

Potential of Low-Cost Air Quality Monitoring



Victor Nthusi - UNEP

UN Environment Assembly Adopts Resolution to strengthen UNEP's Air Quality work

June 2014 - Governments Adopt UNEA Resolution #7: *Strengthening the role of the United Nations Environment Programme in promoting air quality*



Air Quality Data currently available

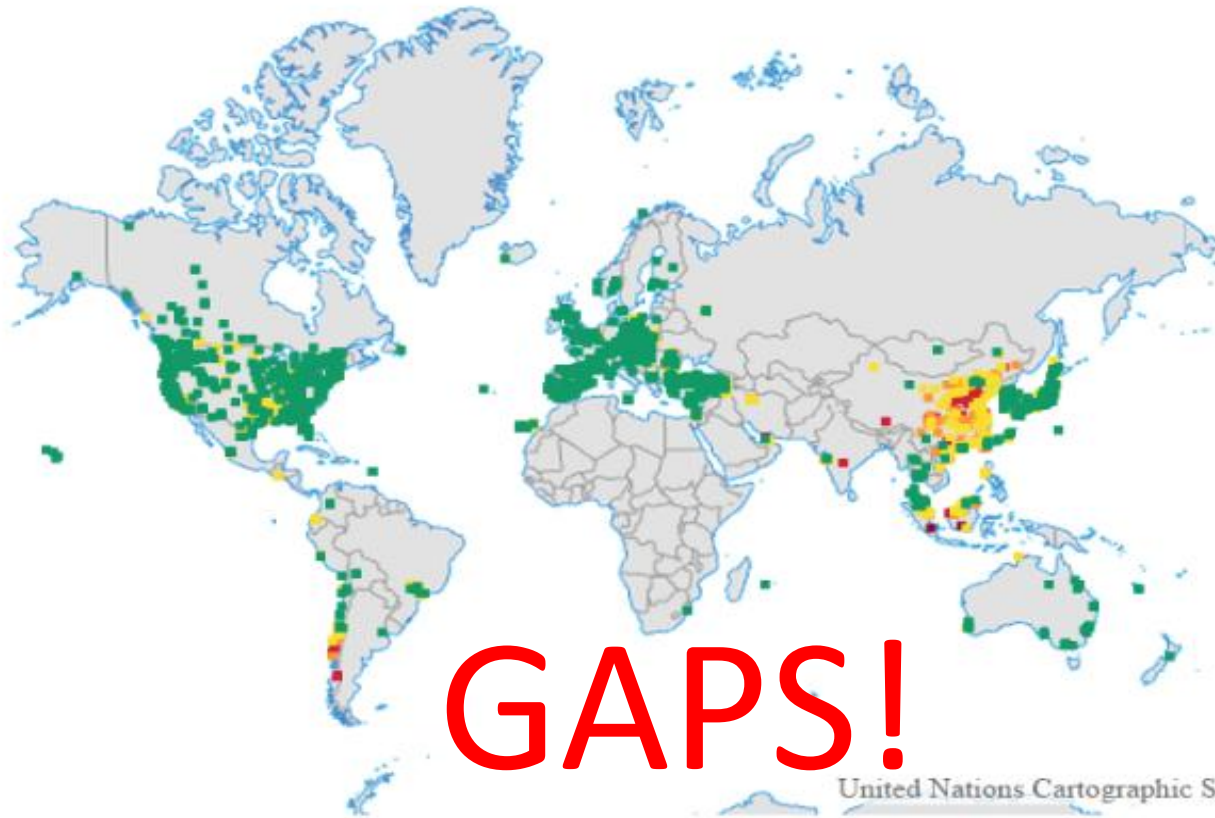
Air Quality-Health-Climate Change

Maps ▾

Graphs

+

-



GAPS!

Legend

■ 0 - 50 ■ 50 - 100 ■ 100 - 150 ■ 150 - 200 ■ 200 - 300 ■ 300 - 1000

Air Quality Monitors: High cost to Low Cost



Reference Air Quality Monitoring Station

- High accuracy
- High Costs (\$150,000-\$200,000)
- High installation costs
- High operation costs



Low cost Air Quality Monitor

- Lower accuracy
- Lower Cost (~few \$100-\$1000)
- Lower installation costs
- Lower operation costs

Assessment through enhanced and low-cost monitoring

UNEP National Air Quality Monitoring Programme

- Air pollution data is sparse in most African cities
- UNEP has developed an affordable air quality monitoring unit
 - Based on electro-chemical sensors for gases and OPC for particulate matter
 - [Blue prints](#) to be made available publically
 - Piloted in Kenya



Nairobi Commercial Low-Cost AQ Network

- 6 sites
- Deployed late April 2016



Nairobi Network Acknowledgements

Nodes- UNEP: funding, planning- Jacqueline McGlade

Alphasense Ltd: John Saffell, Technical Group - sensors, calibration, project management

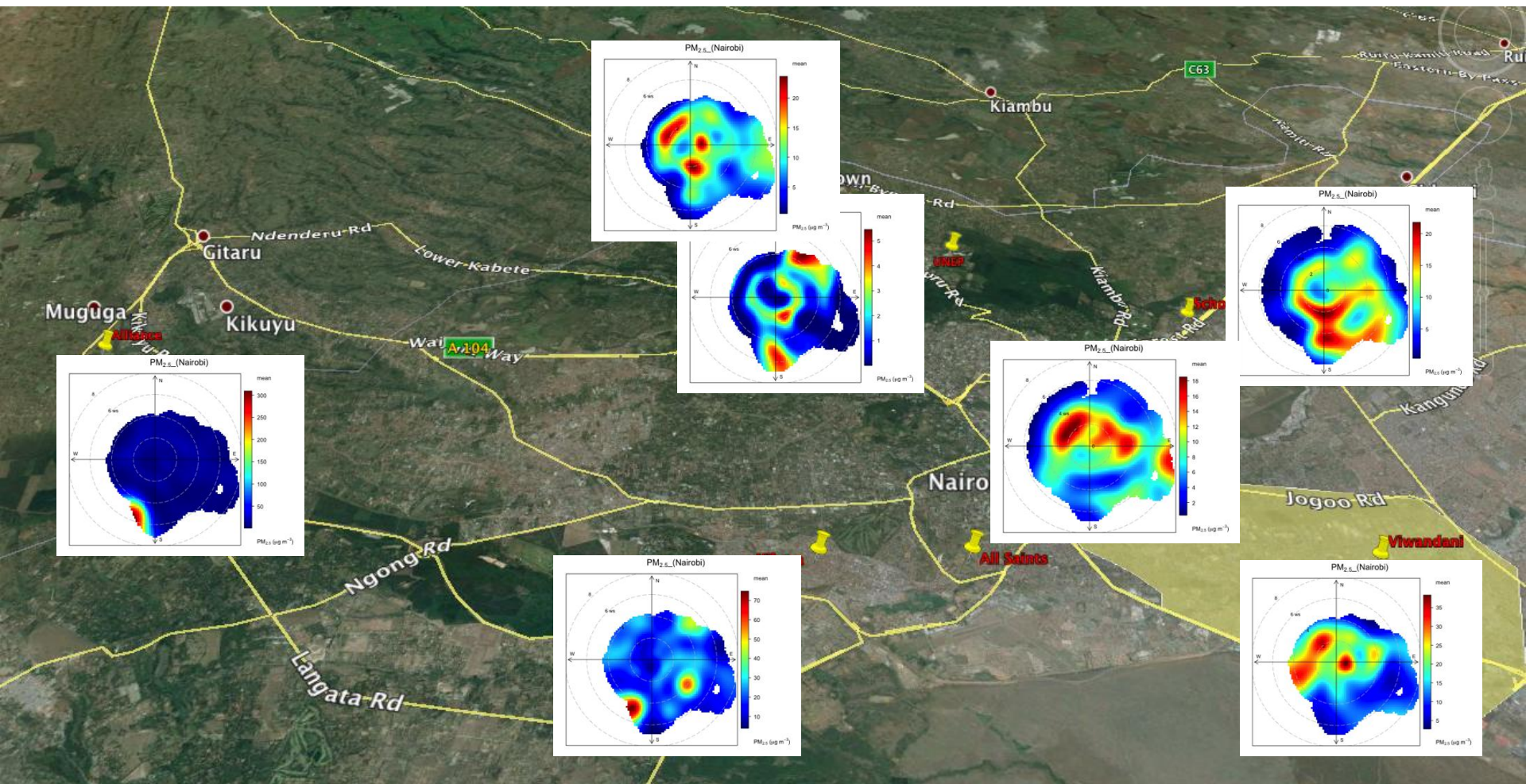
Atmospheric Sensors Ltd: electronics, comms, cloud control

Deployment- *Analytical Monitoring systems Ltd:* Robbie Lambert

UNEP: Valentin Foltescu, Priyanka DeSouza, Victor Nthusi, Sami Dimassi

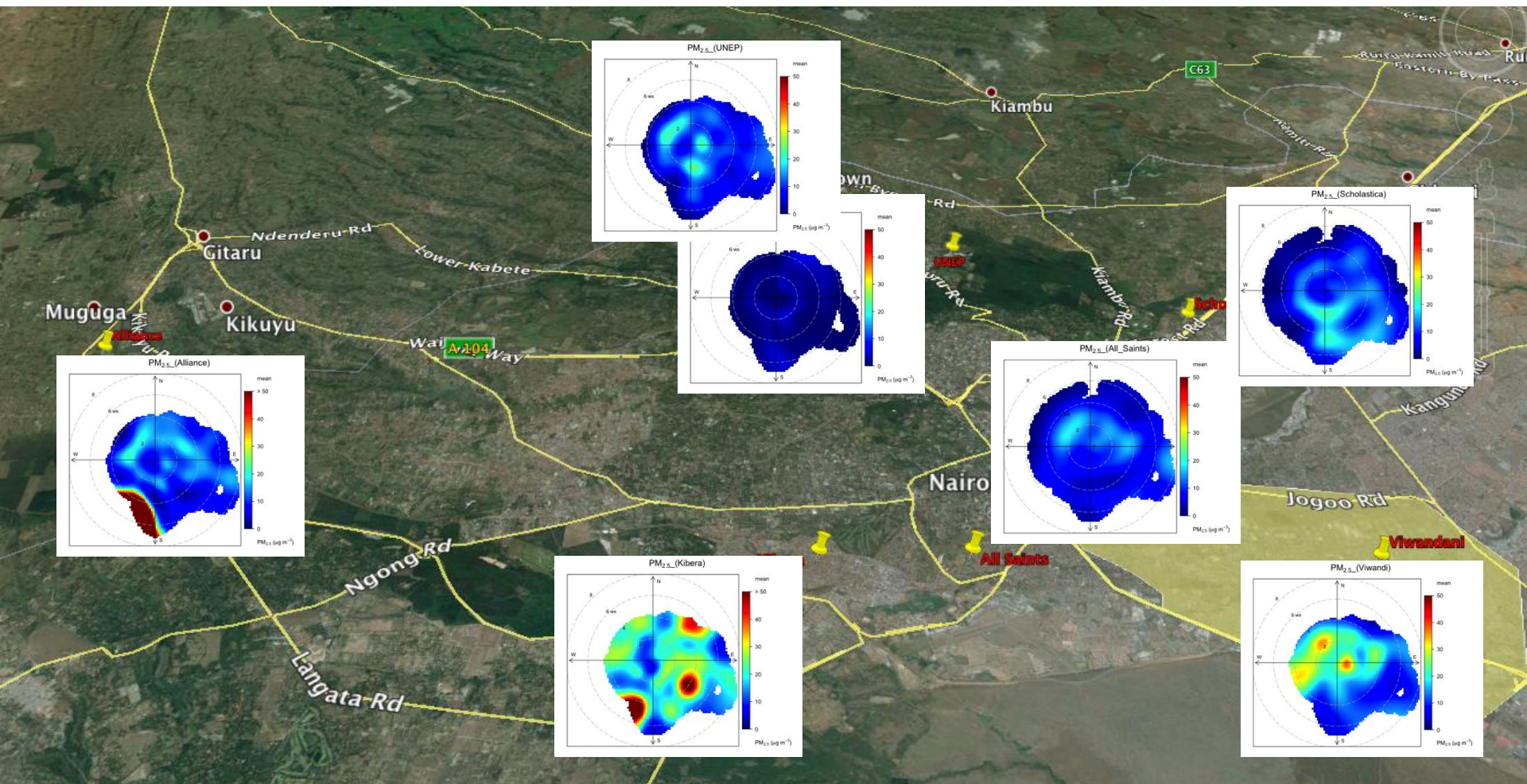
Validation: *AEA Ricardo:* Brian Stacey et al.

Nairobi PM_{2.5} – scaled individually



Distinct local emission features
evident across Nairobi (PM_{2.5})

Nairobi PM_{2.5} - Normalised



Citywide mapping of
emissions (PM_{2.5})

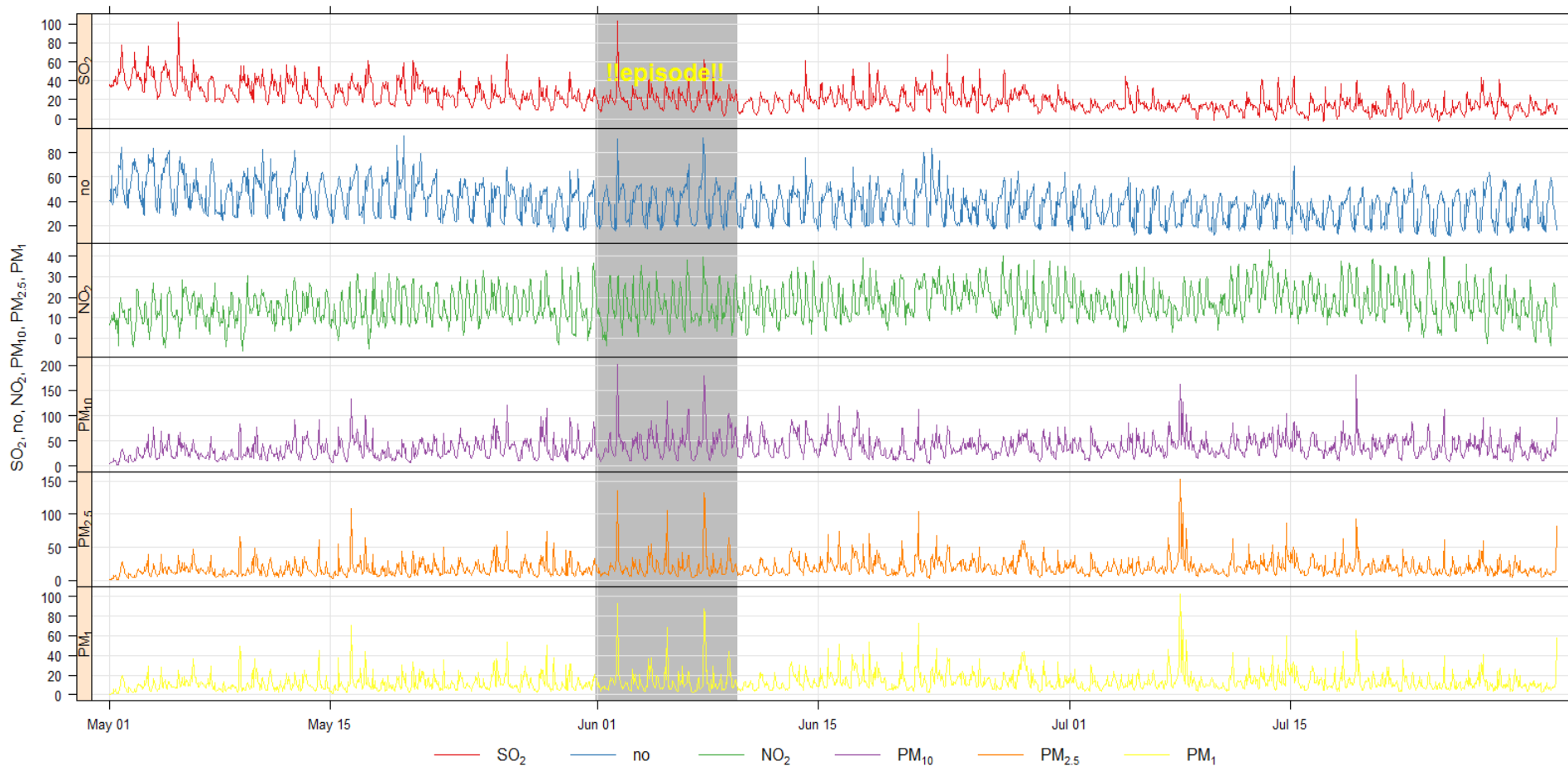
Policy Relevance

Continuous indicative monitoring helps inform policy formulations and implementation:

- Illustrative measurements from data generated gives a snapshot of pollution events
- Source attribution to determine pollution sources and hotspots
- **SDG Reporting**
 - 11.6.2:** Annual mean levels of particulate matter (PM10 and PM2.5) in cities
 - 3.9.1:** Mortality rate attributed to household and ambient air pollution

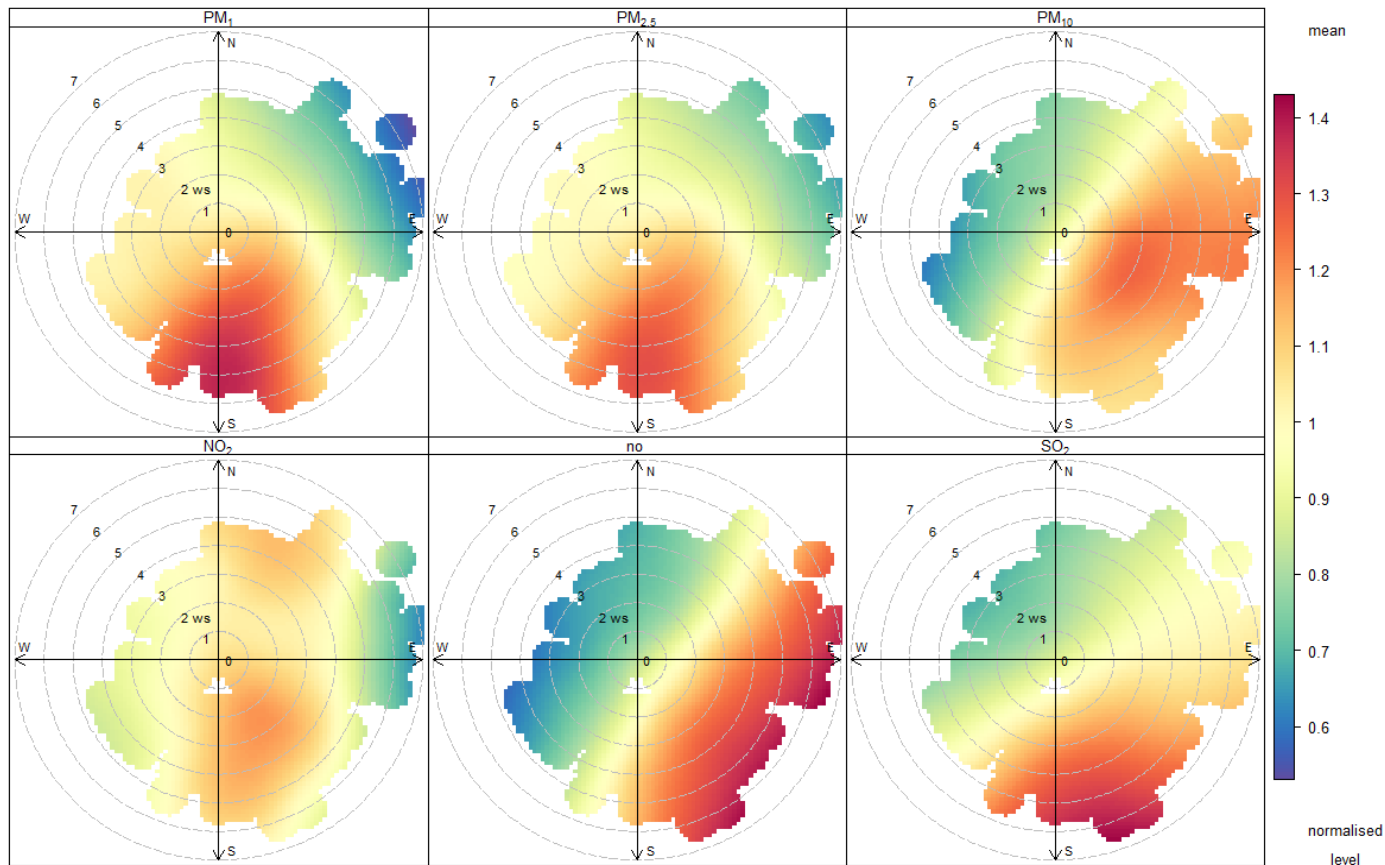
Policy Relevance – Illustrative Measurements

St. Scholastica – Time series



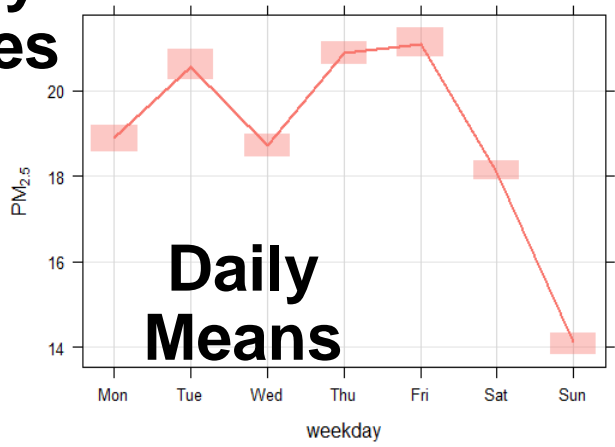
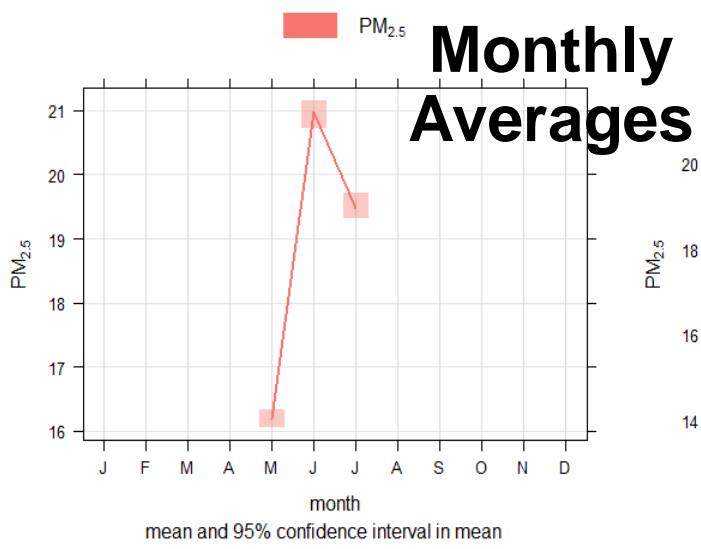
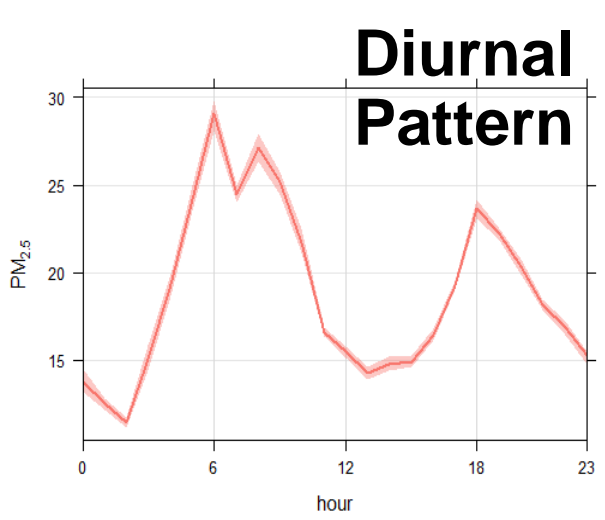
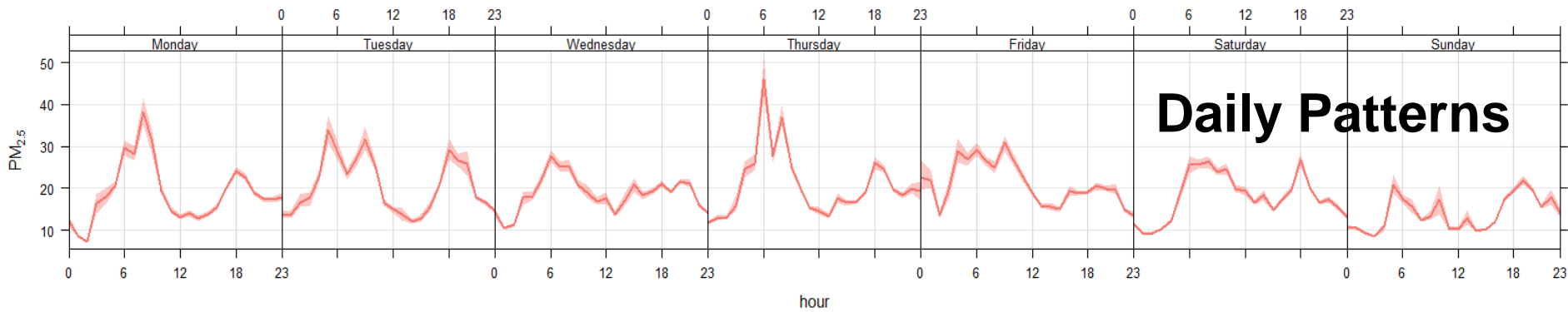
Policy Relevance – Source apportionment

St. Scholastica multi species (PM and Gasses)



Policy Relevance – Source identification

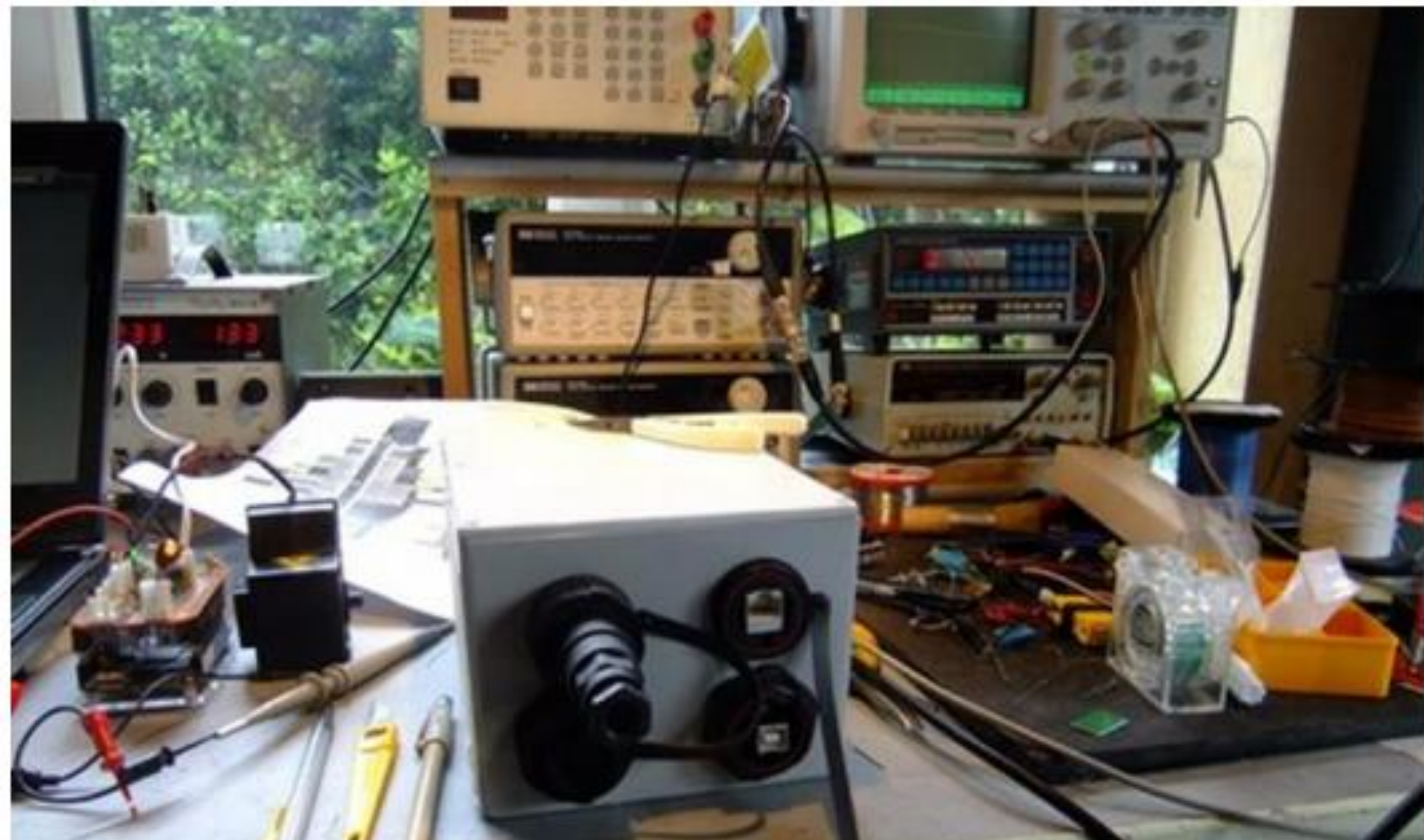
St. Scholastica PM_{2.5}



Conclusion

The successful deployment has shown that:

- Low-cost monitoring units are able to retrieve data for processing, verification and visualization
 - Data collected is sufficiently accurate to determine the state of air quality, pollution hot spots and pollution sources
- **Maintaining reliability of the data and increasing accuracy would require access to calibration of the network alongside reference instrumentation at one location
- The network can be implemented and maintained locally
 - The units are deployable in cities with limited infrastructure and difficult operating conditions



THANK YOU