First measurements of PM2.5 and NO2 in Mombasa, Kenya

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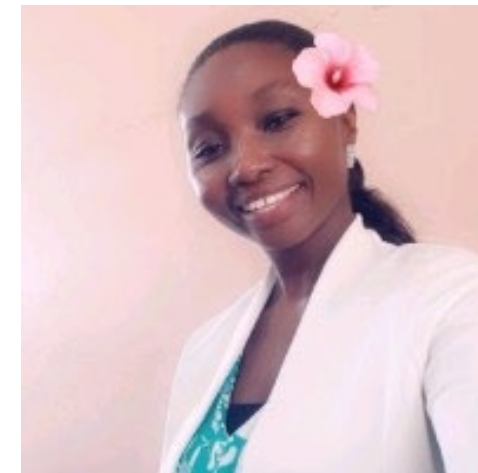
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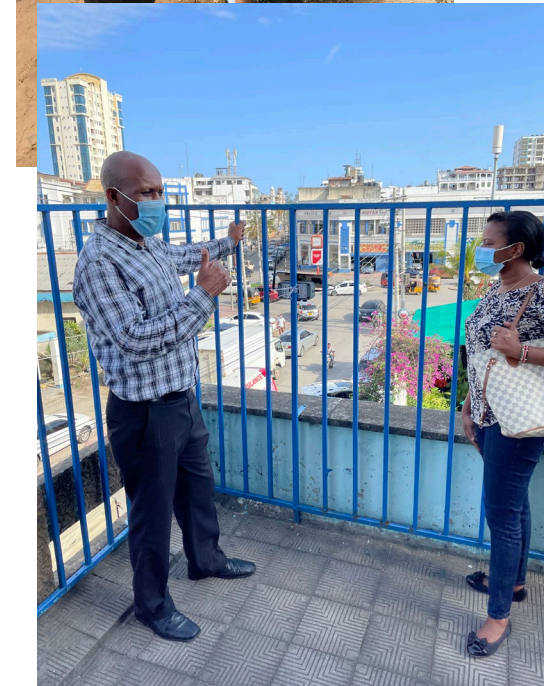
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https://aerosol.ldeo.columbia.edu/

Westervelt Aerosol Group

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Accelerating Research through International
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Air Quality Activities in Africa

Mombasa, Kenya

- 3.5 million people in the metropolitan area
- 2nd largest city in Kenya
- Major port city – most or all imports/exports to/from East Africa come through here
- Pollution sources (informal assessment): tuk tuks, cars, buses, trucks, cement factory, cargo ships, open burning

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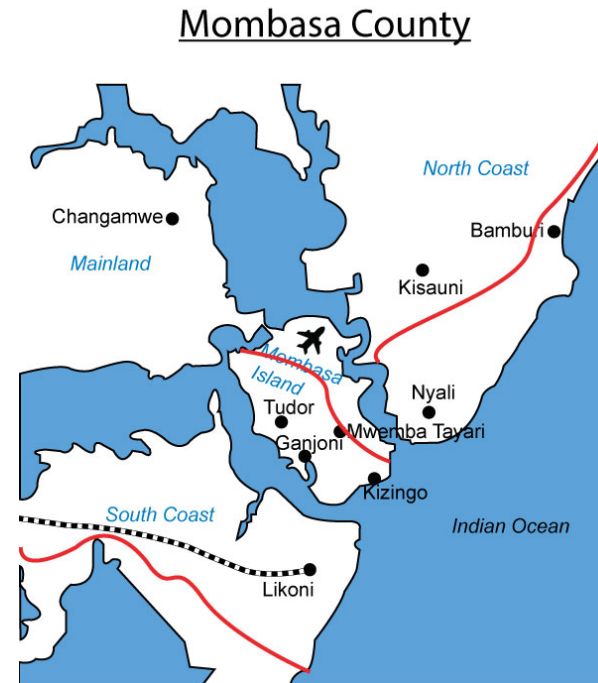
Data collection plan

- Deploy a reference PM2.5 monitor and a network of low cost sensors (Clarity Node-S)
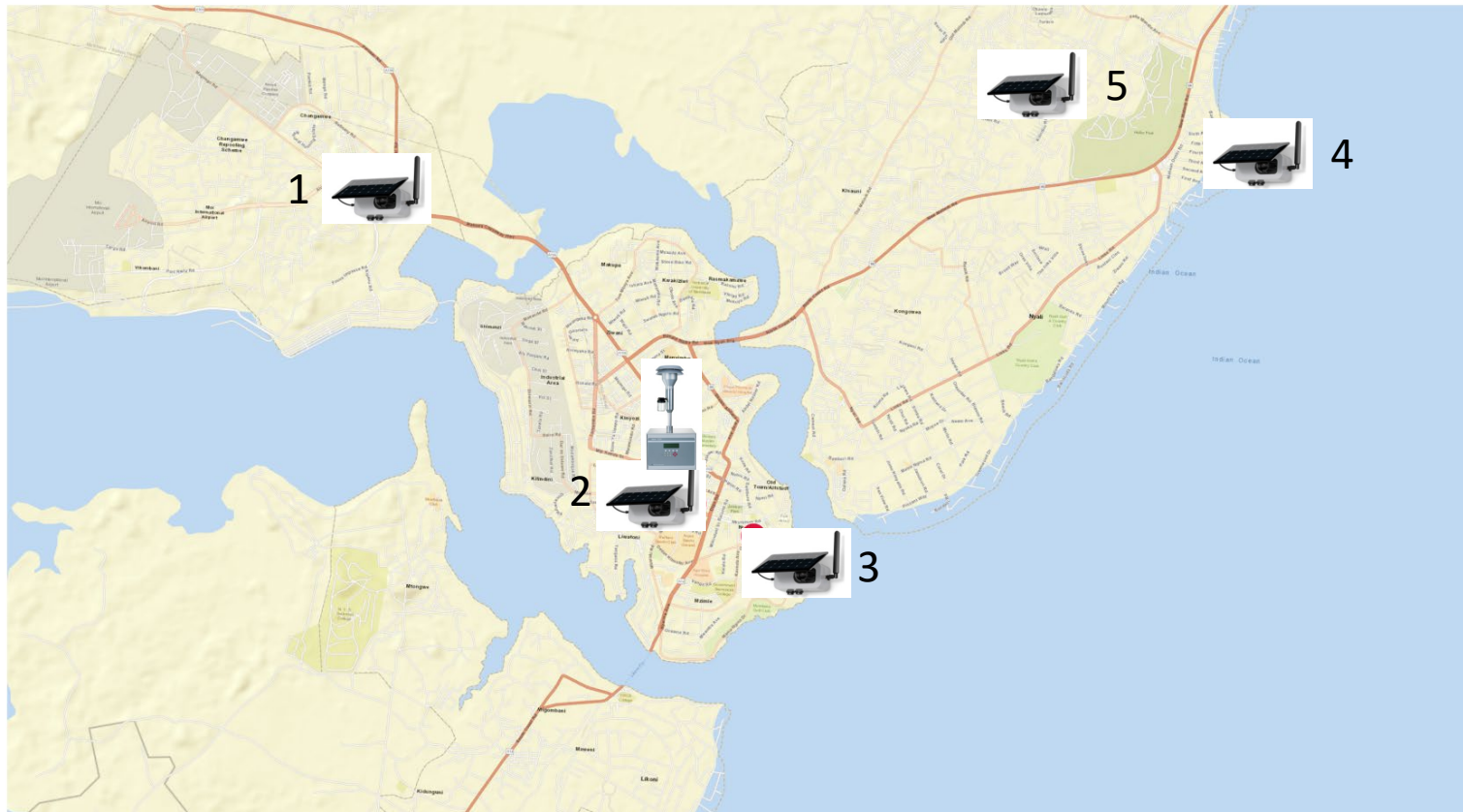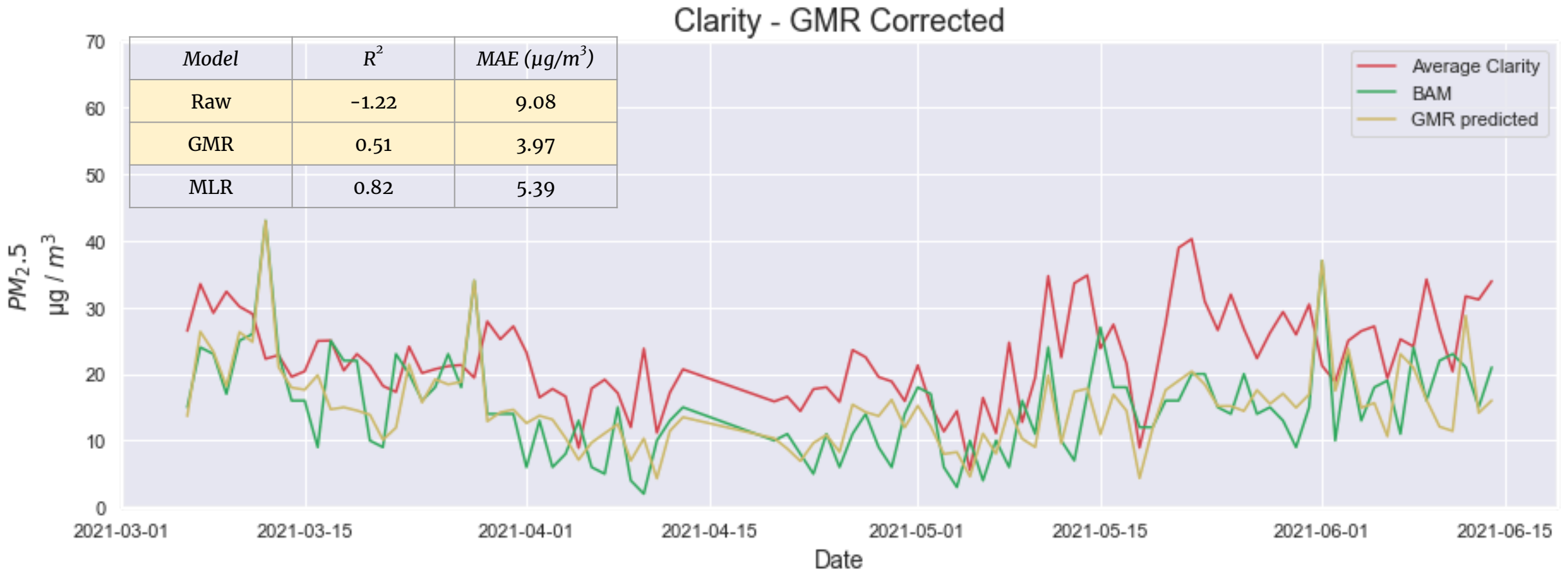

1. Shell Petrol Station (near port)
2. UoN-Mombasa
3. JKUAT-Mombasa
4. Nyali Mall
5. Bamburi Cement Factory

Deployed in July 2021
Replaced in March 2022 (new sensors)

Co-location of Clarity Node-S with BAM-1020 in Nairobi Kenya

Clarity - GMR Corrected

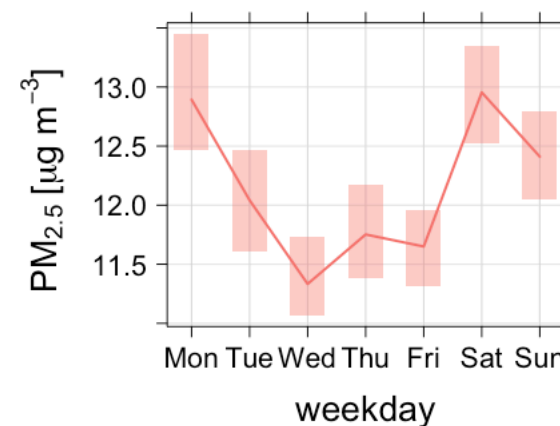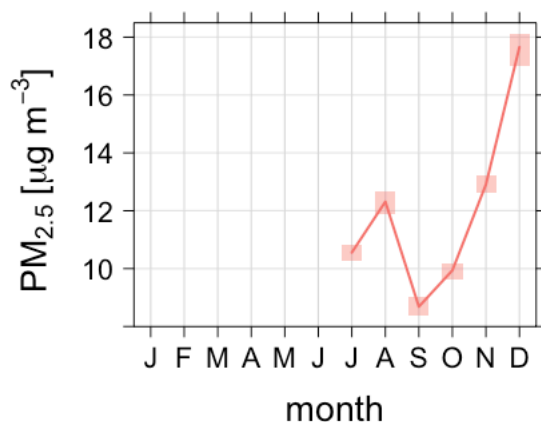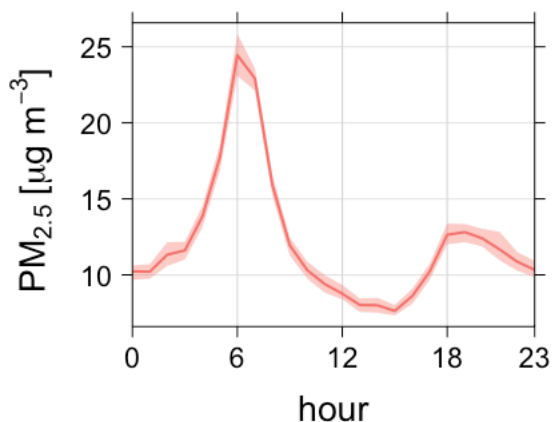| Model	R^2	MAE (µg/m³)
Raw	−1.22	9.08
GMR	0.51	3.97
MLR	0.82	5.39

Without a current reference in Mombasa, this correction factor developed from the closest reference monitor to Mombasa is applied to the clarity nodes
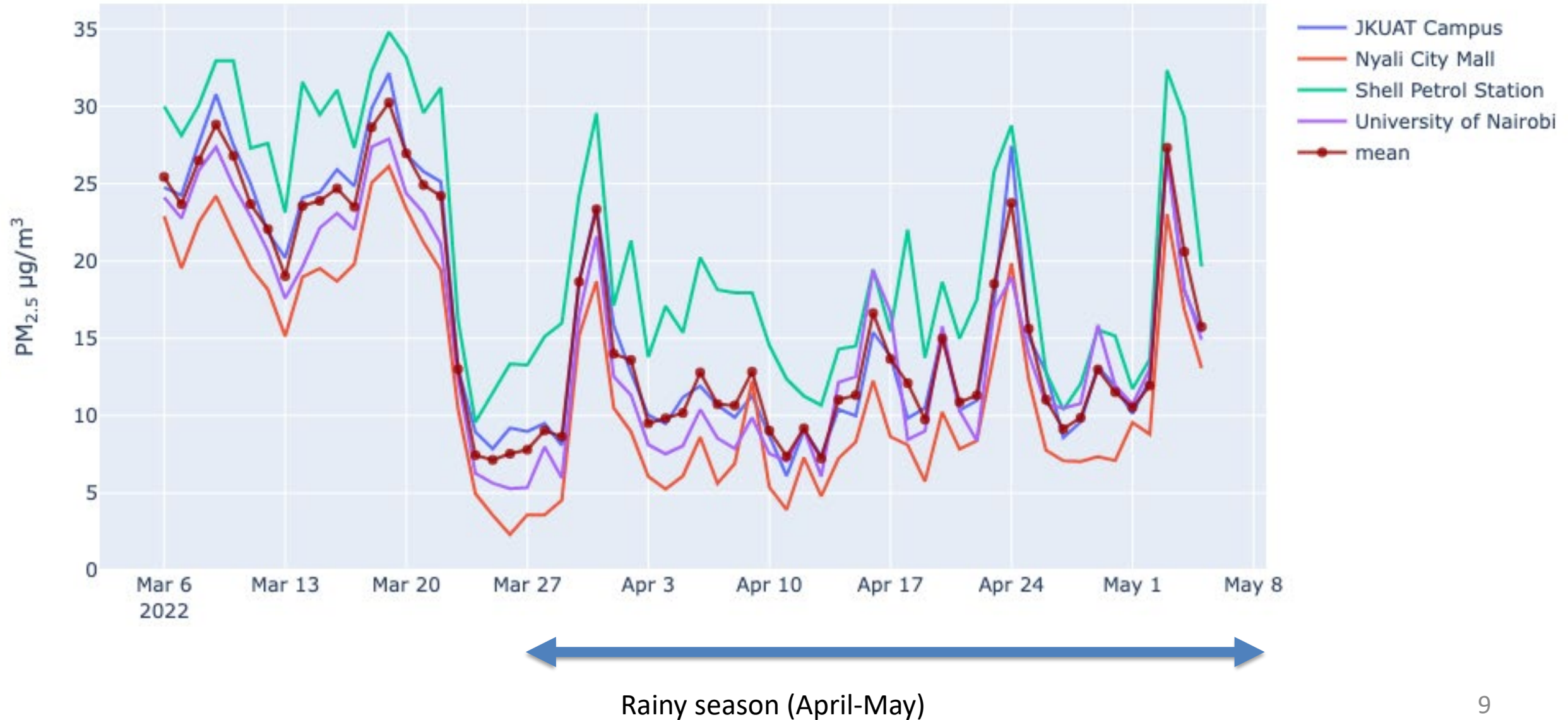
Corrected PM2.5 Data from July - December
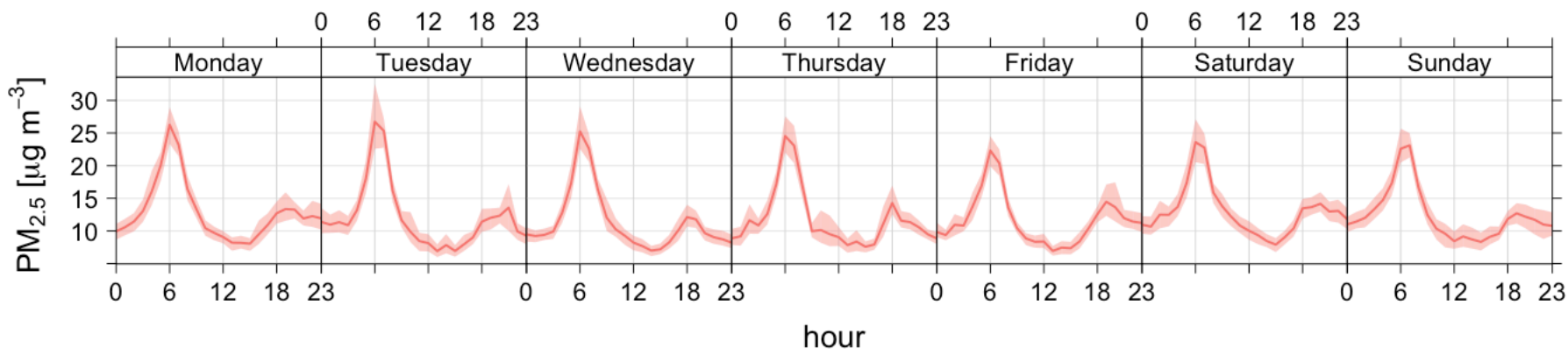
PM2.5 1-Hour Mean Mass Concentration Raw [μg m⁻³]

- Average across all 5 sites ~**17 μg m⁻³**
- Higher in the dryer seasons
- Peaks around 6am and 6pm

Corrected PM2.5 in March, April, and May: impact of rainy season

Rainy season (April-May)

Percentage of days exceeding WHO daily guideline

Shell Petrol Station — 79%

Nyali City Center — 41%

University of Nairobi — 49%

JKUAT Campus — 51%

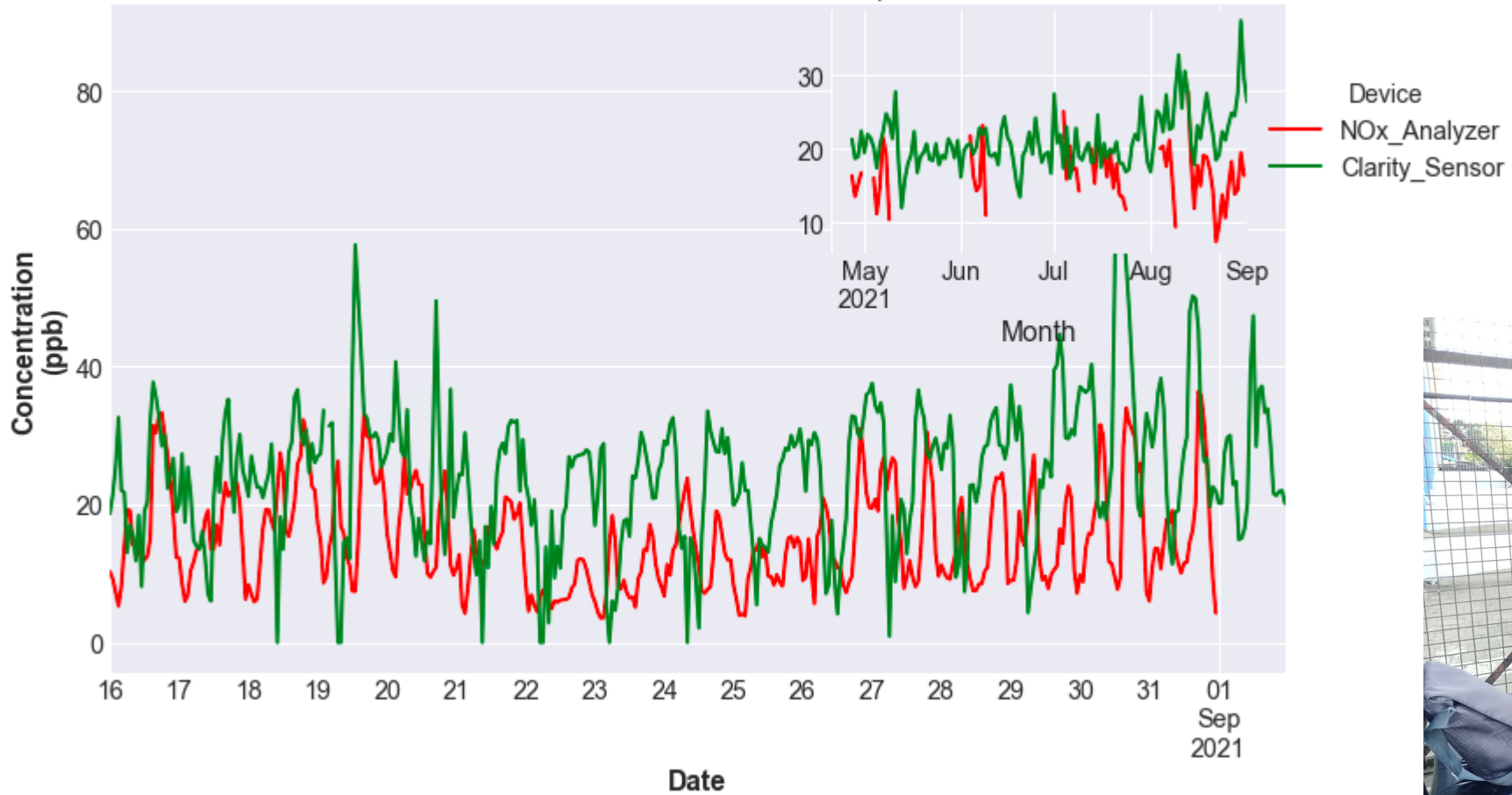# NO2 data: co-location in Nairobi with a Serinus 40 NOx analyzer
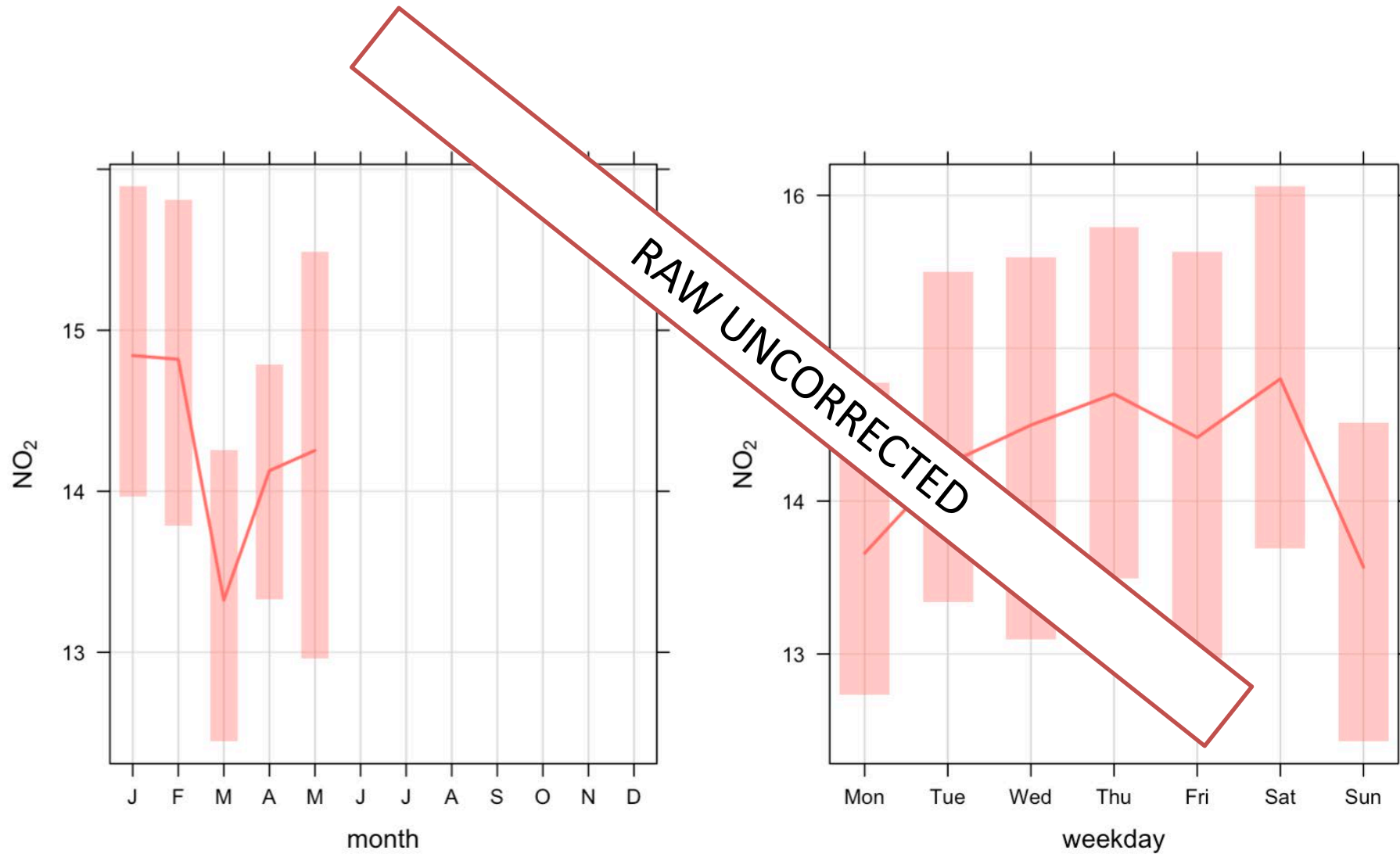

Figure from Ezekiel Waiguru

Uncorrected NO2 data in Mombasa (take with a huge grain of salt!)

Summary

- Preliminary analysis of mostly PM2.5 (briefly NOx) in Mombasa, Kenya
  - 5 Clarity nodes in diverse environments throughout the city
  - BAM-1022 is soon to be operational at UoN-Mombasa

- Correction factor applied to PM2.5 data improves sensor bias from ~9 to less than 4 µg m^{-3}

- "Annual" mean PM2.5 in Mombasa is around ~17 µg m^{-3}
  - However, we have yet to sample the two driest months of the year, which may lead to a few µg m^{-3} higher for the true annual average

- Current WHO annual mean PM2.5 guideline is 5 µg m^{-3}