



AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Field Evaluation Report for

Sparrow Analytics Sparrow Node Ver. 5.8 (Stationary Evaluation)

Report ID: F20260901.0

Published on:

09/18/2026

Published by:

South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

Citation:

South Coast Air Quality Management District (2026). Air Quality Sensor Performance Evaluation Center (AQ-SPEC). Field Evaluation Report for Sparrow Analytics Sparrow Node Ver. 5.8 (Stationary Evaluation) [Revision 0]. Available at <http://www.aqmd.gov/aq-spec>.

Performance Snapshot

Sparrow Analytics Sparrow Node Ver. 5.8 (Stationary Evaluation)

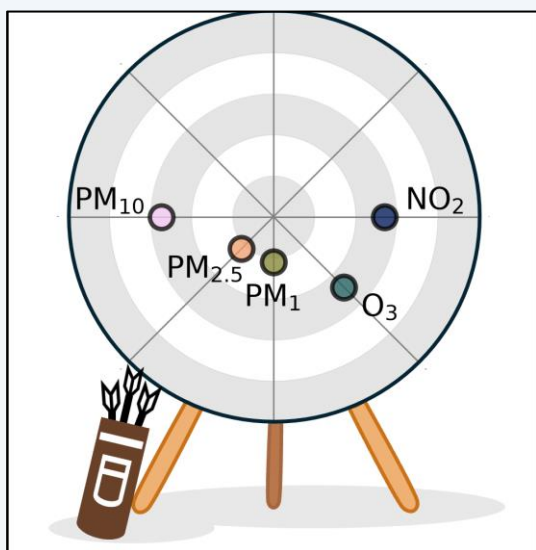


Tested: 06/18/2026 to 08/16/2026

☐ CO	☐ SO ₂
☐ CO ₂	☐ VOC
☐ CH ₄	☒ PM ₁
☐ H ₂ S	☒ PM _{2.5}
☐ NO	☐ PM ₄
☒ NO ₂	☒ PM ₁₀
☐ NO _x	☐ UFP
☒ O ₃	☐ BC

☒ Tested ☐ Not tested ☐ Not available

Does it hit the target?



The closer the sensor lands near the center, the more accurate its readings were compared to the pollution levels.

How well does it track?



A longer bar means the sensor did a better job of tracking the real changes in air pollution levels — going up when the concentration levels went up, and down when they dropped.



Cost



Web portal



Weight



Display



Battery



Solar



Weatherproof



Wi-Fi



Cellular



Bluetooth



Internal memory



Serial

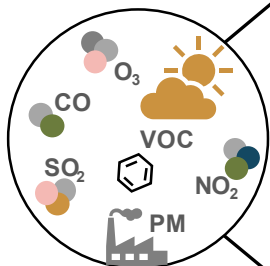


USB



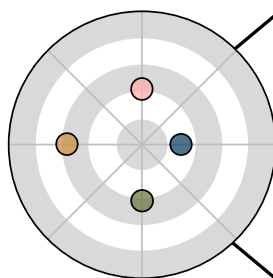
Ethernet

Performance Snapshot Guide



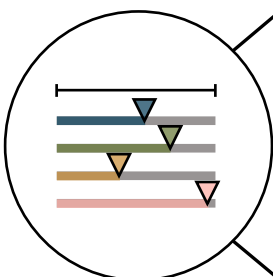
Pollutant List: This list shows the pollutants that the sensor is capable of measuring. Pollutants highlighted in blue with a check mark were tested for performance, those in gray were not tested, and those in white are not measured by the sensor.

◆ CH₄ methane ◆ CO carbon monoxide ◆ CO₂ carbon dioxide ◆ H₂S hydrogen sulfide ◆ NO nitric oxide ◆ NO₂ nitrogen dioxide ◆ NO_x nitrogen oxides ◆ O₃ ozone ◆ SO₂ sulfur dioxide ◆ VOC volatile organic compounds ◆ BC black carbon ◆ PM₁ mass of particles smaller than 1 micrometer ◆ PM_{2.5} mass of particles smaller than 2.5 micrometers ◆ PM₄ mass of particles smaller than 4 micrometers ◆ PM₁₀ mass of particles smaller than 10 micrometers ◆ UFP ultrafine particles, smaller than 0.1 micrometers



Target Graphic: The closer the sensor “hits” the center, the closer the sensor’s readings were to the actual concentrations. If the sensor hit inside the center circle, its readings were within 20% of the actual concentration. Each ring going outward is another 20% further from the actual concentration. If the sensor falls off the target entirely, its readings were either zero, or more than twice the actual concentration!

More technically, the distance from the center is calculated from sensor-reference relative absolute errors, averaged across all 1-hour means, averaged across the number of sensor units tested. These distances are precise and not binned in 20% intervals.



Bar Graphic: The longer the bar, the better the sensor followed the ups-and-downs of the actual concentrations. A long bar doesn’t always mean that the sensor exactly “matched” the actual concentration, but it does mean the sensor was responding when the air was clean or dirty. A long bar also means it’s possible to adjust the sensor’s readings to match the actual concentrations if you can gather data side-by-side with a reference monitor to make a formula to correct the readings!

More technically, the bar length ranges between 0 to 1 and is calculated from sensor-reference coefficients of determination (R^2 ; square of the Pearson correlation coefficient), with 1-hour means, averaged across the number of sensor units tested.



Feature Symbols: Some sensors can be configured with extra features. The price we list in the reports was the price for the product version we tested. Your price may vary from ours. If a symbol has the word **option** in it, it means the manufacturer offers that option at no extra cost. If a symbol has a small \$ sign in it, that means it is a paid option.

The number of \$ signs used for sensor “cost” is based on the 2022 average cell phone price of \$735 (<https://www.wsj.com/business/telecom/how-much-is-too-much-for-a-smartphone-3a300905>), adjusted for inflation for the year we tested the sensor. One \$ sign means the sensor cost less than an average cell phone; two \$\$ signs means it cost less than twice an average cell phone; three \$\$\$ signs means it cost more than twice an average cell phone. For other options, only one \$ sign is used for simplicity as it is too complicated to describe the variety of add-on costs through symbols.

Revision History

Version	Date	Note
0	09/18/2026	Original issued report

Disclaimer: All documents, reports, data, and other information provided are for informational and/or educational use only.

Some sensors evaluated by AQ-SPEC were field-tested inside a custom-made aluminum enclosure to protect the sensors from windblown rain, harsh sunlight, and animals. The field evaluation reports contain data collected at an air monitoring station during a specific 30- to 60-day period and cannot be duplicated at a different location, season, or time period. As sensor performance may be affected by time- and location-specific environmental conditions at the test site, replication and/or duplication of results may not be possible to achieve. The sensor assembly, installation, and use can also impact the performance of products evaluated by AQ-SPEC. No sensor calibration was performed by South Coast AQMD staff for this evaluation. Laboratory chamber testing may be necessary to fully evaluate the performance of these sensors under controlled temperature, humidity, pollutant, and interferent concentrations.

South Coast AQMD makes no claim, warranty, or guarantee that these devices will or will not work when operated by other users for their specific applications.

South Coast AQMD's AQ-SPEC aims at providing information to and for the benefit of the public to make informed purchasing decisions on air quality sensors. In accordance with this mission, the general policy of the Governing Board of the Agency is to exclude all commercial advertising and promotional material, including links which provide exclusive private or financial benefit to commercial, non-public enterprises and which do not promote or enhance a public benefit to the general public. As a Government Agency, the South Coast AQMD neither endorses nor supports individual private commercial enterprises through testing of products by AQ-SPEC or through providing links to the sites of such commercial enterprises.

Report Role	Name	Date
Tested by	Leslie Garcia and Randy Lam	08/16/2026
Analysis by	Ehsan Mosadegh, Ph.D.	09/03/2026
Quality Control Review by	Michelle Kuang, Ph.D.	09/03/2026
Approved by	Wilton Mui, Ph.D.	09/16/2026
Revision by	-----	-----

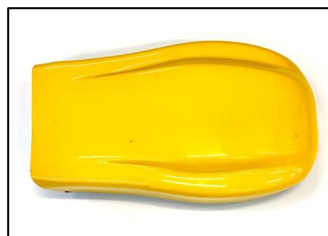
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Section 1: Background

Three Sparrow Analytics Sparrow Node Ver. 5.8 (hereinafter Sparrow) units (IDs: 319, 332, 333) were deployed at the South Coast AQMD stationary ambient monitoring site in Fontana from 06/18/2026 to 08/16/2026. The evaluation period lasted 8 weeks. The sensor units were co-located with reference grade instruments as described below.

Note: According to the user manual, this product “is designed primarily for mobile applications and collects spatially distributed environmental data during vehicle operation”. The results in this report are based on evaluation of the product in a stationary manner and may not reflect the performance when the product is used in a mobile manner.



*Sparrow Analytics
Sparrow Node Ver. 5.8*



Test site at Fontana, CA

Section 2: Manufacturer Specs

Parameter	Sensor: Sparrow (raw sensor is Alphasense electrochemical sensor)	Reference Instrument: Teledyne T200
Pollutant	NO ₂	NO, NO ₂ (FRM), NOx
Cost	\$3,750	~\$11,000
Weight	4.4 pounds	40 lbs
Dimensions (LxWxH)	13.78 x 7.68 x 3.74 inches	7 x 17 x 23.5 inches
Power	12 VDC (18 W peak)	100-240 VAC
Battery	Yes (3 hr)	No
Data transmission	Cellular, WiFi	Serial, Ethernet, USB
Internal memory	No	Yes
Operating temperature range	23-131 degrees F	41-104 degrees F
Operating RH range	0-95%	Not specified
Product website	https://sparrow.city/	https://www.teledyne-api.com/en-us/products/t200
Operating principle	Electrochemical	Chemiluminescence
Time resolution	60 seconds (as-tested)	1 minute (as-configured)
Concentration range	0-1000 ppb	0-20,000 ppb

Section 2: Manufacturer Specs

Parameter	Sensor: Sparrow (raw sensor is Alphasense electrochemical sensor)	Reference Instrument: Teledyne T400
Pollutant	O ₃	O ₃ (FEM)
Cost	\$3,750	~\$7,000
Weight	4.4 pounds	31 lbs
Dimensions (LxWxH)	13.78 x 7.68 x 3.74 inches	7 x 17 x 23.5 inches
Power	12 VDC (18 W peak)	100-240 VAC
Battery	Yes (3 hr)	No
Data transmission	Cellular, WiFi	Serial, Ethernet, USB
Internal memory	No	Yes
Operating temperature range	23-131 degrees F	41-104 degrees F
Operating RH range	0-95%	Not specified
Product website	https://sparrow.city/	https://www.teledyne-api.com/en-us/products/t400
Operating principle	Electrochemical	UV absorption
Time resolution	60 seconds (as-tested)	1 minute (as-configured)
Concentration range	0-1000 ppb	0-10,000 ppb

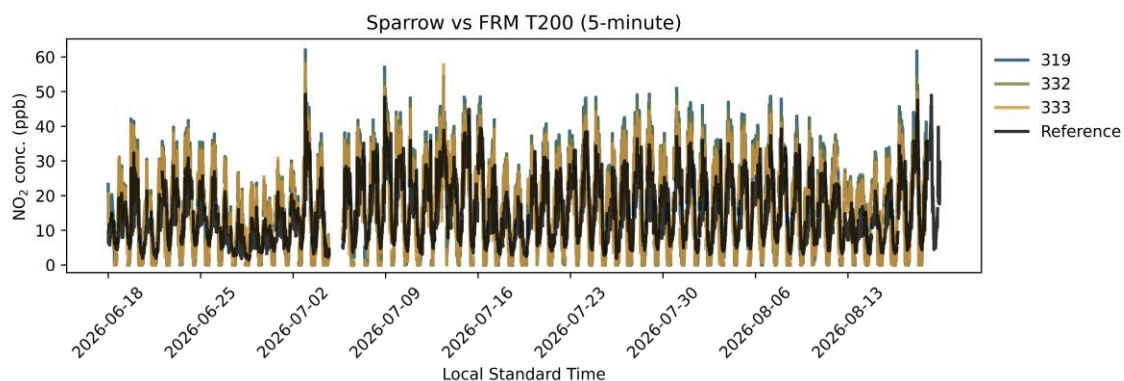
Section 2: Manufacturer Specs

Parameter	Sensor: Sparrow (raw sensor is Tera OPC)	Reference Instrument: Teledyne API T640
Pollutant	PM ₁ , PM _{2.5} , PM ₁₀	PM ₁ , PM _{2.5} (FEM), PM ₁₀
Cost	\$3,750	~\$21,000
Weight	4.4 pounds	19 pounds
Dimensions (LxWxH)	13.78 x 7.68 x 3.74 inches	7 x 17 x 14 inches
Power	12 VDC (18 W peak)	100-240 VAC
Battery	Yes (3 hr)	No
Data transmission	Cellular, WiFi	Serial, Ethernet, USB
Internal memory	No	Yes (with USB flash drive)
Operating temperature range	23-131 degrees F	32-122 degrees F
Operating RH range	0-95%	0%-100%
Product website	https://sparrow.city/	https://www.teledyne-api.com/en-us/products/t640
Operating principle	Optical particle counter (OPC)	Optical light scattering
Time resolution	60 seconds (as-tested)	1 minute (as-configured)
Concentration range	0-1,000 µg/m ³	0.1-10,000 µg/m ³

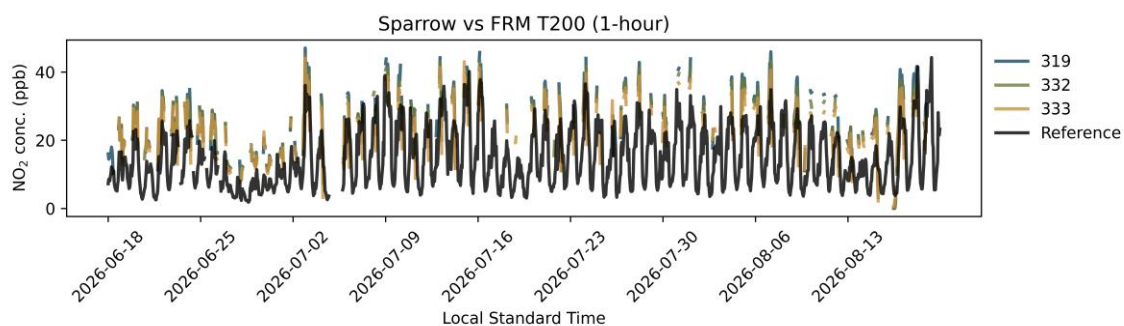
Section 3: NO₂

Section 3.1: Data Overview

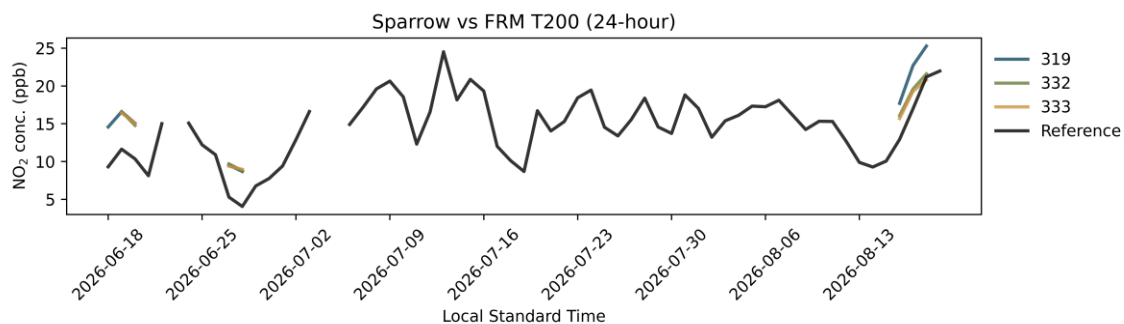
Timeseries of the 8-week evaluation



Timeseries of the 8-week evaluation



Timeseries of the 8-week evaluation



Note: Resampled sensor readings were only considered for inclusion in the analysis if at 75% of records were present during that resampling period.

Section 3: NO₂

Section 3.2: Data Recovery

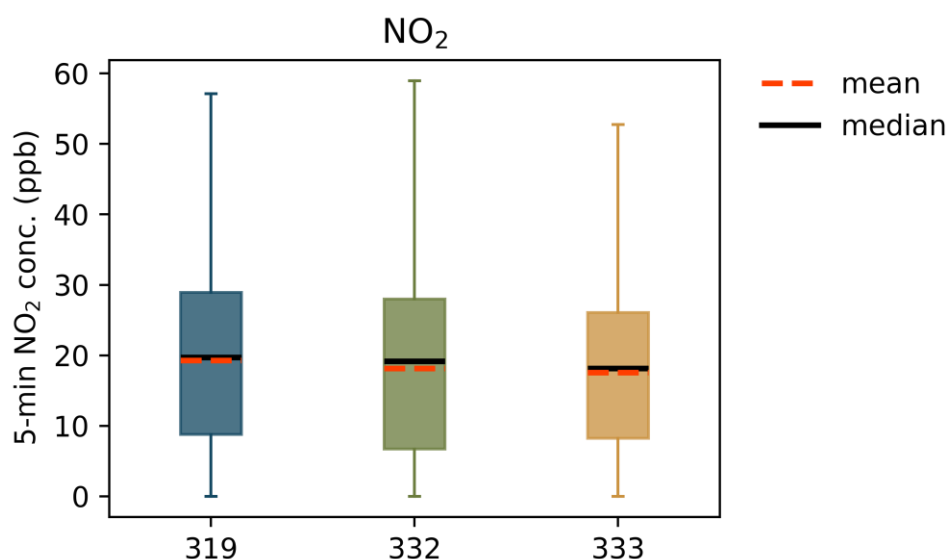
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire evaluation.

Parameter	319	332	333
NO ₂	69.7%	69.0%	69.5%

Section 3.3: Intra-model Variability

Absolute intra-model variability was calculated as the standard deviation of the mean values of the sensors. Relative intra-model variability was calculated as the absolute intra-model variability divided by the sensor grand mean. Calculations were performed using data resampled to 5-minute averages.

Parameter	Absolute intra-model variability (ppb)	Relative intra-model variability (%)
NO ₂	0.9	5.0



Interpretation: Two out of three Sparrow units had similar pollutant distributions.

Section 3: NO₂

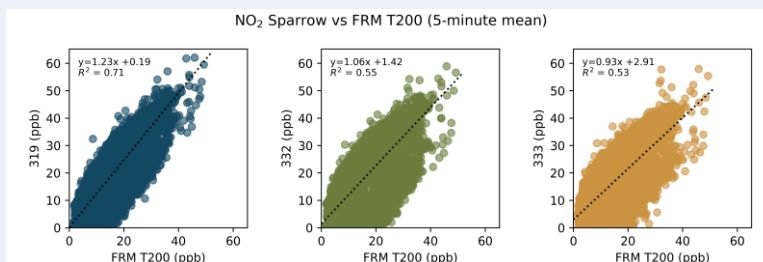
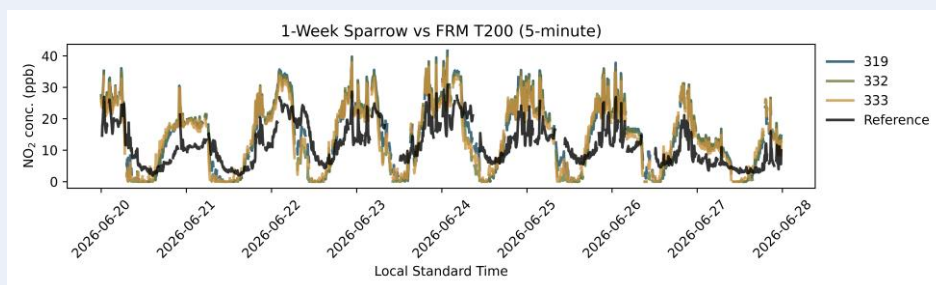
Section 3.4: Linearity (R²)

Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

A summary of the mean R² between the sensor and T200 across all units tested.

Parameter	Time Resolution	FRM T200 (mean ± SD)
NO ₂	5-minute	0.60 ± 0.10
	1-hour	0.71 ± 0.11
	24-hour	0.95 ± 0.04

Timeseries of a 1-week subset of the 8-week evaluation

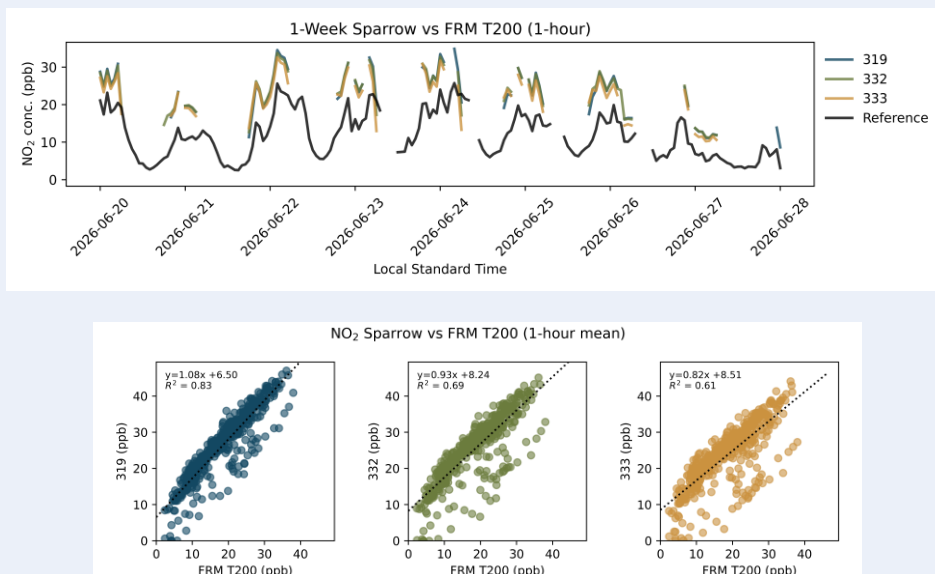


Interpretation: The Sparrow units showed moderate to strong correlation with the corresponding T200 data ($0.53 < R^2 < 0.72$) for 5-minute averaging.

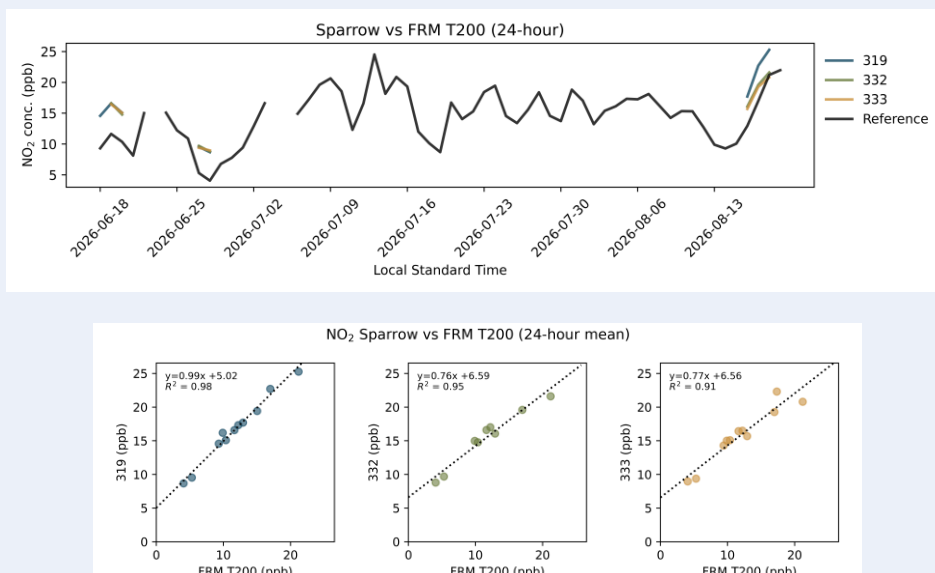
Section 3: NO₂

Section 3.4: Linearity (R²)

Timeseries of a 1-week subset of the 8-week evaluation



Interpretation: The Sparrow units showed moderate to strong correlation with the corresponding T200 data ($0.60 < R^2 < 0.84$) for 1-hour averaging.

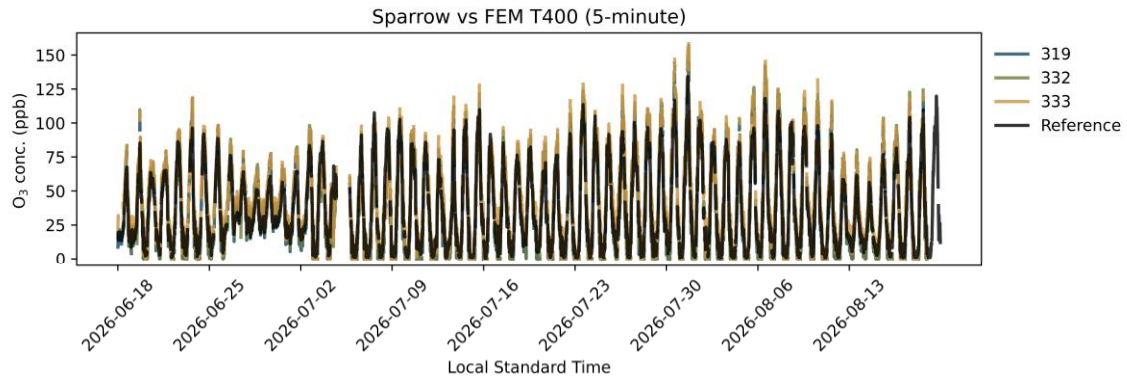


Interpretation: The Sparrow units showed very strong correlation with the corresponding T200 data ($0.90 < R^2 < 0.99$) for 24-hour averaging.

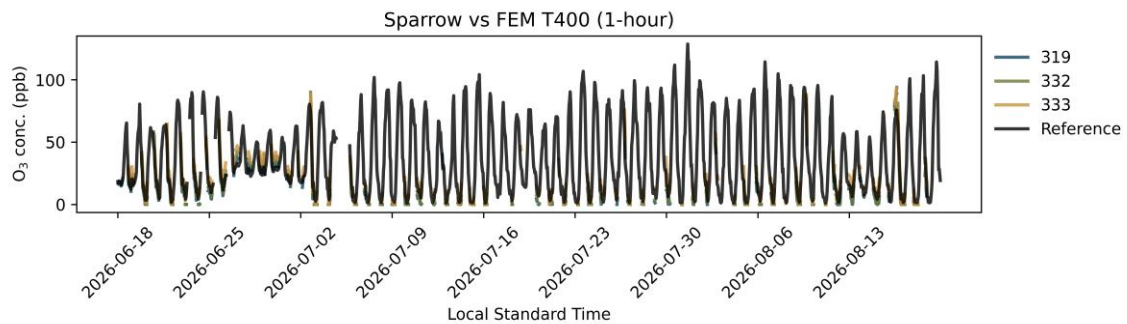
Section 4: O₃

Section 4.1: Data Overview

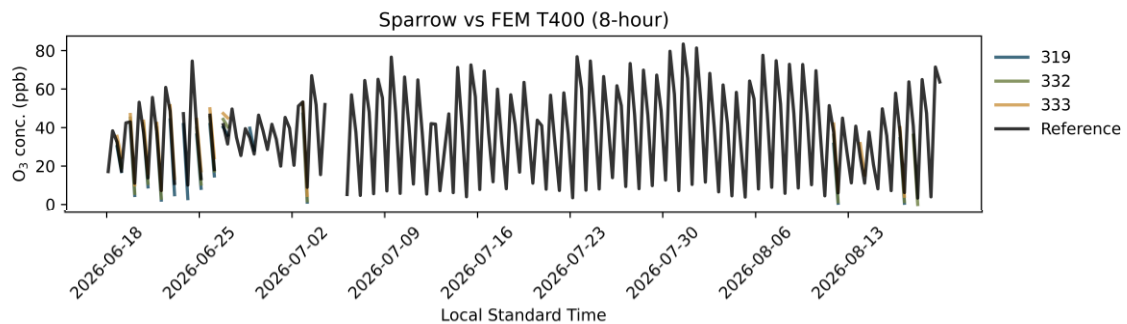
Timeseries of the 8-week evaluation



Timeseries of the 8-week evaluation



Timeseries of the 8-week evaluation



Note: Resampled sensor readings were only considered for inclusion in the analysis if at 75% of records were present during that resampling period.

Section 4: O₃

Section 4.2: Data Recovery

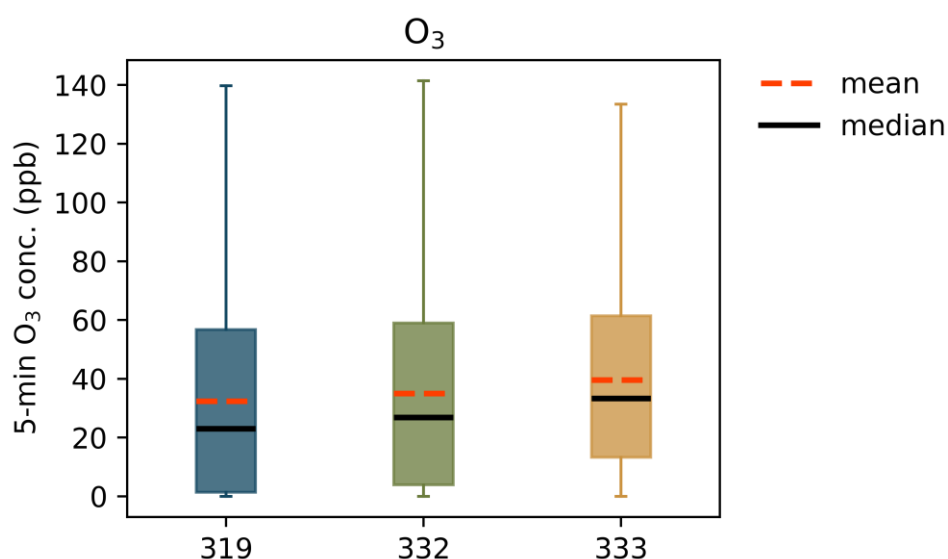
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire evaluation.

Parameter	319	332	333
O ₃	69.7%	69.0%	69.5%

Section 4.3: Intra-model Variability

Absolute intra-model variability was calculated as the standard deviation of the mean values of the sensors. Relative intra-model variability was calculated as the absolute intra-model variability divided by the sensor grand mean. Calculations were performed using data resampled to 5-minute averages.

Parameter	Absolute intra-model variability (ppb)	Relative intra-model variability (%)
O ₃	3.6	10.0



Interpretation: Two out of three Sparrow units had similar pollutant distributions.

Section 4: O₃

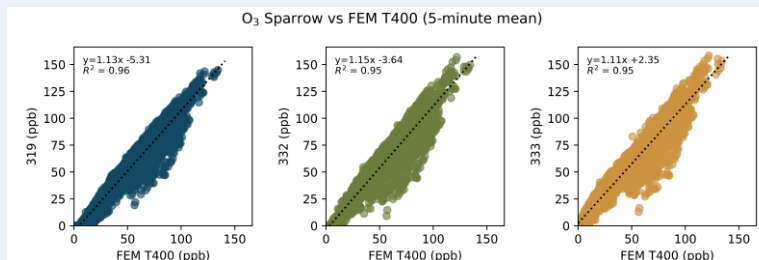
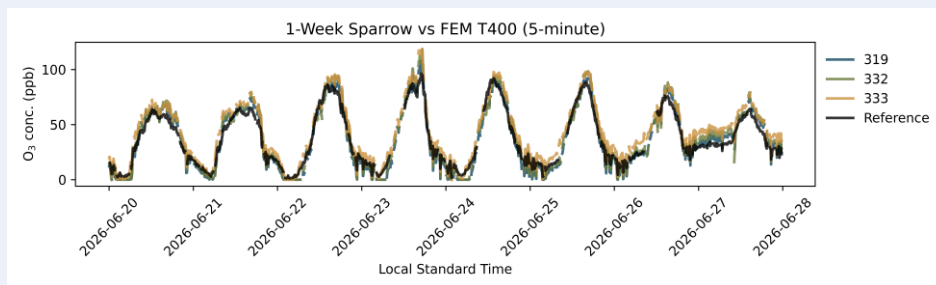
Section 4.4: Linearity (R²)

Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

A summary of the mean R² between the sensor and T400 across all units tested.

Parameter	Time Resolution	FEM T400 (mean ± SD)
O ₃	5-minute	0.96 ± 0.01
	1-hour	0.96 ± 0.00
	8-hour	0.96 ± 0.00

Timeseries of a 1-week subset of the 8-week evaluation

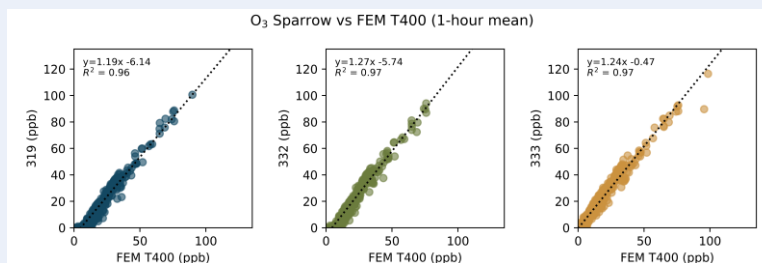
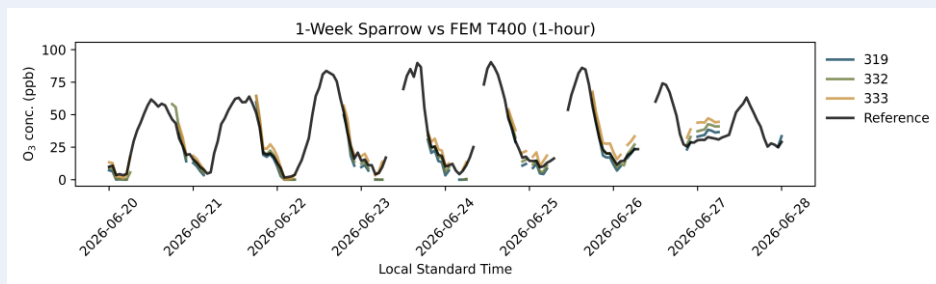


Interpretation: The Sparrow units showed very strong correlation with the corresponding T400 data (0.95 < R² < 0.97) for 5-minute averaging.

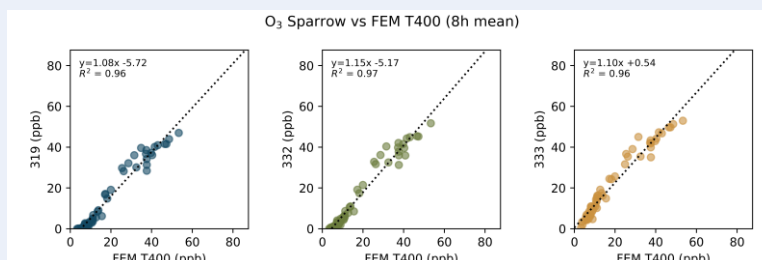
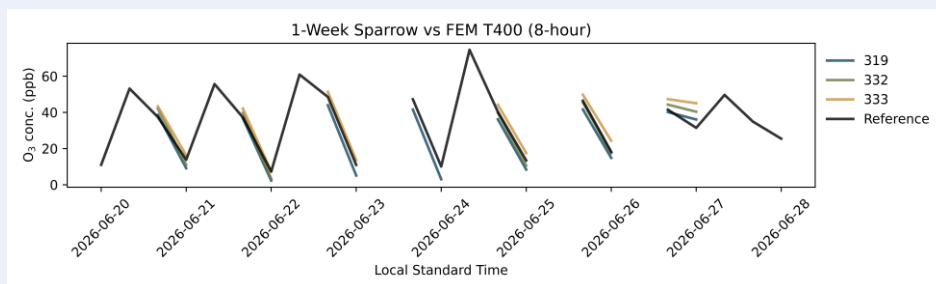
Section 4: O₃

Section 4.4: Linearity (R²)

Timeseries of a 1-week subset of the 8-week evaluation



Interpretation: The Sparrow units showed very strong correlation with the corresponding T400 data ($0.95 < R^2 < 0.97$) for 1-hour averaging.



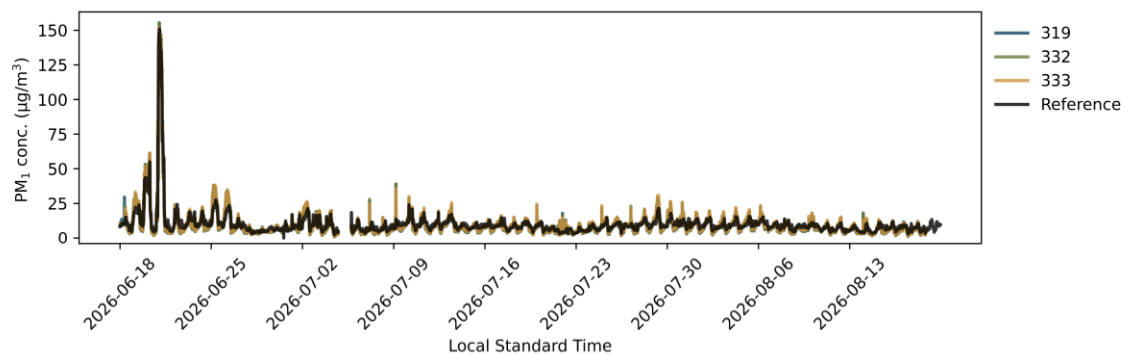
Interpretation: The Sparrow units showed very strong correlation with the corresponding T400 data ($0.95 < R^2 < 0.97$) for 8-hour averaging.

Section 5: PM₁

Section 5.1: Data Overview

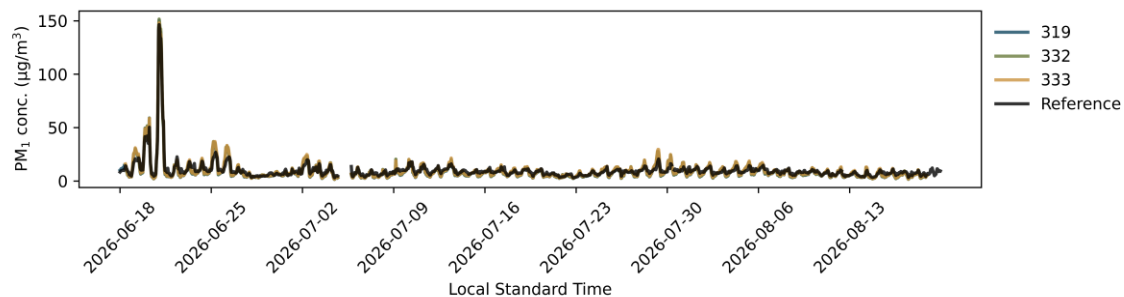
Timeseries of the 8-week evaluation

Sparrow vs T640 (5-minute)



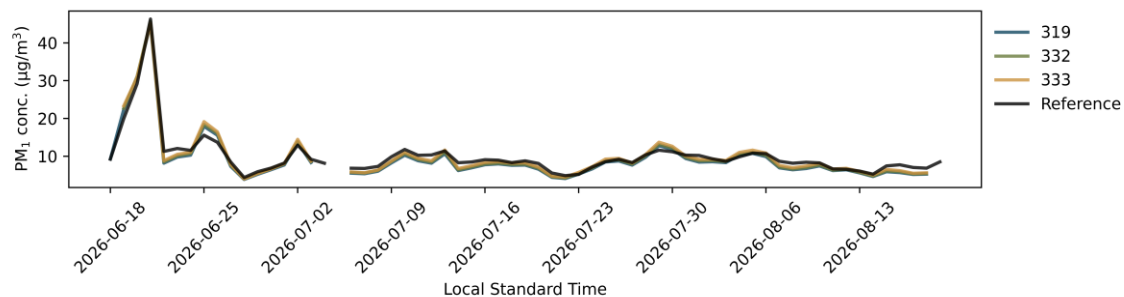
Timeseries of the 8-week evaluation

Sparrow vs T640 (1-hour)



Timeseries of the 8-week evaluation

Sparrow vs T640 (24-hour)



Note: Resampled sensor readings were only considered for inclusion in the analysis if at 75% of records were present during that resampling period.

Section 5: PM₁

Section 5.2: Data Recovery

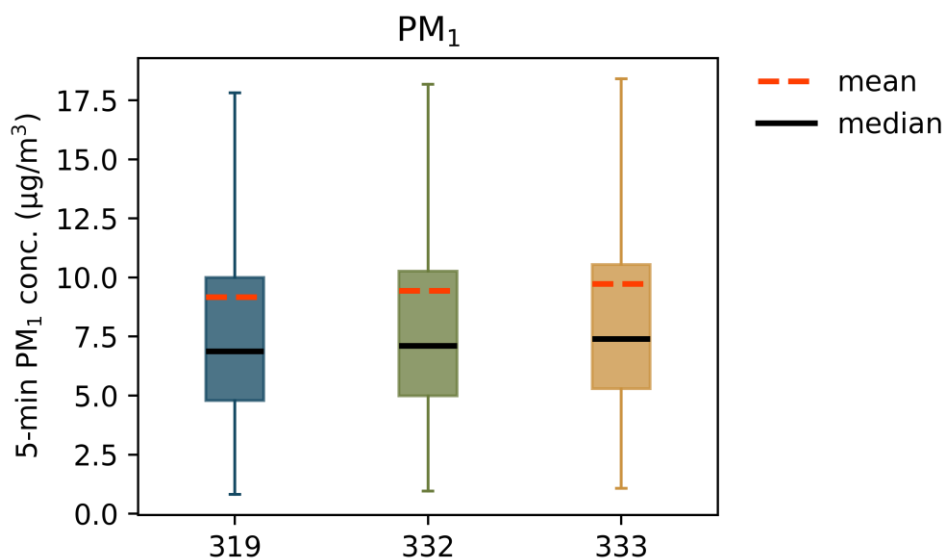
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire evaluation.

Parameter	319	332	333
PM ₁	98.2%	97.5%	97.6%

Section 5.3: Intra-model Variability

Absolute intra-model variability was calculated as the standard deviation of the mean values of the sensors. Relative intra-model variability was calculated as the absolute intra-model variability divided by the sensor grand mean. Calculations were performed using data resampled to 5-minute averages.

Parameter	Absolute intra-model variability (ppb)	Relative intra-model variability (%)
PM ₁	0.3	3.1



Interpretation: The Sparrow units had similar pollutant distributions.

Section 5: PM₁

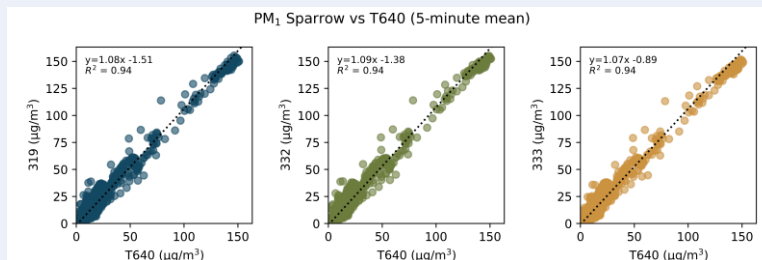
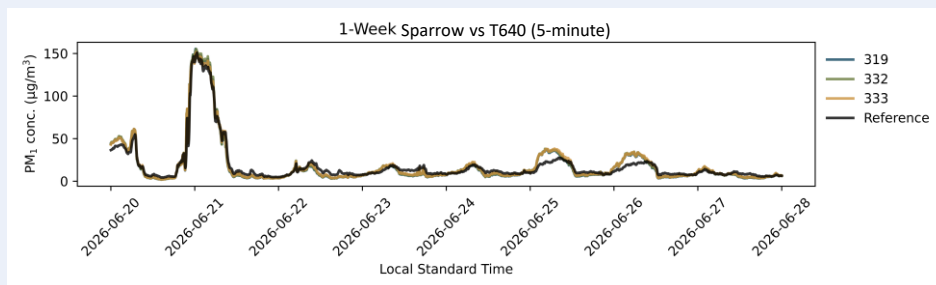
Section 5.4: Linearity (R²)

Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

A summary of the mean R² between the sensor and T640 across all units tested.

Parameter	Time Resolution	T640 (mean ± SD)
PM ₁	5-minute	0.94 ± 0.00
	1-hour	0.95 ± 0.00
	24-hour	0.97 ± 0.00

Timeseries of a 1-week subset of the 8-week evaluation

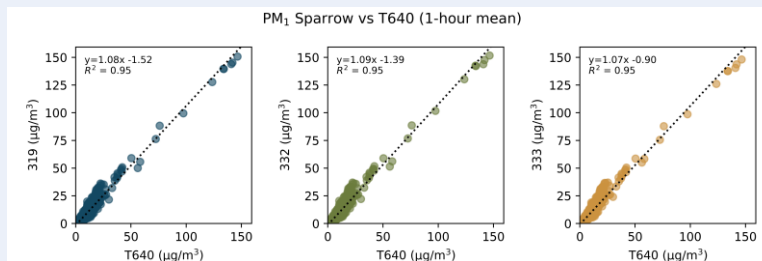
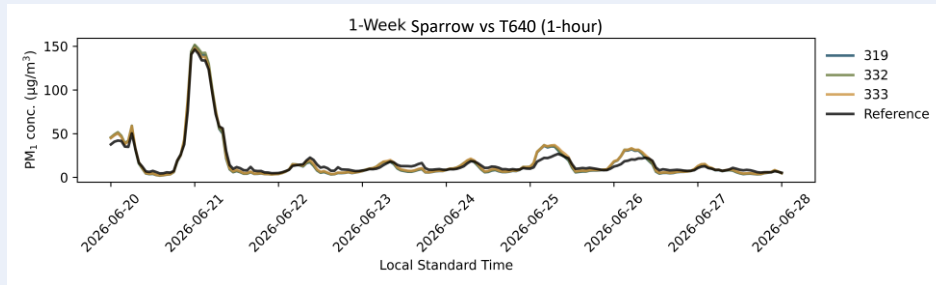


Interpretation: The Sparrow units showed very strong correlation with the corresponding T640 data ($0.93 < R^2 < 0.95$) for 5-minute averaging.

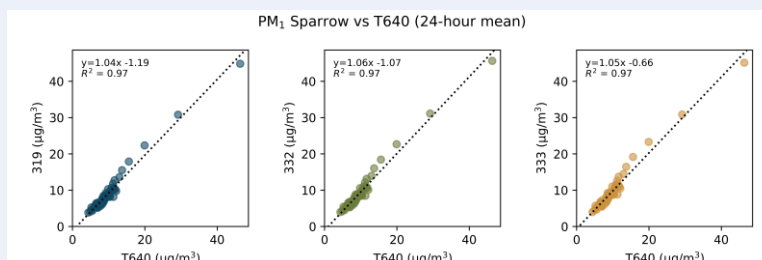
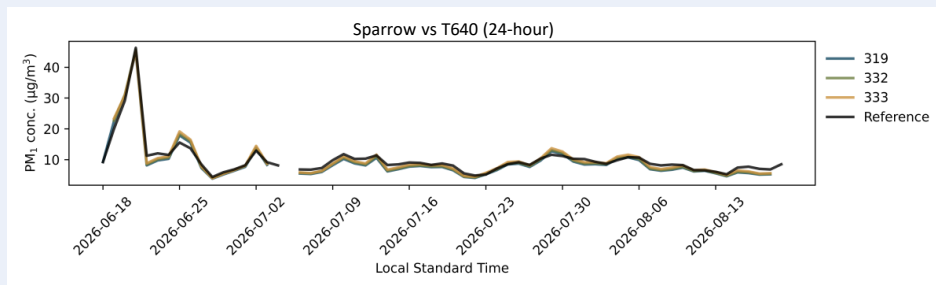
Section 5: PM₁

Section 5.4: Linearity (R^2)

Timeseries of a 1-week subset of the 8-week evaluation



Interpretation: The Sparrow units showed very strong correlation with the corresponding T640 data ($0.94 < R^2 < 0.95$) for 1-hour averaging.

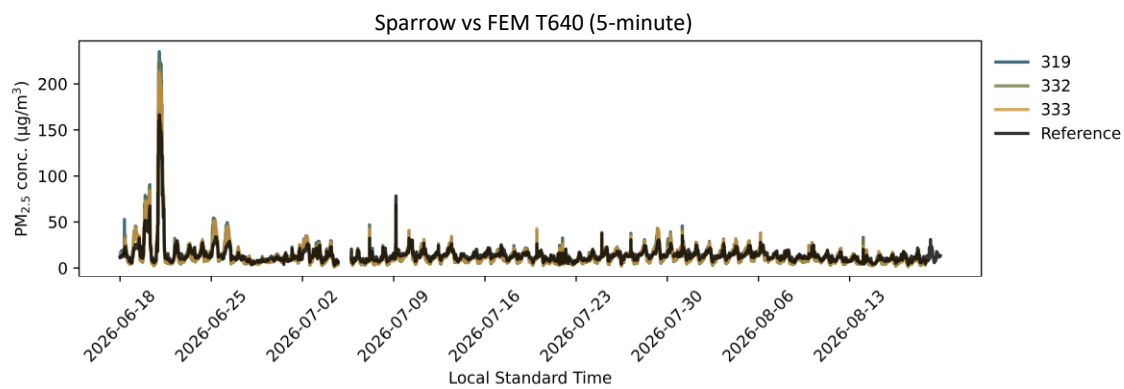


Interpretation: The Sparrow units showed very strong correlation with the corresponding T640 data ($0.96 < R^2 < 0.98$) for 24-hour averaging.

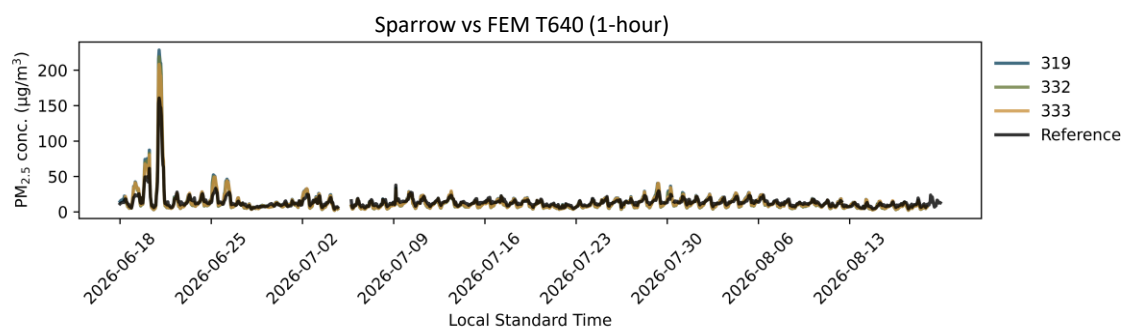
Section 6: PM_{2.5}

Section 6.1: Data Overview

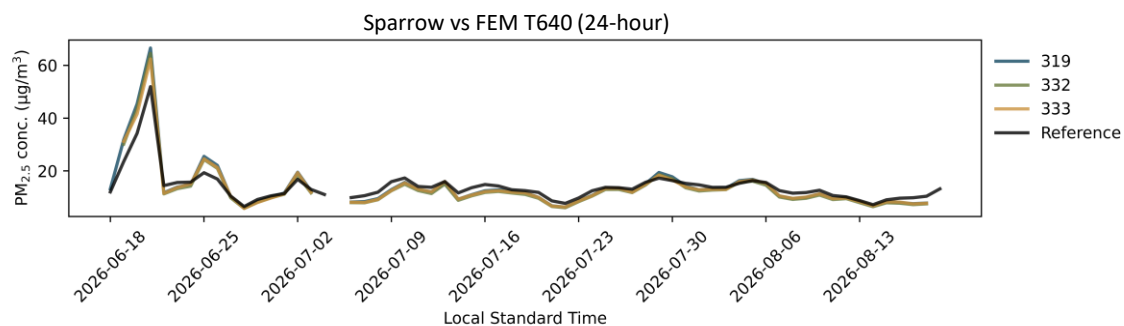
Timeseries of the 8-week evaluation



Timeseries of the 8-week evaluation



Timeseries of the 8-week evaluation



Note: Resampled sensor readings were only considered for inclusion in the analysis if at 75% of records were present during that resampling period.

Section 6: PM_{2.5}

Section 6.2: Data Recovery

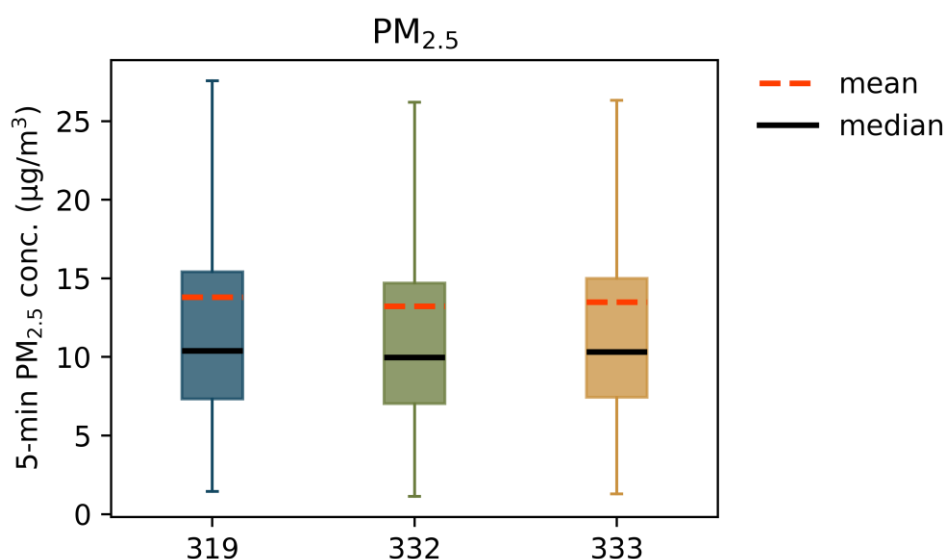
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire evaluation.

Parameter	319	332	333
PM _{2.5}	98.2%	97.5%	97.6%

Section 6.3: Intra-model Variability

Absolute intra-model variability was calculated as the standard deviation of the mean values of the sensors. Relative intra-model variability was calculated as the absolute intra-model variability divided by the sensor grand mean. Calculations were performed using data resampled to 5-minute averages.

Parameter	Absolute intra-model variability (ppb)	Relative intra-model variability (%)
PM _{2.5}	0.3	2.1



Interpretation: The Sparrow units had similar pollutant distributions.

Section 6: PM_{2.5}

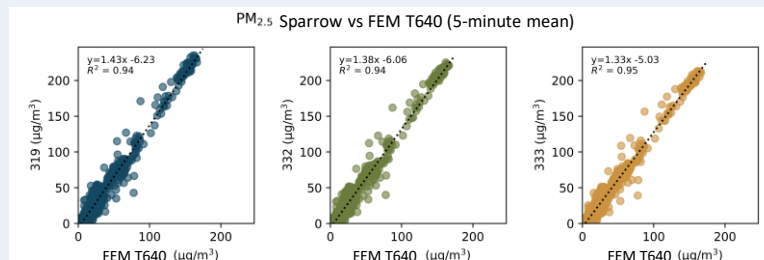
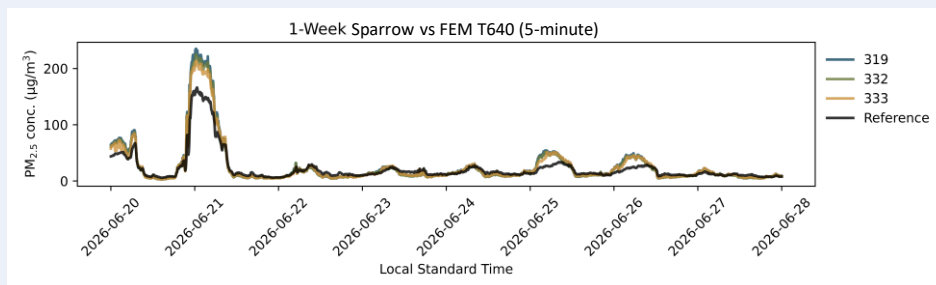
Section 6.4: Linearity (R^2)

Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

A summary of the mean R^2 between the sensor and T640 across all units tested.

Parameter	Time Resolution	FEM T640 (mean $\pm$ SD)
PM _{2.5}	5-minute	0.94 $\pm$ 0.00
	1-hour	0.95 $\pm$ 0.00
	24-hour	0.97 $\pm$ 0.00

Timeseries of a 1-week subset of the 8-week evaluation

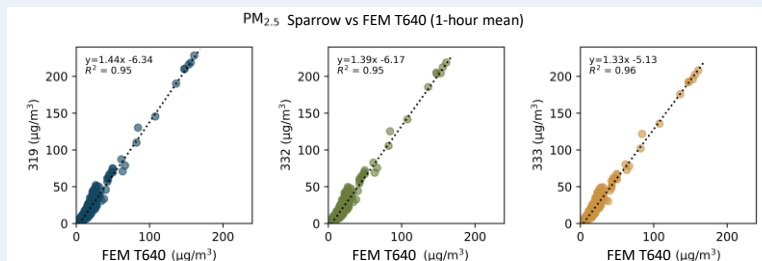
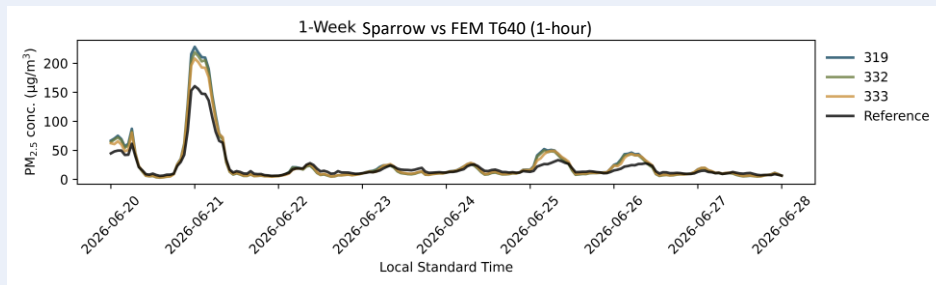


Interpretation: The Sparrow units showed very strong correlation with the corresponding FEM T640 data ($0.94 < R^2 < 0.95$) for 5-minute averaging.

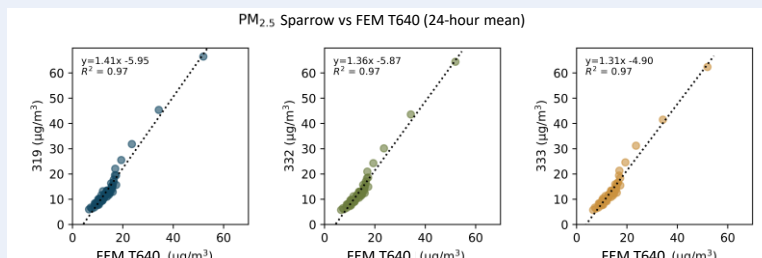
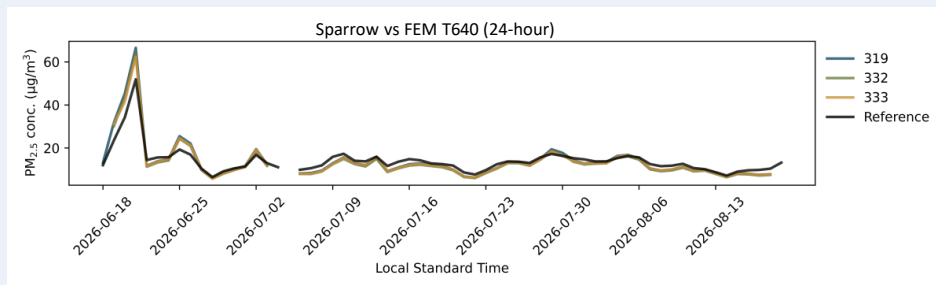
Section 6: PM_{2.5}

Section 6.4: Linearity (R²)

Timeseries of a 1-week subset of the 8-week evaluation



Interpretation: The Sparrow units showed very strong correlation with the corresponding FEM T640 data ($0.95 < R^2 < 0.96$) for 1-hour averaging.

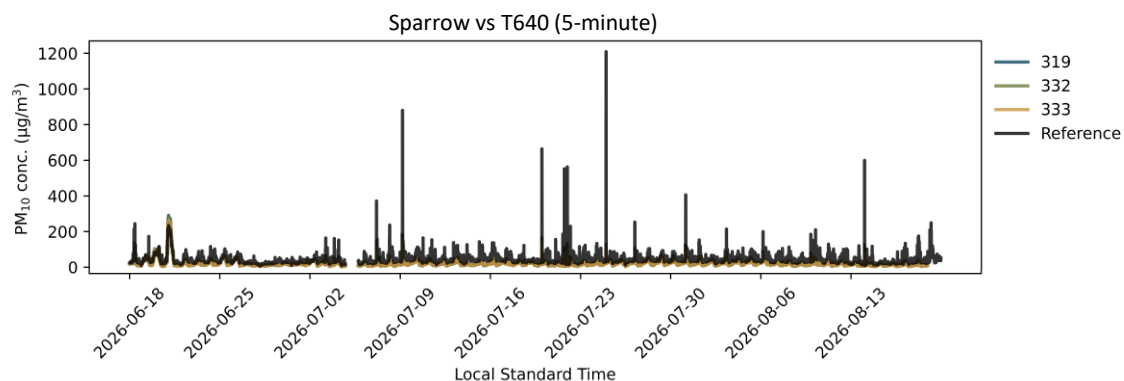


Interpretation: The Sparrow units showed very strong correlation with the corresponding FEM T640 data ($0.96 < R^2 < 0.97$) for 24-hour averaging.

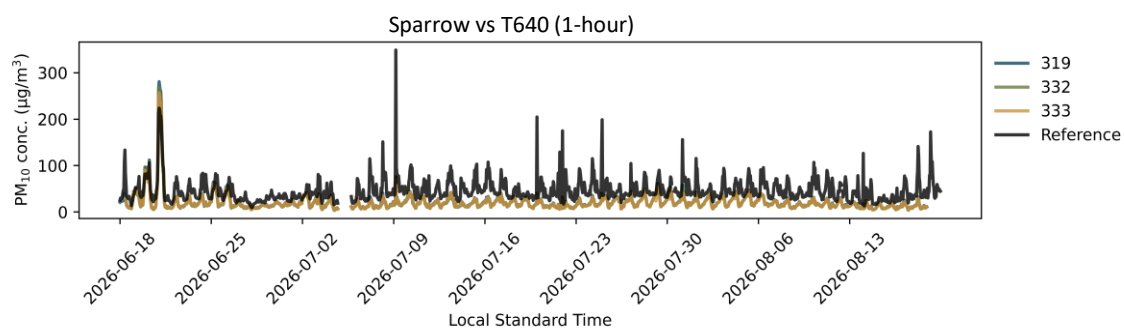
Section 7: PM₁₀

Section 7.1: Data Overview

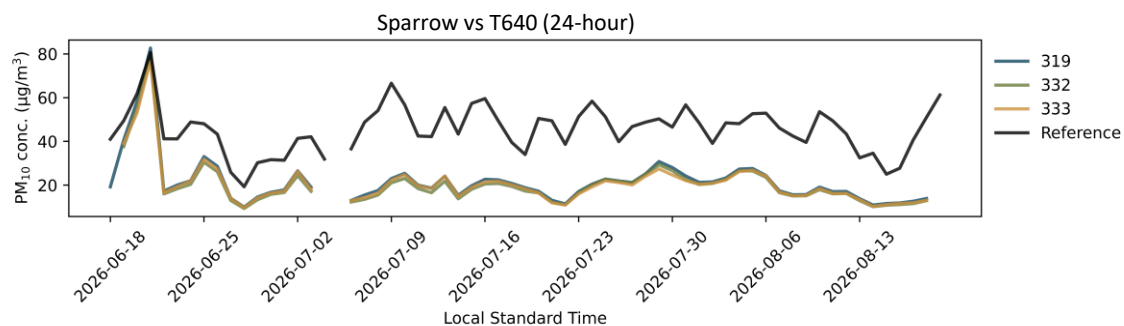
Timeseries of the 8-week evaluation



Timeseries of the 8-week evaluation



Timeseries of the 8-week evaluation



Note: Resampled sensor readings were only considered for inclusion in the analysis if at 75% of records were present during that resampling period.

Section 7: PM₁₀

Section 7.2: Data Recovery

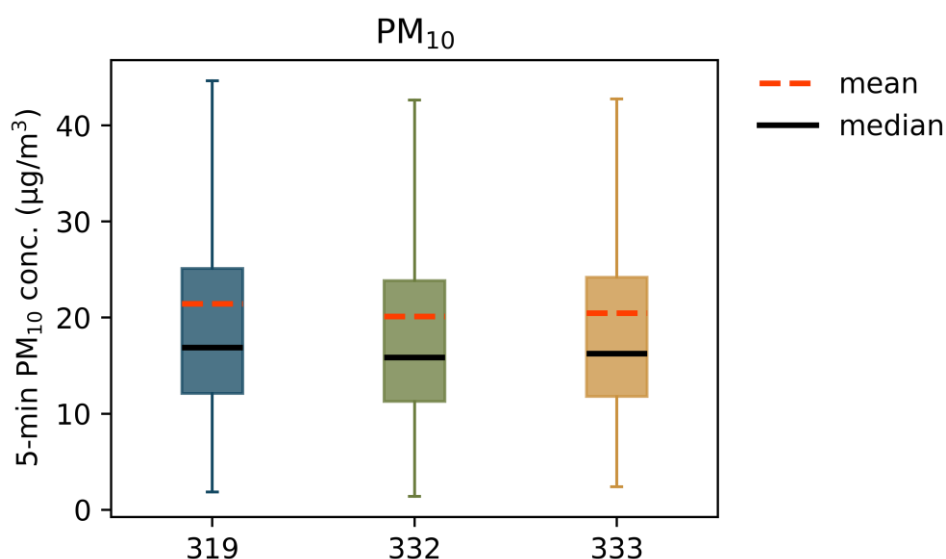
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire evaluation.

Parameter	319	332	333
PM ₁₀	98.2%	97.5%	97.6%

Section 7.3: Intra-model Variability

Absolute intra-model variability was calculated as the standard deviation of the mean values of the sensors. Relative intra-model variability was calculated as the absolute intra-model variability divided by the sensor grand mean. Calculations were performed using data resampled to 5-minute averages.

Parameter	Absolute intra-model variability (ppb)	Relative intra-model variability (%)
PM ₁₀	0.7	3.2



Interpretation: The Sparrow units had similar pollutant distributions.

Section 7: PM₁₀

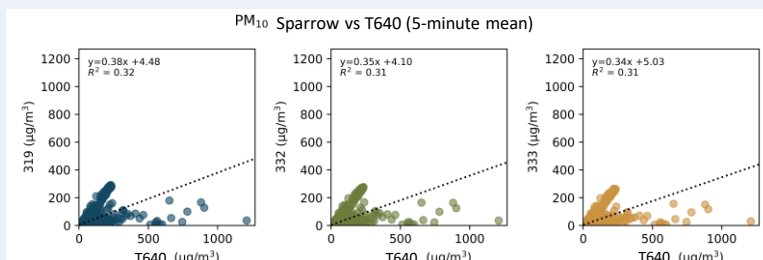
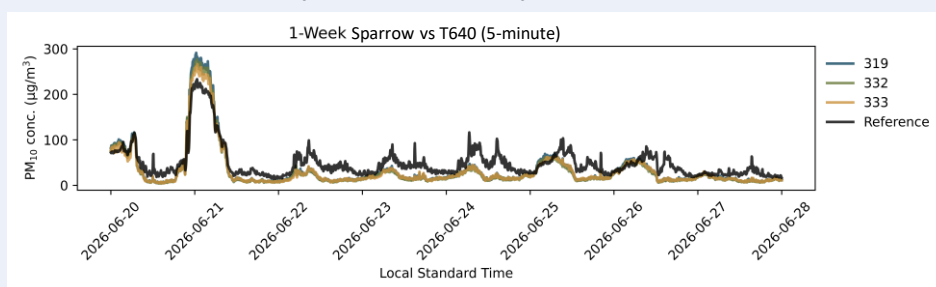
Section 7.4: Linearity (R^2)

Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

A summary of the mean R^2 between the sensor and T640 across all units tested.

Parameter	Time Resolution	T640 (mean $\pm$ SD)
PM ₁₀	5-minute	0.31 $\pm$ 0.00
	1-hour	0.45 $\pm$ 0.00
	24-hour	0.42 $\pm$ 0.00

Timeseries of a 1-week subset of the 8-week evaluation

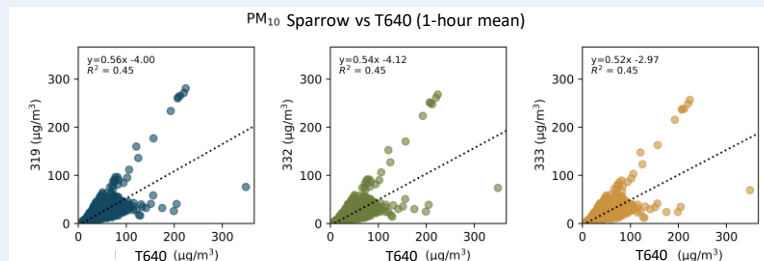
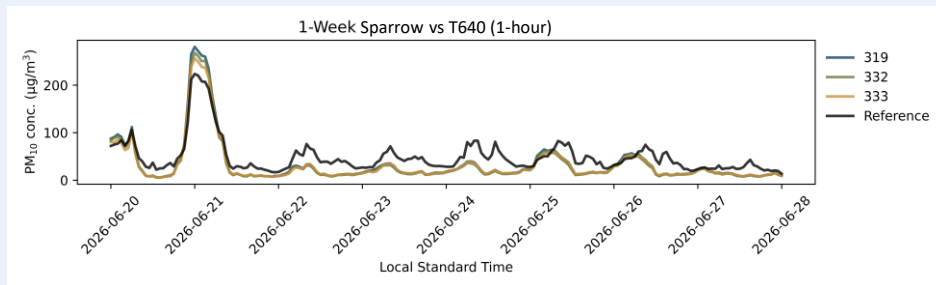


Interpretation: The Sparrow units showed weak correlation with the corresponding T640 data ($0.31 < R^2 < 0.32$) for 5-minute averaging.

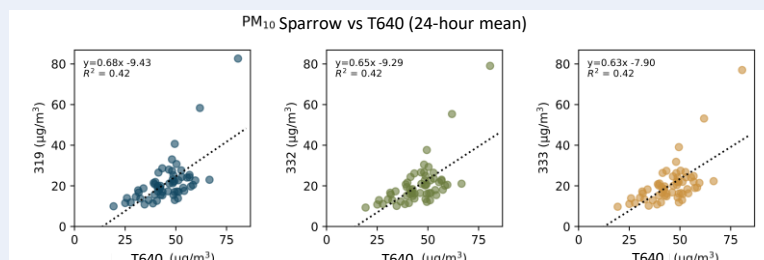
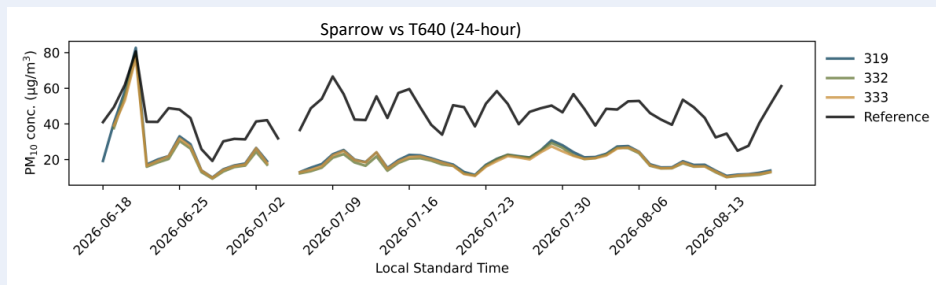
Section 7: PM₁₀

Section 7.4: Linearity (R²)

Timeseries of a 1-week subset of the 8-week evaluation



Interpretation: The Sparrow units showed weak correlation with the corresponding T640 data ($0.44 < R^2 < 0.46$) for 1-hour averaging.



Interpretation: The Sparrow units showed weak correlation with the corresponding T640 data ($0.41 < R^2 < 0.43$) for 24-hour averaging.

Section 8: Summary Metrics

		NO ₂		
		5-minute averages	1-hour averages	24-hour averages
Sparrow	Average*	18.34	25.00	15.97
	SD*	12.09	9.05	4.40
	Range*	0.00 to 62.11	0.00 to 47.04	8.68 to 25.28
	Abs. IMV*	0.9	1.4	0.7
	Rel. IMV (%)	5.0	5.7	4.5
	CV (RSD, %)	65.90	36.19	27.51
FRM T200	Average*	14.50	14.81	14.54
	SD*	8.77	8.46	4.29
	Range*	1.40 to 49.21	1.85 to 44.25	4.06 to 24.53
	CV (RSD, %)	60.46	57.16	29.49
Sparrow vs. FRM T200	Pearson R ²	0.53 to 0.71	0.61 to 0.83	0.91 to 0.98
	Spearman ρ	0.73 to 0.85	0.79 to 0.92	0.93 to 0.99
	Kendall τ	0.56 to 0.67	0.65 to 0.78	0.83 to 0.96
	Slope	0.93 to 1.23	0.82 to 1.08	0.76 to 0.99
	Intercept*	0.19 to 2.91	6.50 to 8.51	5.02 to 6.59
	MBE*	1.87 to 3.61	5.13 to 7.90	3.84 to 4.93
	nMBE _{mean}	0.12 to 0.24	0.28 to 0.43	0.32 to 0.42
	nMBE _{range}	0.04 to 0.08	0.14 to 0.22	0.22 to 0.29
	MAE*	6.94 to 7.77	6.92 to 8.31	3.84 to 4.93
	nMAE _{mean}	0.46 to 0.51	0.38 to 0.46	0.33 to 0.42
	nMAE _{range}	0.15 to 0.16	0.19 to 0.23	0.22 to 0.29
	RMSE*	7.88 to 8.69	7.52 to 8.85	4.11 to 4.97
	nRMSE _{mean}	0.52 to 0.57	0.41 to 0.49	0.35 to 0.42
	nRMSE _{range}	0.16 to 0.18	0.21 to 0.25	0.24 to 0.29

*Units in: ppb

Section 8: Summary Metrics

		O ₃		
		5-minute averages	1-hour averages	8-hour averages
Sparrow	Average*	35.69	16.15	17.76
	SD*	32.31	18.77	16.64
	Range*	0.00 to 158.38	0.00 to 116.47	0.00 to 52.97
	Abs. IMV*	3.6	3.3	3.3
	Rel. IMV (%)	10.0	21.2	18.6
	CV (RSD, %)	91.17	118.94	95.62
FEM T400	Average*	39.51	37.11	37.59
	SD*	29.54	28.79	22.95
	Range*	0.59 to 134.22	1.10 to 128.71	3.33 to 83.44
	CV (RSD, %)	74.76	77.58	61.05
Sparrow vs. FEM T400	Pearson R ²	0.95 to 0.96	0.96 to 0.97	0.96 to 0.97
	Spearman ρ	0.98 to 0.99	0.96 to 0.98	0.97 to 0.98
	Kendall τ	0.90	0.86 to 0.89	0.88 to 0.89
	Slope	1.11 to 1.15	1.19 to 1.27	1.08 to 1.15
	Intercept*	-5.31 to 2.35	-6.14 to -0.47	-5.72 to 0.54
	MBE*	-0.89 to 6.13	-2.99 to 3.50	-4.06 to 2.50
	nMBE _{mean}	-0.03 to 0.17	-0.18 to 0.21	-0.21 to 0.13
	nMBE _{range}	-0.01 to 0.05	-0.03 to 0.04	-0.08 to 0.05
	MAE*	5.68 to 7.82	4.56 to 4.70	3.36 to 4.82
	nMAE _{mean}	0.16 to 0.22	0.28	0.18 to 0.24
	nMAE _{range}	0.04 to 0.06	0.05 to 0.06	0.07 to 0.10
	RMSE*	7.18 to 9.91	5.47 to 6.18	4.42 to 5.28
	nRMSE _{mean}	0.21 to 0.28	0.33 to 0.37	0.23 to 0.27
	nRMSE _{range}	0.05 to 0.07	0.06 to 0.07	0.09 to 0.11

*Units in: ppb

Section 8: Summary Metrics

		PM ₁		
		5-minute averages	1-hour averages	24-hour averages
Sparrow	Average*	9.45	9.44	9.50
	SD*	11.25	11.14	6.47
	Range*	0.82 to 155.50	1.46 to 151.72	3.85 to 45.67
	Abs. IMV*	0.3	0.3	0.3
	Rel. IMV (%)	3.1	3.1	3.1
	CV (RSD, %)	119.18	118.02	68.16
T640	Average*	9.91	9.91	9.91
	SD*	10.04	9.96	5.95
	Range*	2.44 to 150.98	2.93 to 146.45	4.37 to 46.31
	CV (RSD, %)	101.30	100.51	60.00
Sparrow vs. T640	Pearson R ²	0.94	0.95	0.97
	Spearman ρ	0.83 to 0.87	0.84 to 0.88	0.96
	Kendall τ	0.64 to 0.69	0.65 to 0.70	0.83 to 0.84
	Slope	1.07 to 1.09	1.07 to 1.09	1.04 to 1.06
	Intercept*	-1.51 to -0.89	-1.52 to -0.90	-1.19 to -0.66
	MBE*	-0.76 to -0.20	-0.76 to -0.20	-0.76 to -0.19
	nMBE _{mean}	-0.08 to -0.02	-0.08 to -0.02	-0.08 to -0.02
	nMBE _{range}	-0.01 to -0.00	-0.01 to -0.00	-0.02 to -0.00
	MAE*	1.97 to 2.22	1.90 to 2.16	0.90 to 1.14
	nMAE _{mean}	0.20 to 0.22	0.19 to 0.22	0.09 to 0.11
	nMAE _{range}	0.01	0.01 to 0.02	0.02 to 0.03
	RMSE*	2.77 to 2.97	2.61 to 2.82	1.20 to 1.32
	nRMSE _{mean}	0.28 to 0.30	0.26 to 0.28	0.12 to 0.13
	nRMSE _{range}	0.02	0.02	0.03

*Units in: µg/m³

Section 8: Summary Metrics

		PM _{2.5}		
		5-minute averages	1-hour averages	24-hour averages
Sparrow	Average*	13.51	13.50	13.59
	SD*	16.03	15.84	9.03
	Range*	1.13 to 235.01	2.05 to 228.46	5.79 to 66.53
	Abs. IMV*	0.3	0.3	0.3
	Rel. IMV (%)	2.1	2.1	2.1
	CV (RSD, %)	118.65	117.35	66.48
	PM _c Conc.*	6.90 to 7.64	6.90 to 7.64	6.98 to 7.68
	Fine Fraction	0.63 to 0.64	0.62 to 0.64	0.62 to 0.64
FEM T640	Average*	13.95	13.95	13.96
	SD*	11.19	11.07	6.38
	Range*	3.04 to 166.32	3.95 to 160.68	6.53 to 51.91
	CV (RSD, %)	80.21	79.29	45.70
	PM _c Conc.*	31.51	31.50	31.54
	Fine Fraction	0.32	0.32	0.31
Sparrow vs. FEM T640	Pearson R ²	0.94 to 0.95	0.95 to 0.96	0.97
	Spearman ρ	0.87 to 0.90	0.88 to 0.91	0.95 to 0.96
	Kendall τ	0.68 to 0.72	0.70 to 0.74	0.82 to 0.84
	Slope	1.33 to 1.43	1.33 to 1.44	1.31 to 1.41
	Intercept*	-6.23 to -5.03	-6.34 to -5.13	-5.95 to -4.90
	MBE*	-0.74 to -0.16	-0.74 to -0.15	-0.74 to -0.15
	nMBE _{mean}	-0.05 to -0.01	-0.05 to -0.01	-0.05 to -0.01
	nMBE _{range}	-0.00	-0.00	-0.02 to -0.00
	MAE*	3.02 to 3.47	2.91 to 3.35	1.83 to 2.14
	nMAE _{mean}	0.22 to 0.25	0.21 to 0.24	0.13 to 0.15
	nMAE _{range}	0.02	0.02	0.04 to 0.05
	RMSE*	5.07 to 6.37	4.84 to 6.15	2.62 to 3.17
	nRMSE _{mean}	0.36 to 0.46	0.35 to 0.44	0.19 to 0.23
	nRMSE _{range}	0.03 to 0.04	0.03 to 0.04	0.06 to 0.07

*Units in: µg/m³

Section 8: Summary Metrics

		PM ₁₀		
		5-minute averages	1-hour averages	24-hour averages
Sparrow	Average*	20.68	20.68	20.83
	SD*	20.16	19.69	10.72
	Range*	1.40 to 291.42	3.21 to 280.84	9.33 to 82.69
	Abs. IMV*	0.7	0.7	0.7
	Rel. IMV (%)	3.2	3.2	3.2
	CV (RSD, %)	97.44	95.21	51.46
	PM _c Conc.*	6.90 to 7.64	6.90 to 7.64	6.98 to 7.68
	Fine Fraction	0.63 to 0.64	0.62 to 0.64	0.62 to 0.64
T640	Average*	45.47	45.46	45.50
	SD*	31.80	24.81	10.74
	Range*	8.22 to 1209.16	9.46 to 349.08	19.27 to 80.68
	CV (RSD, %)	69.95	54.58	23.60
	PM _c Conc.*	31.51	31.50	31.54
	Fine Fraction	0.32	0.32	0.31
Sparrow vs. T640	Pearson R ²	0.31 to 0.32	0.45	0.42
	Spearman ρ	0.61 to 0.63	0.64 to 0.65	0.56 to 0.58
	Kendall τ	0.43 to 0.45	0.45 to 0.47	0.39 to 0.41
	Slope	0.34 to 0.38	0.52 to 0.56	0.63 to 0.68
	Intercept*	4.10 to 5.03	-4.12 to -2.97	-9.43 to -7.90
	MBE*	-25.08 to -23.75	-25.03 to -23.74	-25.25 to -23.91
	nMBE _{mean}	-0.55 to -0.53	-0.55 to -0.53	-0.55 to -0.53
	nMBE _{range}	-0.02	-0.07	-0.41 to -0.39
	MAE*	24.66 to 25.70	24.59 to 25.59	23.98 to 25.25
	nMAE _{mean}	0.55 to 0.57	0.54 to 0.57	0.53 to 0.55
	nMAE _{range}	0.02	0.07 to 0.08	0.39 to 0.41
	RMSE*	35.49 to 36.40	30.20 to 31.12	25.56 to 26.77
	nRMSE _{mean}	0.79 to 0.81	0.67 to 0.69	0.56 to 0.59
	nRMSE _{range}	0.03	0.09	0.42 to 0.44

*Units in: µg/m³

Summary Metrics Guide

Average:	mean of individual sensor means; the grand mean
SD:	mean of individual sensor standard deviations (σ ; measure of variation of the values about its mean)
Range:	the highest and the lowest values observed
CV (RSD):	mean of individual sensor coefficient of variations (relative standard deviation; the ratio of the standard deviation to the mean, expressed as a percentage)
Abs. IMV:	intra-model variability expressed in absolute terms; standard deviation of individual sensor means
Rel. IMV:	intra-model variability expressed in relative terms; the ratio of the Absolute IMV to the Average
Pearson R^2 :	the squared value of the Pearson correlation coefficient; the square of the covariance of the reference and sensor measurements divided by the product of their standard deviations (a value from 0 to 1)
Spearman ρ :	Spearman's rank correlation coefficient; a measure of how well the reference and sensor measurements follow a monotonic relationship, based on their ranked values (a value from -1 to 1)
Kendall τ :	Kendall's rank correlation coefficient; a measure of the agreement in ordering between paired reference and sensor measurements, based on how often the pairs are in the same vs. opposite order (a value from -1 to 1)
Slope:	change in the sensor's value per unit increase in the reference monitor's value
Intercept:	the sensor's value when the reference monitor observes zero
MBE:	mean bias error; mean of the differences between reference and sensor measurements
$nMBE_{mean}$:	mean bias error normalized with respect to the reference mean value
$nMBE_{range}$:	mean bias error normalized with respect to the difference of the highest and lowest reference values
MAE:	mean absolute error; mean of the absolute differences between reference and sensor measurements
$nMAE_{mean}$:	mean absolute error normalized with respect to the reference mean value
$nMAE_{range}$:	mean absolute error normalized with respect to the difference of the highest and lowest reference values
RMSE:	root mean square error; the square root of the average squared differences between reference and sensor measurements
$nRMSE_{mean}$:	root mean square error normalized with respect to the reference mean value
$nRMSE_{range}$:	root mean square error normalized with respect to the difference of the highest and lowest reference values