

Waterview tunnel low-cost sensor trial

Results and next steps

Transport Knowledge Hub Environment – Emissions Group

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Context

- Currently NZTA measures NO₂ by diffusion tubes in more than 100 sites nationally.
- Small and low-cost sensors are developing fast with good results for PM and O₃.
- NZTA would like to improve and expand the NO₂ network to include PM and BC.
- The Waterview tunnels offer a unique platform to understand traffic emissions

Plan

- 1) Place NO₂, PM, BC, CO sensors in the Waterview tunnel to test their response to high concentrations.
- 2) Compare data from low-cost sensors with traditional technologies in the tunnel environment.
- 3) Deploy low-cost sensors at the outdoor monitoring station near Waterview tunnel.
- 4) Complete the analysis of low-cost response to ambient concentrations

In the tunnel

Pollutant	Reference Instrument	Trial sensor
PM	BAM + Grimm	ODIN + Dustmote
BC	AE22	MA350
NO2	Chemiluminescence	SPEC
CO		SPEC



360 degrees view

At the portal



Pollutant	Reference Instrument	Trial sensor
PM	BAM	ODIN
BC		MA350
NO2	Chemiluminescence	SPEC



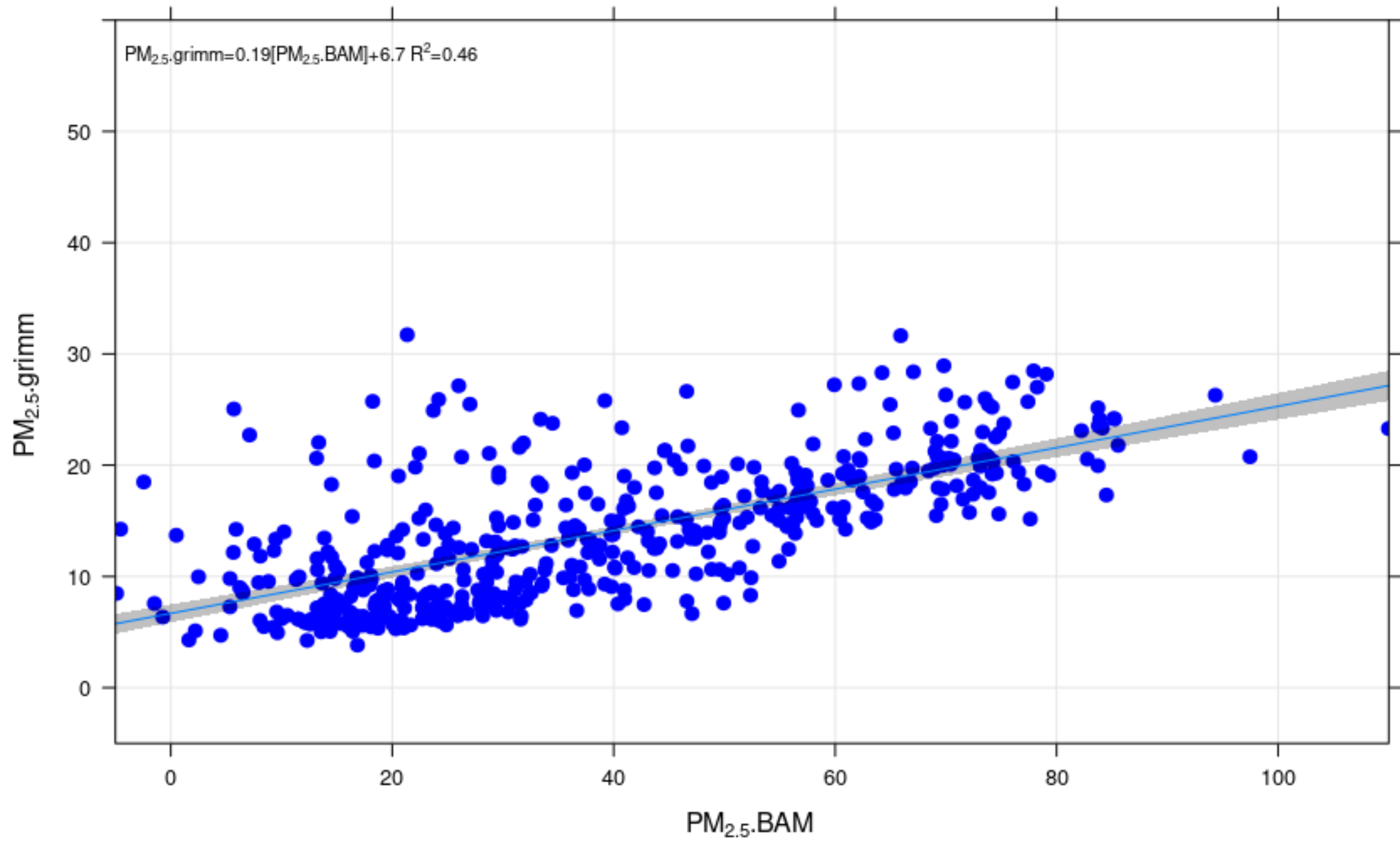
[Street View](#)

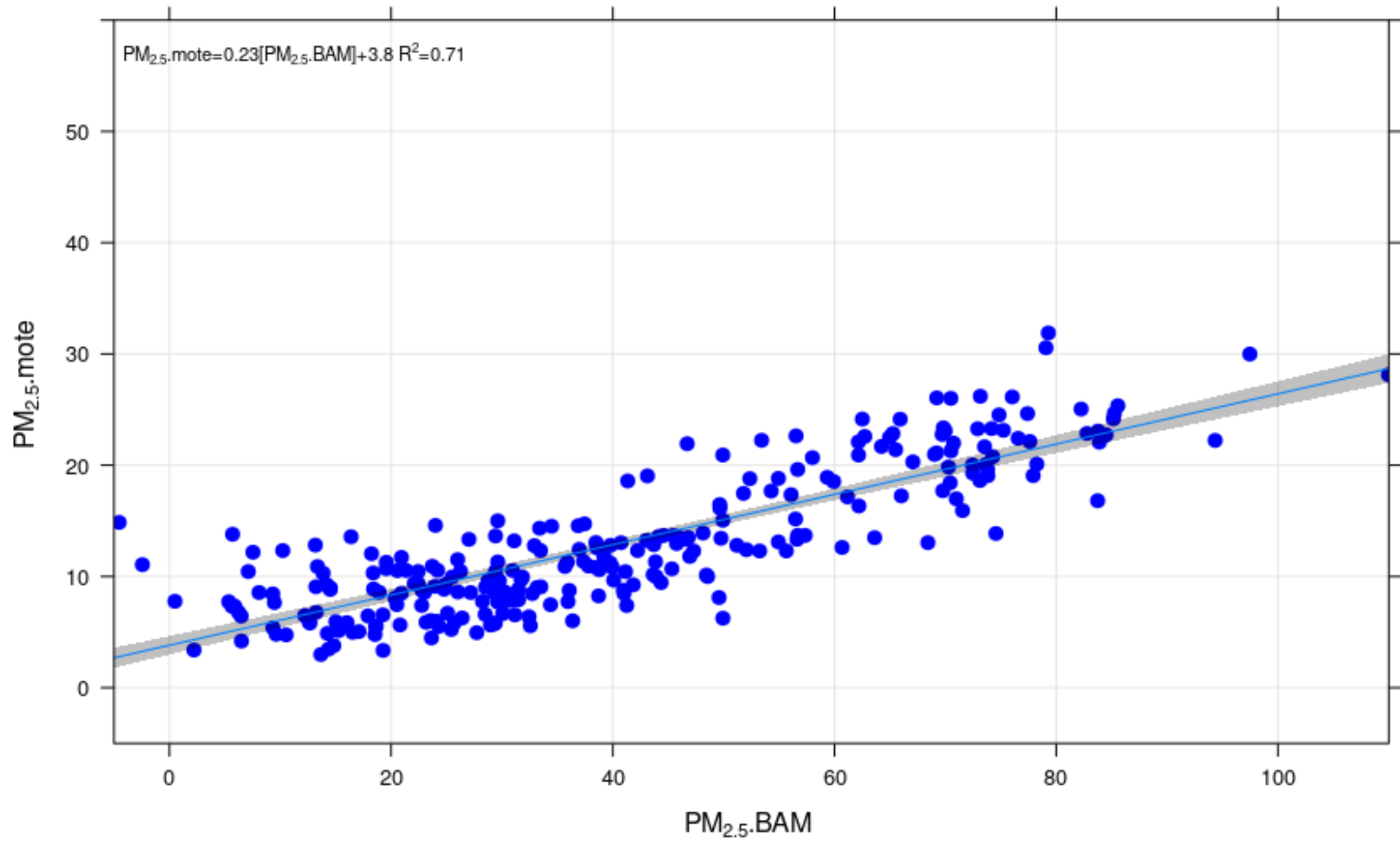
Issues

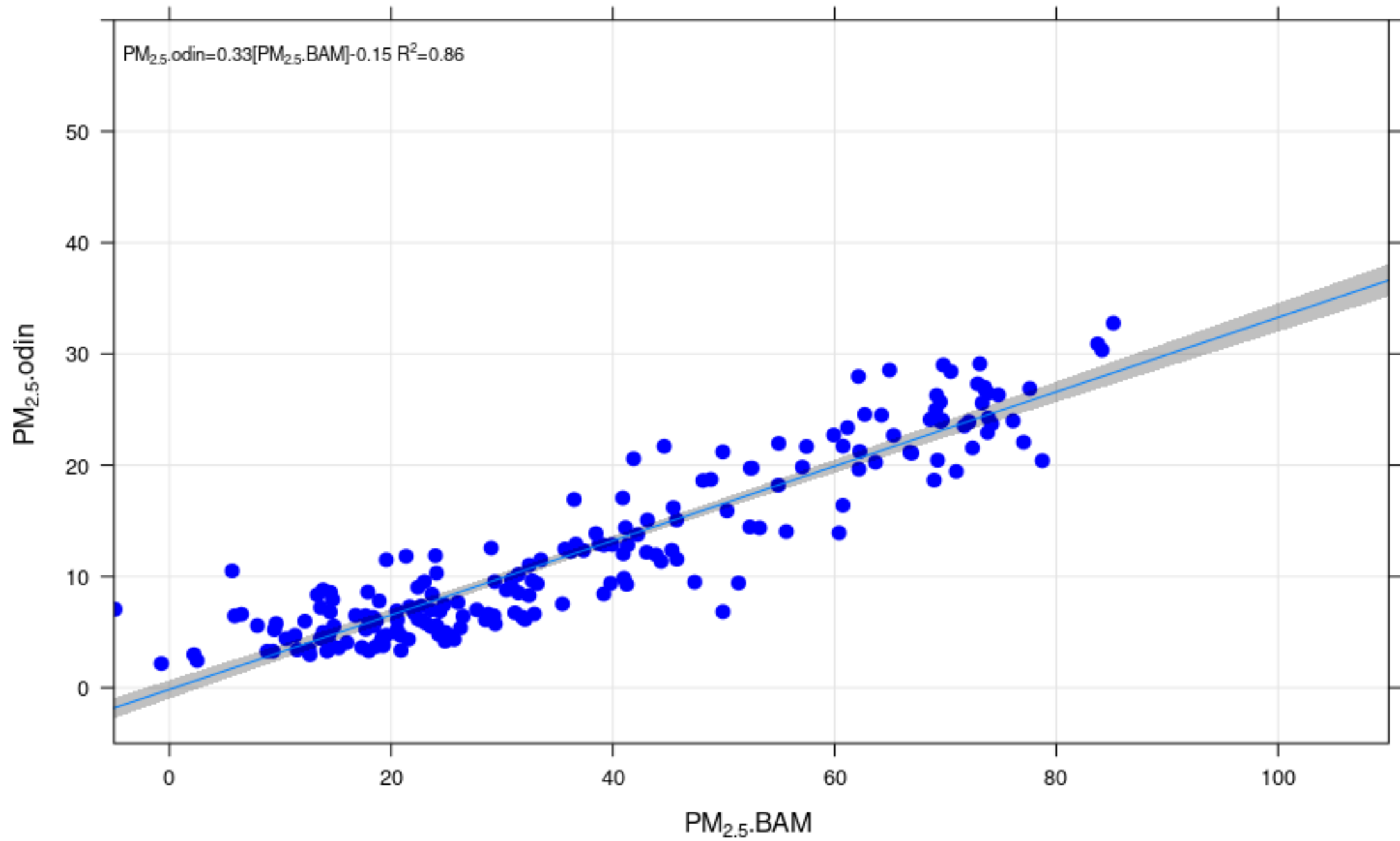
- Deployment schedule
 - It took longer to get all the instruments in place
- GSM and WiFi based telemetry
 - No 2G reception in the tunnel.
 - “Less than mature” WiFi firmware on ODIN
- Power
- “Interesting” tunnel air
 - Too much for the AE22

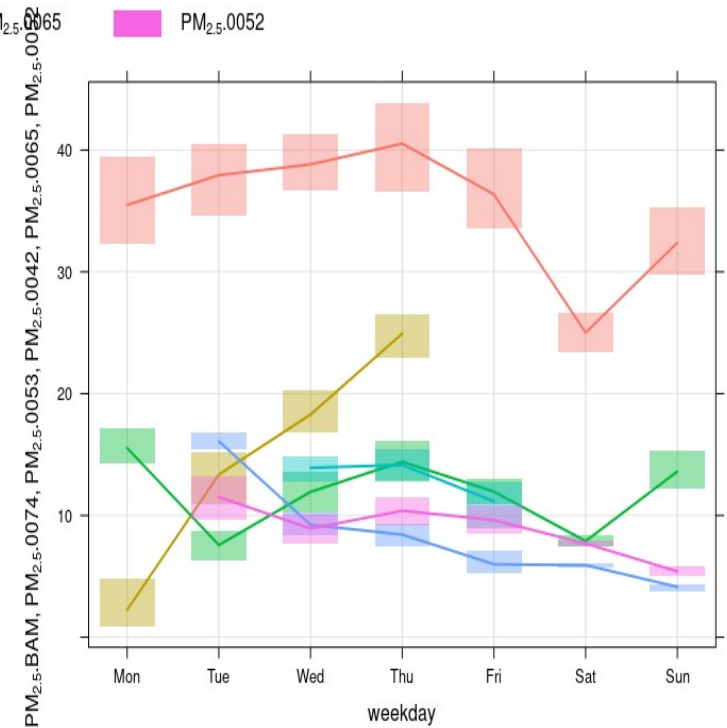
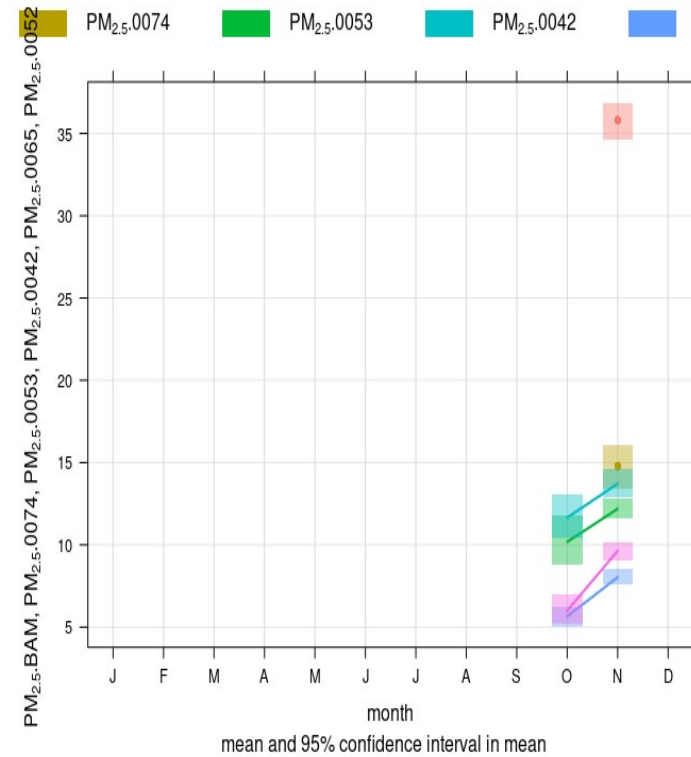
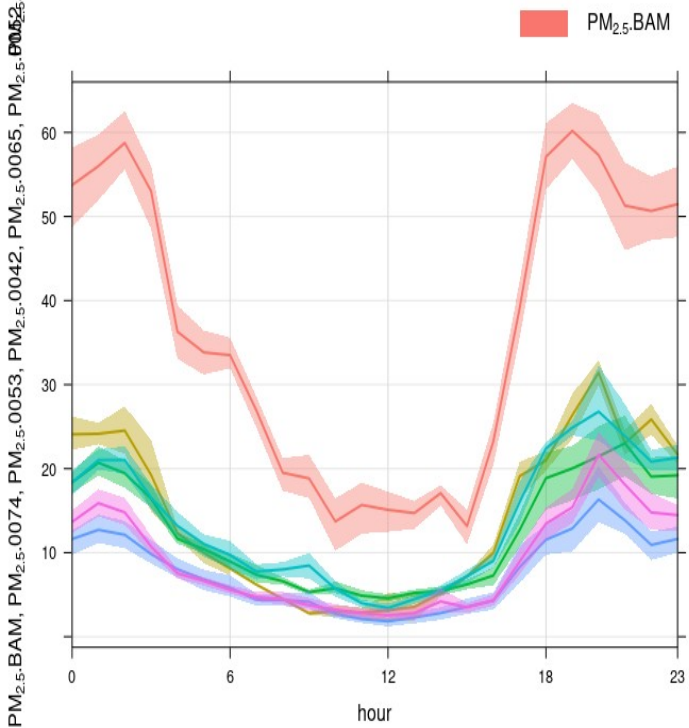
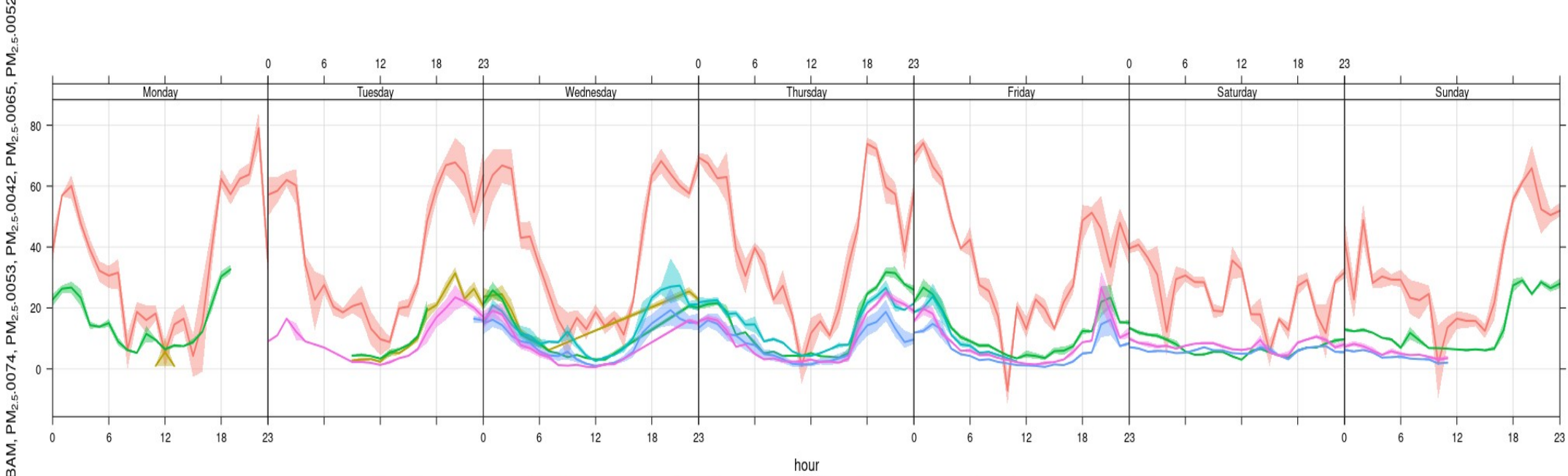
Questions

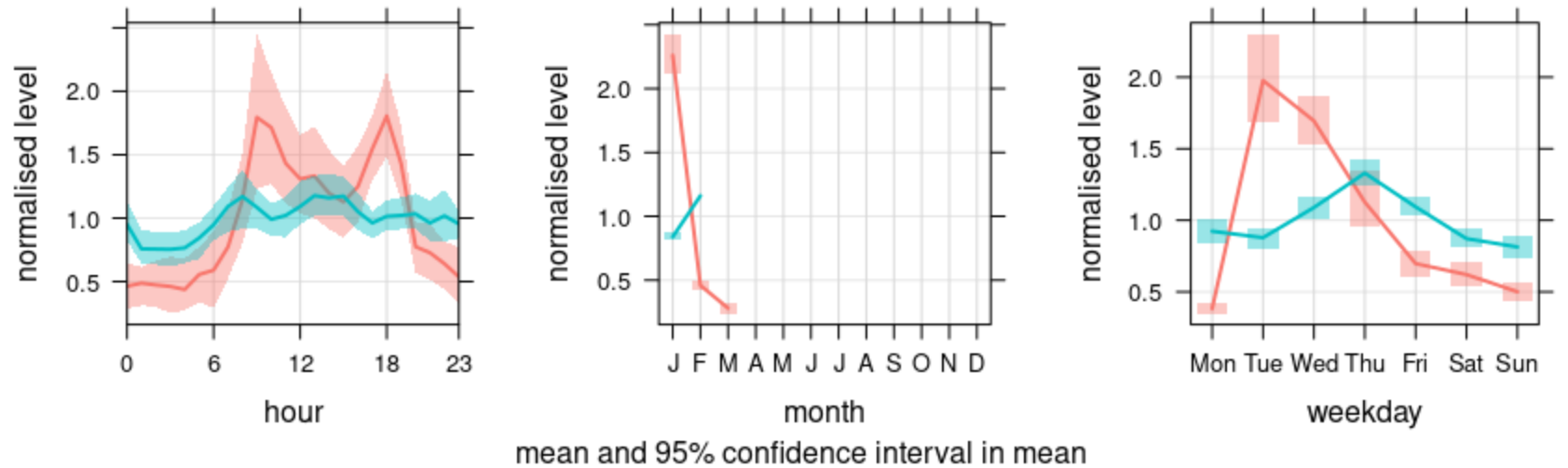
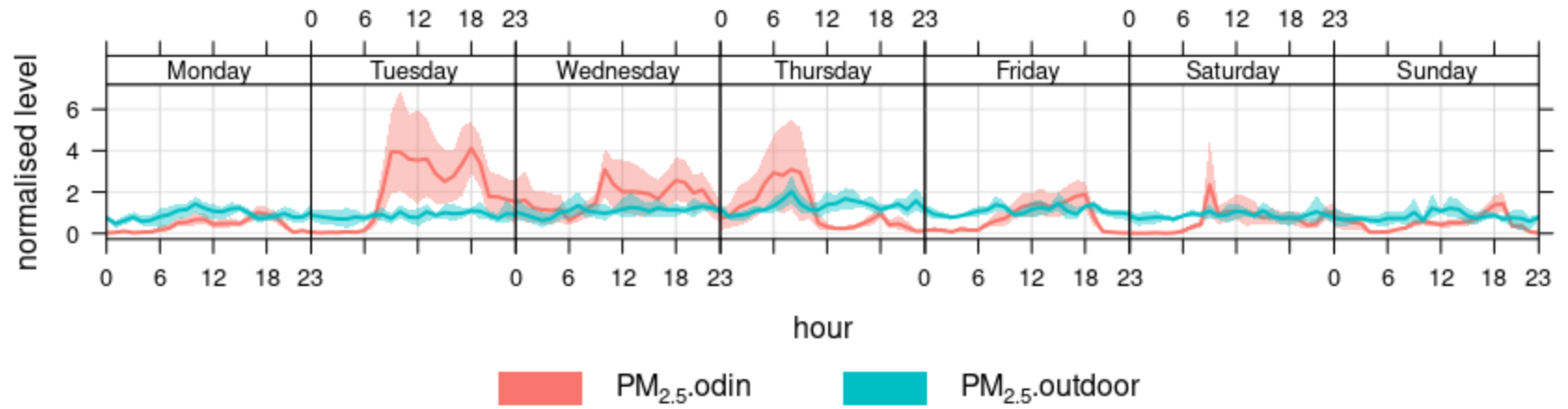
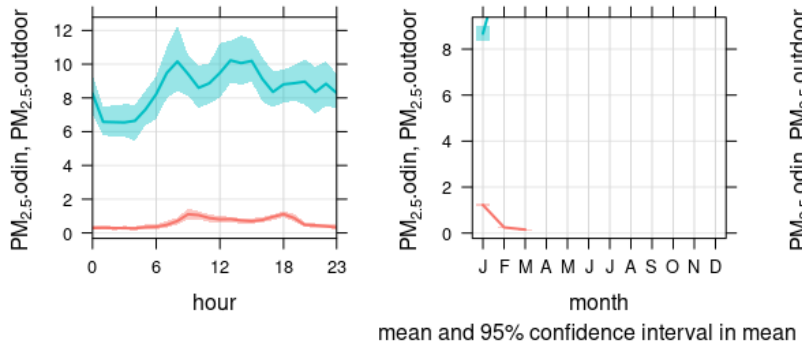
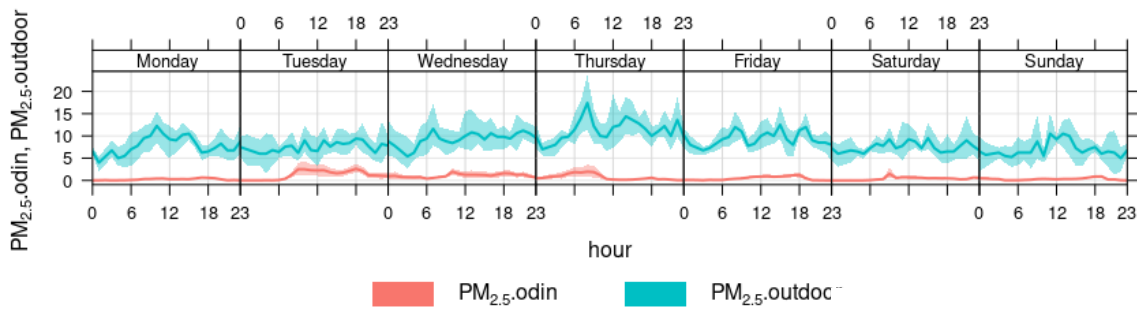
- 1) How sensitive are the new sensors?
 - *Do they respond to the typical diurnal cycle of concentrations?*
 - *What are their typical baselines?*
- 2) How repeatable are their readings?
 - *Does their performance change over time?*
- 3) Are their responses linear?
- 4) What are their logistic requirements? (e.g. power, exposure, weather)











Scorecard PM_{2.5}

1) Sensitivity ✓ ⚠

- ODIN was the most sensitive but less than ideal

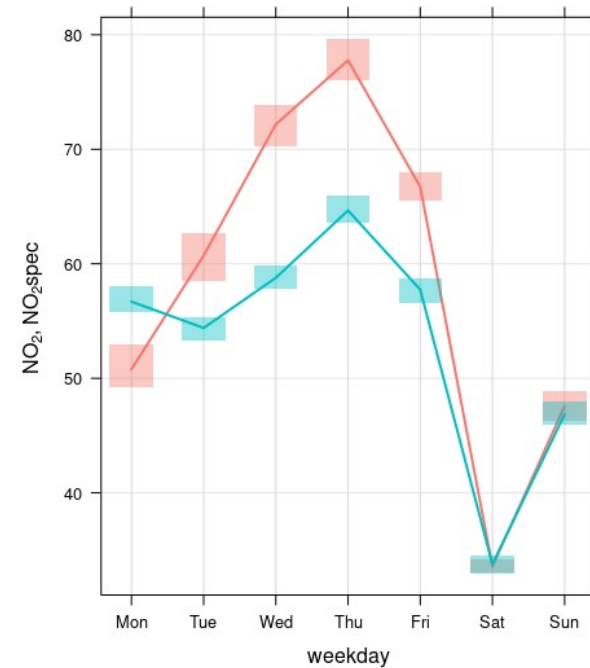
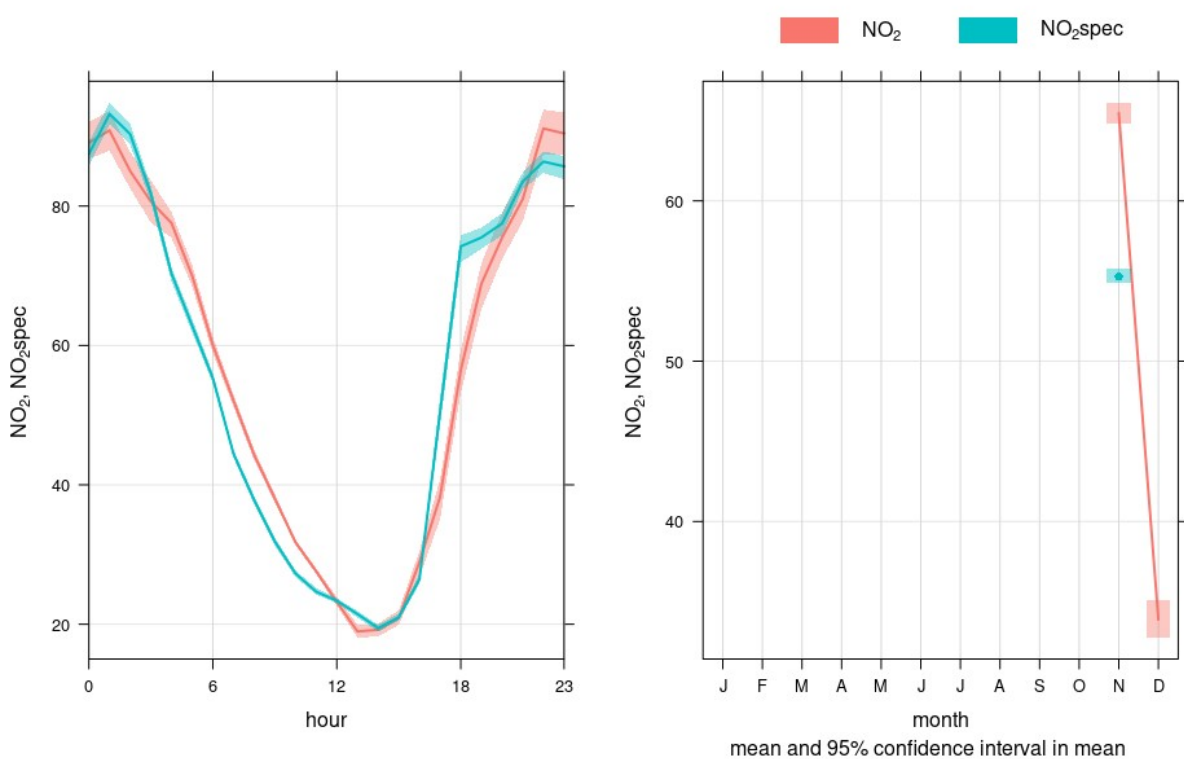
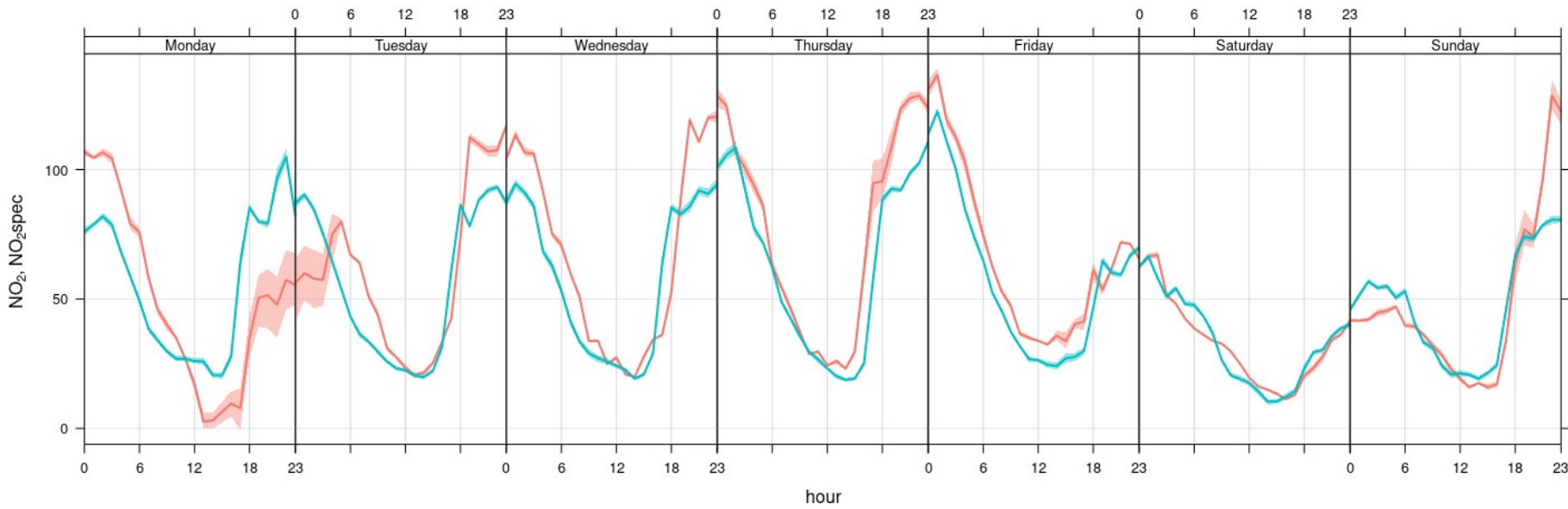
2) Repeatability ✓ ✓

3) Linearity ✓ ⚠

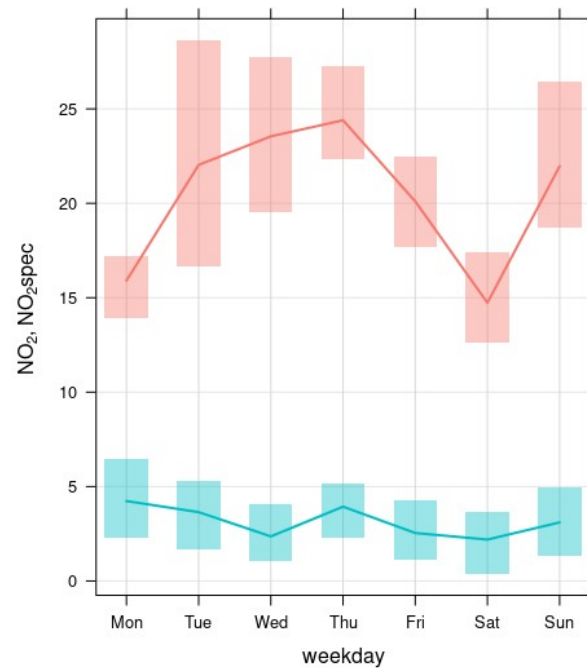
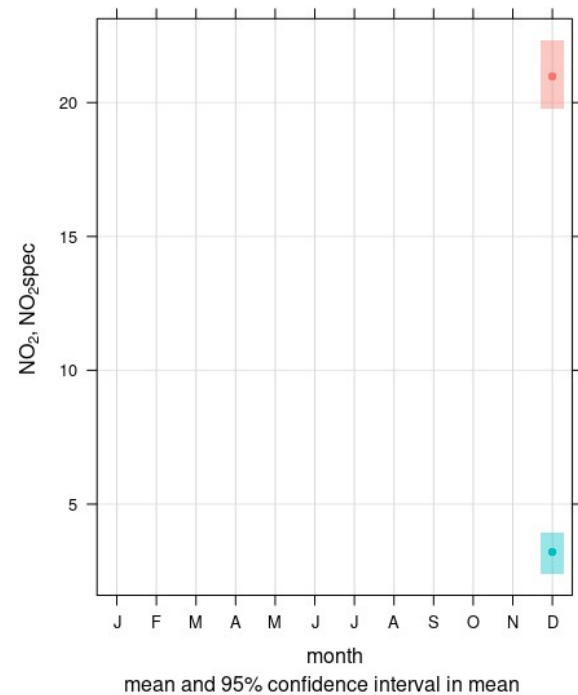
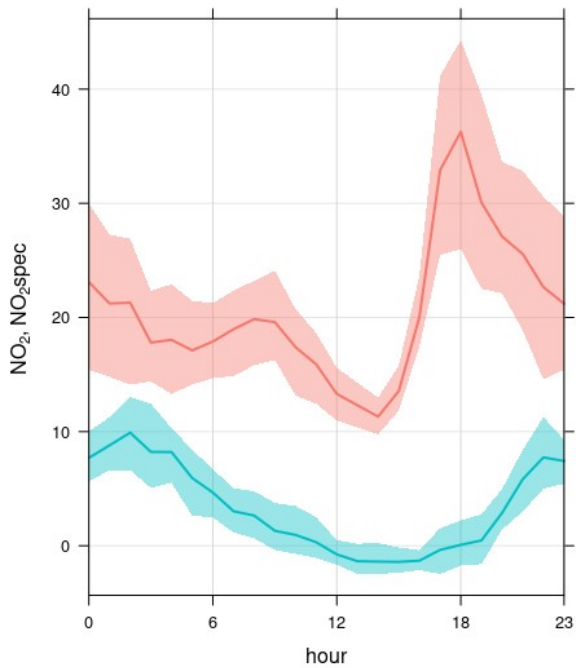
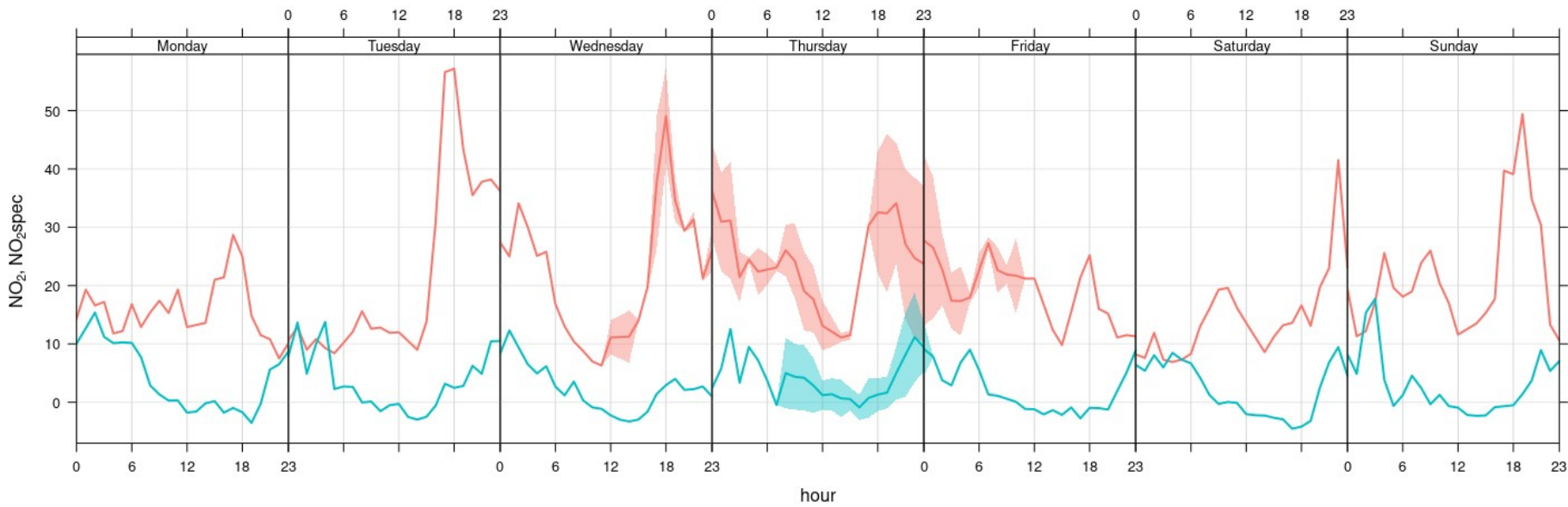
4) Logistics ✓ ✓

- ODIN requires GSM reception

In tunnel NO₂



Ambient NO₂



Scorecard NO₂

- 1) Sensitivity ✓ ✗
- 2) Repeatability ✓ ✗
- 3) Linearity ✓ ✗
- 4) Logistics ✓ ✓

What's next?

- How long do they survive?
- What's up with the SPEC temperature response?
- Can we have different telemetry?
- Can we extract emissions information?

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Thank you

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