

Designing Air Quality Measurement Systems in Data-Scarce Settings

Testing and comparing three pollution data sources in Dakar, Sénégal

Motivation

- Air pollution causes over 4.2 million deaths annually.
- Most research focuses on high-income countries due to better data availability.
- Accurate measurement is essential for effective policy design and evaluation.

Context

Location: Dakar, Senegal, where air pollution data exists thanks to regulatory-grade monitors owned by the Air Quality Management Center (CGQA), but is limited.

Objective: Evaluate three air pollution data sources in an urban, low-resource setting and their cost-effectiveness for spatial analysis of policies.



REGULATORY GRADE MONITORS

- ✓ High accuracy
- ✗ Expensive
- Limited coverage



LOW-COST MONITORS

- ✓ Affordable
- ✗ Needs calibration
- ✓ Scalable
- ✗ Sensitive to dust

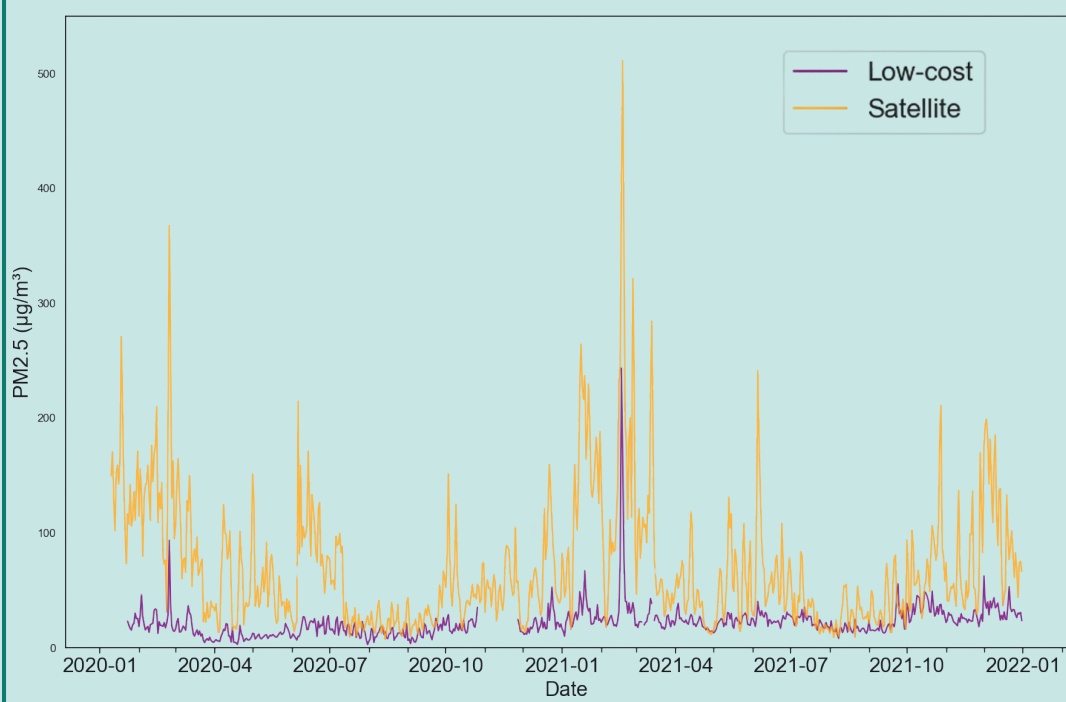


SATELLITE DATA

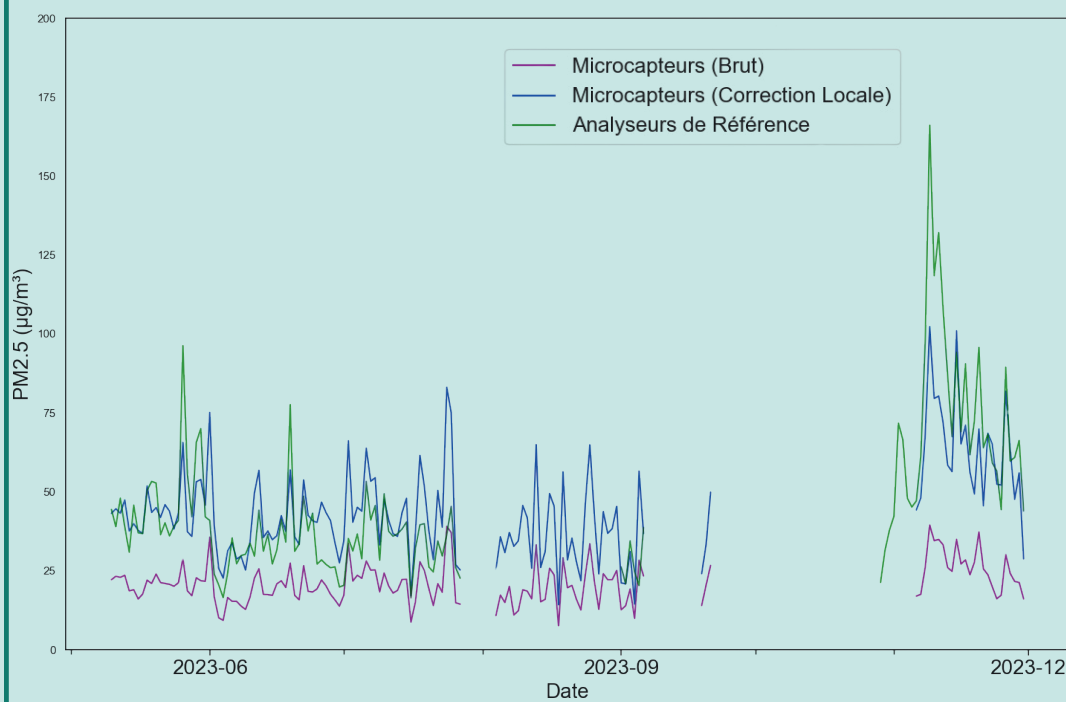
- ✓ Global
- ✗ Affected by cloud cover
- ✓ Free
- ✗ Lower resolution

Comparison findings

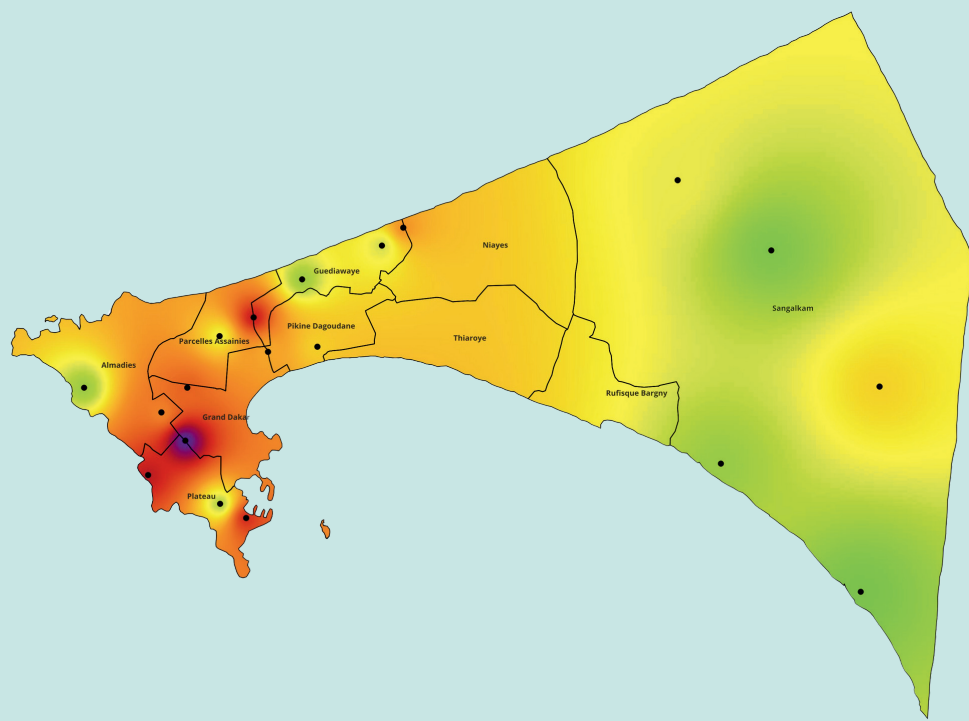
Low-cost monitors underestimate the amount of fine particulate matter relative to the other data sources.



Using other data sources to calibrate low-cost monitors' data improves its alignment.



Calibrated low-cost monitors' data can, in turn, complement satellite and regulatory data with a more dense spatial coverage.



A regression analysis of the three data sources found a 25% air pollution reduction, linked to city-wide mobility policies enacted in March 2020.

Takeaways

REGULATORY GRADE MONITORS

- ✓ Good to formulate regulations
- ✓ Measure pollution at the city level

LOW-COST MONITORS

- ✓ Good to capture spatial variations
- ✓ Relevant for intra-urban measures

SATELLITE DATA

- ✓ Good to capture trends
- ✓ Measure pollution across a region or country

Combining a network of low-cost monitors with another air pollution data source is a cost-effective system to obtain spatially granular and accurate air quality measures

Sources: Compendium of WHO and other UN guidance on health and environment. Geneva: World Health Organization, 2021.