

kunak SENSING ANYWHERE

kunak air PRO

Co-location field studies

Test procedure

- **Installation:** On top of AQS (3-4meters).
- **Stabilization time:** 2 days.
- **Calibration procedure:** None.
- **Post-processing:** None. Real corrected data is calculated directly in the device without any delay. No re-calibrations or corrections are applied during the field tests unless specified. Then, the initial calibration is maintained during the whole field tests and results shown in this study.
- **Sampling period:** data is averaged every hour to match data from reference station.
- **100%** of Kunak AIR data is used for analysis, therefore, any possible outlier is included in the statistics.
- **Validation:** statistics are only calculated if valid Reference Data is available.

Analysis and characterization procedure

- **Accuracy**: is obtained as the mean absolute error (MAE) between Kunak AIR measurements and the reference instruments.
- **90% Confidence Interval**: the 90% of the measurements are below this error. Also, the relative error of the maximum error in the 90% of measurements is shown.
- **Relative expanded uncertainty**:

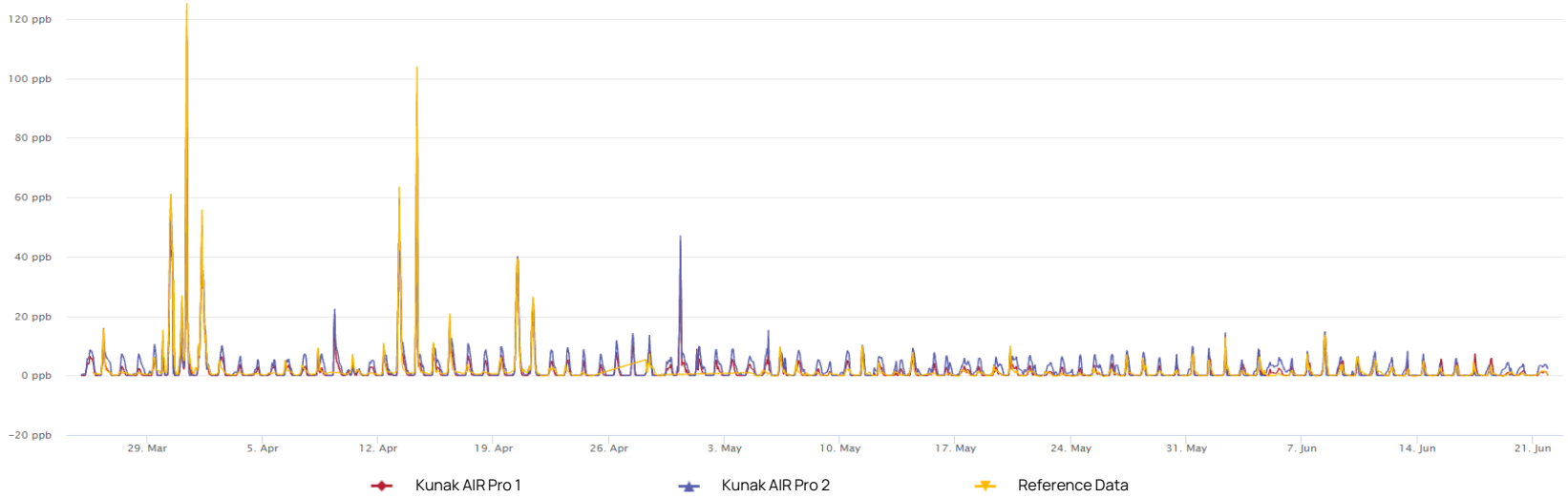
$$\mathrm{U(exp)} = \mathrm{k} * \sqrt{\sqrt{\left(\frac{\mathrm{RSS}}{\mathrm{n-2}} - u(bs, RM)^2\right) + [a + (b-1) * L]^2}}$$

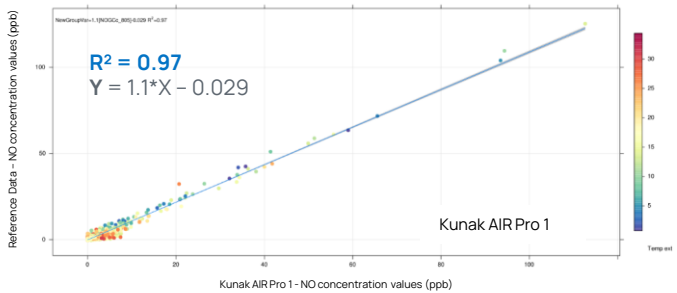
- **Data Quality Objective (DQO):** concentration value from which DQO defined in the EU Air Quality Directive (2008/50/EC) is met. Also, it is shown the DQ obtained for the Limit Values set in EU directive for indicative measurements.
- **Availability**: is defined as the number of 1 hour averaged samples sent by the device/number of hours in the month.
- Results also include the average concentrations (AVG. GC) during the whole tests.
- **Temporal plots, Scatter plots, DQO plot and Time Variation of the Mean** are used to analyze the test results.
- **Field test main objectives:**
  1. Check the performance of KUNAKAIR V3 device vs. Reference equipment over time, obtaining the statistics defined previously during autumn, winter and spring time.

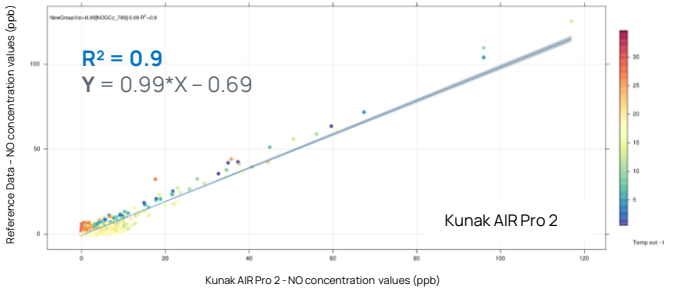
NO

Nitrogen monoxide

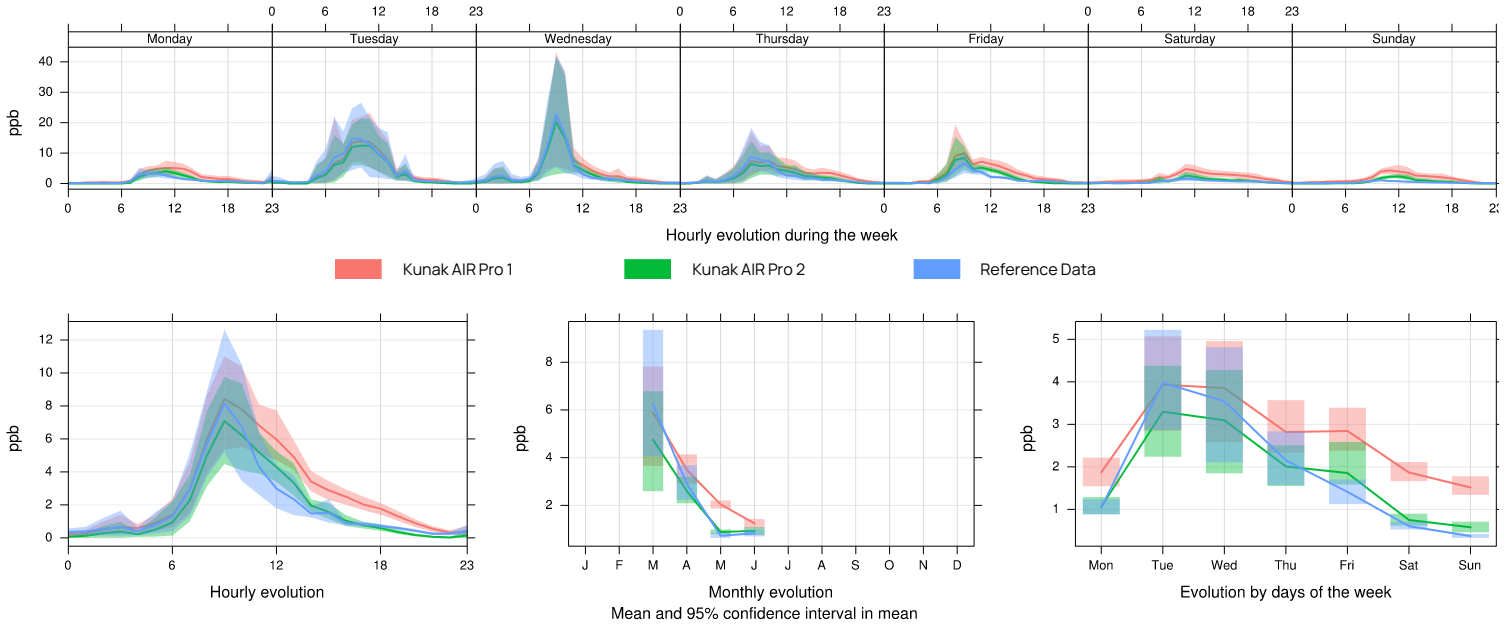
Nitrogen Monoxide (NO), Lille (France) - Mar'21 – Jun'21







Nitrogen Monoxide (NO), Lille (France) - Mar'21 – Jun'21

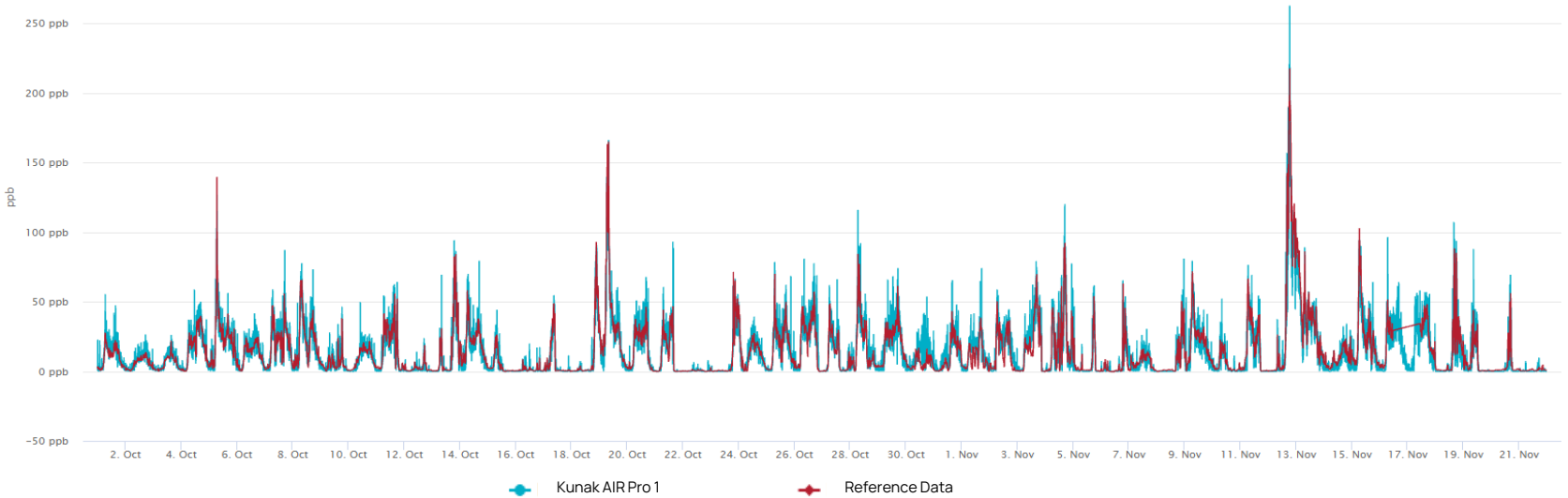


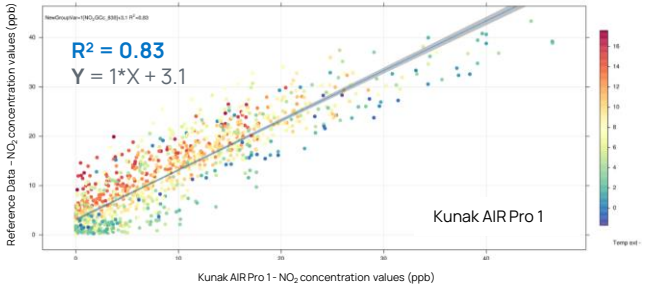
Device	R^2	Accy. (ppb)	90% Conf. (ppb)	U(exp)/U(exp) cal (<25%)	N > LV (160 ppb)	Avg. GC. DUT (ppb)	Avg. GC. Ref. (ppb)
Kunak AIR Pro 1	0.97	0.79	1.96	17.98%	0	1.80	1.84
Kunak AIR Pro 2	0.90	1.48	4.03	4.54%	0	2.67	1.84

NO_2

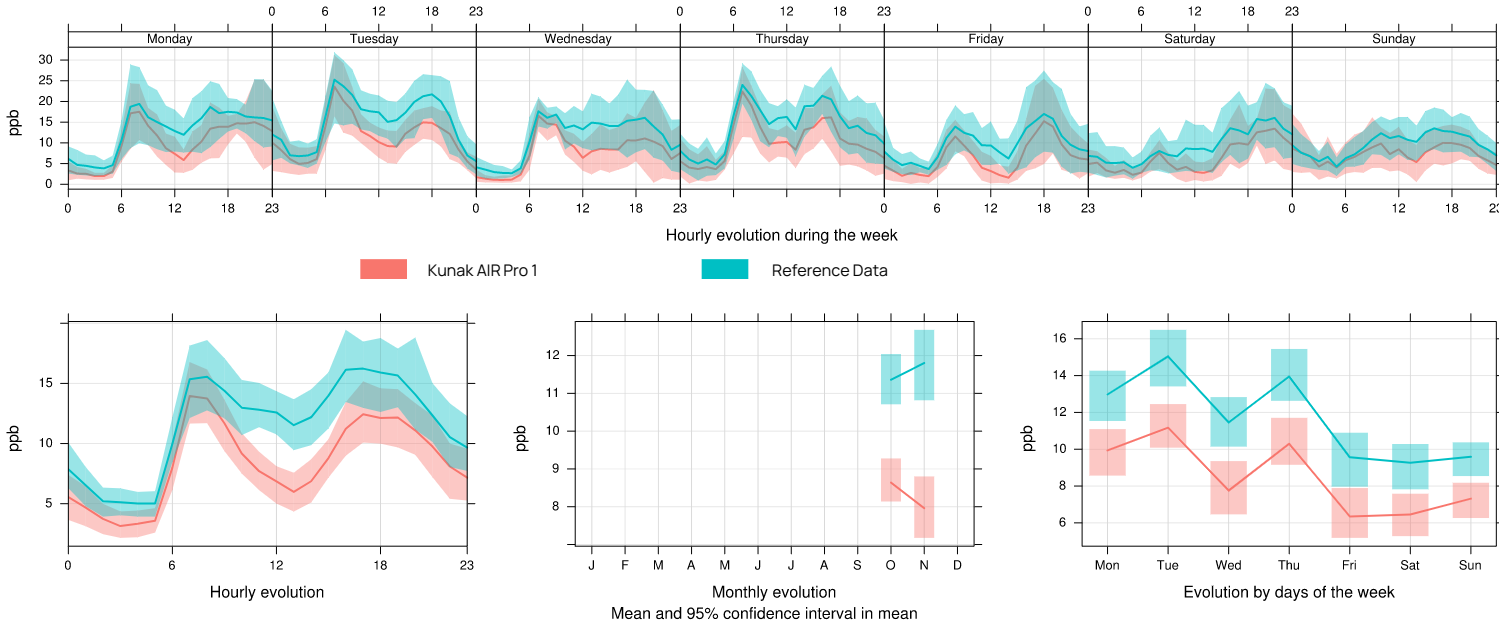
Nitrogen dioxide

Nitrogen Dioxide (NO_2), Stockholm (Sweden), Oct'21-Nov'21





Nitrogen Dioxide (NO_2), Stockholm (Sweden), Oct'21-Nov'21

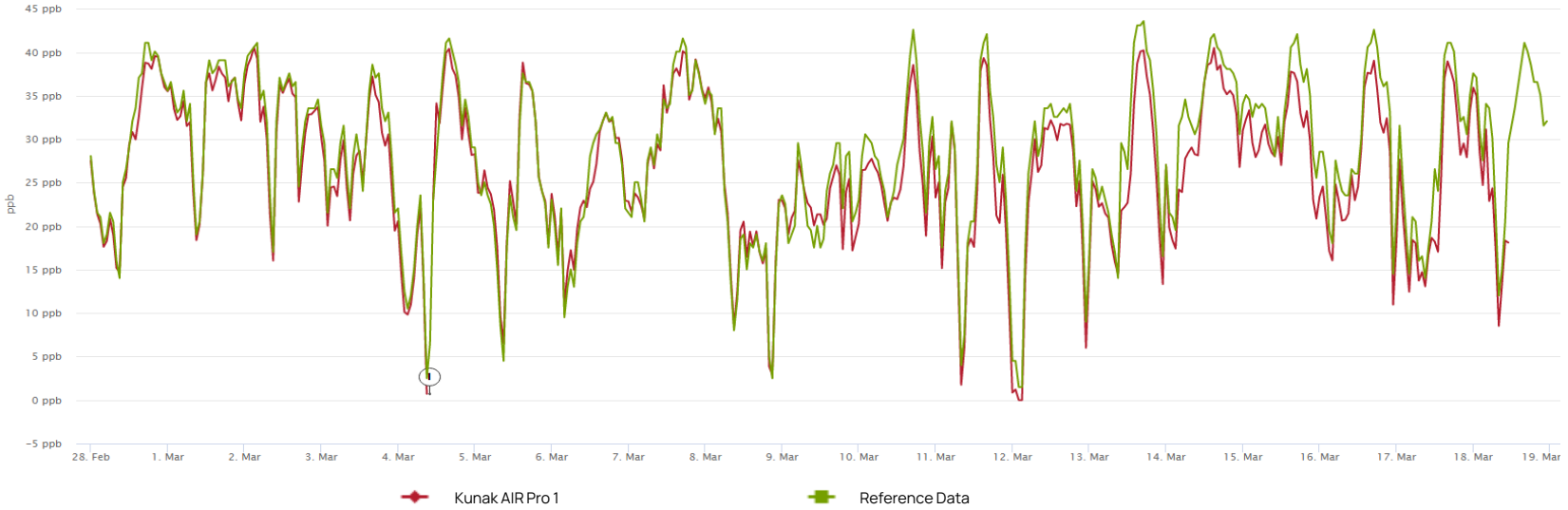


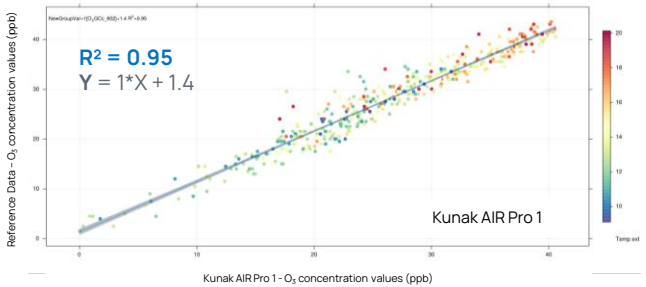
Device	R^2	Accy. (ppb)	90% Conf. (ppb)	U(exp) (<25%)	N > LV (105 ppb)	Avg. GC. DUT (ppb)	Avg. GC. Ref. (ppb)	Availability Ref. / DUT
Kunak AIR Pro 1	0.83	3.89	8.42	15.99%	0	8.37	11.53	100% / 100%

O_3

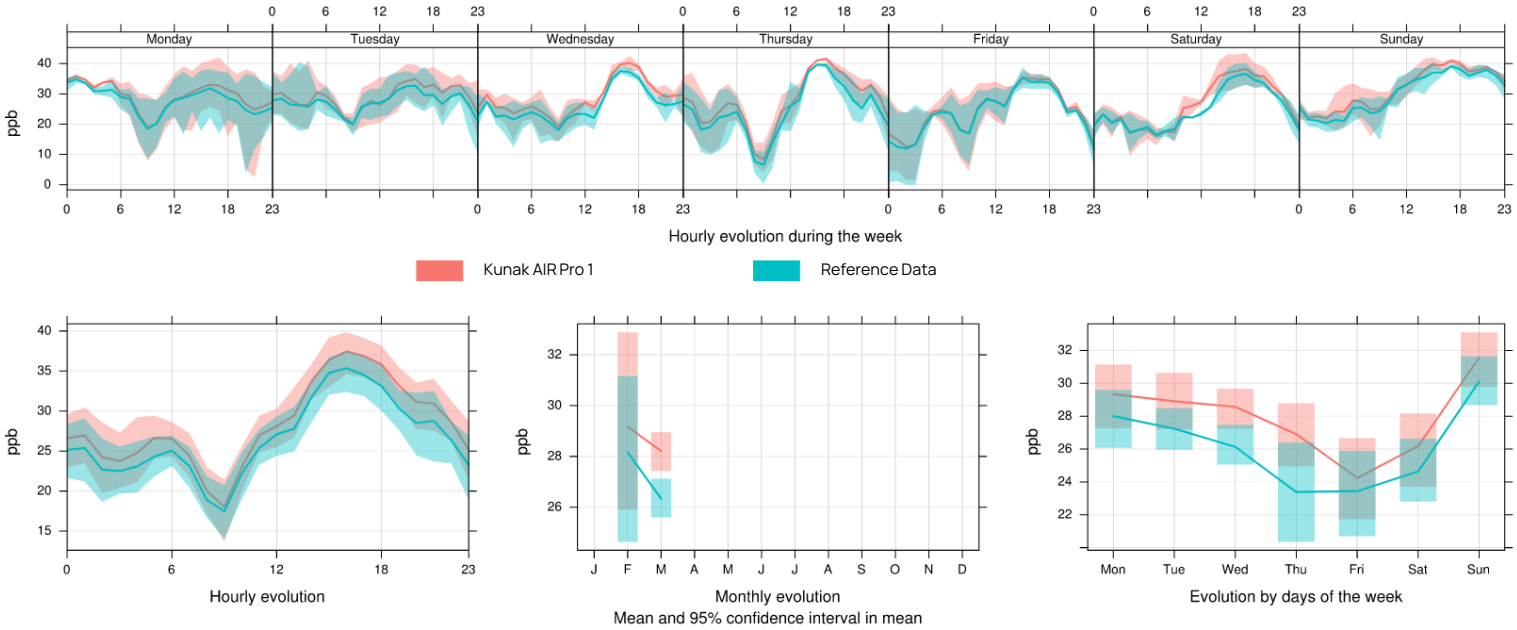
Ozone

Ozone (O_3), Barcelona (Spain), Feb'21-Mar'21





Ozone (O_3), Barcelona (Spain), Feb'21-Mar'21

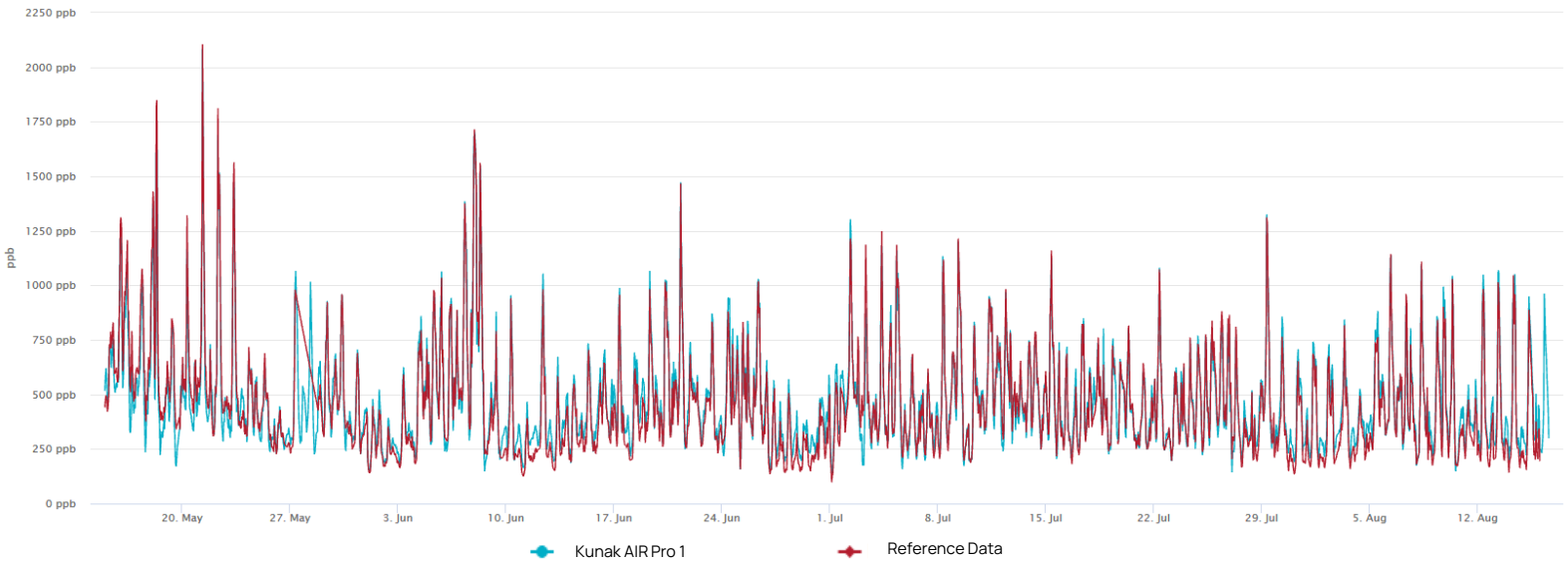


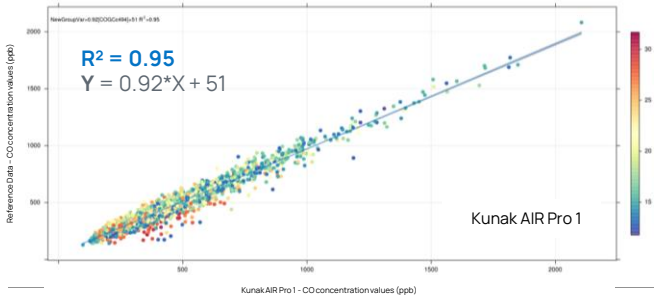
Device	R^2	Accy. (ppb)	90% Conf. (ppb)	U(exp) (<25%)	N > LV (60 ppb)	Avg. GC. Ref. (ppb)	Avg. GC. DUT (ppb)	Availability Ref. / DUT
Kunak AIR Pro 1	0.95	2.06	4.08	11.66%	0	28.26	26.44	99% / 99%

CO

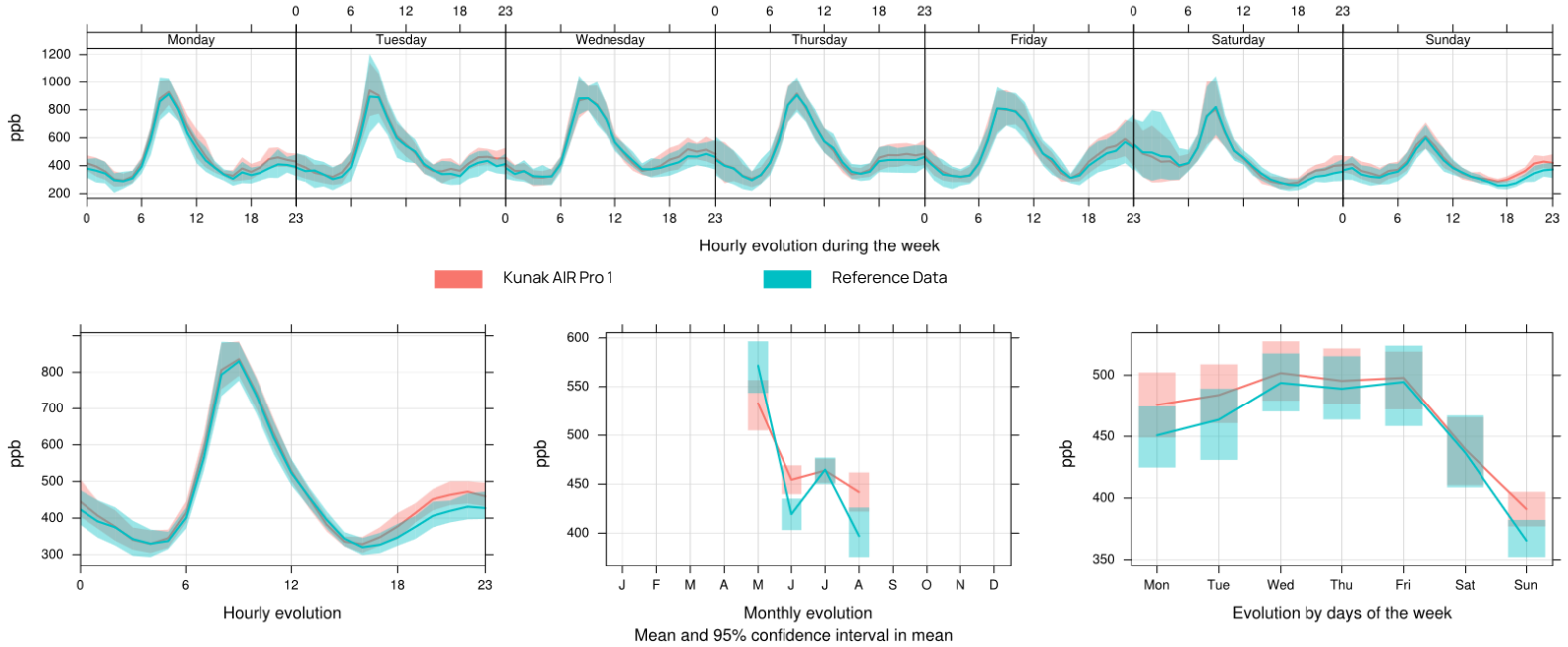
Carbon monoxide

Carbon Monoxide (CO), Mexico City (Mexico), May'19-Aug' 19





Carbon Monoxide (CO), Mexico City (Mexico), May'19-Aug' 19

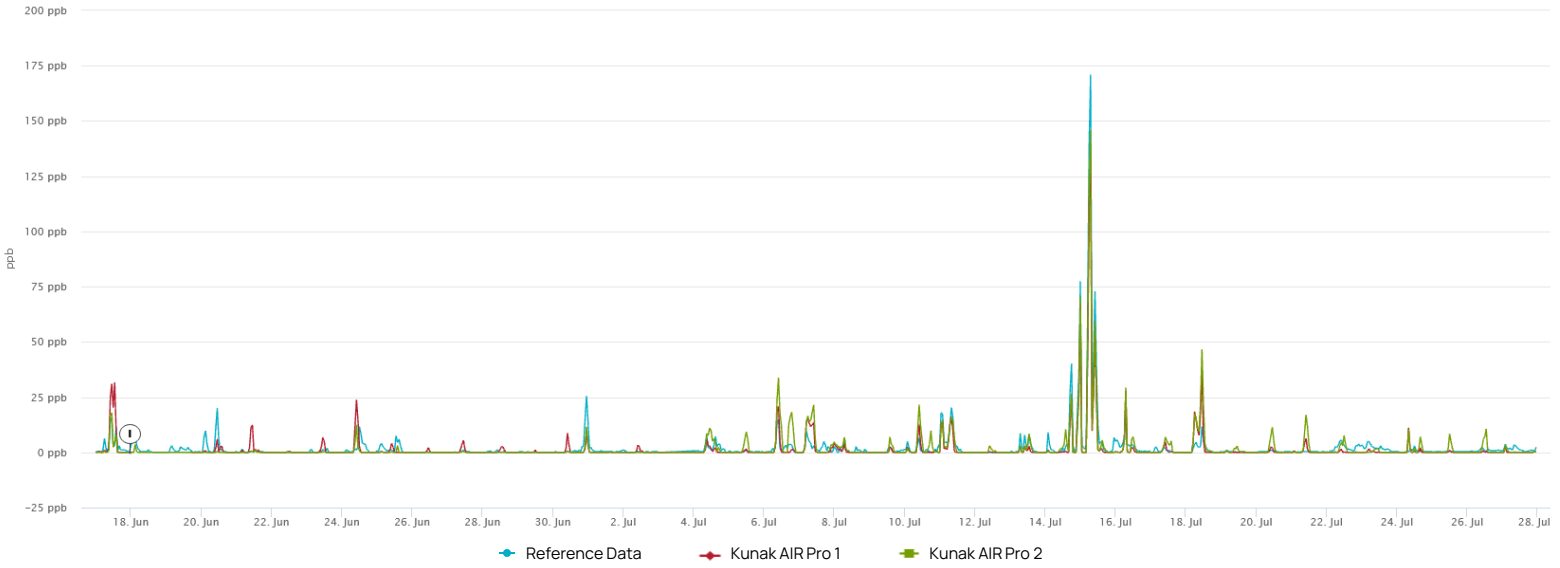


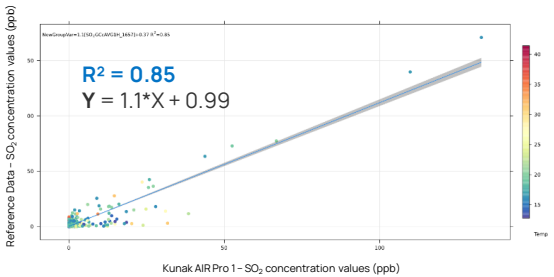
Device	R^2	Accy. (ppb)	90% Conf. (ppb)	U(exp) (<25%)	N > LV (8733 ppb)	Avg. GC. Ref. (ppb)	Avg. GC. DUT (ppb)	Availability Ref. / DUT
Kunak AIR Pro 1	0.95	45.18	90.20	10.57%	0	456.78	470.19	99.4% / 100%

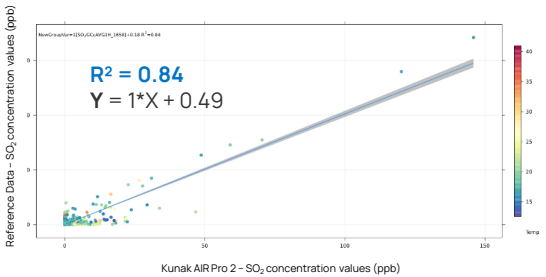
SO_2

Sulphur dioxide

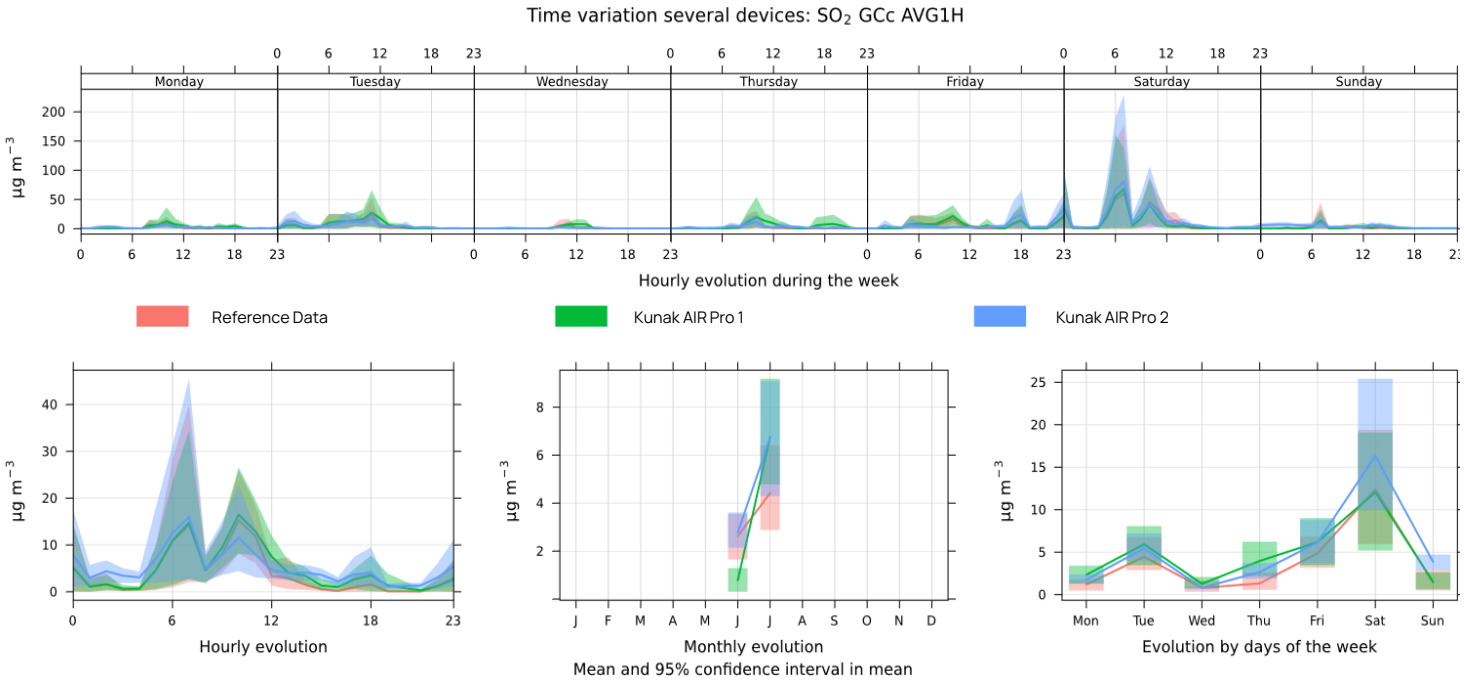
Sulphur dioxide (SO_2), Le Havre (France), Jun'23-Jul'23







Sulphur dioxide (SO_2), Le Havre (France), Jun'23-Jul'23



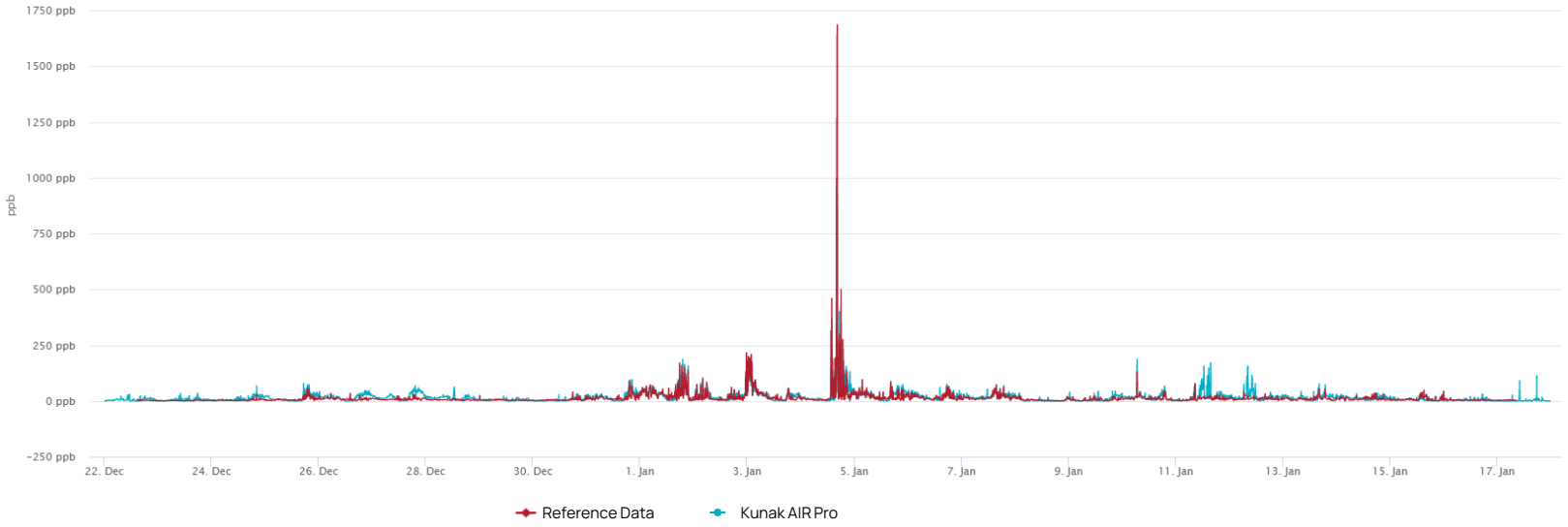
Device	R^2	MAE (ppb)	90% Conf. (ppb)	Avg. GC. Ref. (ppb)	Avg. Gc. DUT (ppb)	U(exp) (<25%)	N > LV (47 ppb)
Kunak AIR Pro 1	0.85	1.46	3.38	2.01	1.45	24.86%	1
Kunak AIR Pro 2	0.84	1.55	3.94	2.01	1.77	5.91%	1

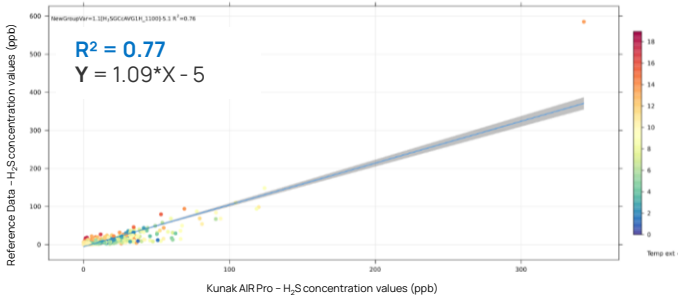
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H_2S

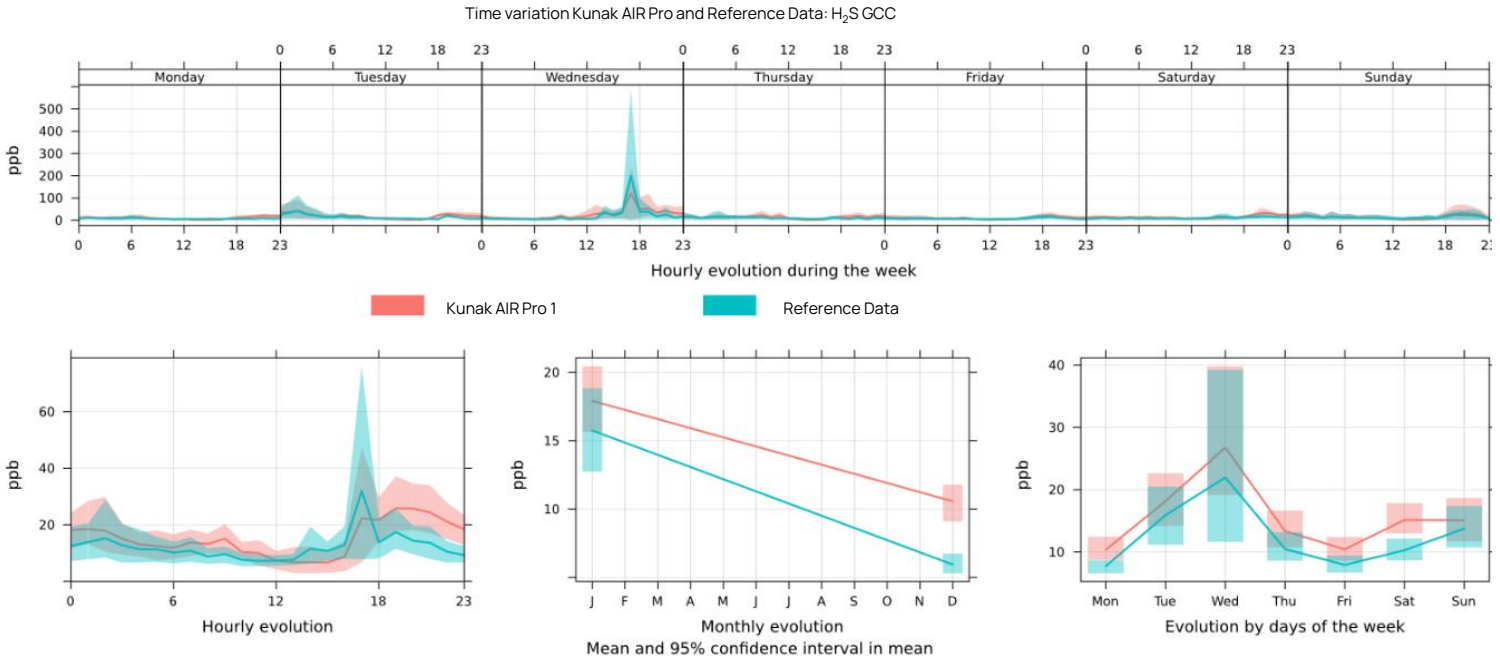
Hydrogen sulphide

Hydrogen Sulphide (H_2S), Madrid (Spain), Dec'22-Jan'23





Hydrogen Sulphide (H_2S), Madrid (Spain), Dec'22-Jan'23

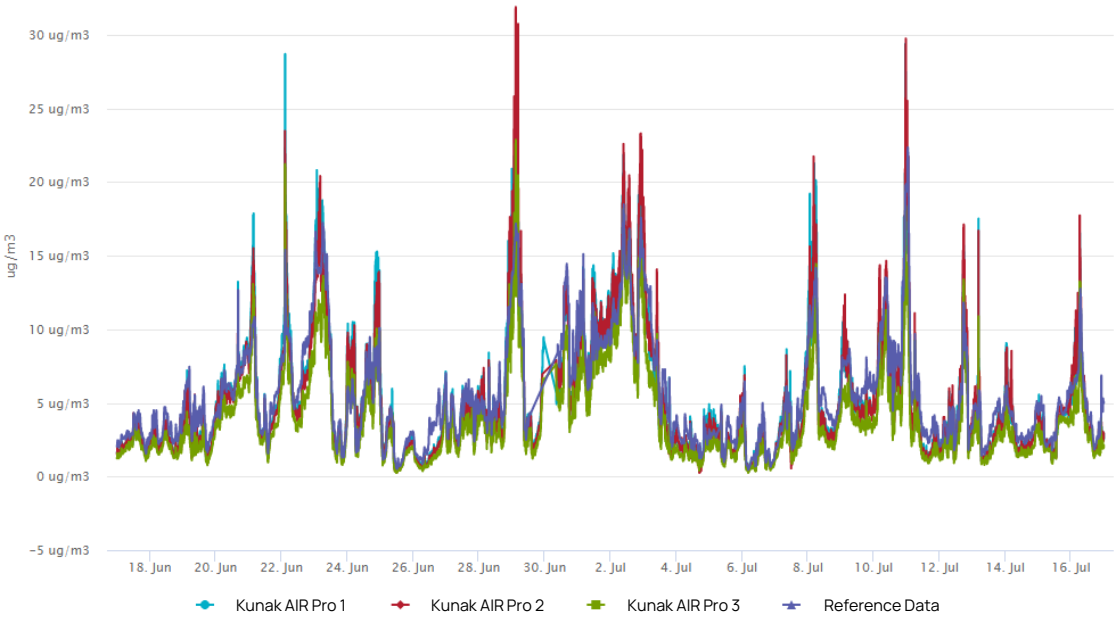


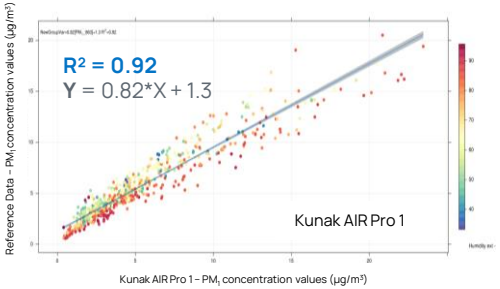
Device	R^2	MAE (ppb)	90% Conf. (ppb)	Avg. GC. Ref. (ppb)	Avg. Gc. DUT (ppb)	U(exp) (<25%)
Kunak AIR Pro 1	0.77	6.98	15.07	12.19	15.20	NA

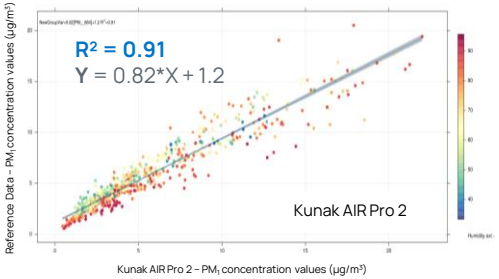
PM_1

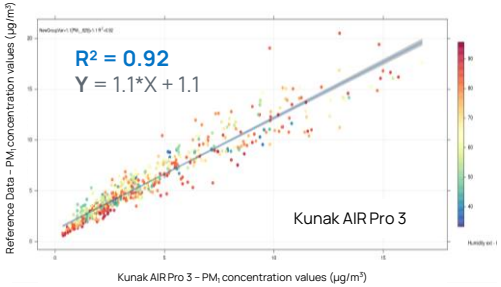
Particulate Matter

Particles (PM_1), Manchester (UK), Jun'21-Jul'21

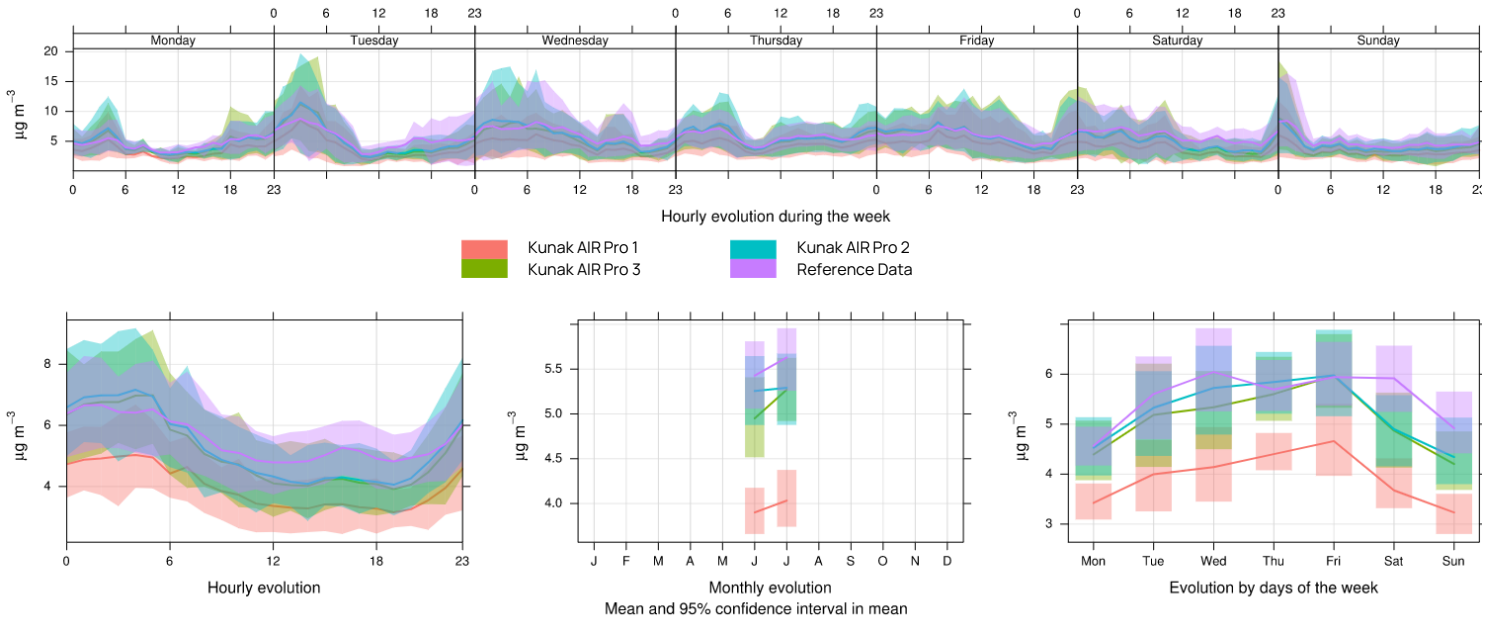








Particles (PM_1), Manchester (UK), Jun'21-Jul'21

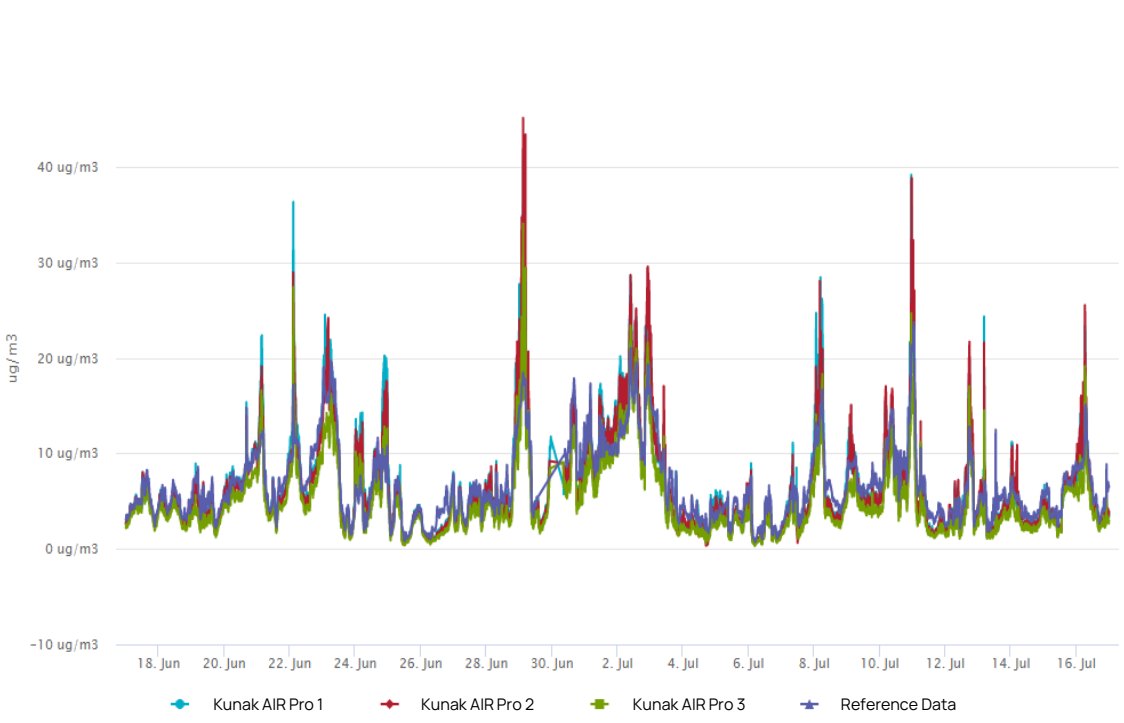


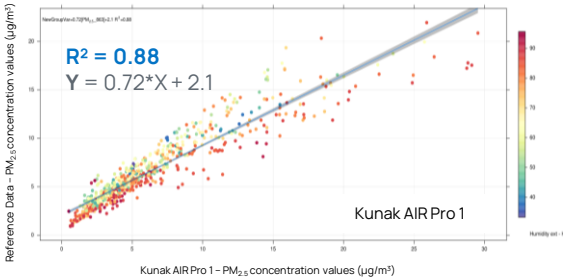
Device	R^2	Accy. (µg/m³)	90% Conf. (µg/m³)	U(exp) (<50%)	N > LV (15 µg/m³)	Avg. GC. Ref. (µg/m³)	Avg. GC. DUT (µg/m³)	Availability Ref. / DUT
Kunak AIR Pro 1	0.95	2.06	4.08	11.66%	0	28.26	26.44	100% / 100%
Kunak AIR Pro 2	0.91	1.05	2.04	17.64%	1	5.54	4.77	100%/100%
Kunak AIR Pro 3	0.92	1.26	2.40	26.98%	1	5.54	4.36	100%/100%

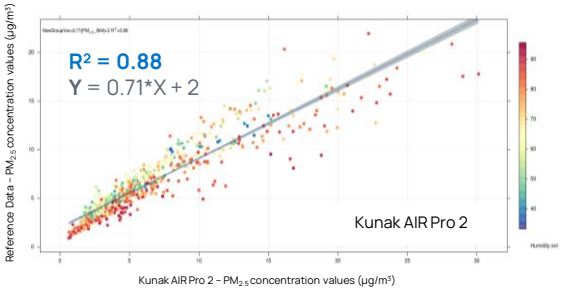
$PM_{2.5}$

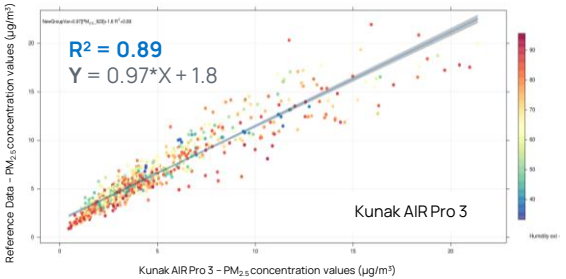
Particulate Matter

Particles ($PM_{2.5}$), Manchester (UK), Jun'21-Jul'21

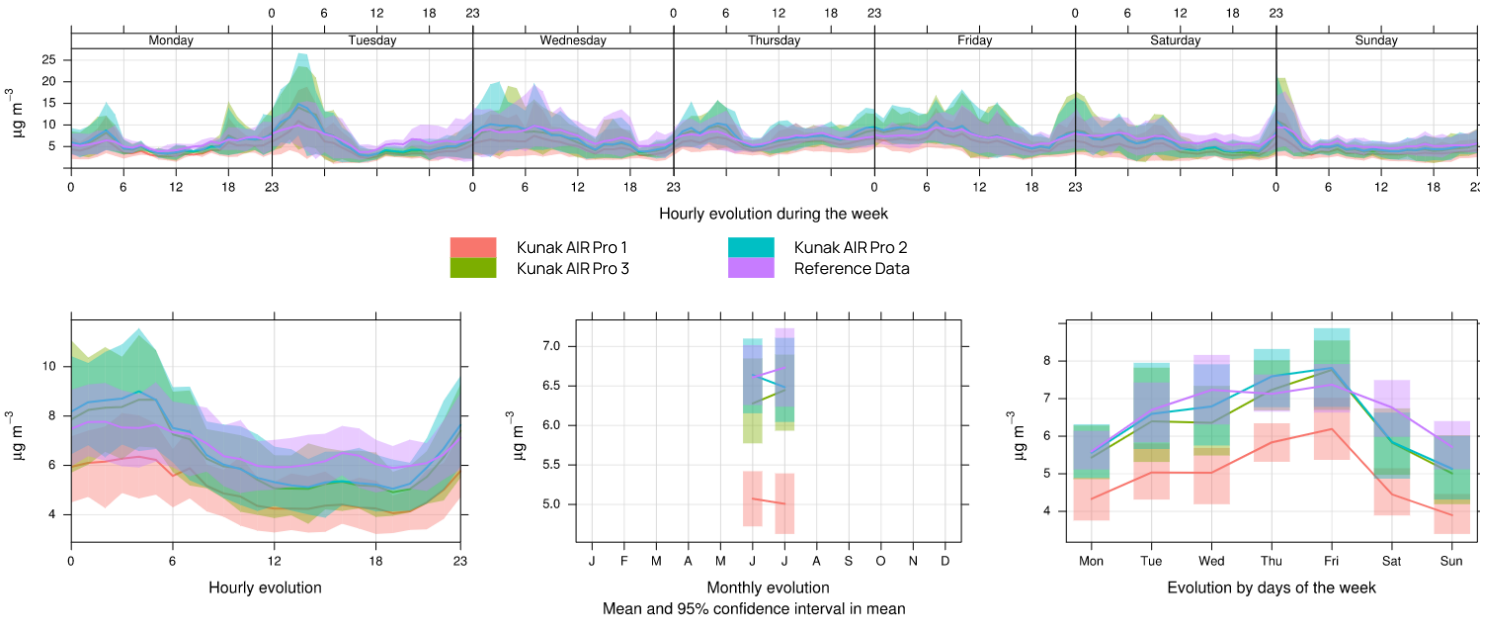








Particles ($PM_{2.5}$), Manchester (UK), Jun'21-Jul'21

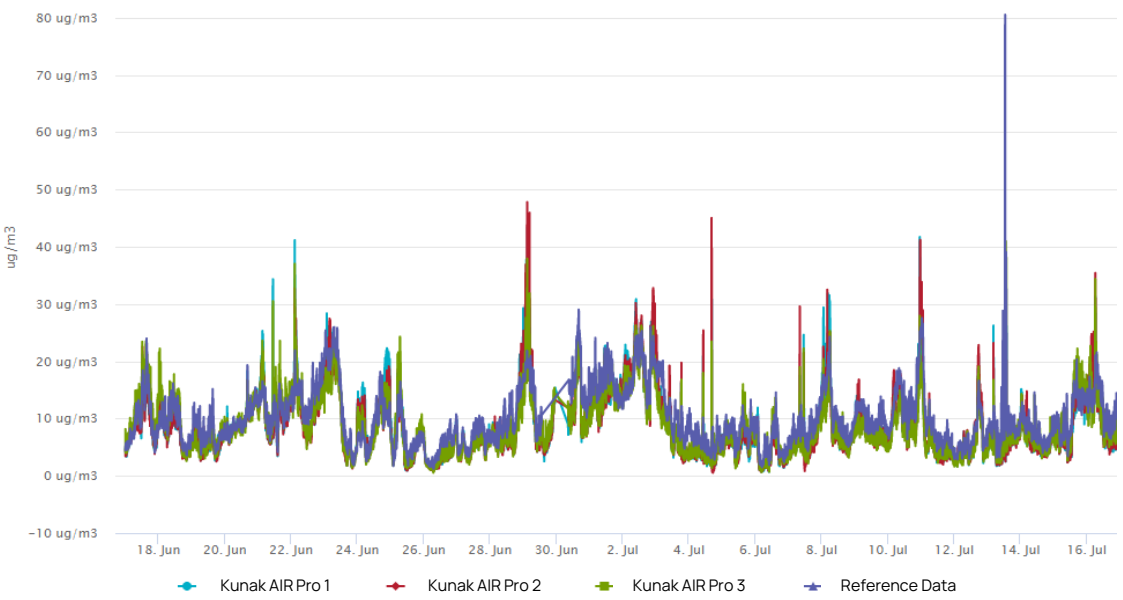


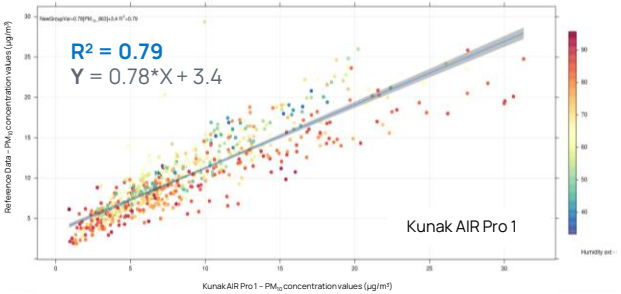
Device	R^2	Accy. (µg/m³)	90% Conf. (µg/m³)	U(exp) (<50%)	N > LV (15 µg/m³)	Avg. GC. Ref. (µg/m³)	Avg. GC. DUT (µg/m³)	Availability Ref. / DUT
Kunak AIR Pro 1	0.88	1.43	2.67	32.89%	0	6.68	5.88	100%/100%
Kunak AIR Pro 2	0.88	1.40	2.52	31.91%	0	6.68	5.93	100%/100%
Kunak AIR Pro 3	0.89	1.46	2.73	21.63%	0	6.68	5.54	100%/100%

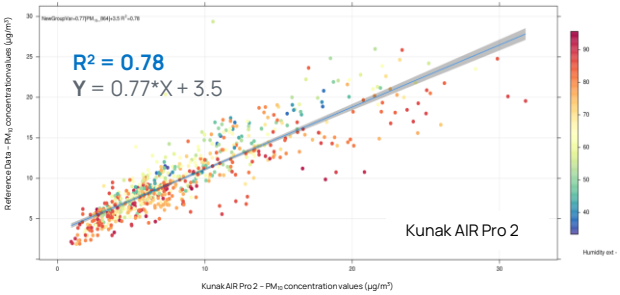
PM_{10}

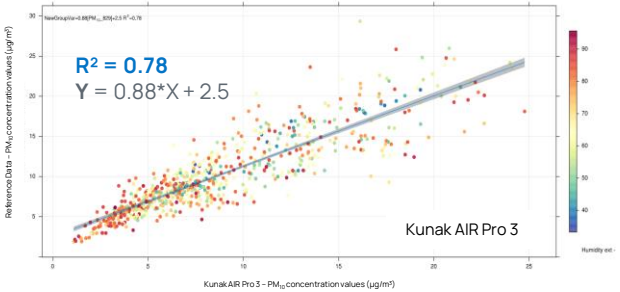
Particulate Matter

Particles (PM_{10}), Manchester (UK), Jun'21-Jul'21

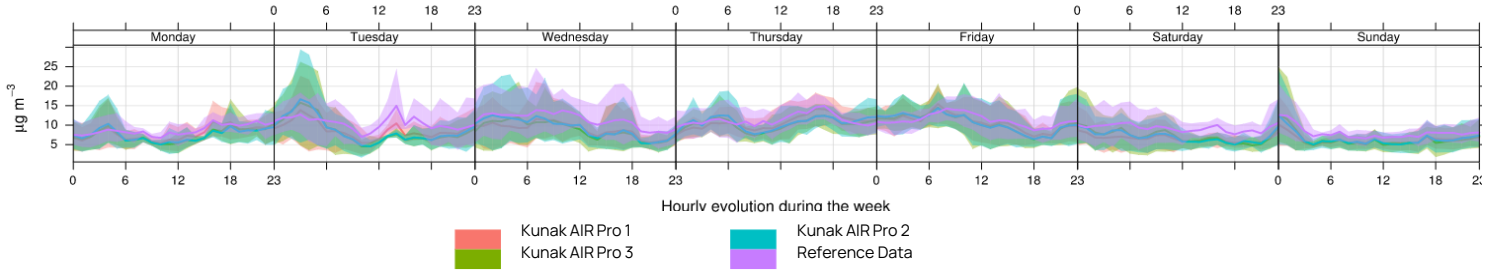


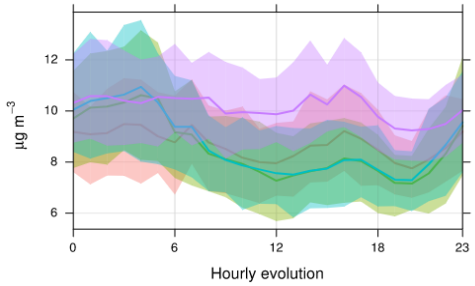


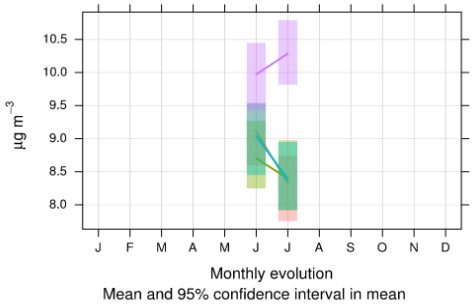


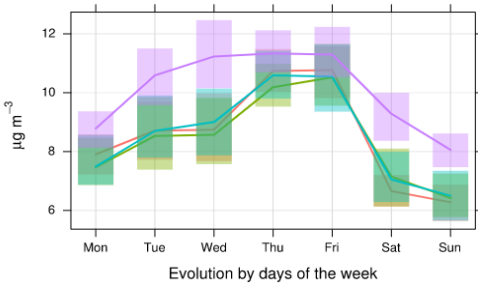


Particles (PM_{10}), Manchester (UK), Jun'21-Jul'21









Device	R^2	Accy. (µg/m³)	90% Conf. (µg/m³)	U(exp) (<50%)	N > LV (15 µg/m³)	Avg. GC. Ref. (µg/m³)	Avg. GC. DUT (µg/m³)	Availability Ref. / DUT
Kunak AIR Pro 1	0.79	2.18	3.99	42.28%	0	10.14	9.13	100%/100%
Kunak AIR Pro 2	0.78	2.21	4.15	42.71%	0	10.14	9.12	100%/100%
Kunak AIR Pro 3	0.78	1.97	3.79	32.28%	0	10.14	9.54	100%/100%

Want to know more?



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