# What do we know about air quality in Uganda

*Existing data on air quality in Uganda*

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airqo
Breathe Clean.

MAKERERE UNIVERSITY

# About AirQo

**Founded in 2015 at Makerere University, to close the gaps in air quality management in Uganda and across Sub-Saharan Africa through leveraging technology innovation to influence action through contextual evidence**

## Clean Air for All African Cities.

Low-Cost Air Pollution Monitors | High Resolution Network | Air Quality Mobile App | Air Quality Analytics, API Access

## Our impact

| | | | | |
|---|---|---|---|---|
| 10+ African Cities | 200+ Monitors Deployed | 67M+ Data Records | 6762+ Mobile App Downloads |
| 2000+ Air Quality Champions | 3000+ Student Engaged | 500K+ Citizens Engaged | 400+ Duty Bearers Trained |

# What is Air Quality

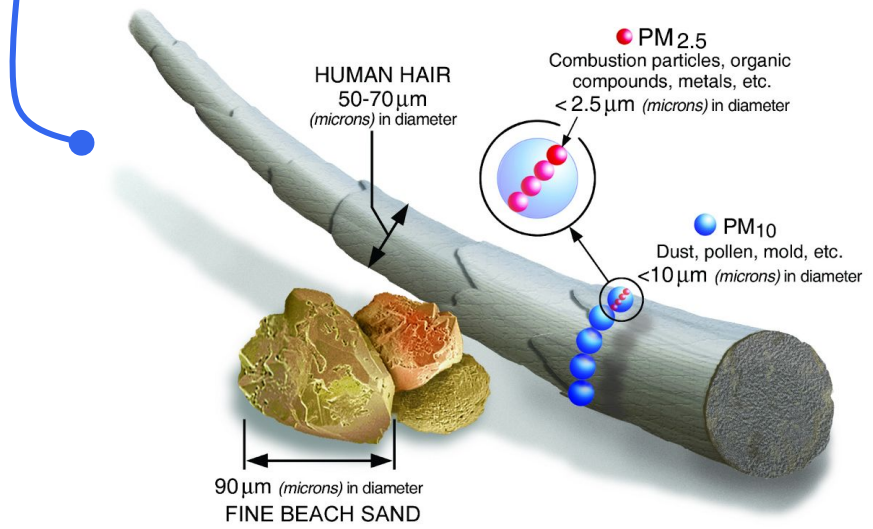
**Air quality**: measure of how clean or polluted the air is.

When air **quality is good**, the air is clear and contains only small amounts/natural concentrations of chemical pollutants (solids and gases)

**Poor quality** air quality contains chemical pollutants and is harmful to health, and the ecosystem.

**Air pollution** is among the leading environmental risk factors globally.

Pollutants: Particulate Matter (most common), Gases ($O_3$, CO, $NO_2$, $SO_2$)




**"If we cannot measure air pollution well, we cannot manage it effectively."**

# Known Sources of Air Pollution

# Sources of Air Pollution: Natural Sources

**Volcanic Eruptions** (https://pixabay.com/)

**Wildfires** (Fire in sugarcane in Lamwo)

**Dust Storms** (Lagos)

**Biological contaminats**; Biological contaminants include bacteria, viruses, animal dander and cat saliva, house dust, mites, cockroaches, and pollen.

# Sources of Air Pollution: Man-made Sources

Industrial activities


Transportation:


Domestic combustion

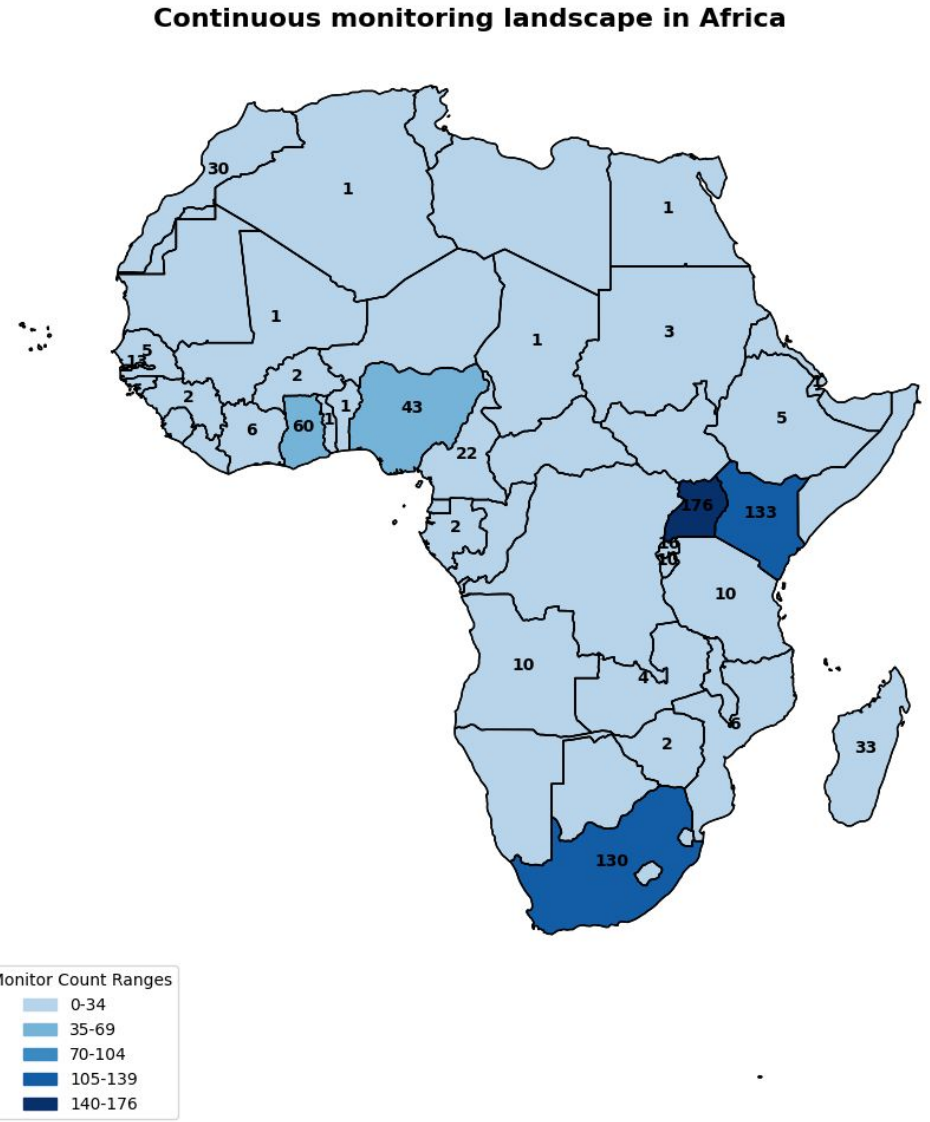
There are Primary and secondary pollutants

# Existing data on local air quality

# Monitoring landscape

- A number of countries have no access to continuous monitoring
- LCS offer …..
- In Uganda there currently  more than 150 air-quality monitoring devices nationwide, with a substantial expansion over time. Of these, over 90 sensors are deployed within the Kampala Metropolitan Area

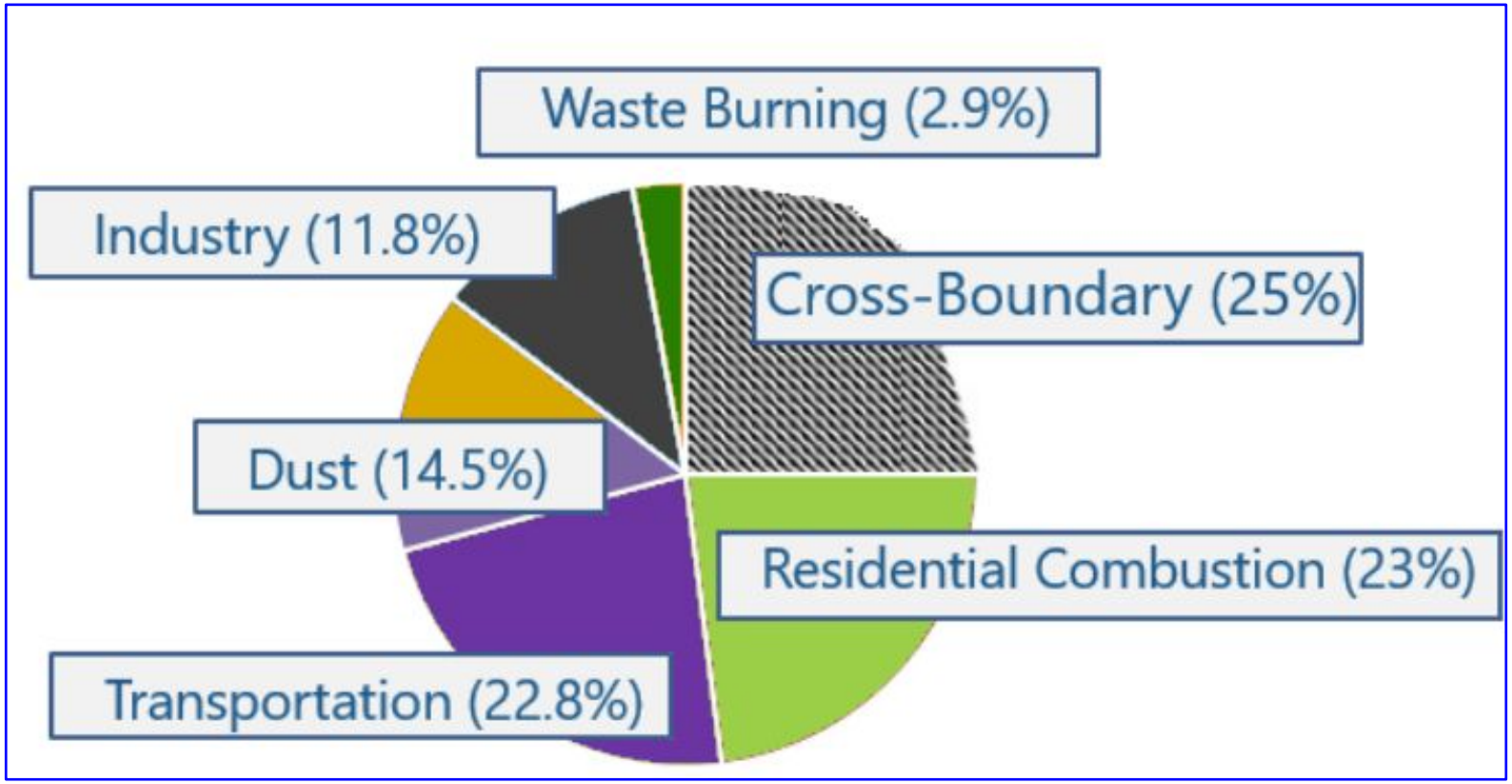
Visit https://analytics.airqo.net/



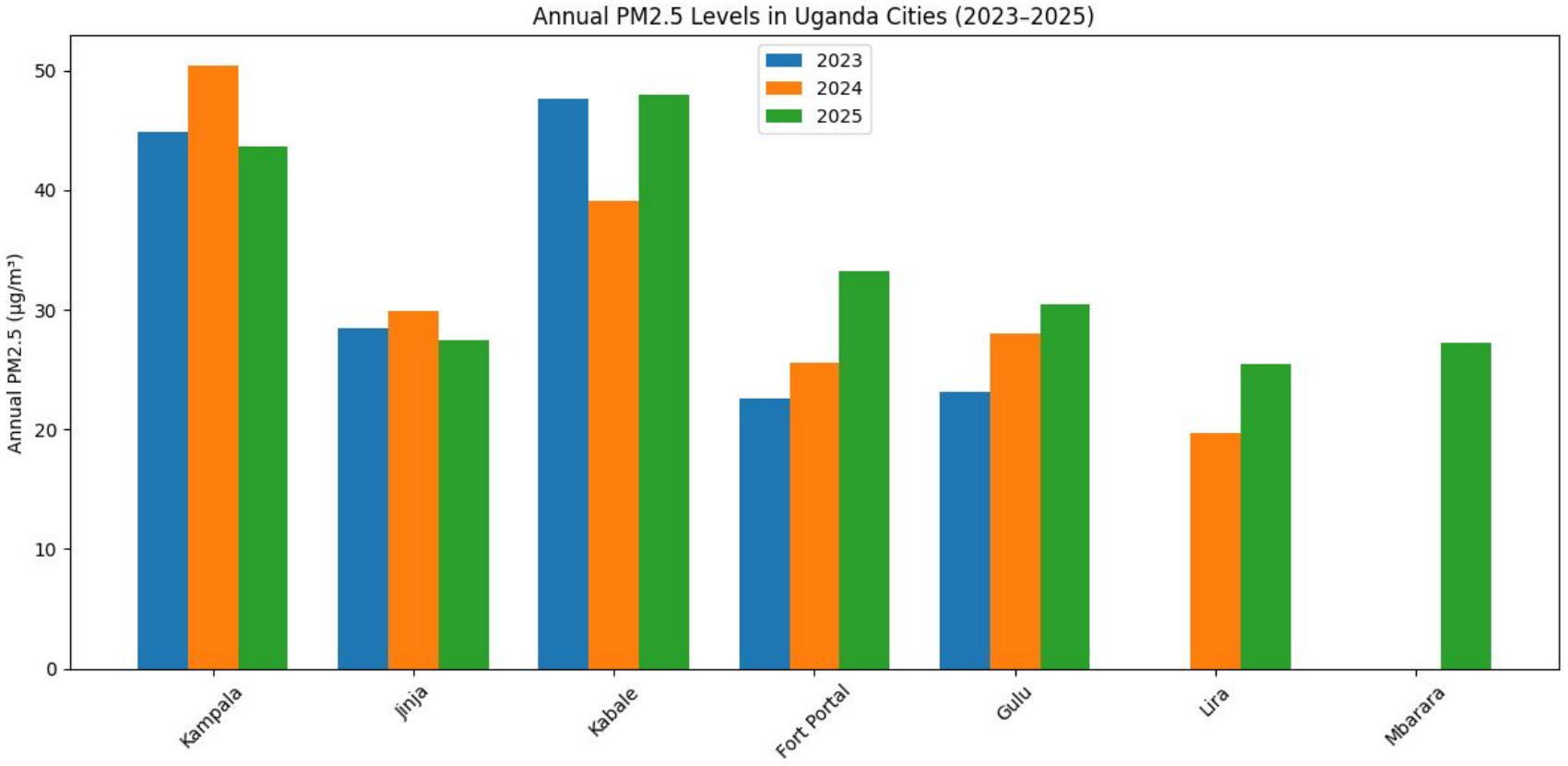
# Key air pollution sectoral drivers for Kampala

**Energy use and solid waste management**: use of biomass fuels for cooking, open waste burning.

Figure: Okure et al. 2025



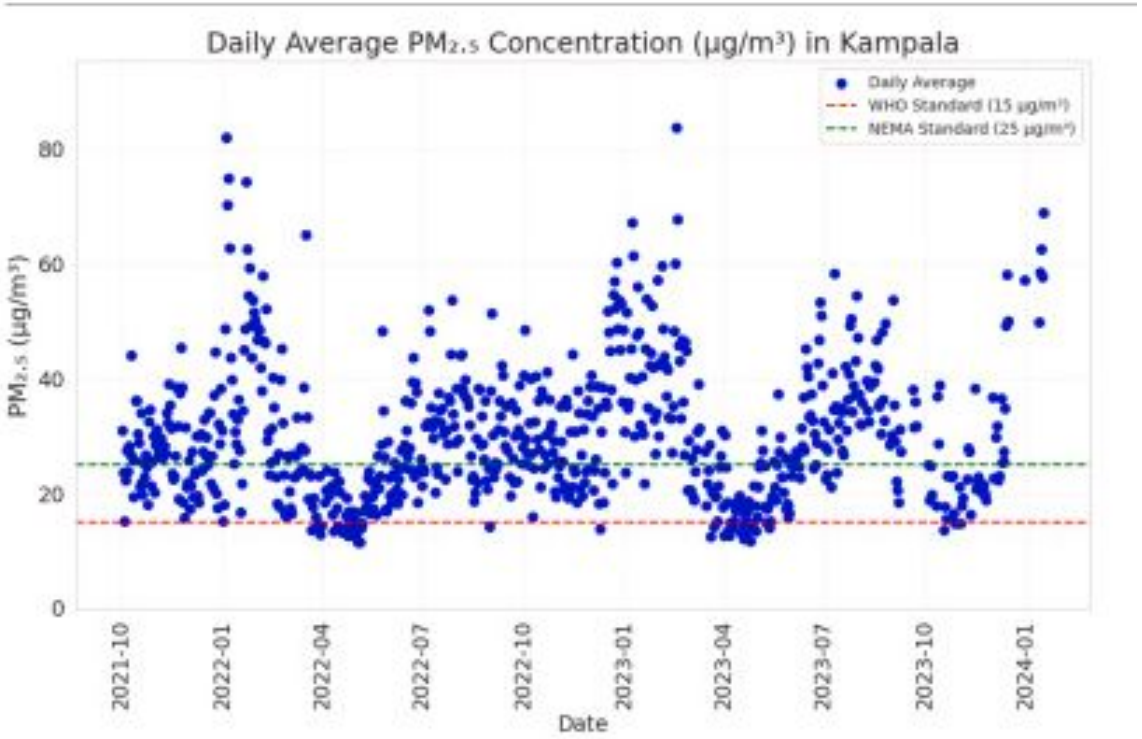
# Annual Population-weighted mean $PM_{2.5}$



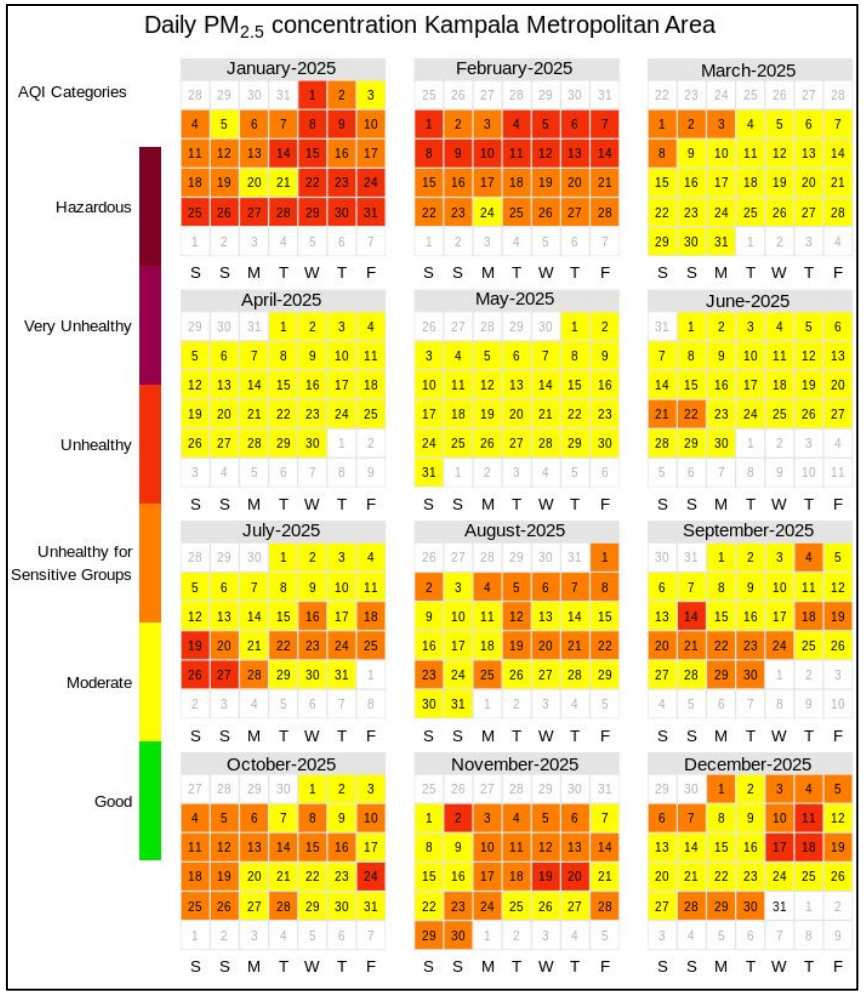

Population-weighted mean PM2.5 representing the average air-pollution level experienced by people, not simply the average across monitoring locations.

Diurnal variation of $PM_{2.5}$

# Average $PM_{2.5}$ - Kampala

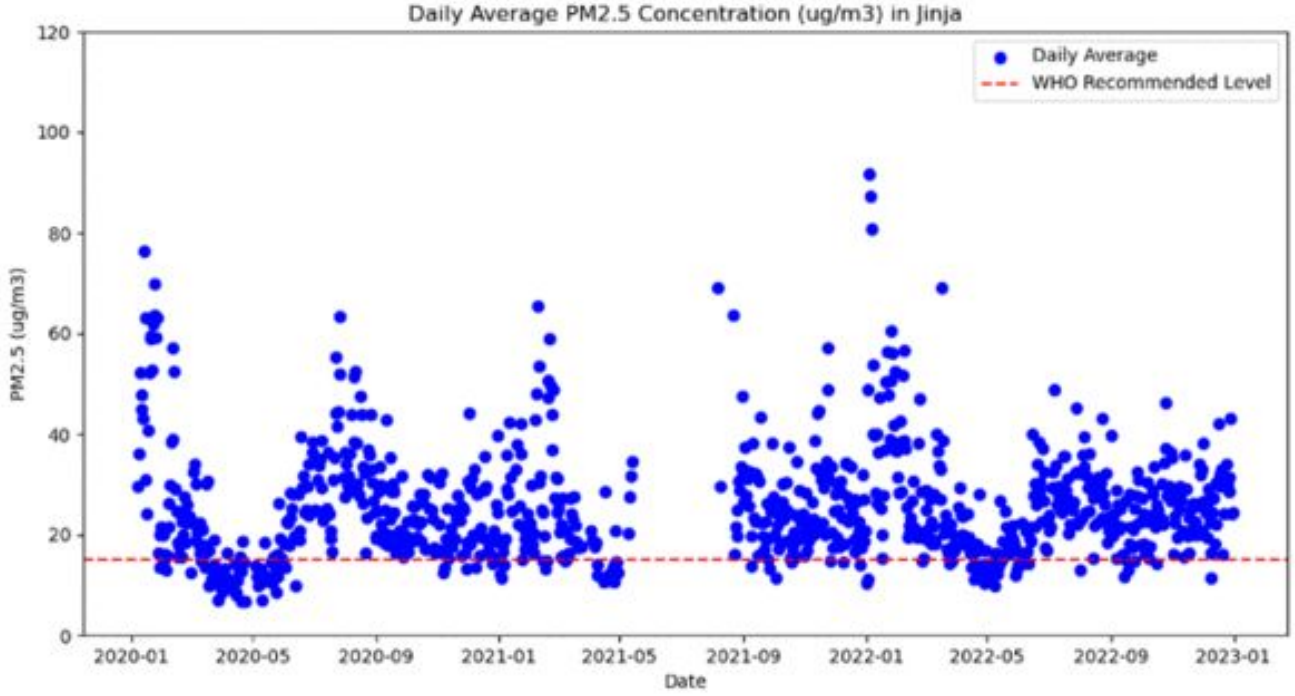



Daily average $PM_{2.5}$ concentrations

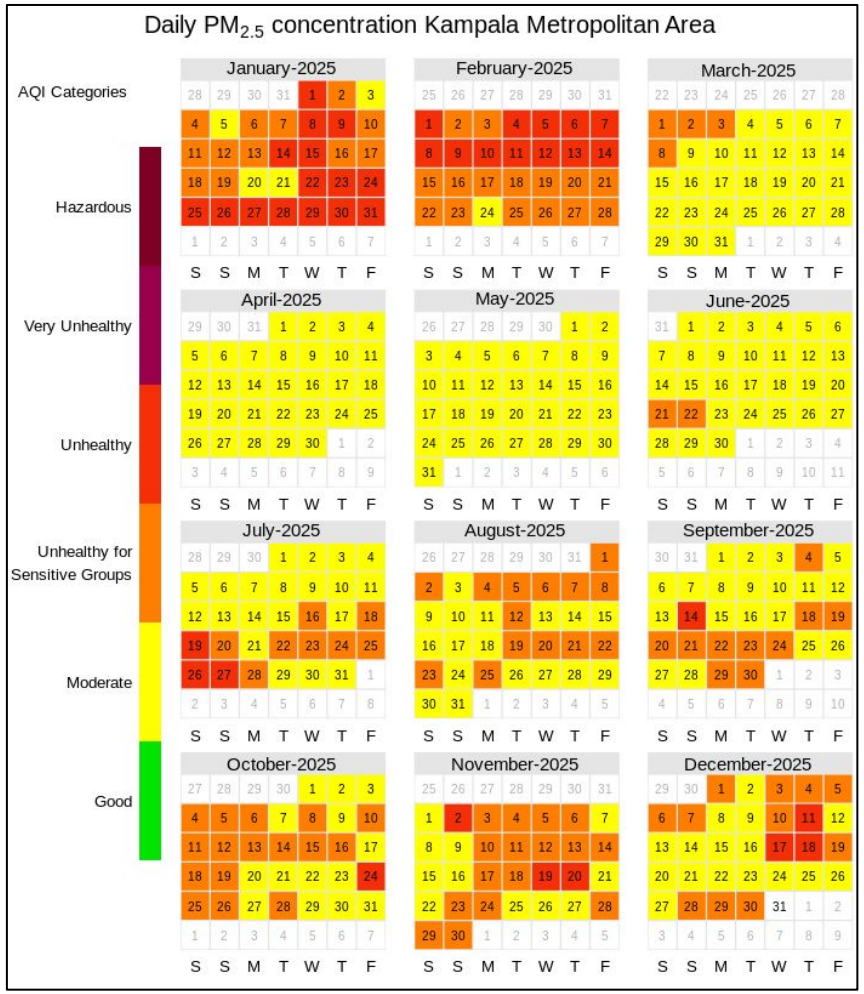



Kampala calendar plot

# Average $PM_{2.5}$ - Jinja

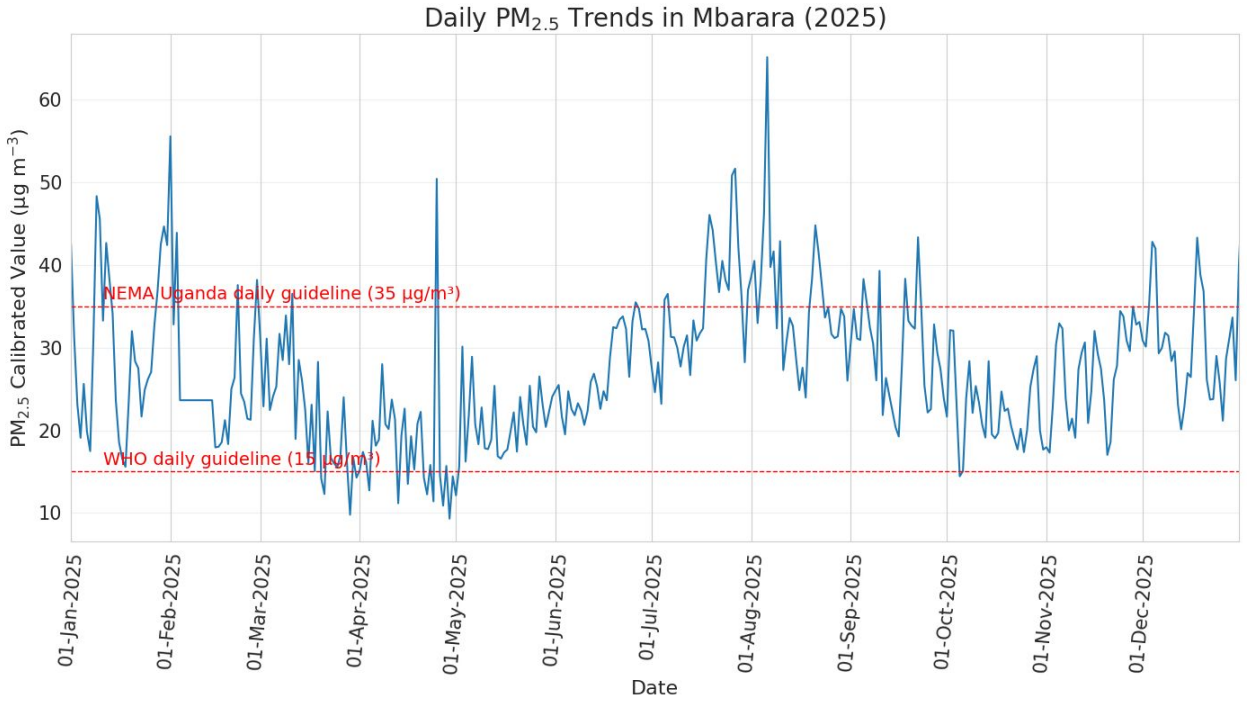


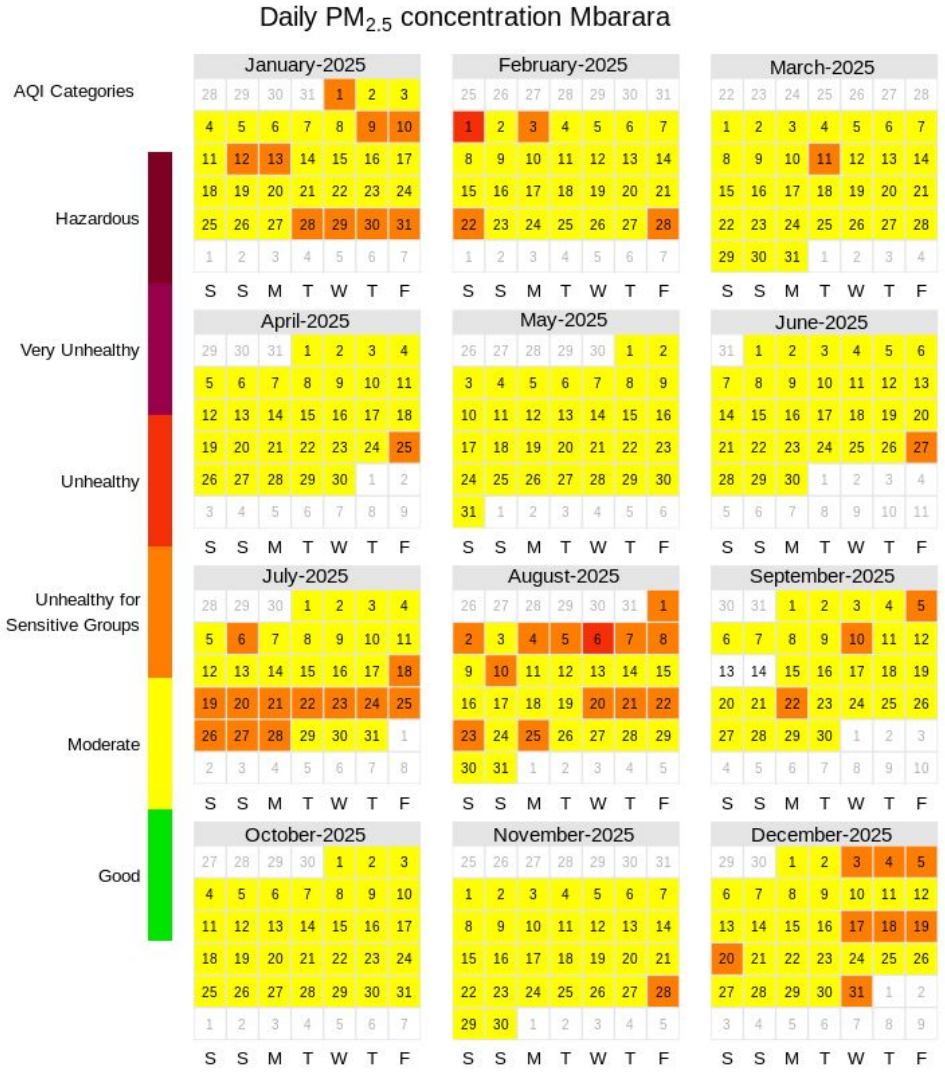

Daily average $PM_{2.5}$ concentrations




Kampala calendar plot

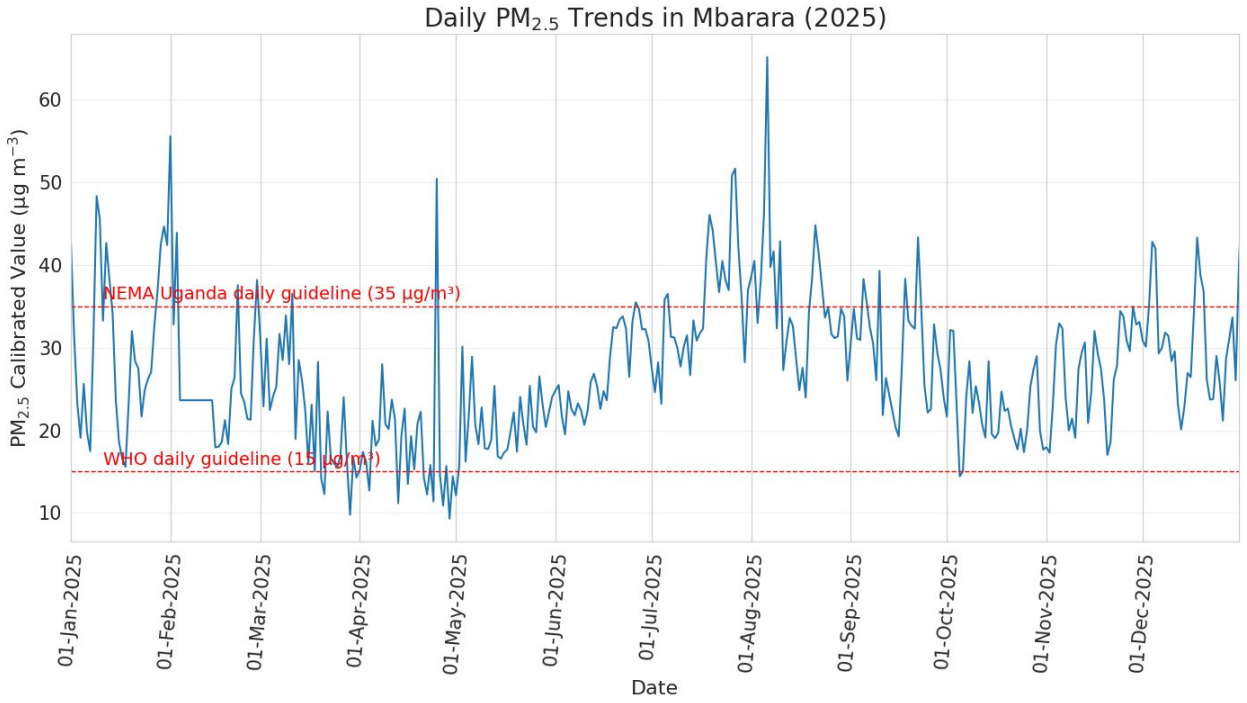
# Average $PM_{2.5}$ - Mbarara

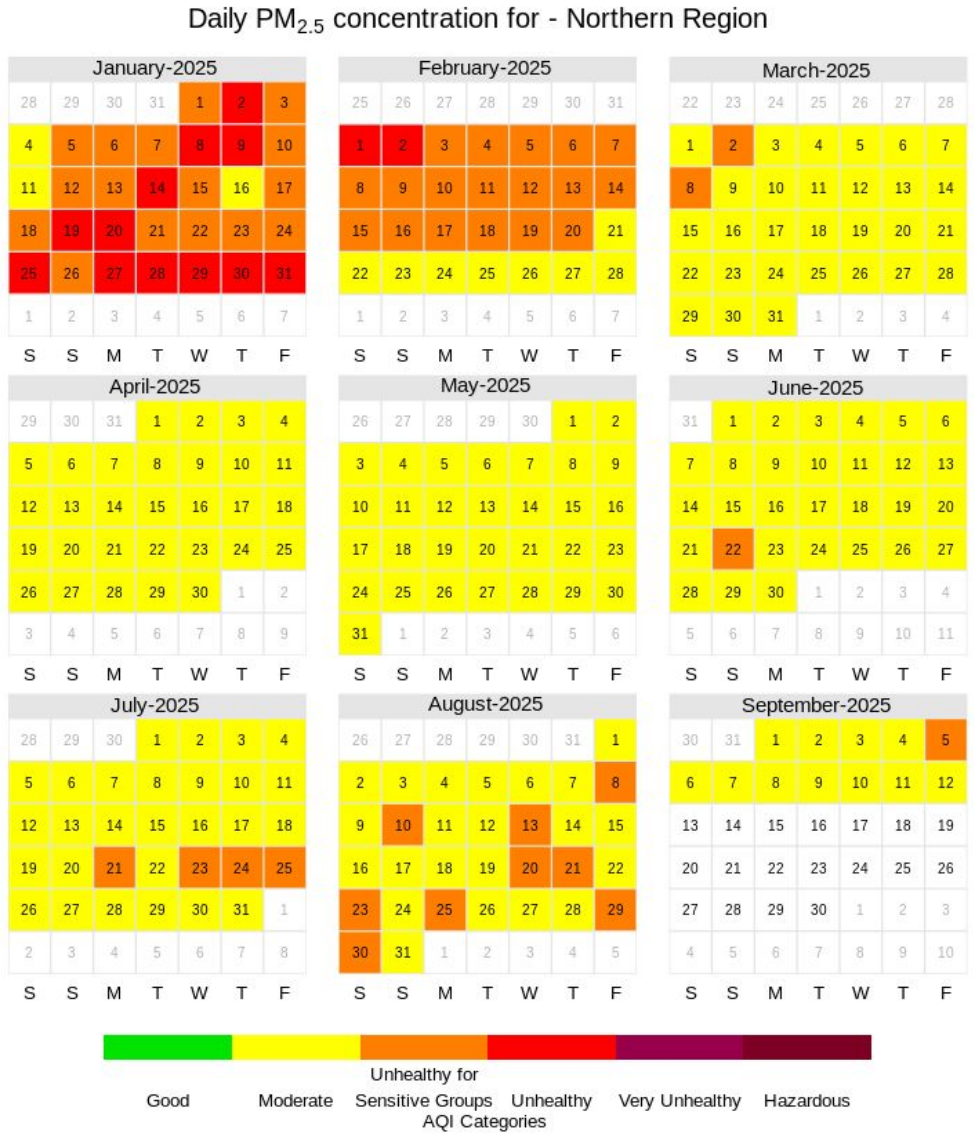



Daily average $PM_{2.5}$ concentrations

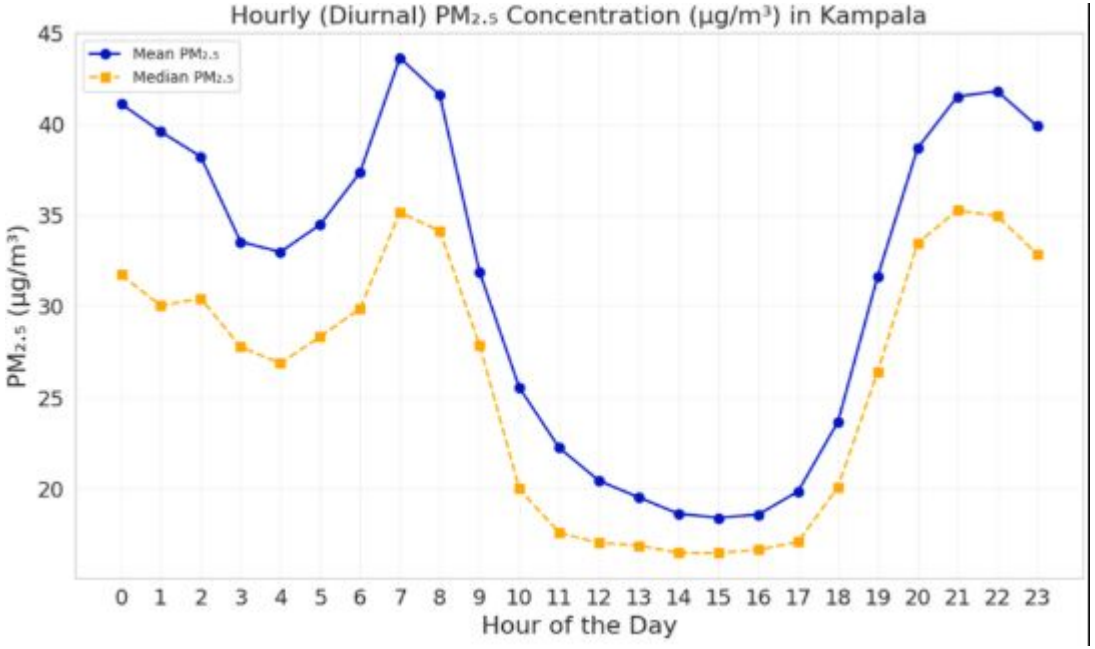
# Average $PM_{2.5}$ - Gulu



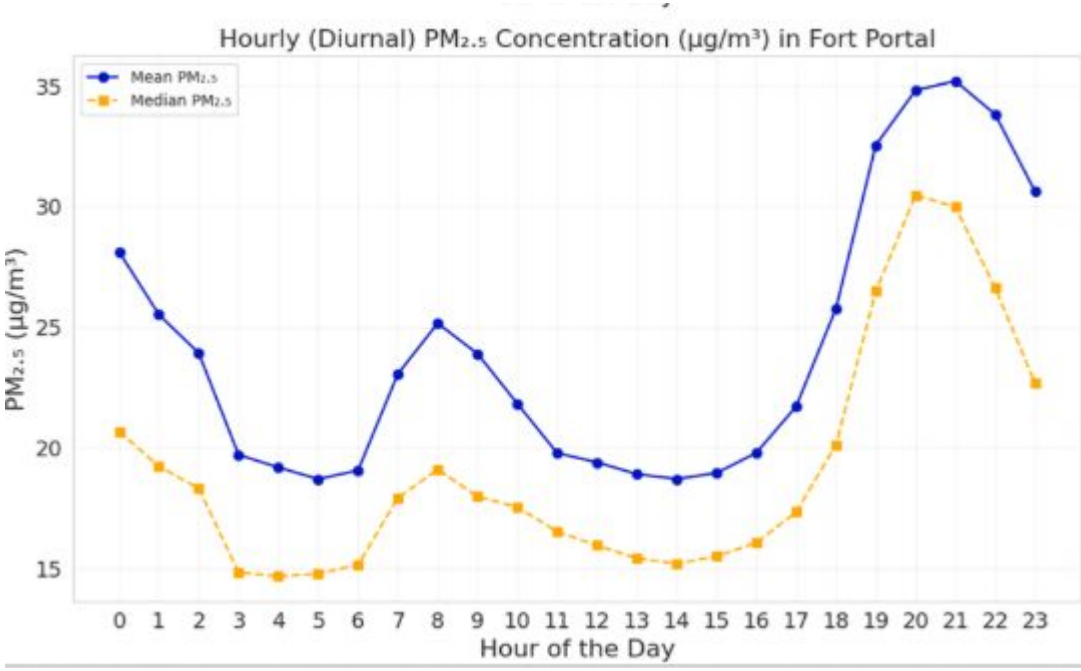




Daily average $PM_{2.5}$ concentrations

# Diurnal $PM_{2.5}$

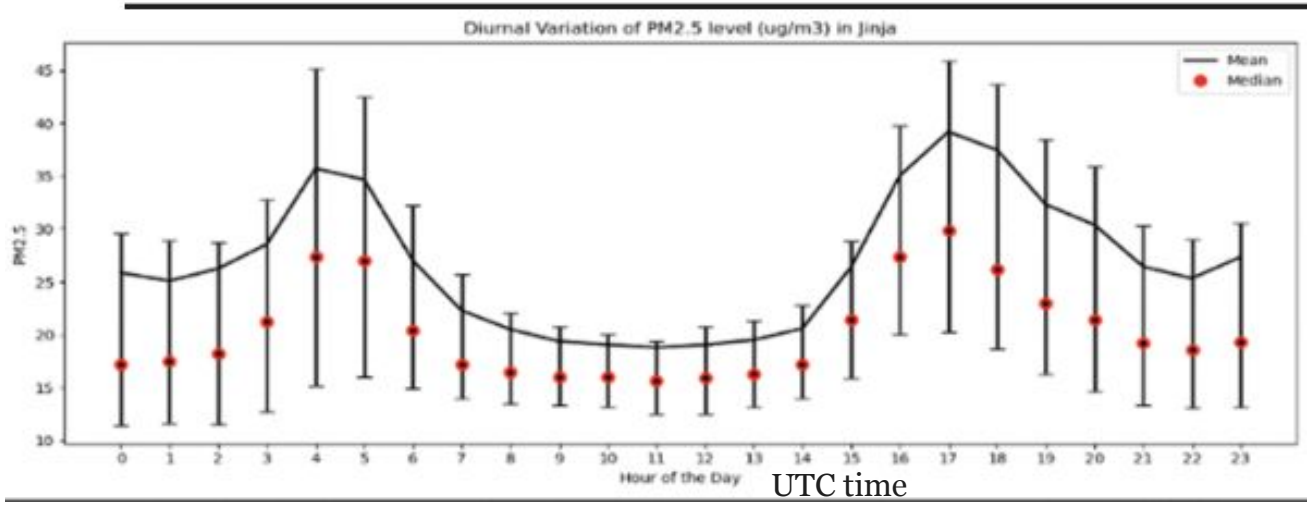



Kampala City



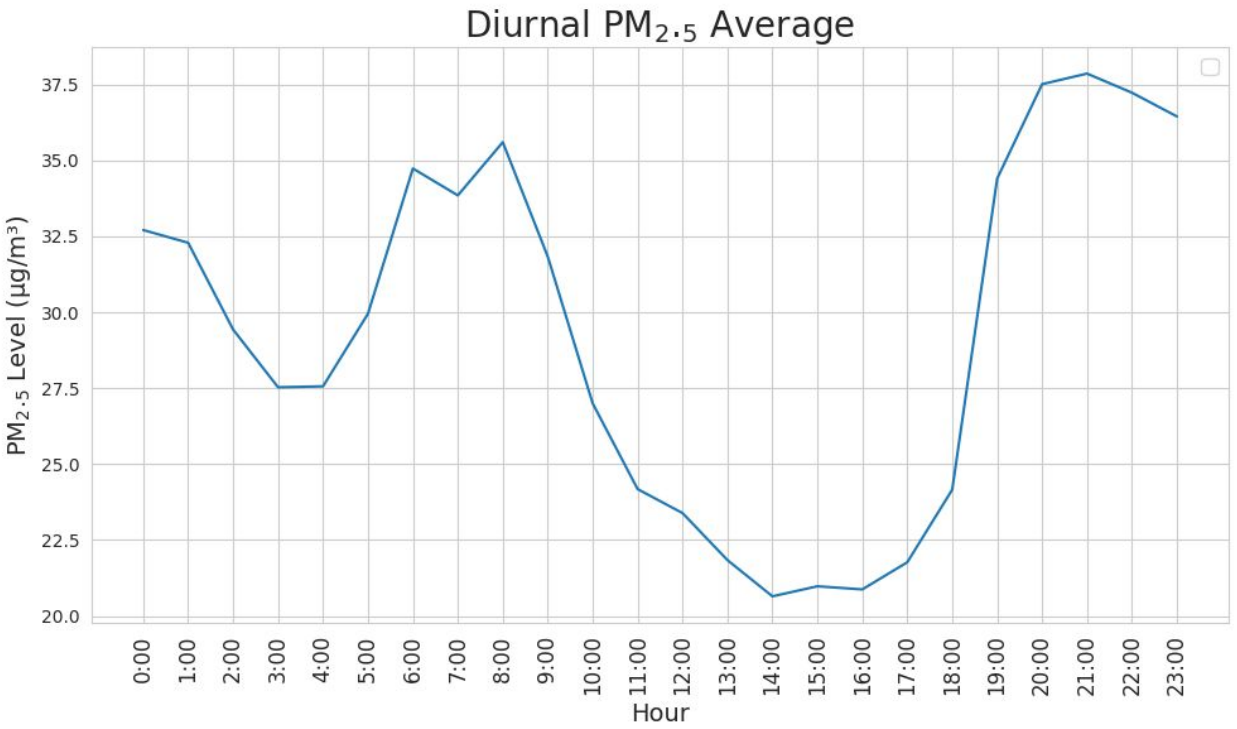

Fort Portal

# Diurnal $PM_{2.5}$



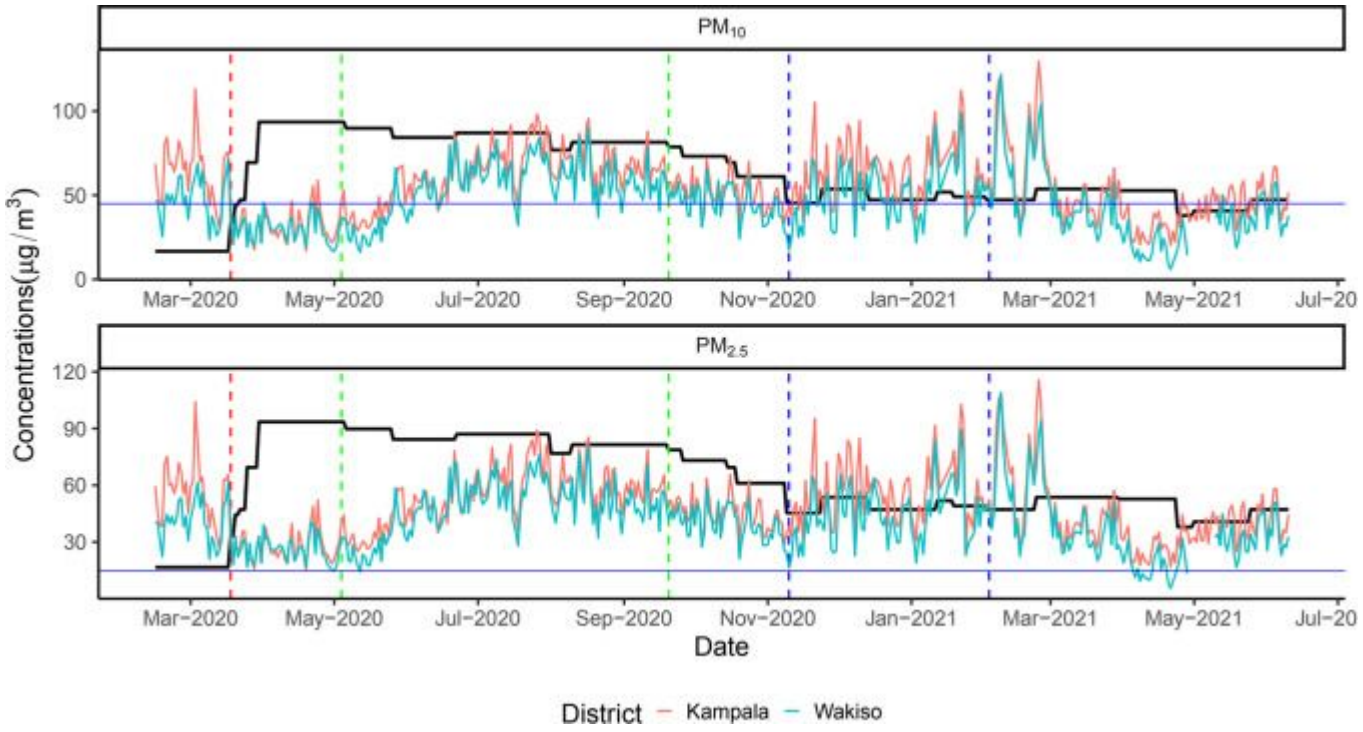

UTC time

Jinja City




Mbarara City

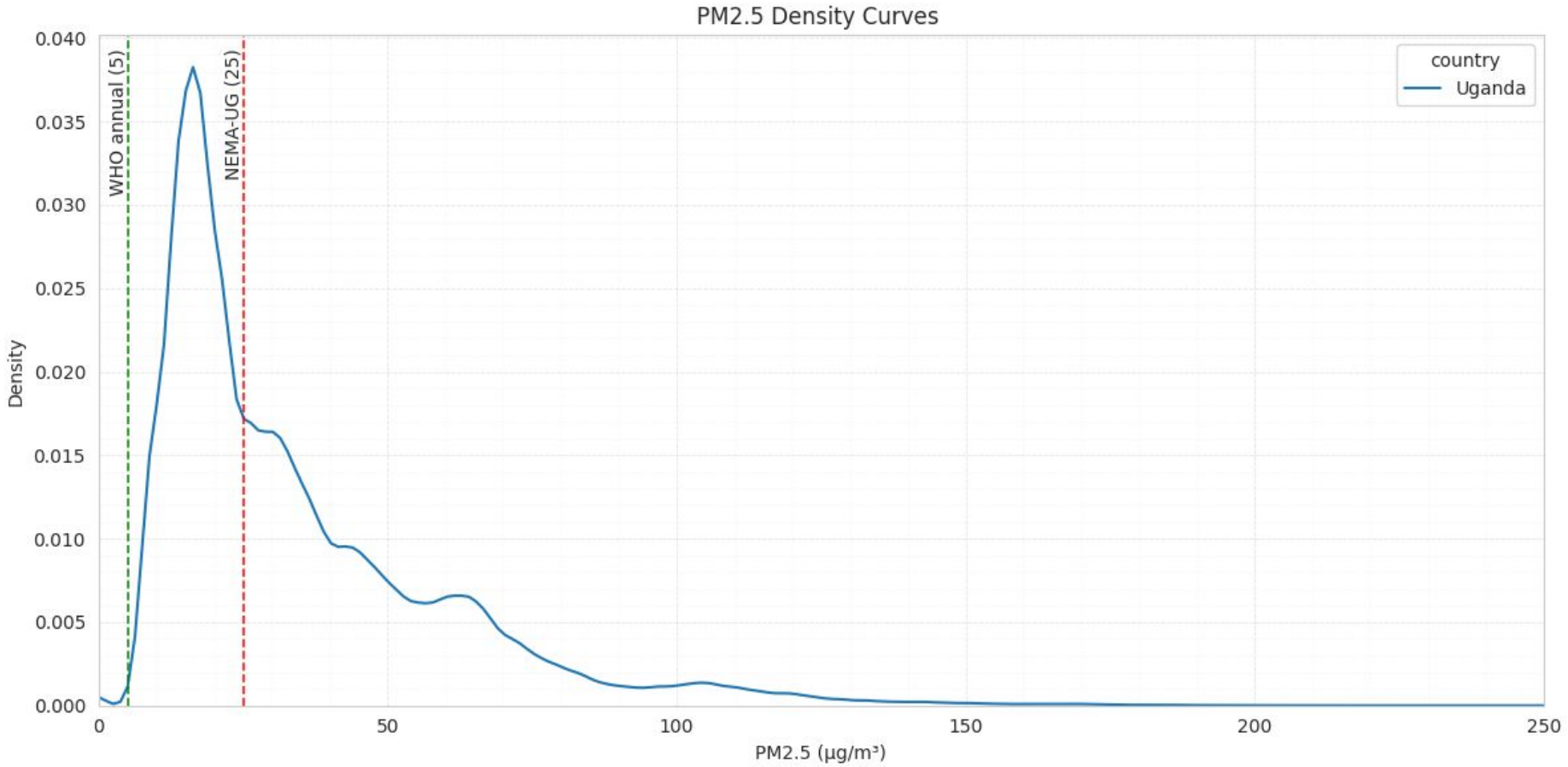
# Impact of COVID-19 mobility Restrictions




Ambient air quality temporal variation for Kampala and Wakiso districts

- The red dashed vertical line start of restrictions 18th March 2020.
- First green dashed vertical line (4th May 2020) for the start of the first phase of easing restrictions
- air quality data can reflect human mobility patterns
- COVID-19 movement restrictions led to measurable improvements in air quality
  - Improvement of up to 50%

# Density curves $PM_{2.5}$




The density curve shows that most PM2.5 concentrations cluster between about 10 and 40 µg/m³, with a strong peak around the 20s

# Reflections

### Shared challenges and dynamics

- Common sources and pollution patterns **across cities** can foster **national and regional** collaboration

### Limited monitoring access

- Expanding and sustaining affordable **sensor networks** is crucial for informed decision-making

### Innovative intervention models needed

- Holistic, **low-cost strategies** critical for effective air-quality action in low-resourced cities

### Lessons from COVID-19

- Pandemic demonstrated **rapid air quality improvements** are achievable with policy change

### Emphasis on collaboration

- Data-driven policies and **participatory development** are essential for sustainable progress

# List of references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