Manchester Urban Observatory

Develop, create, research, learn… discover your city

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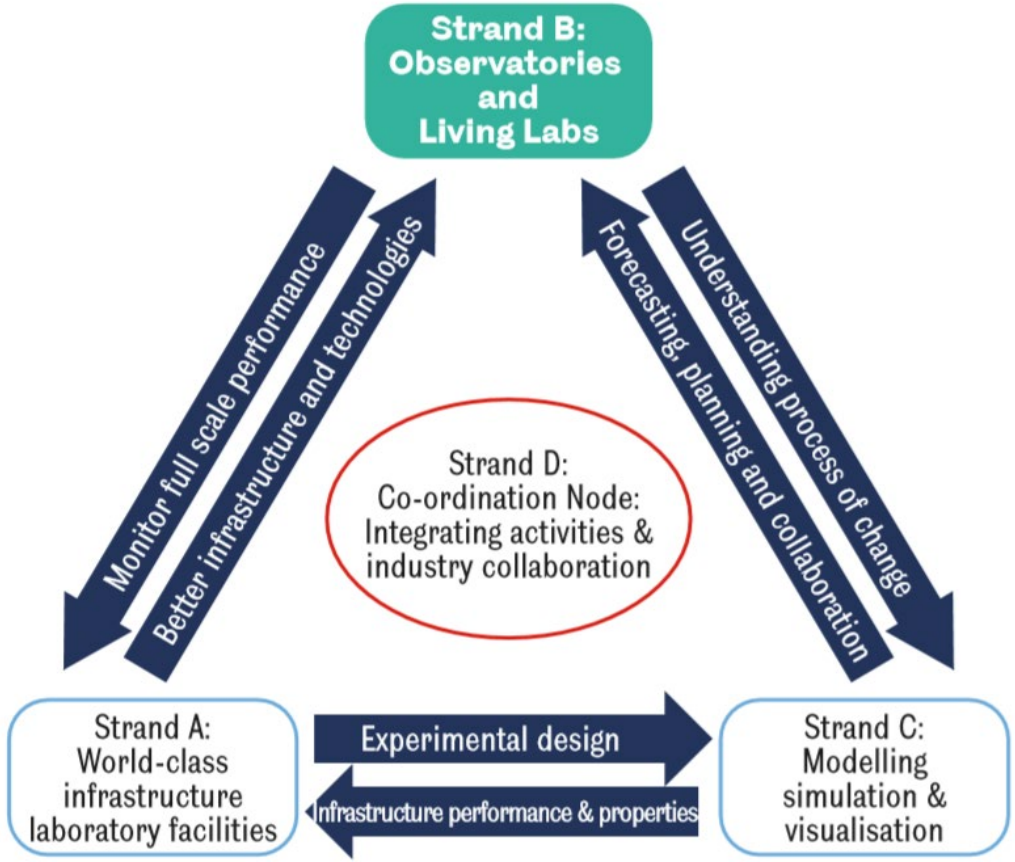
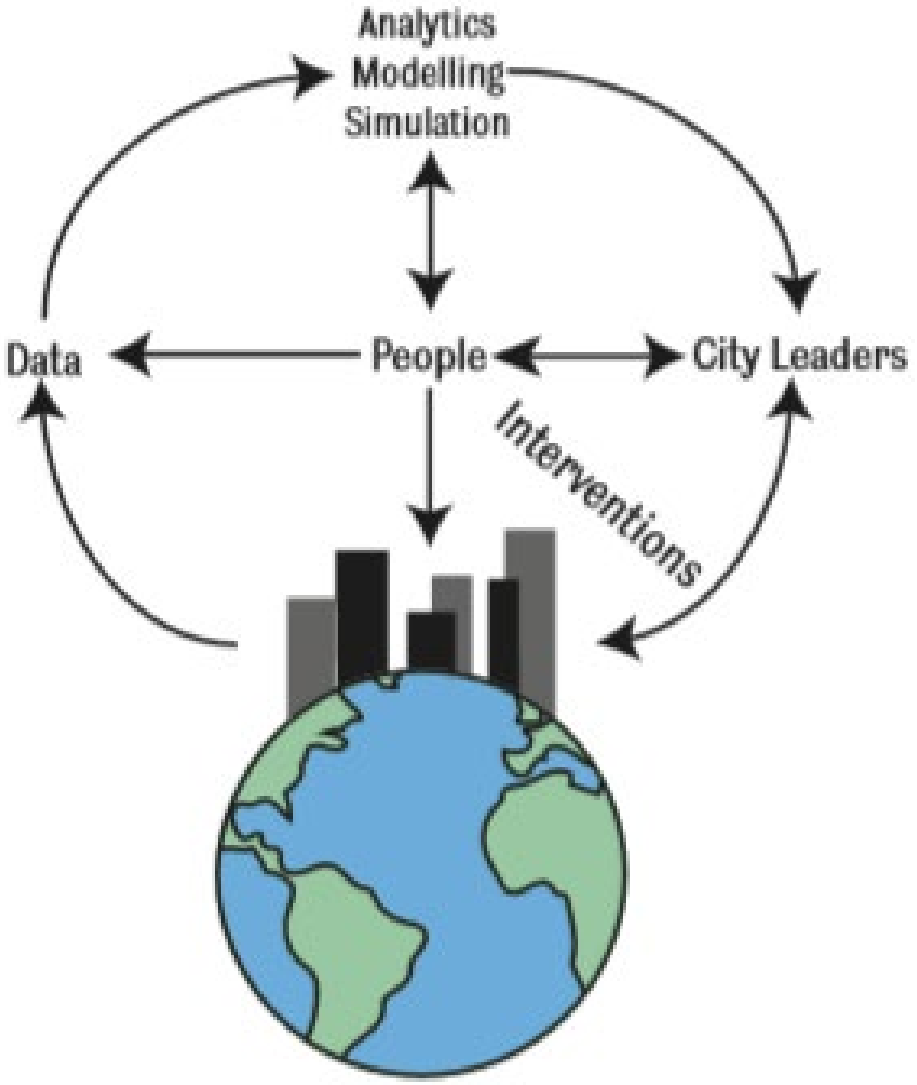
Manchester Urban Observatory

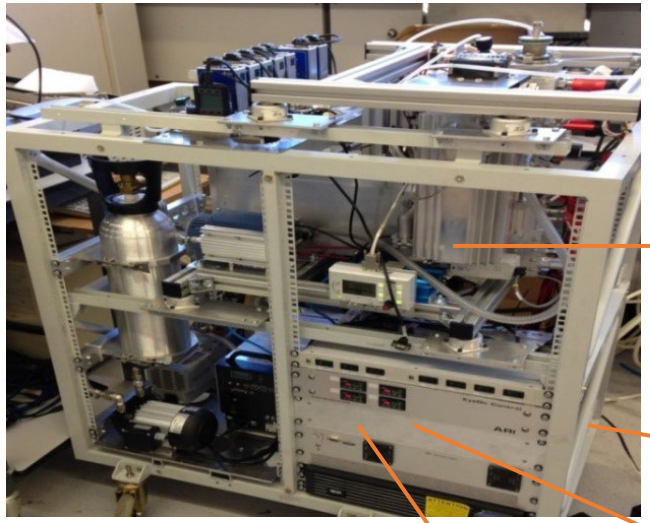
Vision

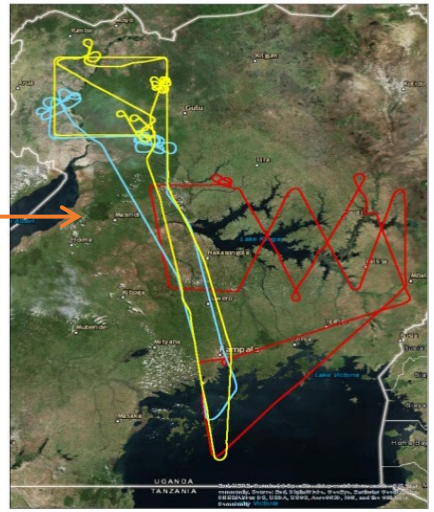
- Working with stakeholders and researchers to understand and improve urban environments using **data and sensors**.





Air Quality Measurements





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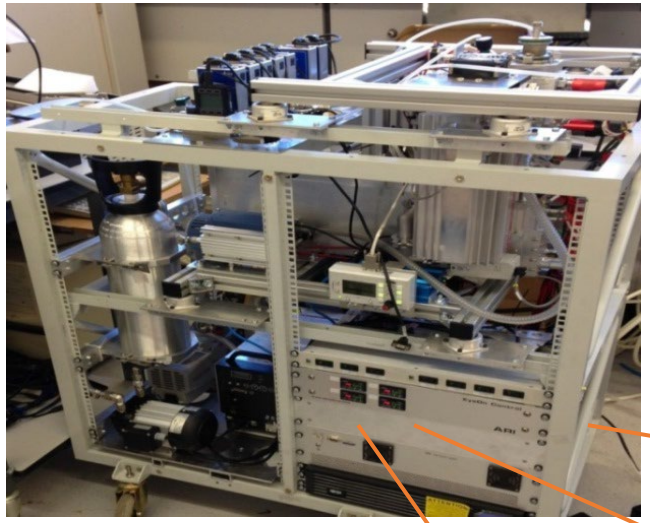
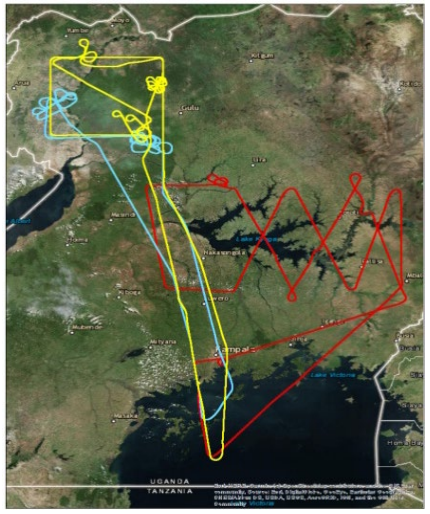
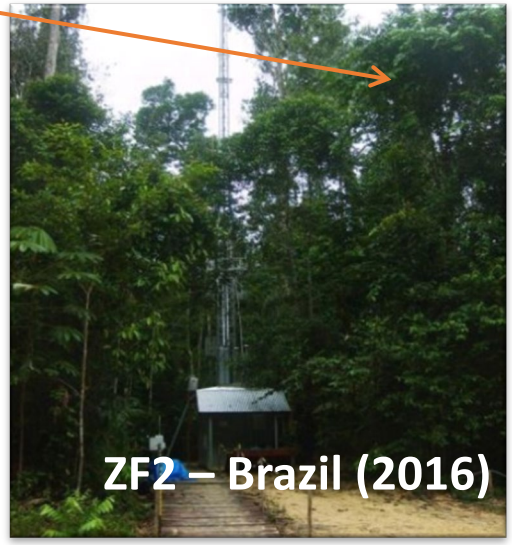
Air Quality Measurements



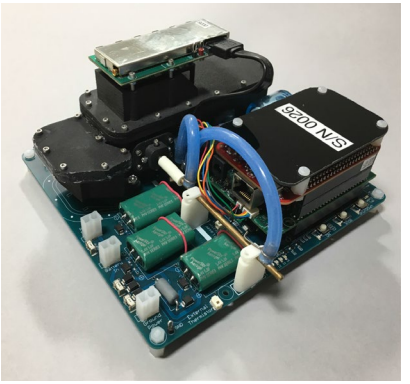



London (2012)


Beijing (2016 & 2017)

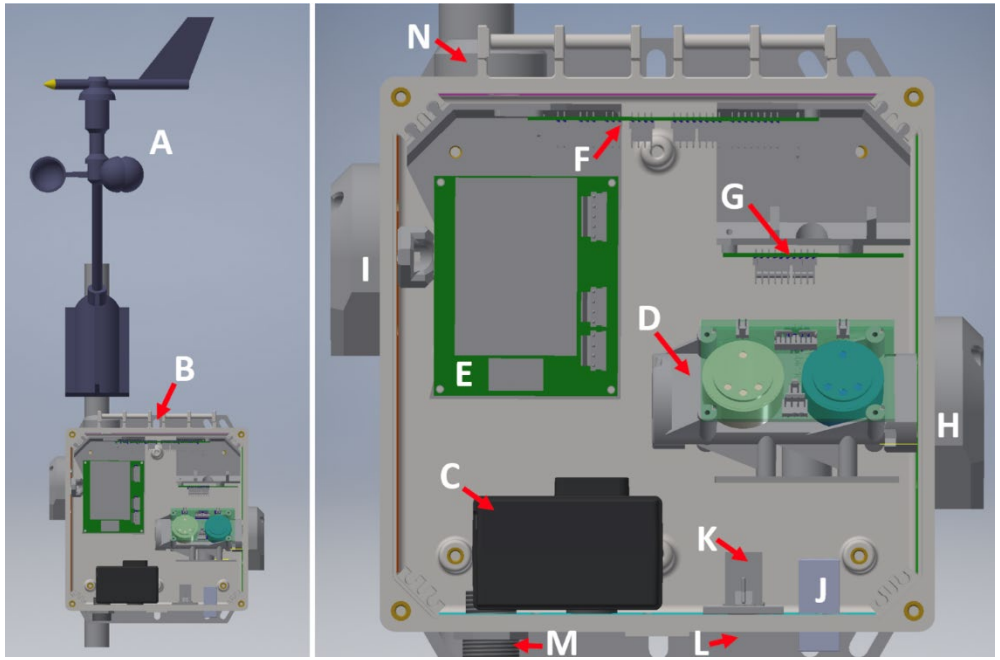

ZF2 – Brazil (2016)

ARISense



AQ Sensors

Systems generally measure ambient levels of five gaseous pollutants (CO, NO, NO2 , O3 and CO2), atmospheric aerosol particles (0.4–17 µm in diameter), and related meteorological and environmental parameters (temperature, pressure, relative humidity, wind speed and direction and noise).



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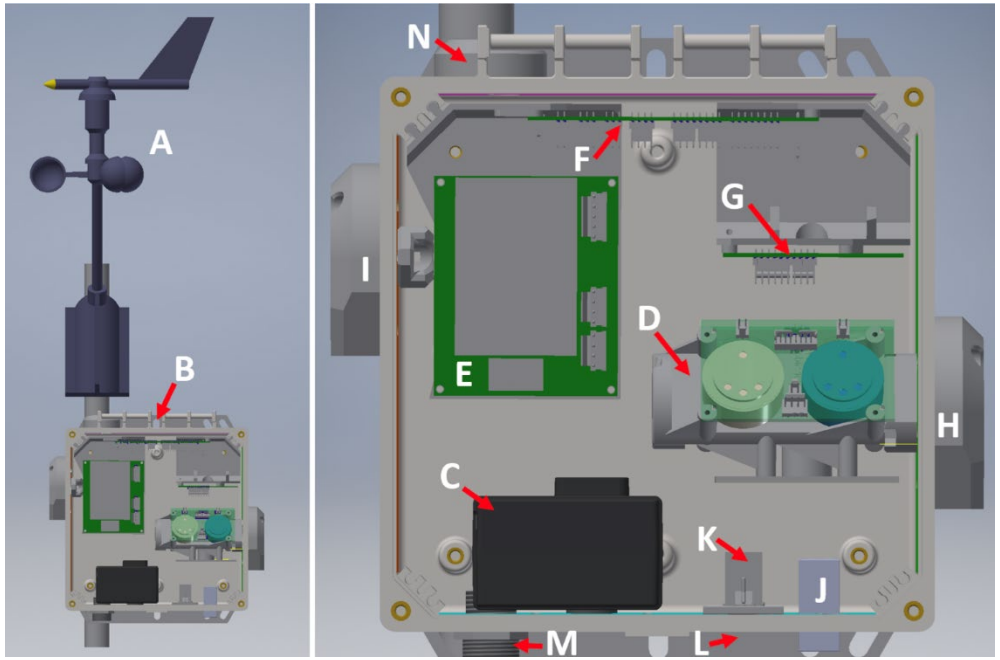

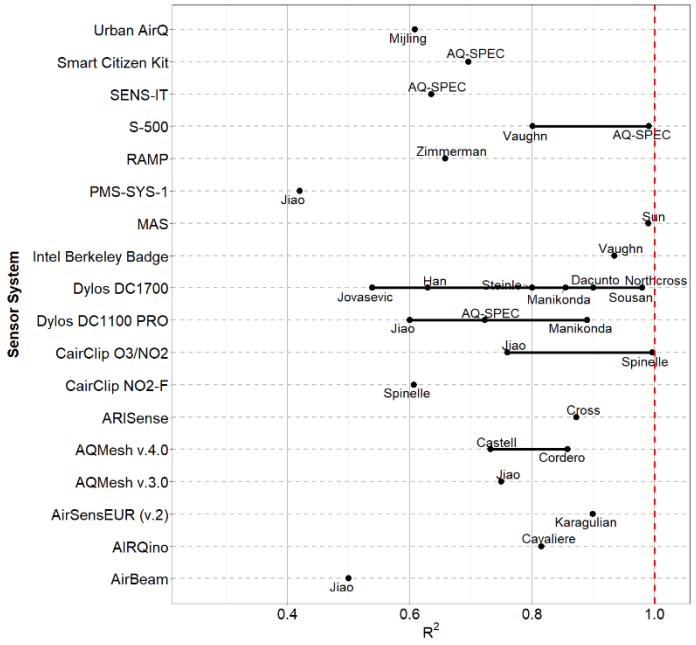

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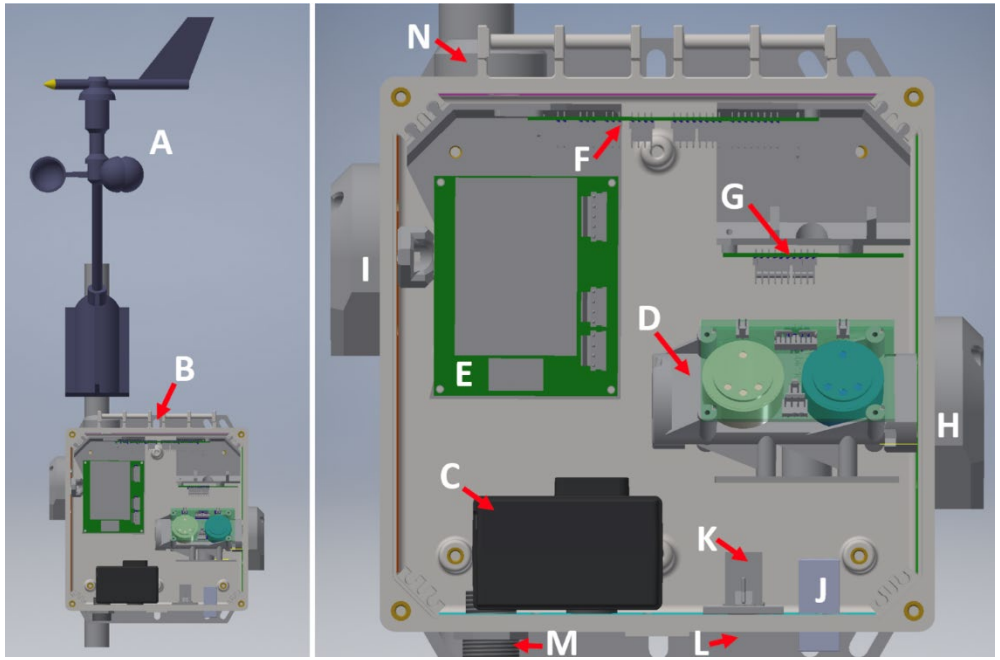


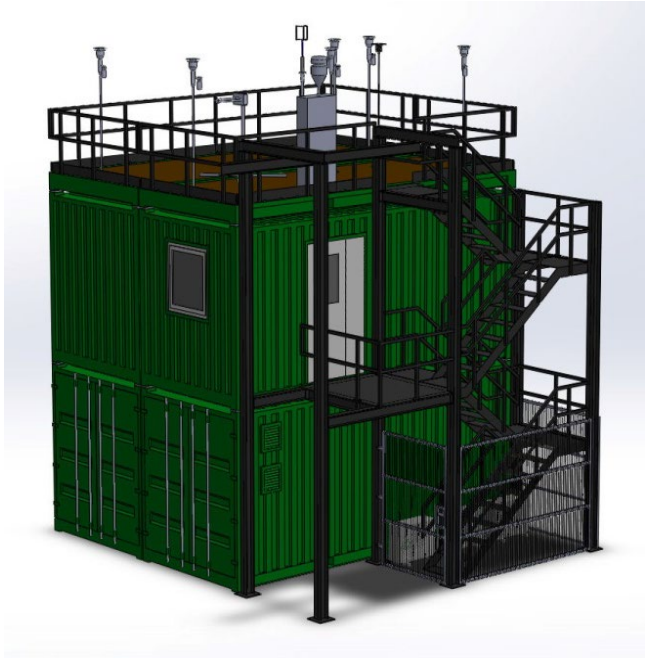
NERC AQ Supersites

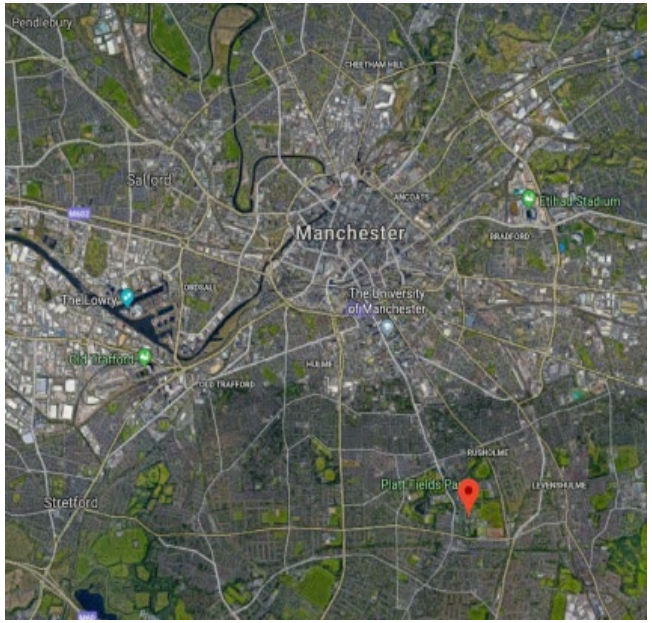
Aerosol:
- FIDAS (PM_x)
- Digitel High-volume sampler
- XACT (online metals analysis)
- ACSM (nonrefractory composition)
- Aethalometer AE33 (black and brown carbon)
- SMPS (aerosol size distributions)
- CPC (ultrafine particles

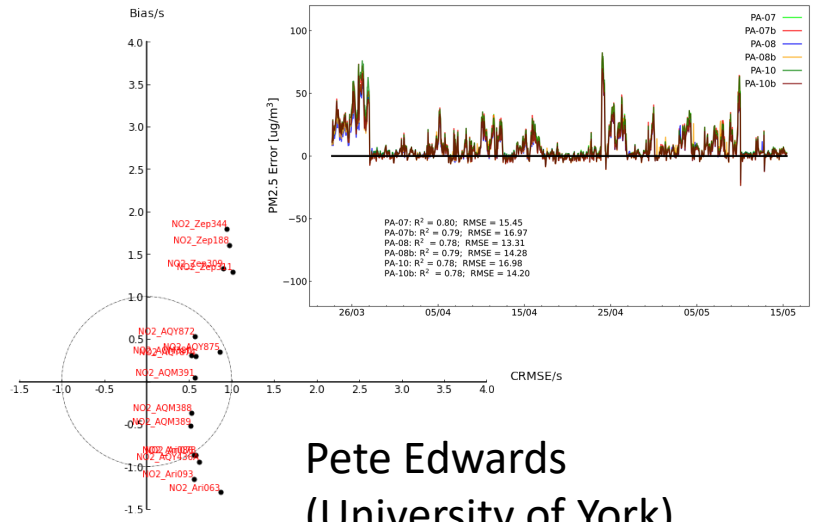
Gases:
- NO_y (NO and NO_y)
- O_3
- CAPS-NO_2 (spectroscopic NO_2)
- LGR Multi-carbon emissions analyser (CO, CO_2, CH_4)
- LGR ammonia analyser
- Automated GC-FID (VOCs)

Meteorology:
- 3D sonic anemometer
- Precipitation laser distrometer
- Actinic spectral radiometer
- Aerosol ceiliometer (boundary layer profiles)

= Perfect test case for new AQ Sensor Technology and essential calibrations to guide our work







Pete Edwards
(University of York)

AQ Sensors

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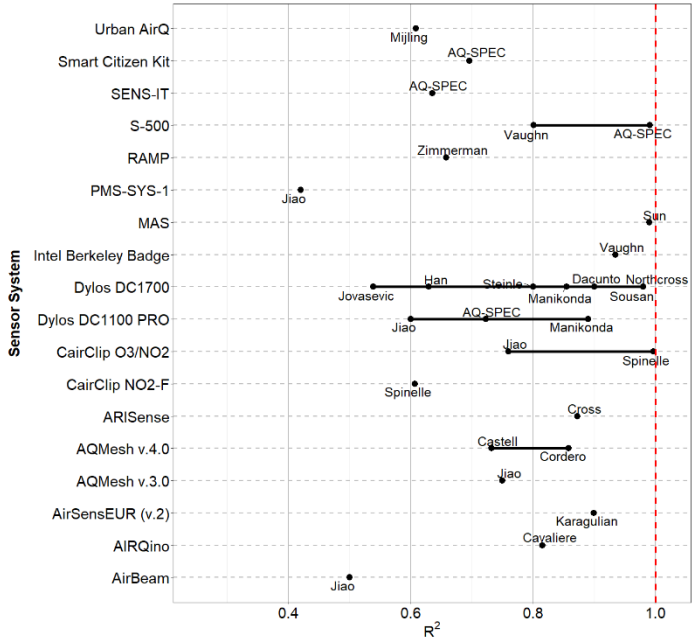
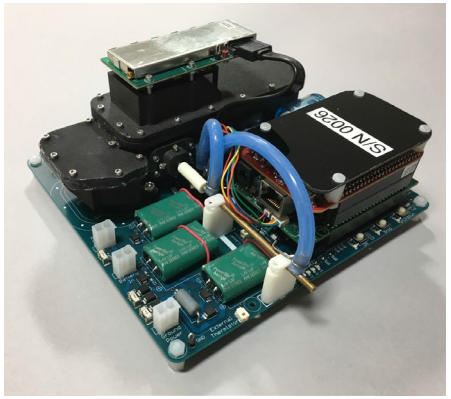
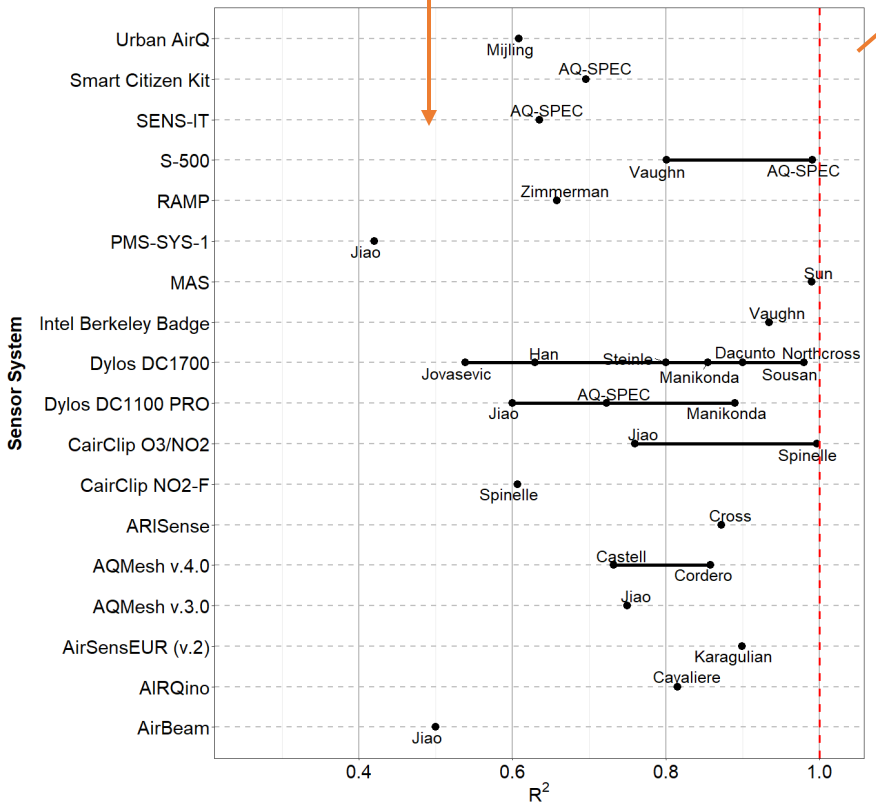
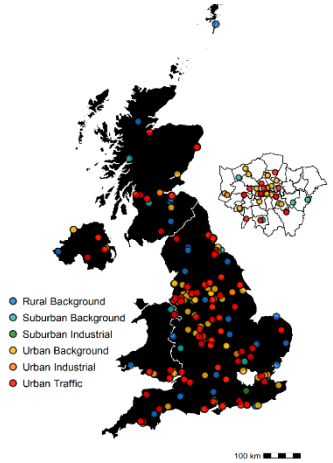


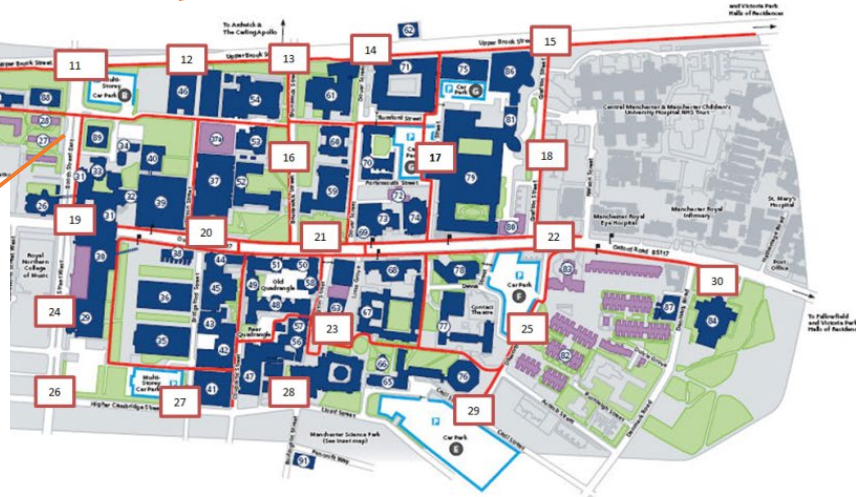
Deploying lower-cost AQ-sensor systems in the absence of calibration and colocation against reference grade instrumentation significantly undermines the credibility of the data (e.g. Cross et al., 2017, 2020)

AQ Measurement Strategy









- Health
- Wellbeing
- Flourishing
- Behaviour

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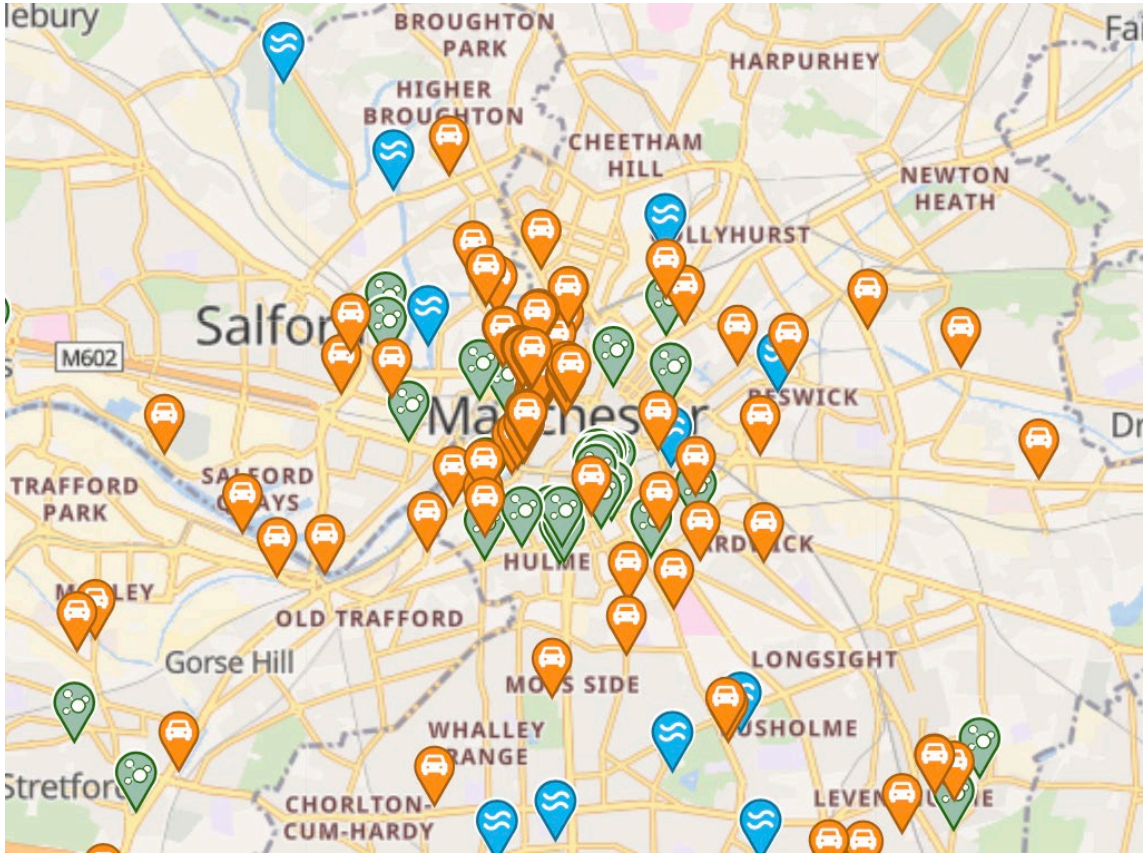

We are interested in understanding the whole system as best as possible to gain a complete picture of the effect of interventions

- Movement
- Health
- Wellbeing Quantification
- Behaviour Changes
- Air Quality
- Meteorology

This work is underpinned through use of state of the art monitoring technology, modelling and novel methodologies with an integrated and intuitive open source data solution

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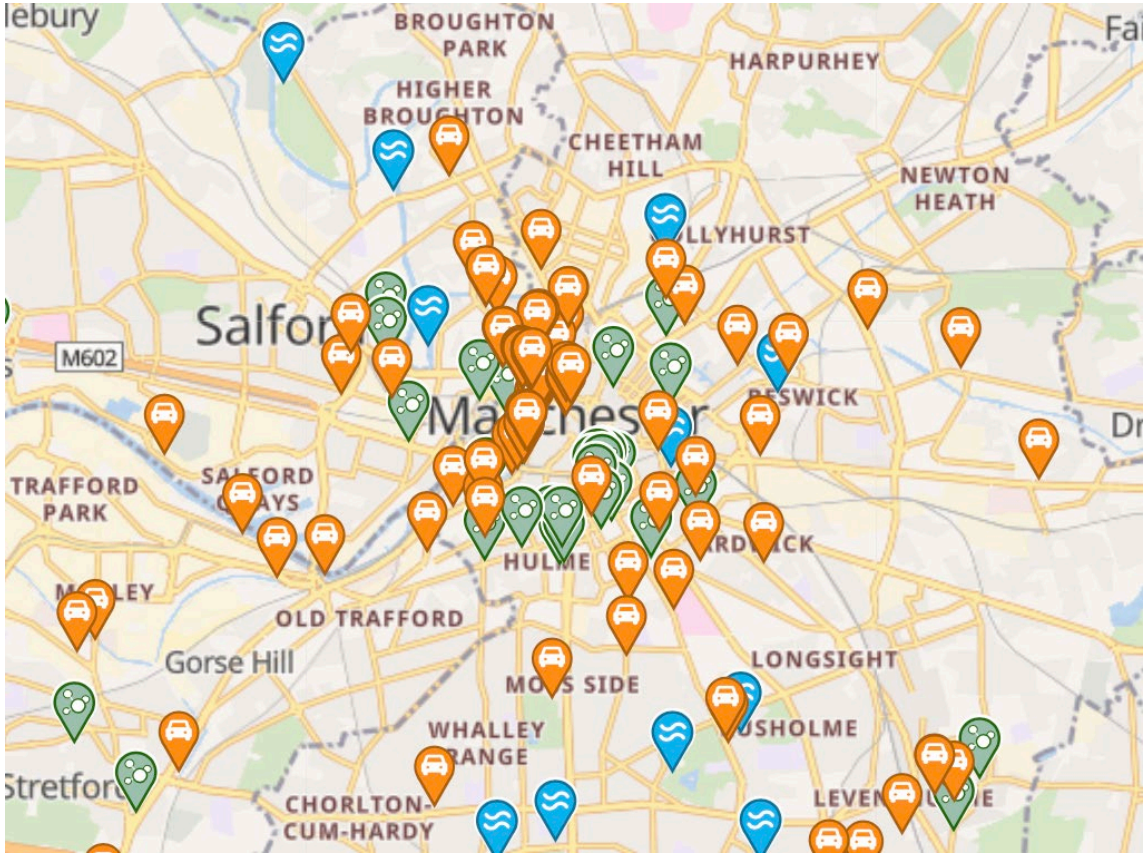
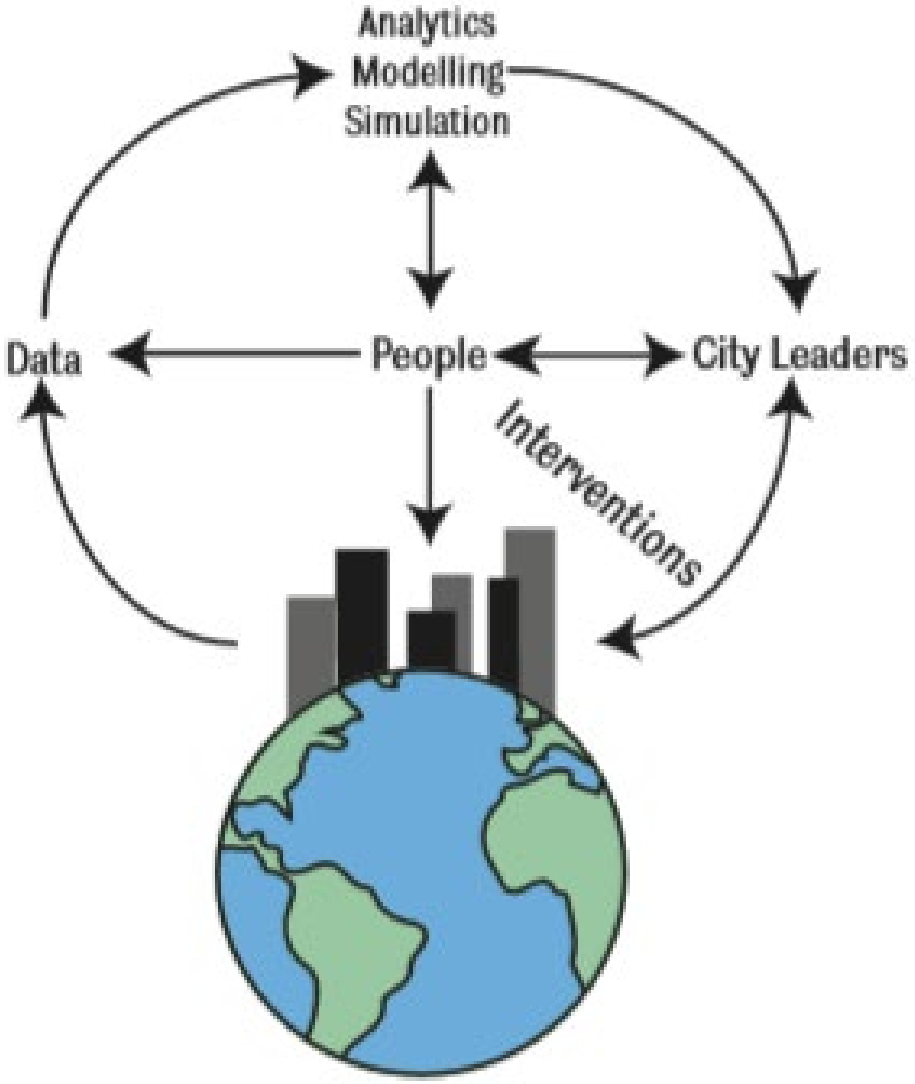
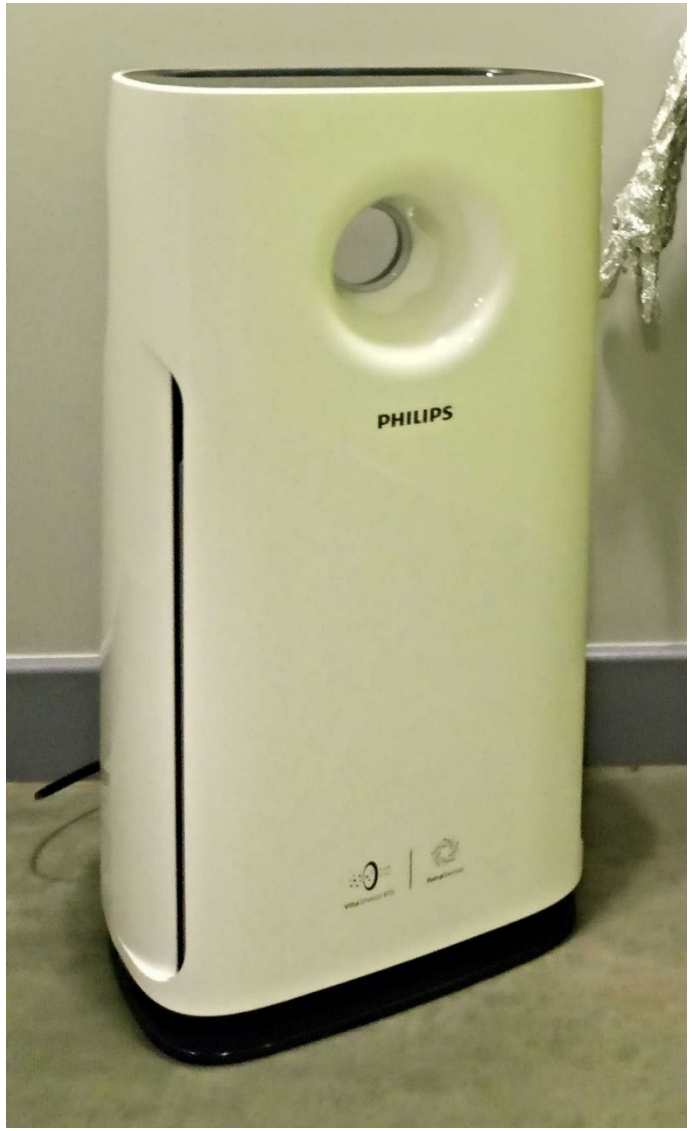




GAP and Phillips Foundation
Effectiveness of Air Purification in Schools

GAP and Phillips Foundation



Childhood exposure to particulate matter (PM), NO_x, O_3 and black carbon (BC) can impair lung development, cause respiratory inflammation and there is evidence to suggest that attainment can also be compromised.

Therefore active measures that can reduce a child's exposure in the school setting is desirable.

One cost effective mitigation strategy is the use of High Efficiency Particulate Air (HEPA) filters

HEPA filters have been widely tested in controlled environments and shown to be effective at reducing PM (e.g. Peck et al., 2016), however evaluating their performance in the environment in which they are to be used is essential (e.g. Dai et al., 2018).

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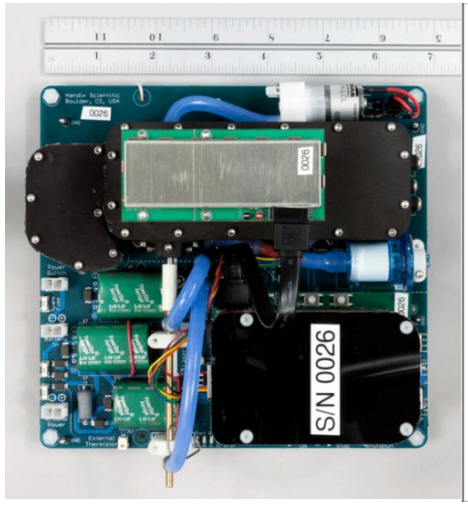
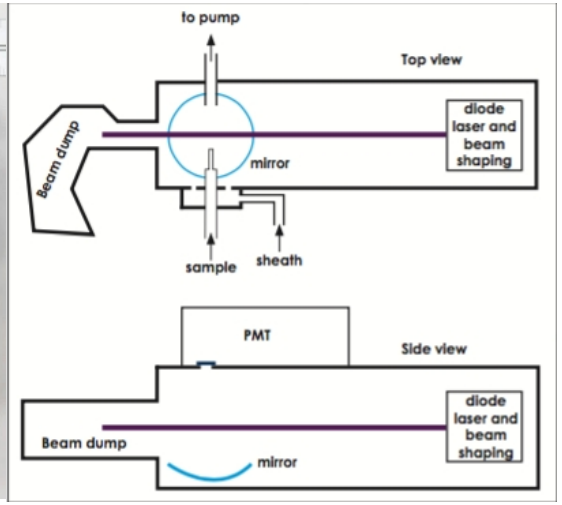
Effectiveness of Air Purification in Schools

PORTABLE OPTICAL PARTICLE SPECTROMETER





Gao, R. S., et al., A light-weight, high-sensitivity particle spectrometer for PM2.5 aerosol measurements, Aerosol Science and Technology, 50, 88-99, 2016.

Yu, Pengfei, et al. "Efficient transport of tropospheric aerosol into the stratosphere via the Asian summer monsoon anticyclone." National Academy of Sciences (2017): 201701170.

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PORTABLE OPTICAL PARTICLE SPECTROMETER

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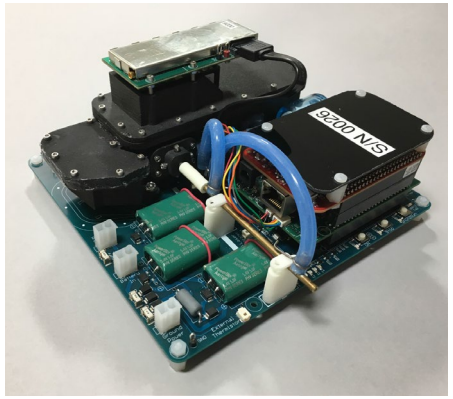
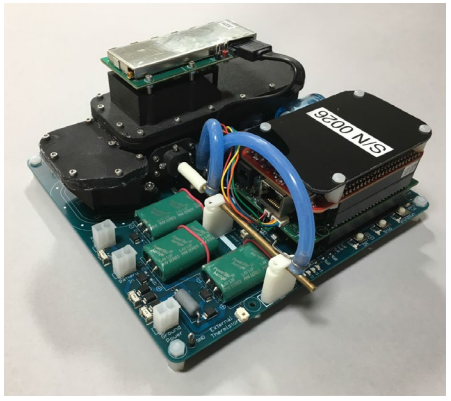
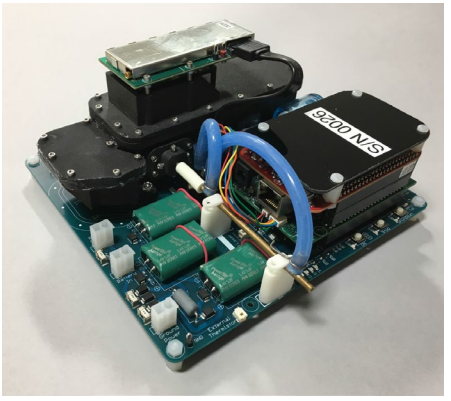
Outdoor



Classroom 1



Classroom 2



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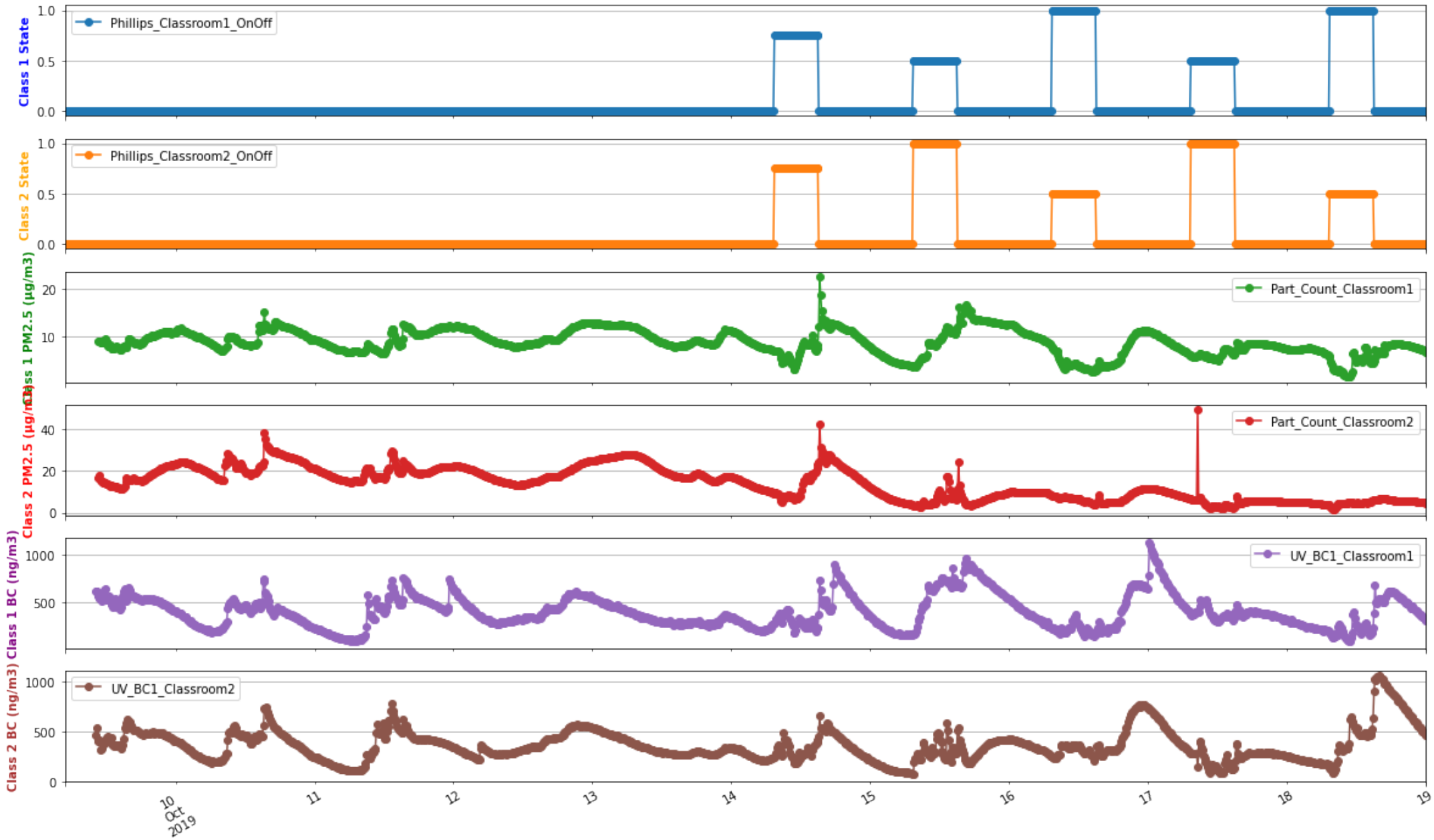

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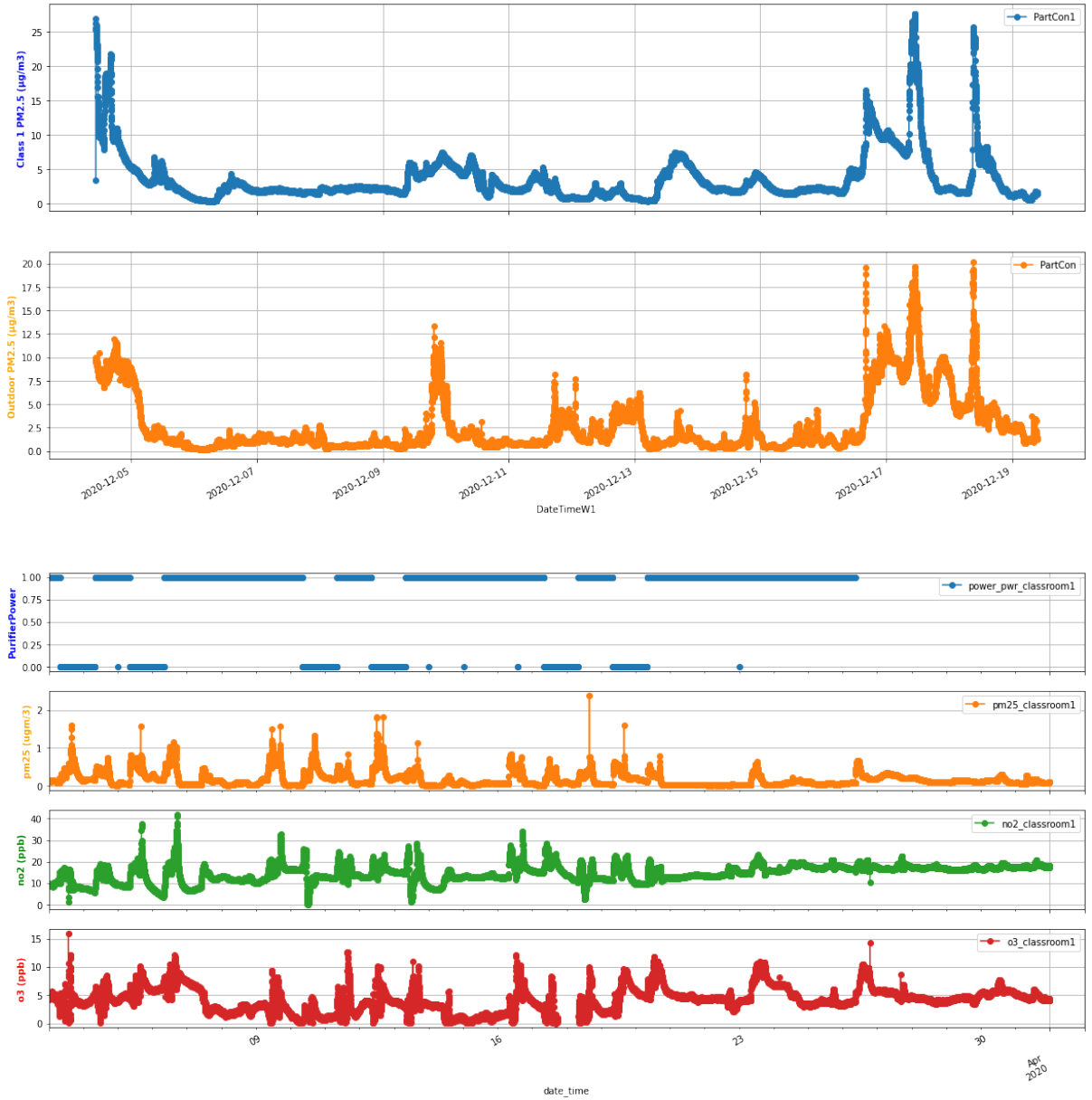

Intervention reduced BC by 32.3% during times when the purifiers were on in comparison to the reference measurement.

Intervention reduced PM 2.5 by 37.4% during times when the purifiers were on in comparison to the reference measurement.

These numbers are very dependent on local conditions and the length of experiment is very short.

In comparison to the reference instrument there was no significant change in PM2.5, NO_2 or O_3 when the purifiers were on and off.

NO2 was on average <1% lower when the purifiers were on

O3 was on average 3% lower when the purifiers were on

PM2.5 was on average 2.2% lower when the purifiers were on