ENHANCING AIR QUALITY MONITORING: RANDOM FORESTS AND LOW-COST SENSORS

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Develop a random forest model to calibrate low-cost sensor measurements in an operational context

Why?

- ✓ Affordable continuous monitoring of pollutants
- ✗ Data accuracy and reliability

Data collection

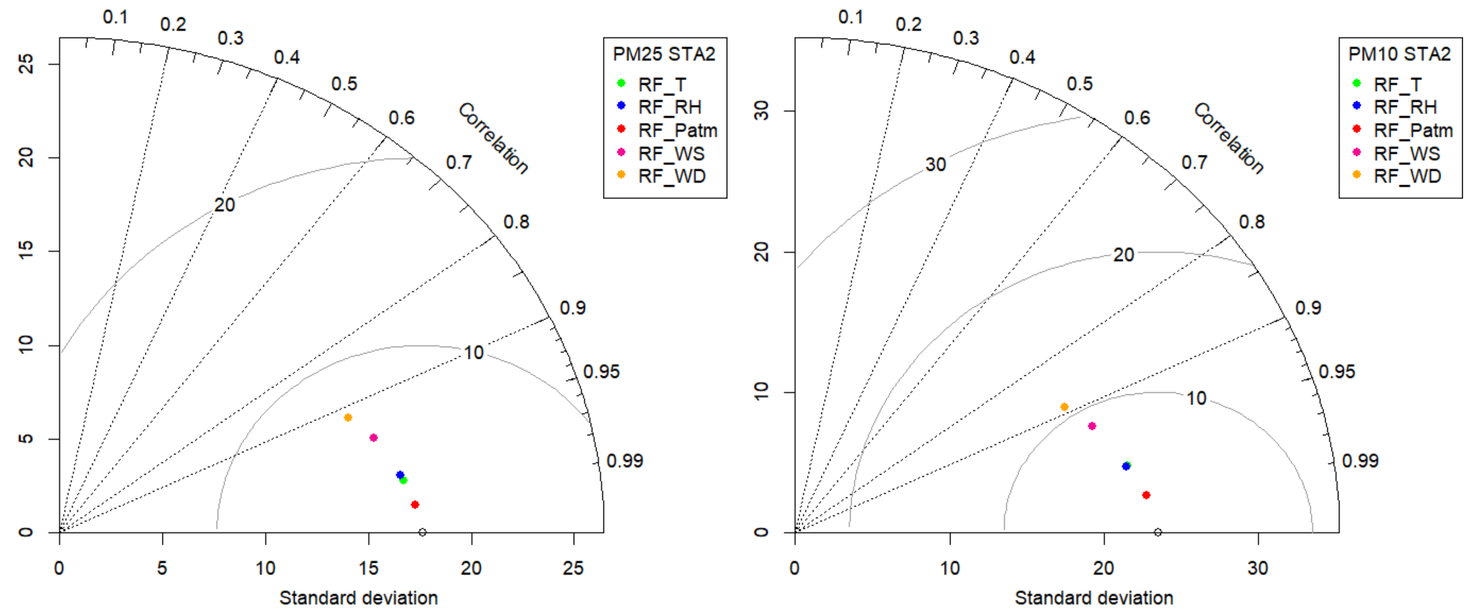
Sensirion : PM2.5 & PM10 concentration
1-min frequency

2 weeks in February 2024

2 weeks in March 2024

Which predictive variables?

- ***Low-cost PM concentration***
- ***Temperature*** : response time
- ***Atmospheric pressure*** : current peak
- ***Relative humidity*** : bias from water adsorption by particles [1]
- ***Wind features*** : pollutant dispersion
- ***Cross-sensitivity gases***



Taylor Diagram for random forest models using one of the predictive variables

$$PM(RF) \sim PM(LC) + T(LC) + RH(LC) + Patm(LC)$$

Calibration period? *Cross validation*

Dataset	k-fold used for validation	PM2.5 RMSE (µg/m³)	PM2.5 R^2	PM10 RMSE (µg/m³)	PM10 R^2
Merged	1	*19.20*	0.63	*27.88*	0.50
	2	2.61	0.59	3.16	0.54
	3	3.17	0.74	3.49	0.73
	4	4.12	0.70	5.23	0.75
	5	6.12	0.61	8.34	0.53
February 2024	1	3.41	0.65	7.23	0.67
	2	*35.37*	*-0.14*	*48.34*	*0.18*
	3	2.01	0.42	2.92	0.30
	4	3.95	0.38	4.93	0.27
	5	7.19	0.28	8.93	0.12

→ February

✓

Unique combination

Drop in atmospheric pressure
Increase of relative humidity
PM concentration peak

→ PM concentration variations

Future works

Extend calibration **period** span [1,2]

Field calibration [3]

Include **NO2** concentration (data source reliability)

Continuous calibration & generalised model (inter-device variability)

Take-home insight

- Calibration **period** duration and its **span**
- Including **environmental variables**

→ **Robust** calibration models

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References

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