CHARACTERIZING URBAN ENVIRONMENTAL SYSTEMS THROUGH FIELD STUDIES AND DATA ANALYTICS

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THE VISION

There are important questions to ask about air quality in cities, such as:
- How does air quality vary in an urban environmental system vs. a natural environmental
- Do people using bike lanes and sidewalks on certain streets experience worse air quality than in other places?
- How can we measure air quality in an urban area?
- How can I better understand air quality?

Our study proposes:
- To use a suite of different mobile sensors
- Develop a finer scale to understand air quality spatially in urban environmental systems
- Design an experiment that allows us to compare preliminary measured data within/across an approximately 300m radius area to assess the true spatial heterogeneity of air quality .

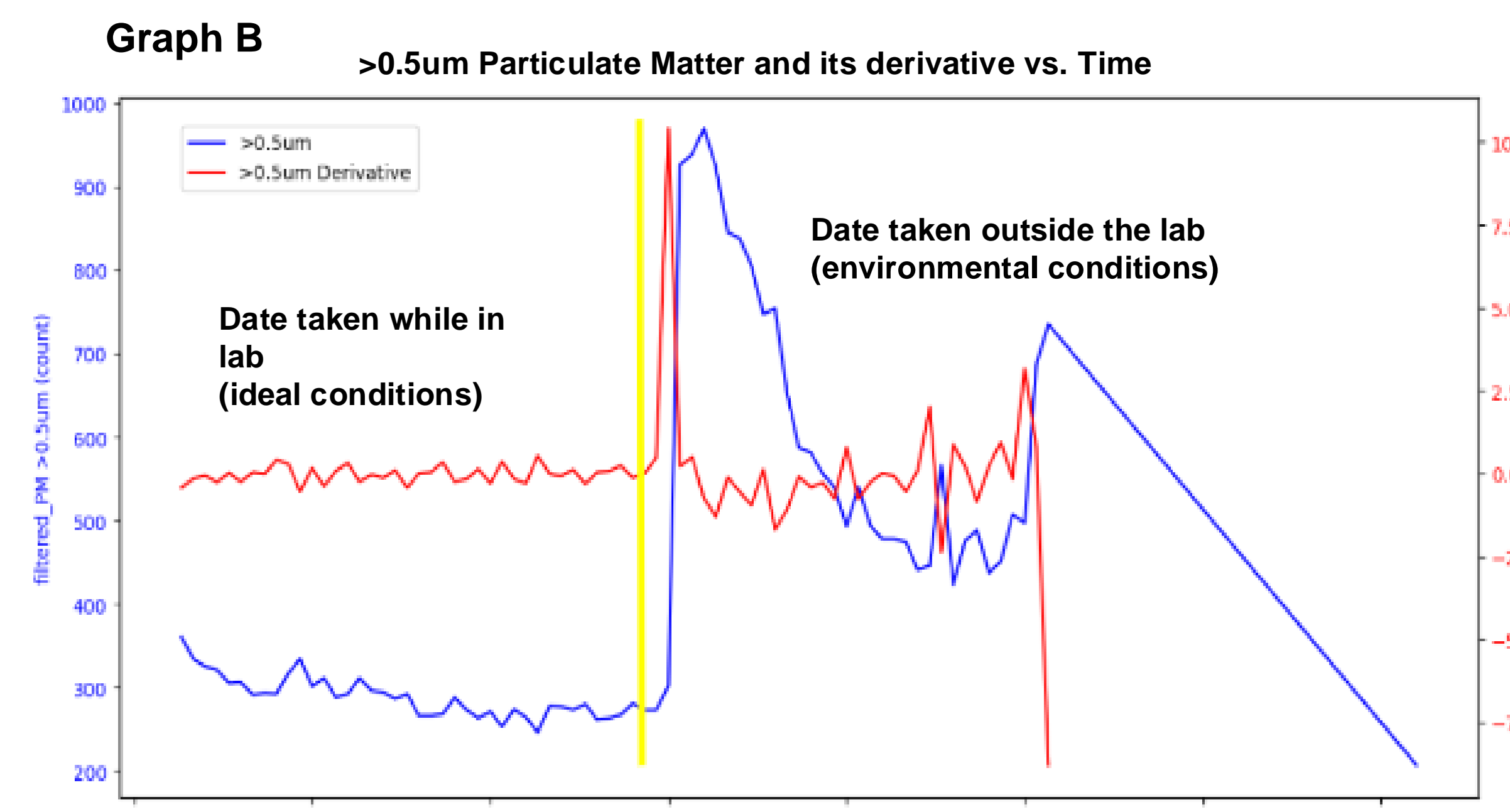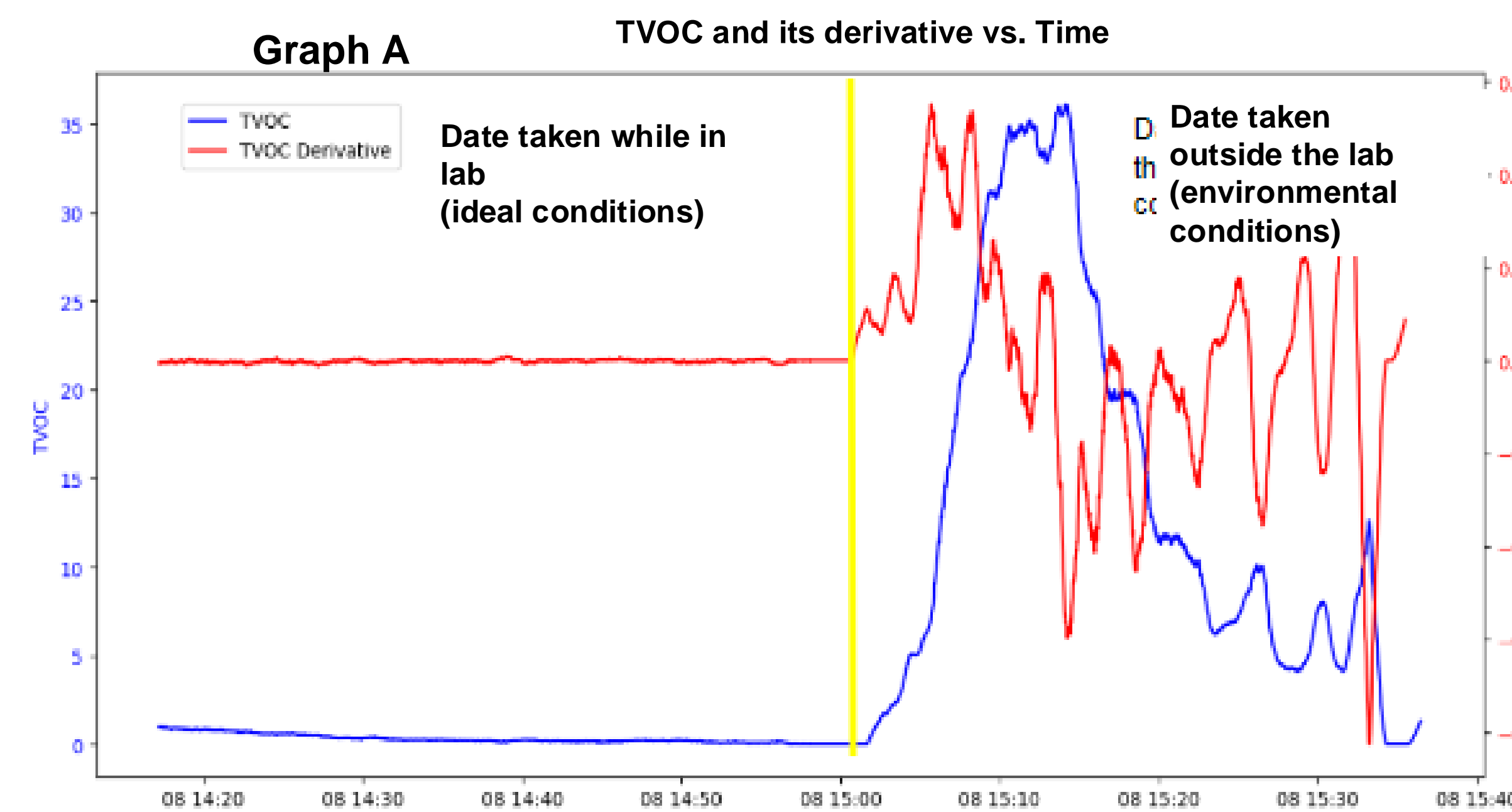## TWO BIG QUESTIONS:

1. **Which sensors are we going to use to measure air quality?**

2. **How much time will we spend at each location?**

Goal: Use our sensors to conduct sample fieldwork experiments in order to:
A) Become familiar with the sensors
B) Design an experiment protocol
C) Analyze data, as the one shown below, to find a time window big enough to allow sensors to reach equilibrium but small enough before the environment changed **(Graph A,B)**

METHODOLOGY

Name	D3 Kestrel	Dylos DC1700	VOC Meter HHAQ-107	TSI BlueSky	PurpleAir	QuantAQ Modulair
Measure / Sampling Frequency	Ambient temperature and relative humidity / 5sec/sample	Particulate matter, the number of particles in the air / 1min/sample	Volatile Organic Compounds in the air / 1sec/sample	Different sizes of particulate matter PM2.5,PM10 / 1min/sample	Different sizes of particulate matter PM2.5,PM10 / 1min/sample	Different sizes of particulate matter PM2.5,PM10 / 1min/sample
Visual						

Graph A — TVOC and its derivative vs. Time

Graph B — >0.5um Particulate Matter and its derivative vs. Time

RESULTS AND DATA ANALYSIS

Our official set up:

Mobile Pole(on the far left) contains:
- VOC Meter ,TSI, PurpleAir, Dylos, Kestrel, Hotspot, and Power Bank

Home Station(on the far right) contains:
- QuantAQ, Dylos, VOC Meter

Using home station (QuantAQ primarily) as our reference, allowed us to:
- Compare the data collected from our mobile sensors to that of the home station sensors
- Use a line of regression to visualize the relationship between our two data sets**(Graph C)**
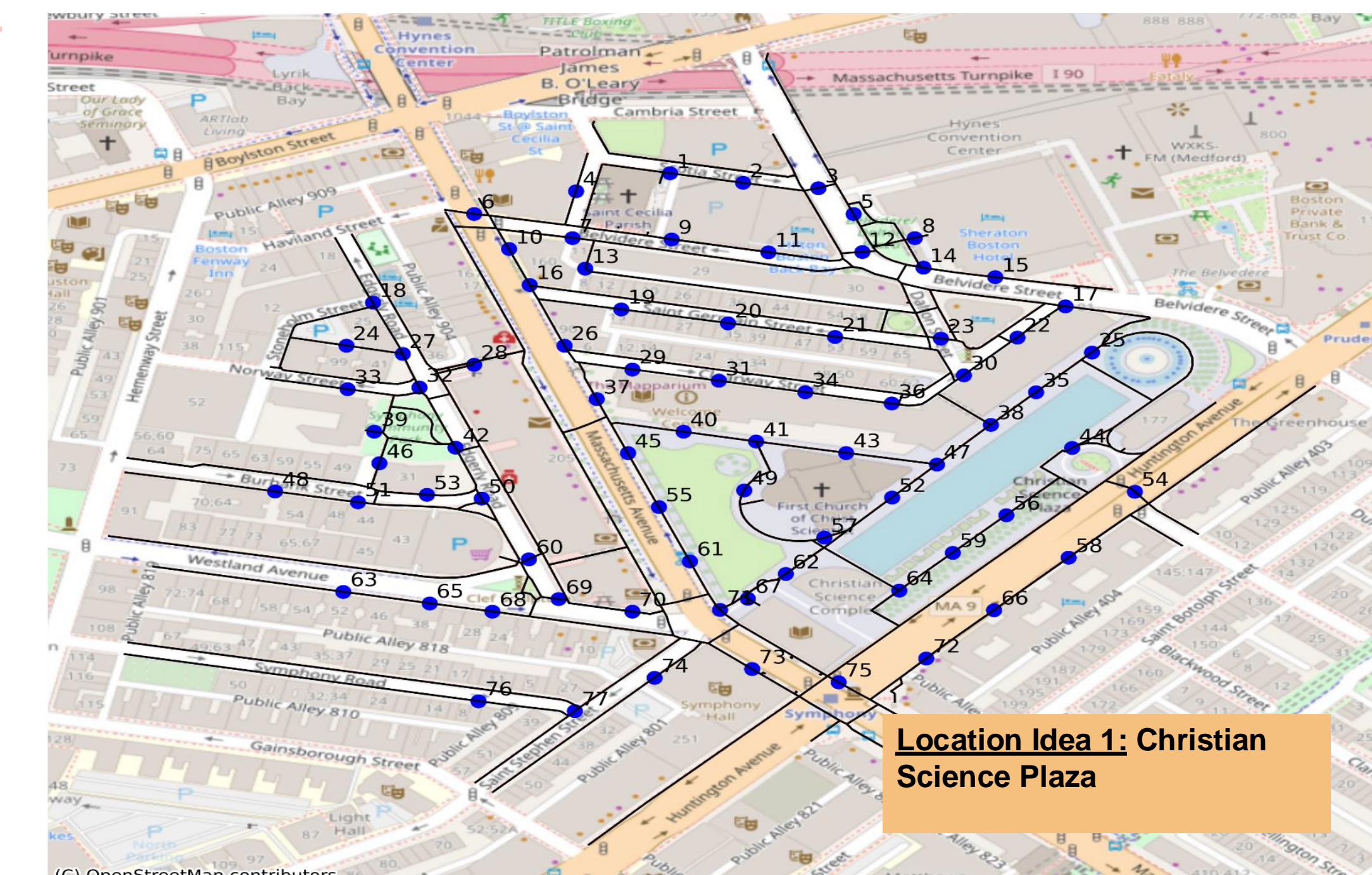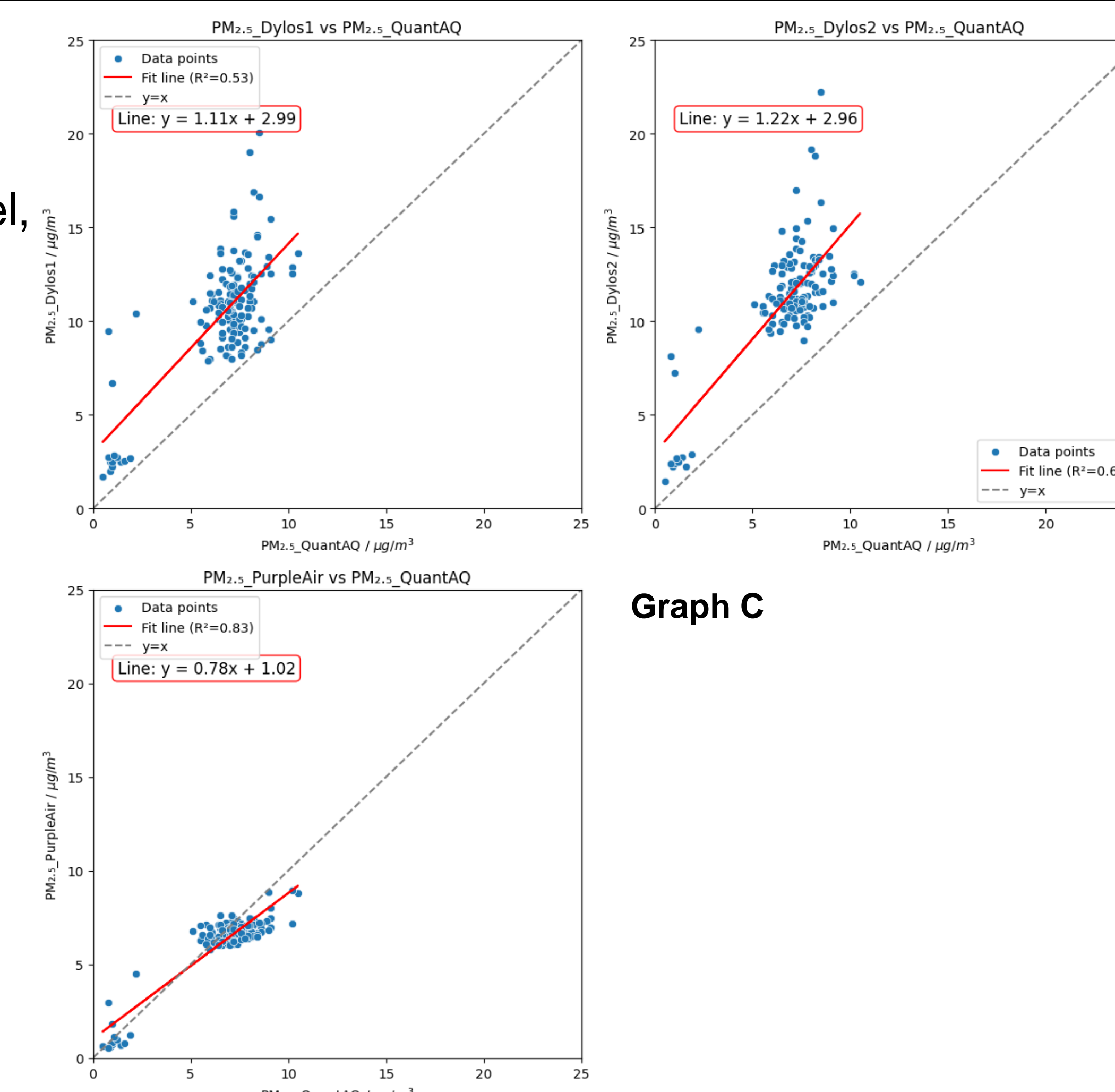

Graph C

CONCLUSION

Air quality varies block-by-block in an urban environment and our research project demonstrates that we are still trying to do so in a careful and considerable process.

Next Steps:
- Improve the fieldwork protocol and experiment design with each day, so we can come to create a best efficient experiment design for future use
- Continue this process of fieldwork through a variety of 9 other selected locations
- Analyze data between locations for further understanding of air quality variance in an urban environment

Visual of experiment route in 1 of the 9 selected locations

Location Idea 1: Christian Science Plaza
(C) OpenStreetMap contributors

ACKNOWLEDGMENTS

NSF REU-Site: Research Experience for Undergraduates site to create "Pathways for community college students to enrich their education and careers" (REU-PATHWAYS)

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