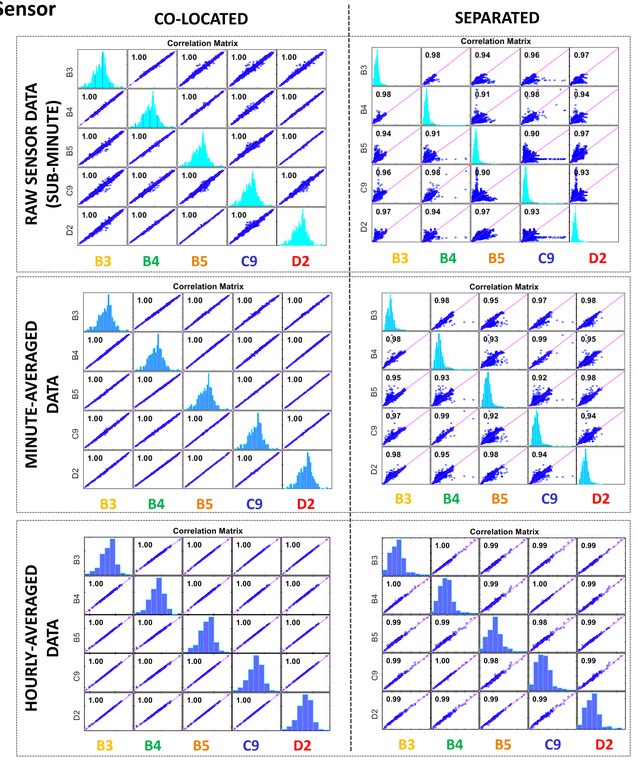


Y-Pod Monitor

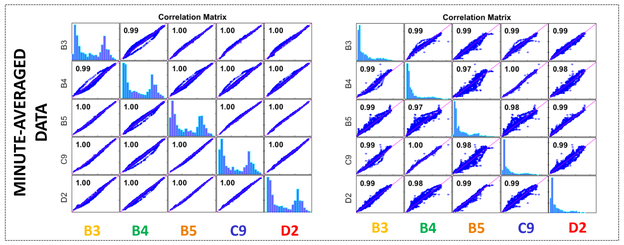
RESULTS

- Correlation among separated sensors increases with larger averaging times
- Less correlation among VOC sensors as opposed to O_3 -> primary vs. secondary pollutants
- For VOC's, the lowest correlations primarily with monitor B5 -> most 'obstructed'

VOC – Metal Oxide Sensor

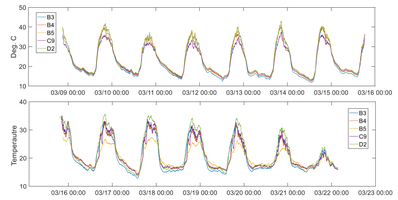


Ozone – Metal Oxide Sensor



- *Environmental differences (e.g., lower temperatures) may also explain lower correlation with monitor B5

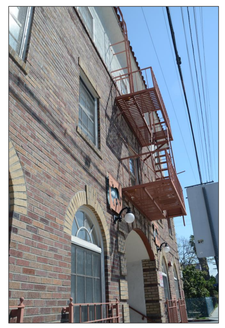
Top – Co-located; Bottom - Separated



DISCUSSION & NEXT STEPS

Discussion

- Monitor placement seems less important for lower-time resolution data (e.g., studying long term trends or for monitoring secondary pollutants
- If the interest is in primary emissions or specific local sources (e.g., roadway emissions), attempts should be made to minimize obstructions



Next Steps

- *Convert data to concentrations, reanalyze complete data (~2.5 months)*
- *Quantify the locations differences at higher-time resolutions*

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