AQ-SPEC
Air Quality Sensor Performance Evaluation Center

Field Evaluation Report for

Air Quality Egg 2024 Model

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Performance Snapshot

Air Quality Egg 2024 Model

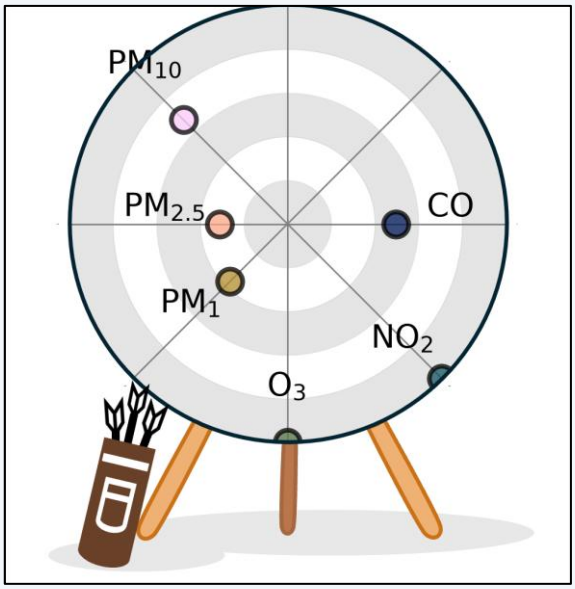


Tested: 10/09/2024 to 12/10/2024

✓ CO	○ SO_2
○ CO_2	○ VOC
○ CH_4	✓ PM_1
○ H_2S	✓ $PM_{2.5}$
○ NO	○ PM_4
✓ NO_2	✓ PM_{10}
○ NO_x	○ UFP
✓ O_3	○ BC

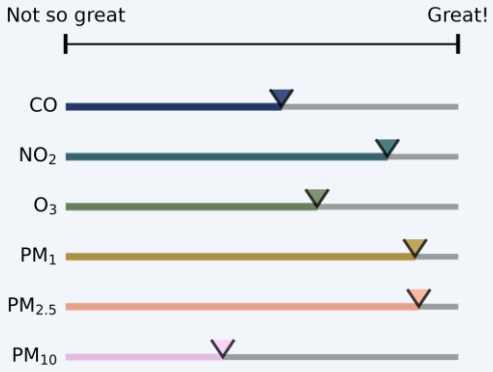
✓ Tested ○ Not tested ○ Not available

Does it hit the target?

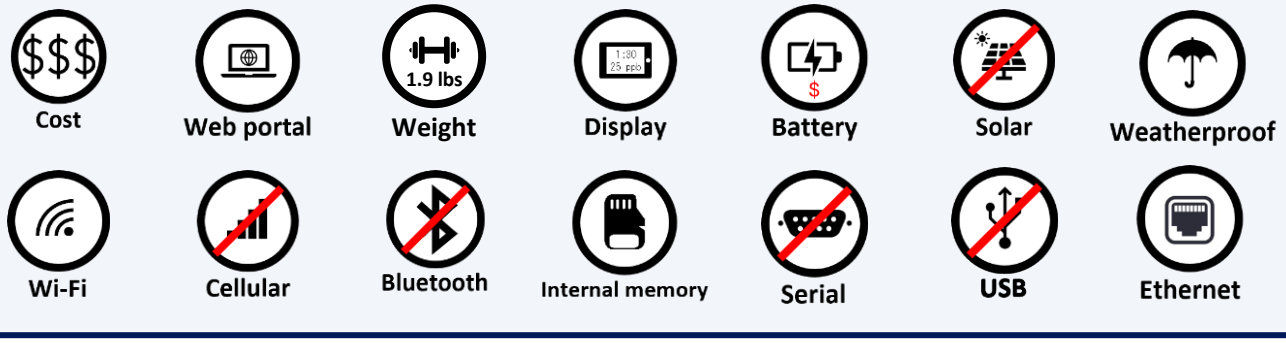


The closer the sensor lands near the center, the more accurate its readings were compared to the pollution levels.

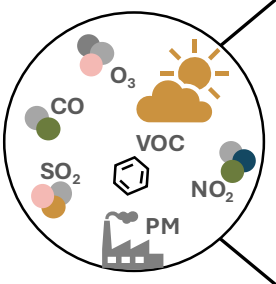
How well does it track?



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.

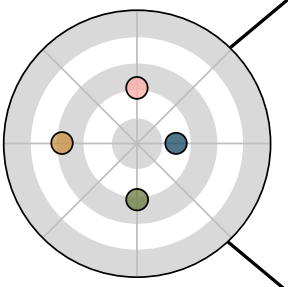


Performance Snapshot Guide



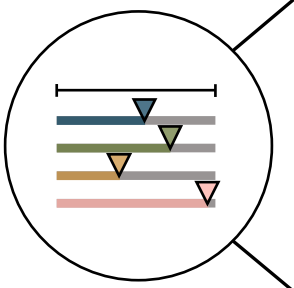
Pollutant List: This list shows the pollutants that the sensor is capable of measuring. Pollutants highlighted in blue with a check mark were tested for performance, those in gray were not tested, and those in white are not measured by the sensor.

◆ **CH_4** methane ◆ **CO** carbon monoxide ◆ **CO_2** carbon dioxide ◆ **H_2S** hydrogen sulfide ◆ **NO** nitric oxide ◆ **NO_2** nitrogen dioxide ◆ **NO_x** nitrogen oxides ◆ **O_3** ozone ◆ **SO_2** sulfur dioxide ◆ **VOC** volatile organic compounds ◆ **BC** black carbon ◆ **PM_1** mass of particles smaller than 1 micrometer ◆ **$PM_{2.5}$** mass of particles smaller than 2.5 micrometers ◆ **PM_4** mass or particles smaller than 4 micrometers ◆ **PM_{10}** 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	04/01/2025	Original issued report
1	10/29/2026	Revision issued due to: reanalysis with automated script; price update; PM results against T640 only; new AQ-SPEC report format

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	Jenna Drewitz, Victor Rocha Jr., and Randy Lam	12/10/2024
Analysis by	Ehsan Mosadegh, PhD	03/05/2025
Quality Control Review by	Michelle Kuang, PhD	03/05/2025
Approved by	Wilton Mui, PhD	03/27/2025
Revision by	Ehsan Mosadegh, PhD	09/01/2026

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Section 1: Background

Three Air Quality Egg 2024 (hereinafter Egg 2024) units (IDs: 37eb, 57b6, 4f80) were deployed at the South Coast AQMD stationary ambient monitoring site in Rubidoux, CA from 10/09/2024 to 12/10/2024. The evaluation period lasted 9 weeks. The sensor units were co-located with reference grade instruments as described below.



Air Quality Egg 2024 Model



Test site at Rubidoux, CA

Section 2: Manufacturer Specs

Parameter	Sensor: Air Quality Egg 2024 Model (raw sensor is Winsen ZE-12A)	Reference Instrument: Horiba APMA 370
Pollutant	CO	CO (FRM)
Cost	$2,694 (as-configured)	~$10,000
Weight	0.8 pounds	35 pounds
Dimensions (LxWxH)	5.9 x 8.3 x 2.2 inches	9 x 17 x 21 inches
Power	5 VDC @ 2 A (10 W)	100-240 VAC
Battery	No	No
Data transmission	Wi-Fi, Ethernet	Serial
Internal memory	Yes	No
Operating temperature range	32-104 degrees F	32-104 degrees F
Operating RH range	0-99%	nan
Product website	https://airqualityegg.com/home	https://www.horiba.com/int/process-and-environmental/products/detail/action/show/Product/apma-370-453/
Operating principle	Electrochemical	Non-dispersive infrared (NDIR) absorption
Time resolution	1 minute	1 minute (as-configured)
Concentration range	0-10 ppm	0-100 ppm

Section 2: Manufacturer Specs

Parameter	Sensor: Air Quality Egg 2024 Model (raw sensor is Winsen ZE-12A)	Reference Instrument: Teledyne T200
Pollutant	NO_2	NO (FRM), NO_2 (FRM), NOx
Cost	$2,694 (as-configured)	~$11,000
Weight	0.8 pounds	40 lbs
Dimensions (LxWxH)	5.9 x 8.3 x 2.2 inches	7 x 17 x 23.5 inches
Power	5 VDC @ 2 A (10 W)	100-240 VAC
Battery	No	No
Data transmission	Wi-Fi, Ethernet	Serial, Ethernet, USB
Internal memory	Yes	Yes
Operating temperature range	32-104 degrees F	41-104 degrees F
Operating RH range	0-99%	nan
Product website	https://airqualityegg.com/home	https://www.teledyne-api.com/en-us/products/t200
Operating principle	Electrochemical	Chemiluminescence
Time resolution	1 minute	1 minute (as-configured)
Concentration range	0-1000 ppb	0-20,000 ppb

Section 2: Manufacturer Specs

Parameter	Sensor: Air Quality Egg 2024 Model (raw sensor is Winsen ZE-12A)	Reference Instrument: Teledyne T400
Pollutant	O3	O3 (FEM)
Cost	$2,694 (as-configured)	~$7,000
Weight	0.8 pounds	31 lbs
Dimensions (LxWxH)	5.9 x 8.3 x 2.2 inches	7 x 17 x 23.5 inches
Power	5 VDC @ 2 A (10 W)	100-240 VAC
Battery	No	No
Data transmission	Wi-Fi, Ethernet	Serial, Ethernet, USB
Internal memory	Yes	Yes
Operating temperature range	32-104 degrees F	41-104 degrees F
Operating RH range	0-99%	nan
Product website	https://airqualityegg.com/home	https://www.teledyne-api.com/en-us/products/t400
Operating principle	Electrochemical	UV absorption
Time resolution	1 minute	1 minute (as-configured)
Concentration range	0-1000 ppb	0-10,000 ppb

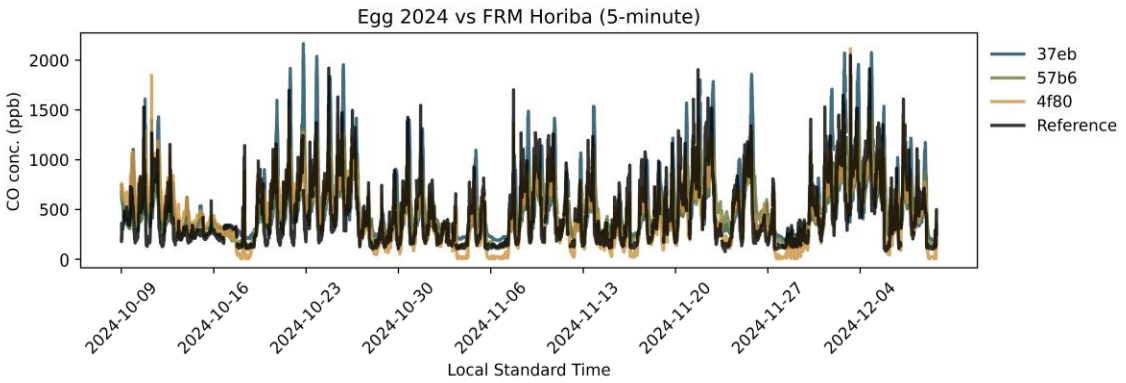
Section 2: Manufacturer Specs

Parameter	Sensor: Egg 2024 (raw sensor is Plantower PMS5003)	Reference Instrument: Teledyne API T640
Pollutant	PM_1, $PM_{2.5}$, PM_{10}	PM_1, $PM_{2.5}$ (FEM), PM_{10}
Cost	$2,694 (as-configured)	~$21,000
Weight	0.8 pounds	19 pounds
Dimensions (LxWxH)	5.9 x 8.3 x 2.2 inches	7 x 17 x 14 inches
Power	5 VDC @ 2 A (10 W)	100-240 VAC
Battery	No	No
Data transmission	Wi-Fi, Ethernet	Serial, Ethernet, USB
Internal memory	Yes	Yes (with USB flash drive)
Operating temperature range	32-104 degrees F	32-122 degrees F
Operating RH range	0-99%	0%-100%
Product website	https://airqualityegg.com/home	https://www.teledyne-api.com/en-us/products/t640
Operating principle	Optical light scattering	Optical light scattering
Time resolution	1 minute	1 minute (as-configured)
Concentration range	0-1000 µg/m³	0.1-10,000 µg/m³

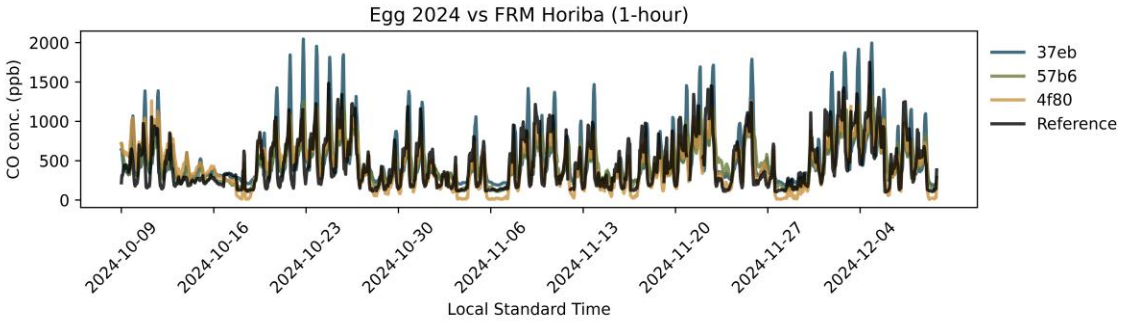
Section 3: CO

Section 3.1: Data Overview

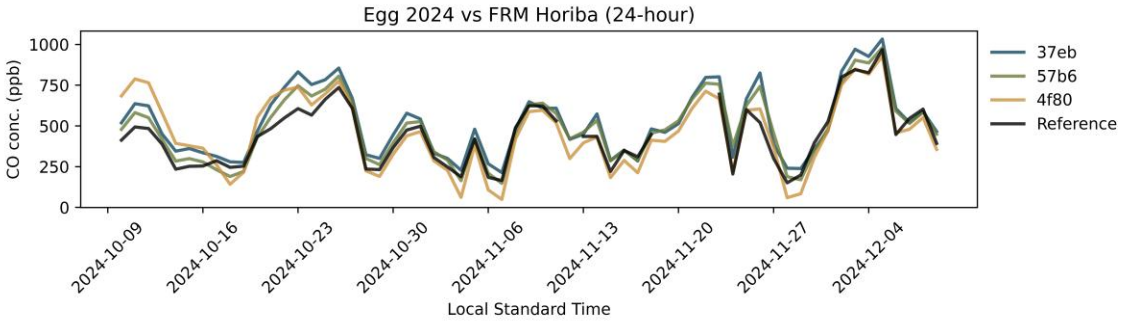
Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Section 3: CO

Section 3.2: Data Recovery

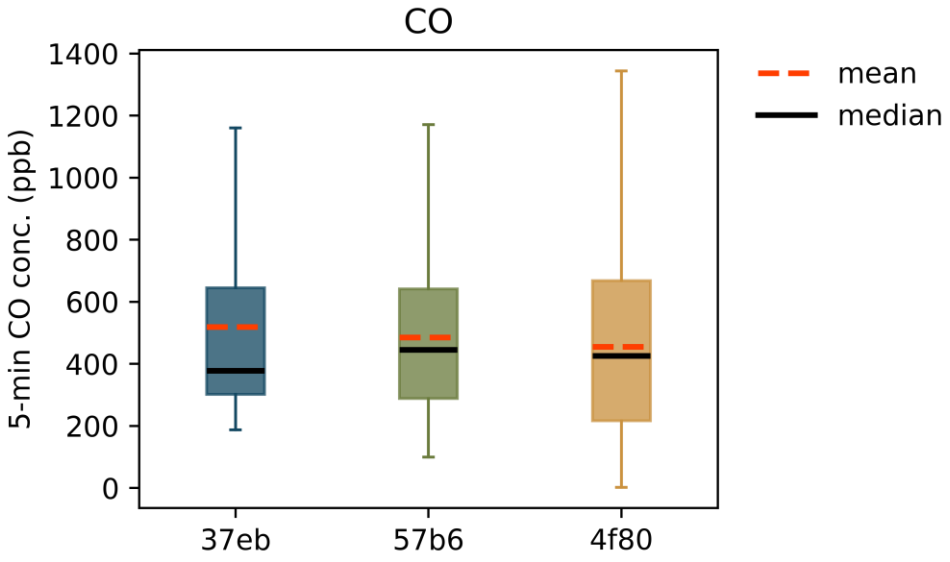
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire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

Parameter	37eb	57b6	4f80
CO	99.0%	97.3%	99.8%

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 (%)
CO	30.2	6.2



Interpretation: The Egg 2024 units had dissimilar pollutant distributions.

Section 3: CO

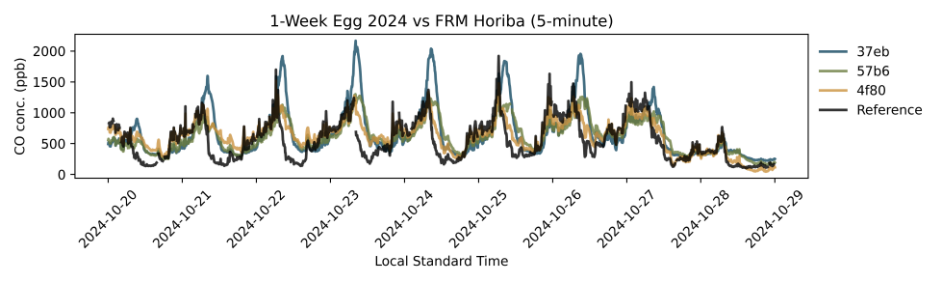
Section 3.4: Linearity (R^2)

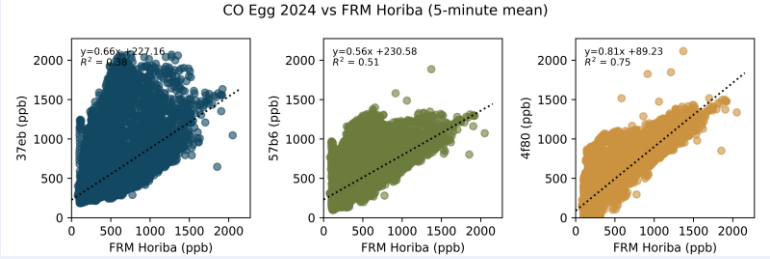
Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

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

Parameter	Time Resolution	FRM Horiba (mean ± SD)
CO	5-minute	0.54 ± 0.19
	1-hour	0.55 ± 0.19
	24-hour	0.87 ± 0.06

Timeseries of a 1-week subset of the 9-week evaluation



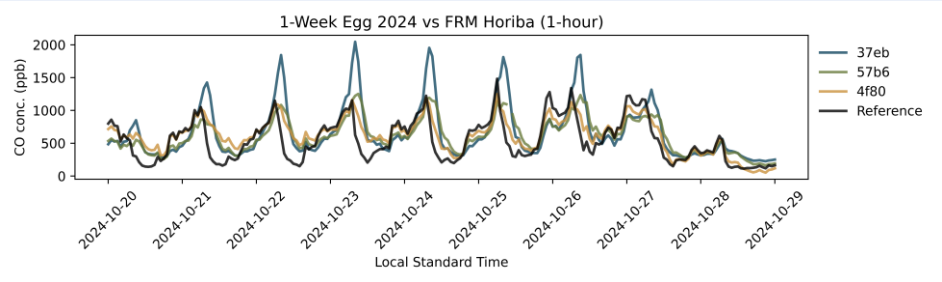


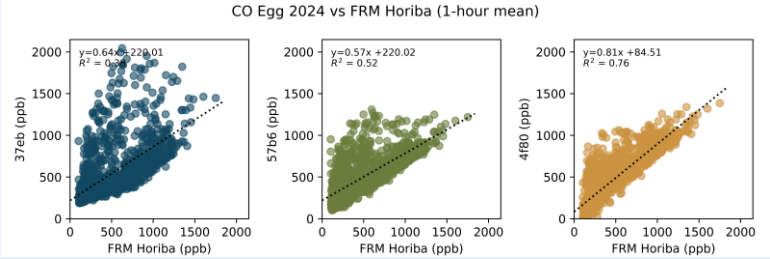
Interpretation: The Egg 2024 units showed weak to strong correlation with the corresponding FRM Horiba data ($0.37 < R^2 < 0.75$) for 5-minute averaging.

Section 3: CO

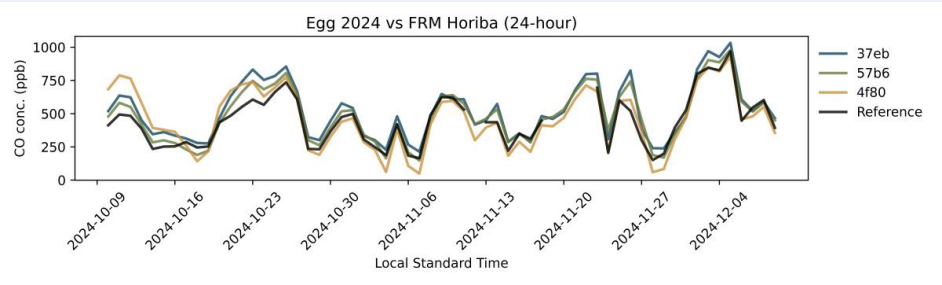
Section 3.4: Linearity (R^2)

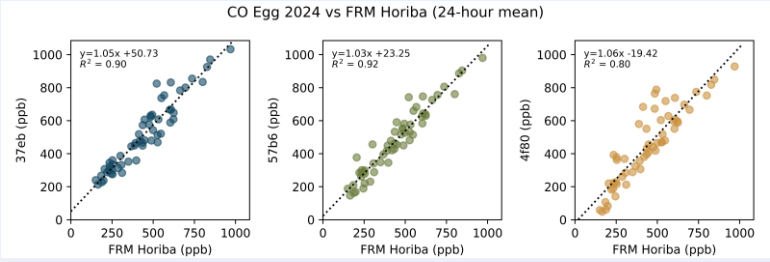
Timeseries of a 1-week subset of the 9-week evaluation





Interpretation: The Egg 2024 units showed weak to strong correlation with the corresponding FRM Horiba data ($0.38 < R^2 < 0.76$) for 1-hour averaging.



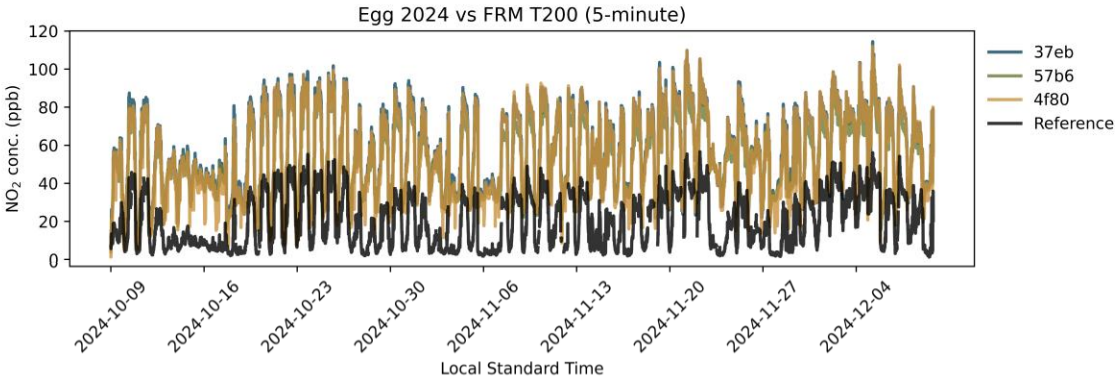


Interpretation: The Egg 2024 units showed strong to very strong correlation with the corresponding FRM Horiba data ($0.80 < R^2 < 0.92$) for 24-hour averaging.

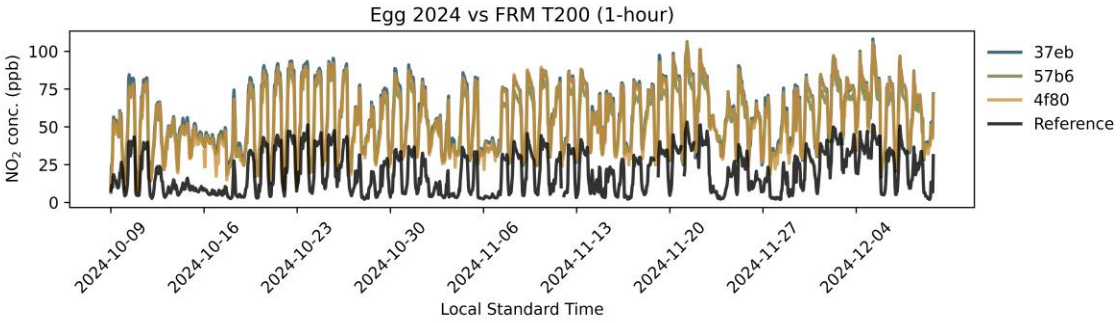
Section 4: NO_2

Section 4.1: Data Overview

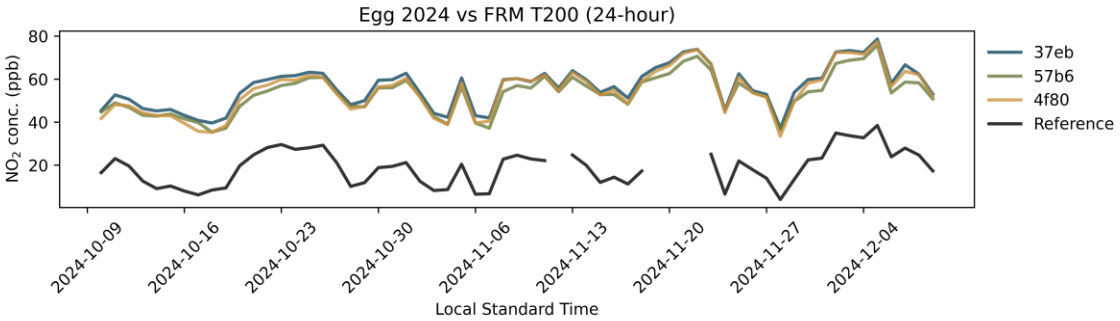
Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Section 4: NO_2

Section 4.2: Data Recovery

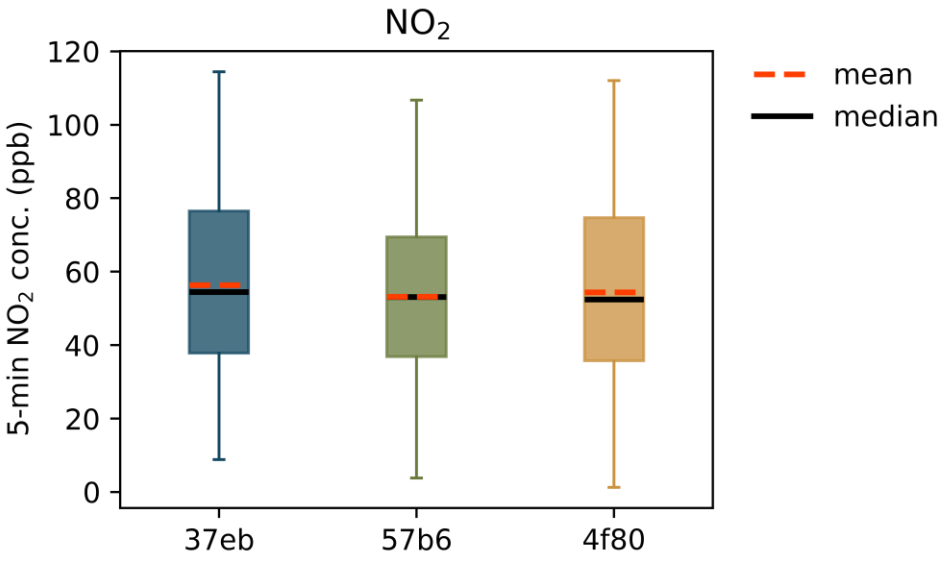
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire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

Parameter	37eb	57b6	4f80
NO_2	99.0%	97.2%	99.8%

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 (%)
NO_2	1.8	3.3



Interpretation: The Egg 2024 units had similar pollutant distributions.

Section 4: NO_2

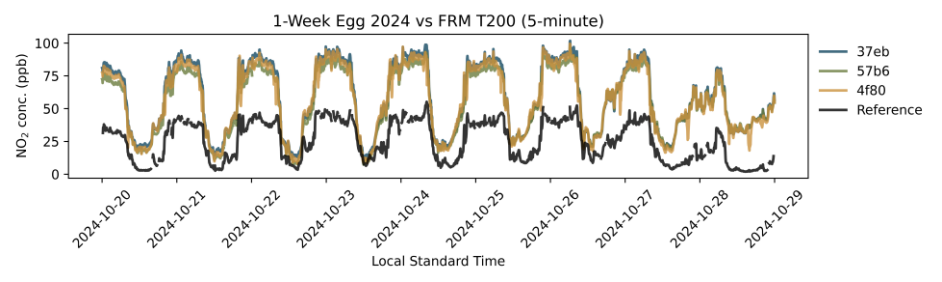
Section 4.4: Linearity (R^2)

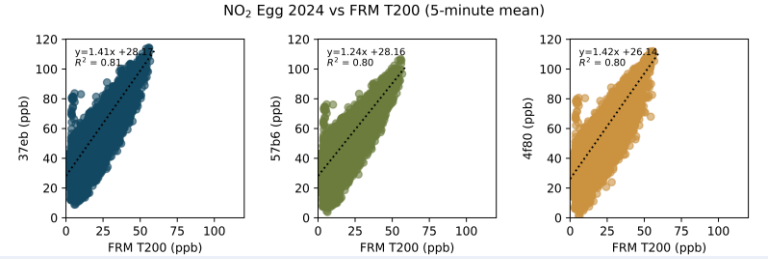
Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

A summary of the mean R^2 between the sensor and FRM T200 across all units tested.

Parameter	Time Resolution	FRM T200 (mean ± SD)
NO_2	5-minute	0.80 ± 0.01
	1-hour	0.82 ± 0.00
	24-hour	0.83 ± 0.03

Timeseries of a 1-week subset of the 9-week evaluation



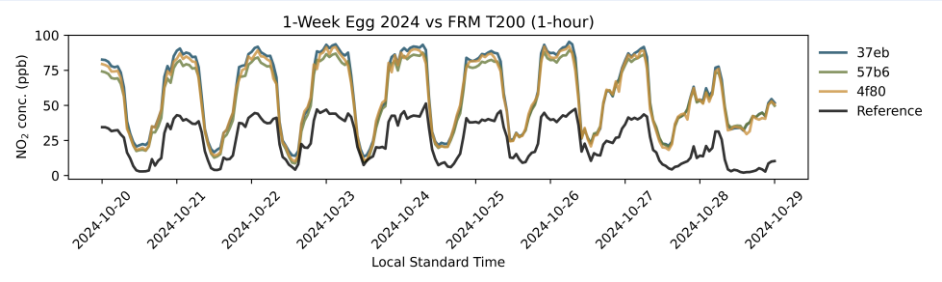


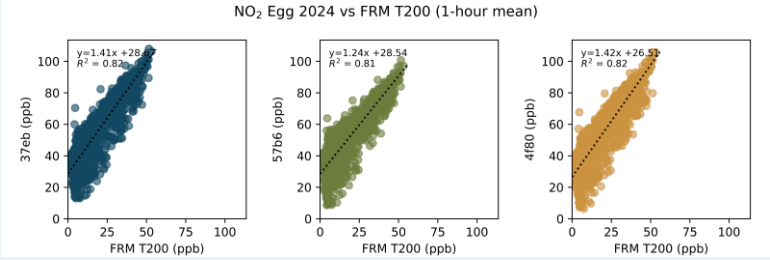
Interpretation: The Egg 2024 units showed strong correlation with the corresponding FRM T200 data ($0.79 < R^2 < 0.81$) for 5-minute averaging.

Section 4: NO_2

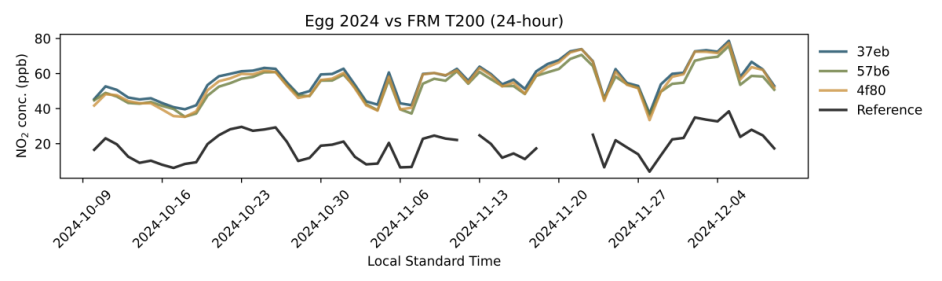
Section 4.4: Linearity (R^2)

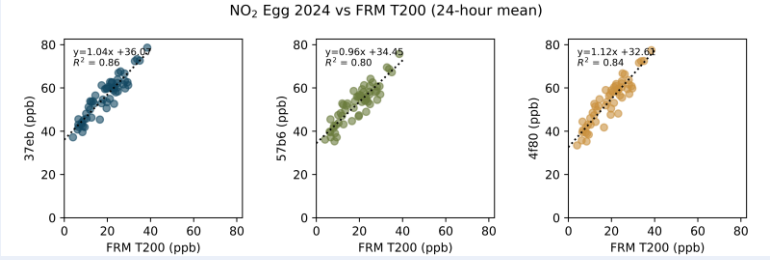
Timeseries of a 1-week subset of the 9-week evaluation





Interpretation: The Egg 2024 units showed strong correlation with the corresponding FRM T200 data ($0.81 < R^2 < 0.82$) for 1-hour averaging.



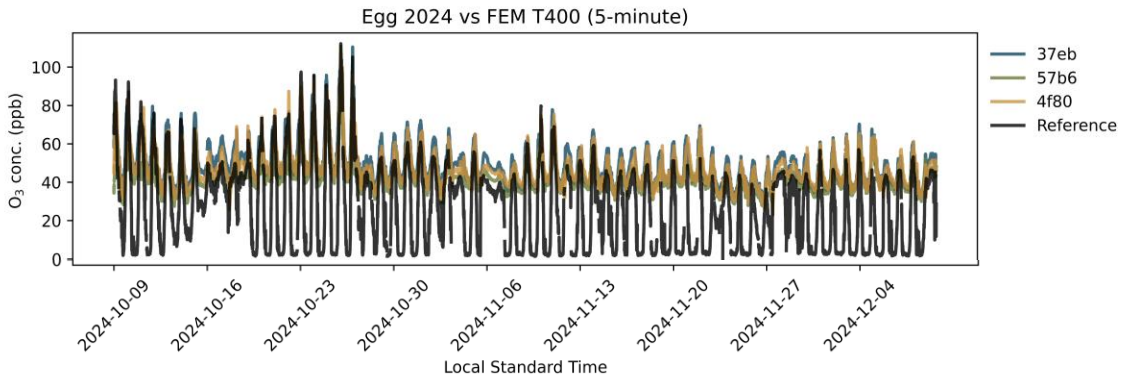


Interpretation: The Egg 2024 units showed strong correlation with the corresponding FRM T200 data ($0.80 < R^2 < 0.86$) for 24-hour averaging.

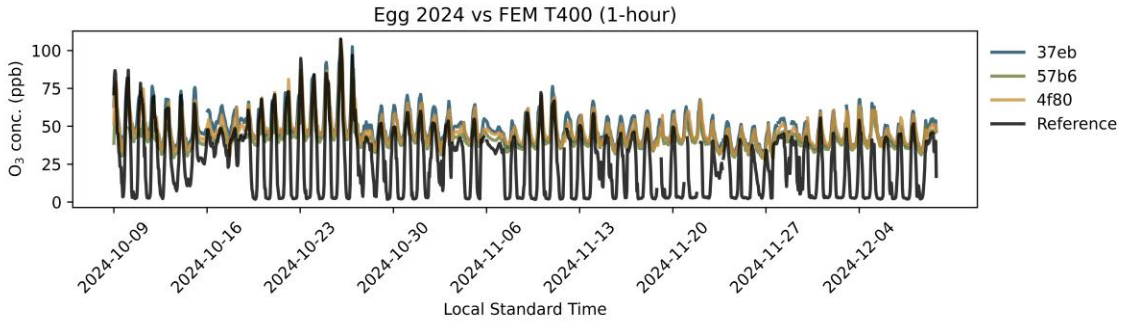
Section 5: O_3

Section 5.1: Data Overview

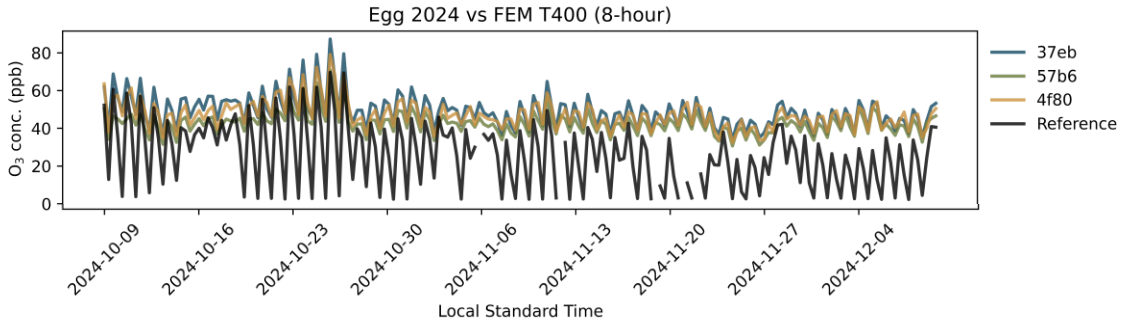
Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Section 5: O_3

Section 5.2: Data Recovery

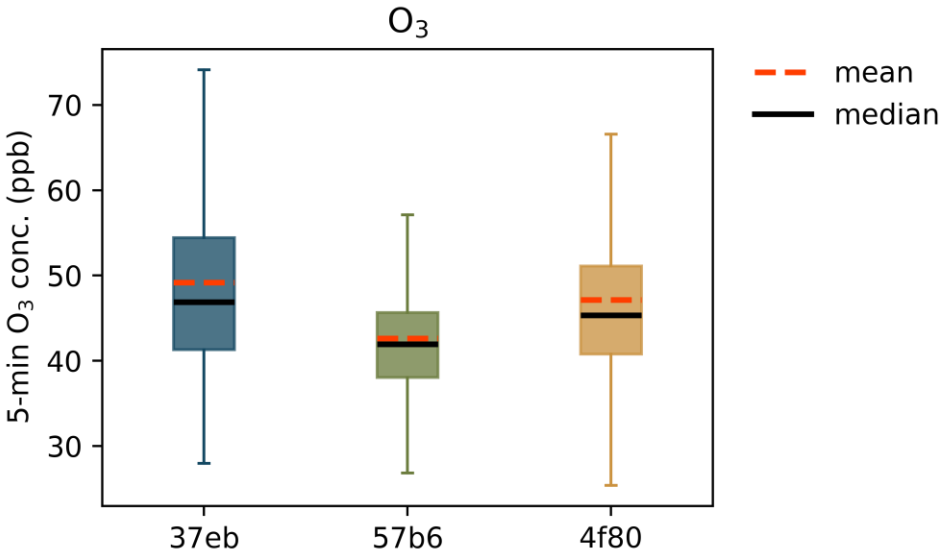
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire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

Parameter	37eb	57b6	4f80
O3	98.9%	97.3%	99.8%

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 (%)
O3	3.2	7.0



Interpretation: Two out of three of the Egg 2024 units had similar pollutant distributions.

Section 5: O_3

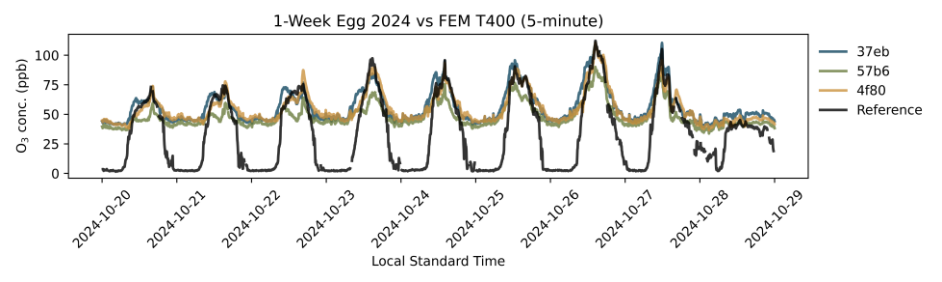
Section 5.4: Linearity (R^2)

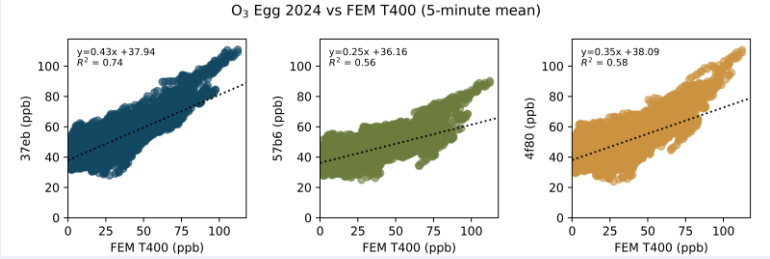
Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

A summary of the mean R^2 between the sensor and FEM T400 across all units tested.

Parameter	Time Resolution	FEM T400 (mean ± SD)
O3	5-minute	0.63 ± 0.10
	1-hour	0.64 ± 0.10
	8-hour	0.60 ± 0.12

Timeseries of a 1-week subset of the 9-week evaluation



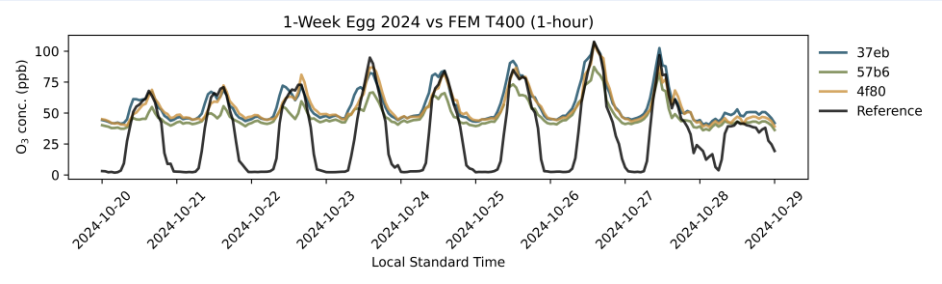


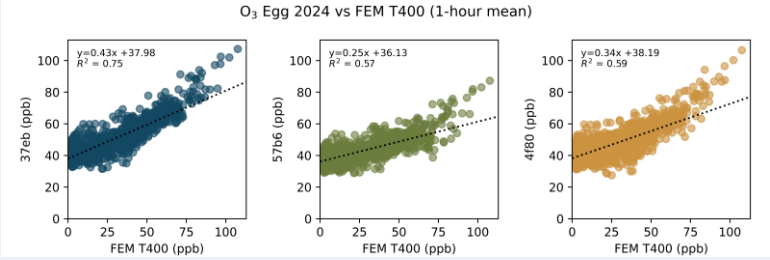
Interpretation: The Egg 2024 units showed moderate to strong correlation with the corresponding FEM T400 data ($0.56 < R^2 < 0.75$) for 5-minute averaging.

Section 5: O_3

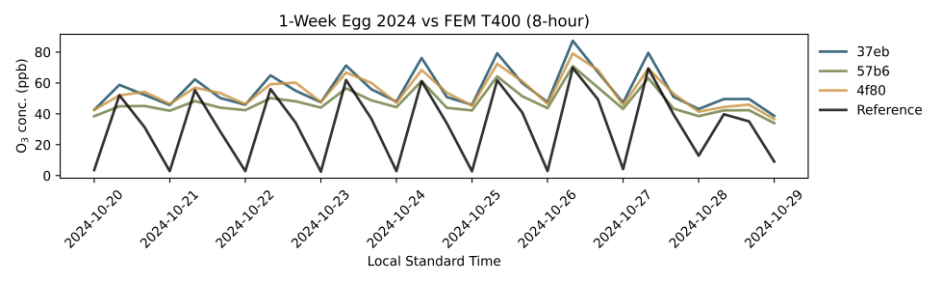
Section 5.4: Linearity (R^2)

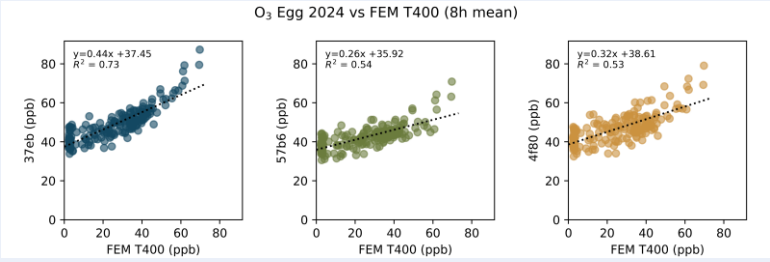
Timeseries of a 1-week subset of the 9-week evaluation





Interpretation: The Egg 2024 units showed moderate to strong correlation with the corresponding FEM T400 data ($0.57 < R^2 < 0.75$) for 1-hour averaging.



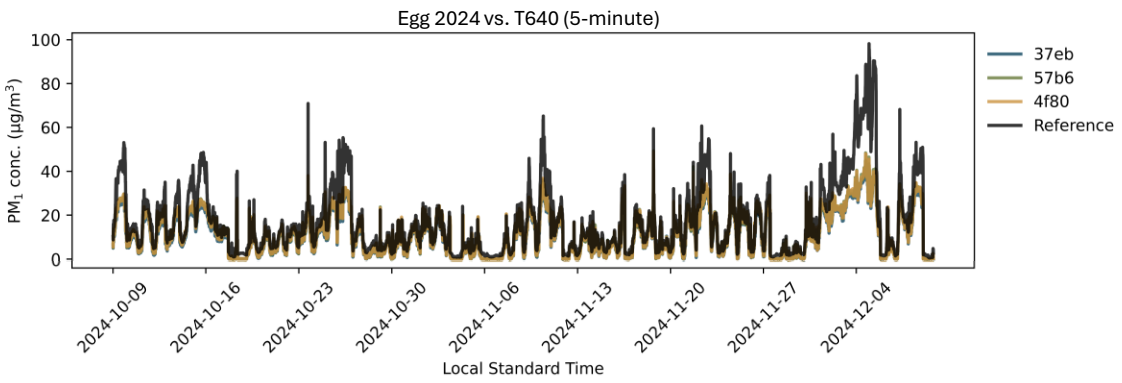


Interpretation: The Egg 2024 units showed moderate to strong correlation with the corresponding FEM T400 data ($0.52 < R^2 < 0.74$) for 8-hour averaging.

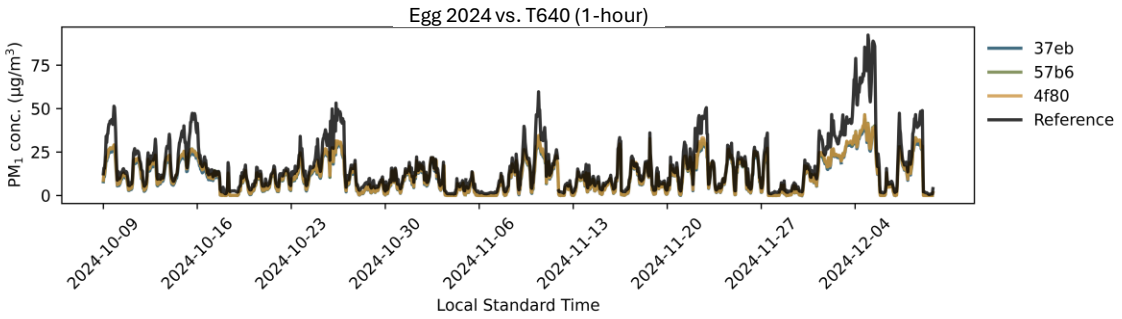
Section 6: PM_1

Section 6.1: Data Overview

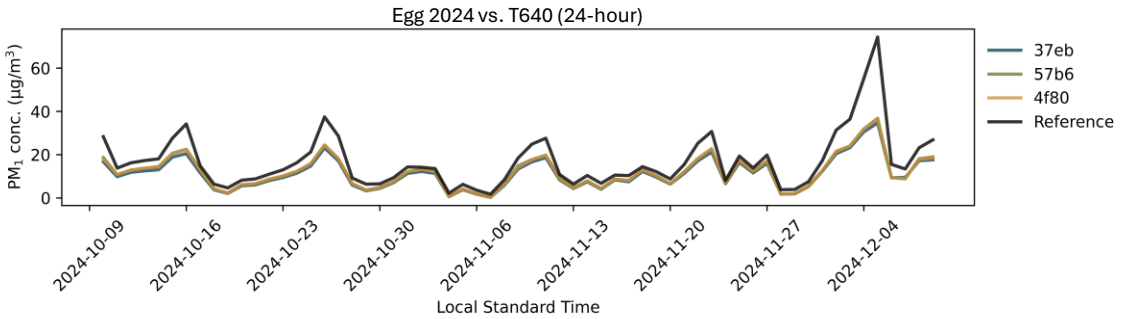
Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Section 6: PM_1

Section 6.2: Data Recovery

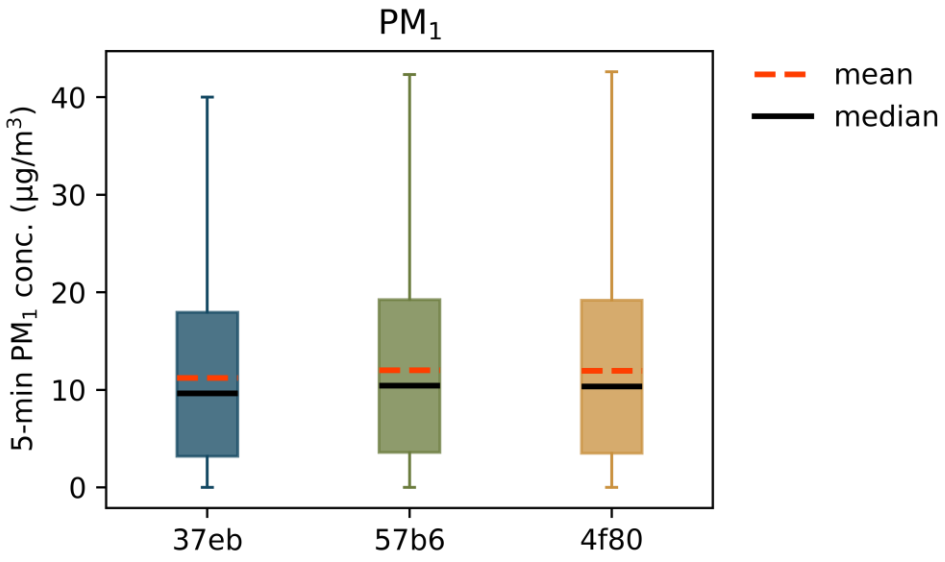
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire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

Parameter	37eb	57b6	4f80
PM_1	99.0%	97.3%	99.8%

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_1	0.4	3.5



Interpretation: The Egg 2024 units had similar pollutant distributions.

Section 6: PM_1

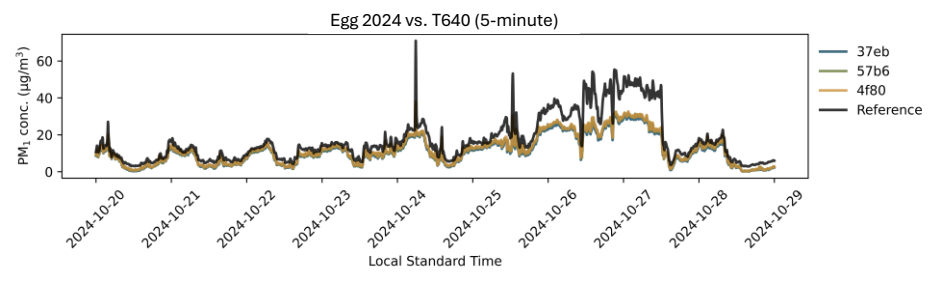
Section 6.4: Linearity (R^2)

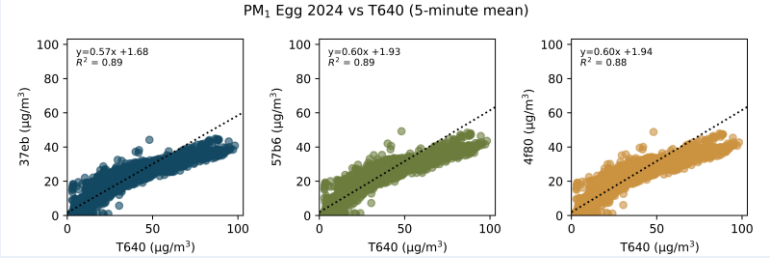
Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

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

Parameter	Time Resolution	T640 (mean ± SD)
PM_1	5-minute	0.89 ± 0.00
	1-hour	0.89 ± 0.00
	24-hour	0.93 ± 0.00

Timeseries of a 1-week subset of the 9-week evaluation



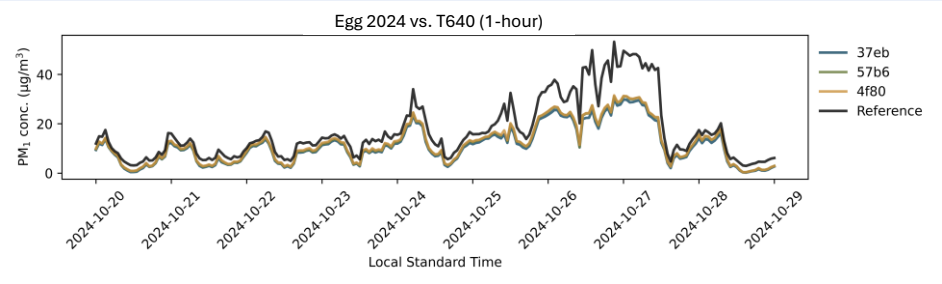


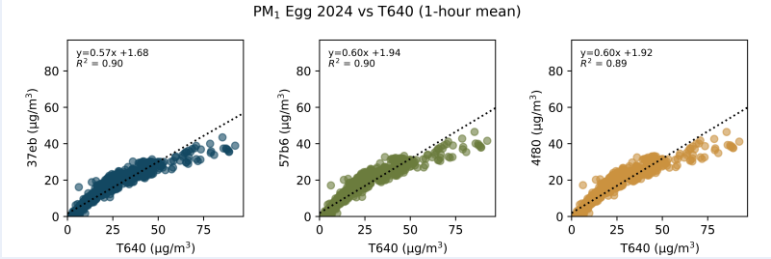
Interpretation: The Egg 2024 units showed strong correlation with the corresponding T640 data (0.88 < R^2 < 0.89) for 5-minute averaging.

Section 6: PM_1

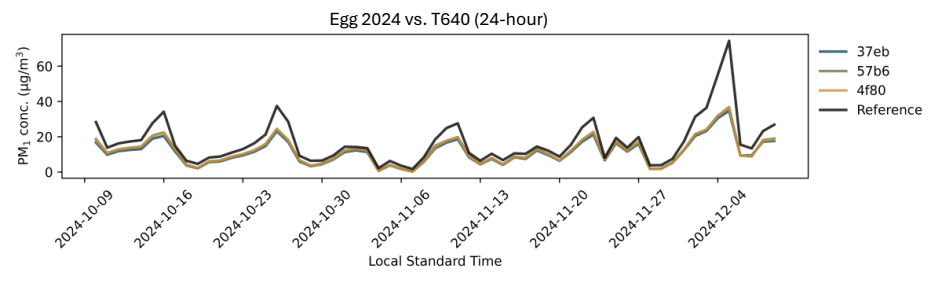
Section 6.4: Linearity (R^2)

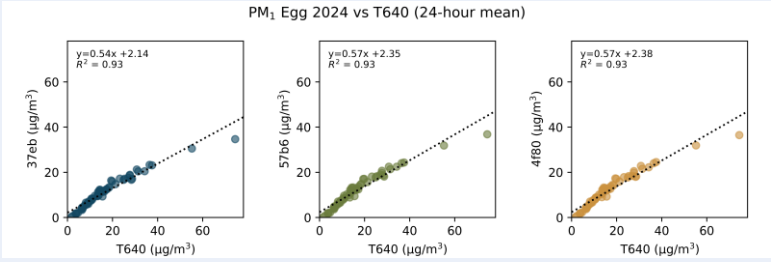
Timeseries of a 1-week subset of the 9-week evaluation





Interpretation: The Egg 2024 units showed strong to very strong correlation with the corresponding T640 data ($0.89 < R^2 < 0.90$) for 1-hour averaging.



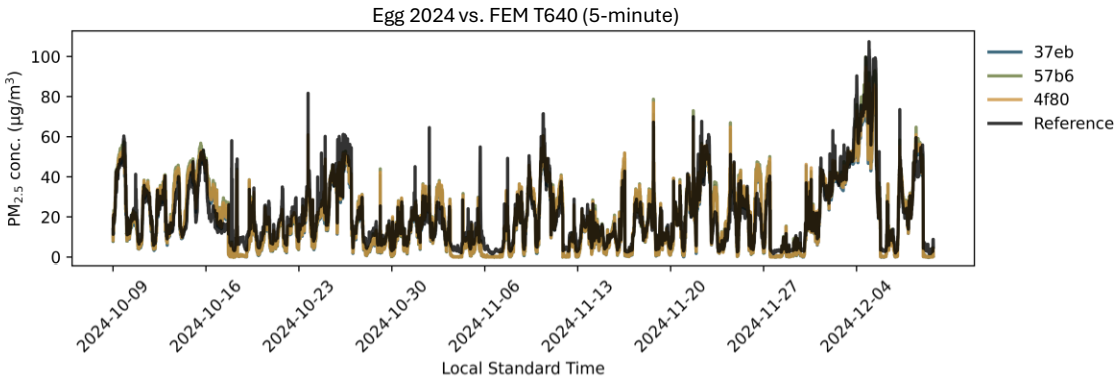


Interpretation: The Egg 2024 units showed very strong correlation with the corresponding T640 data ($0.92 < R^2 < 0.94$) for 24-hour averaging.

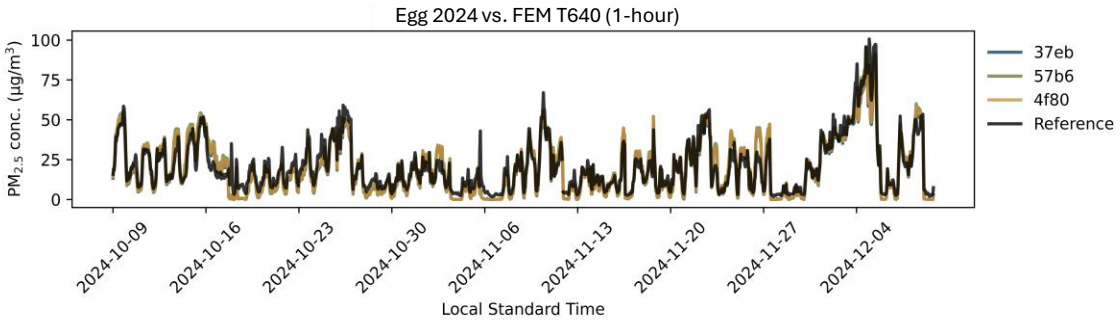
Section 7: $PM_{2.5}$

Section 7.1: Data Overview

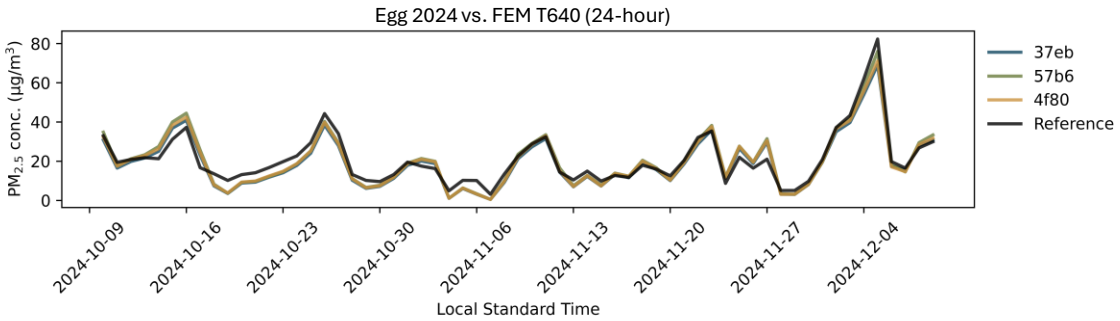
Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Section 7: $PM_{2.5}$

Section 7.2: Data Recovery

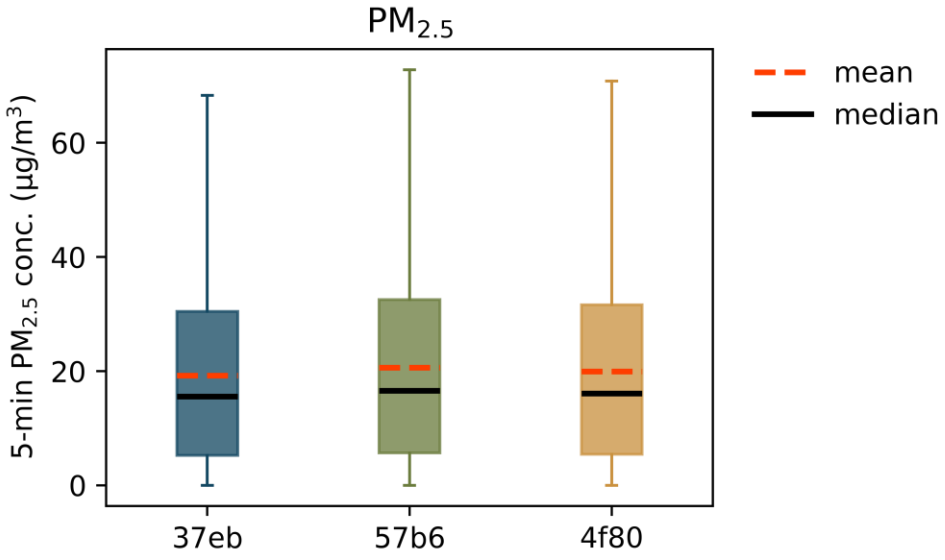
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire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

Parameter	37eb	57b6	4f80
$PM_{2.5}$	99.0%	97.3%	99.8%

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 (%)
$PM_{2.5}$	0.6	3.0



Interpretation: The Egg 2024 units had similar pollutant distributions.

Section 7: $PM_{2.5}$

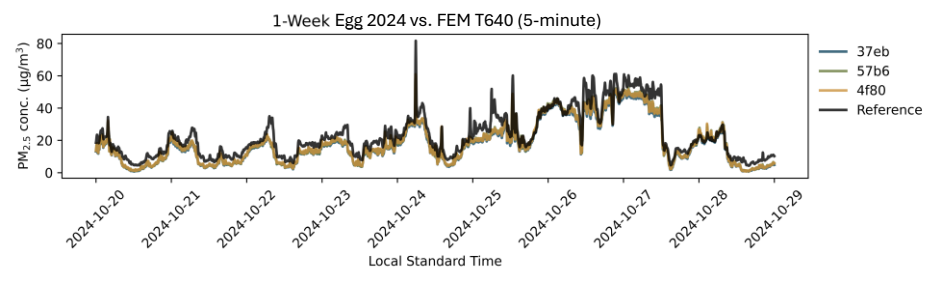
Section 7.4: Linearity (R^2)

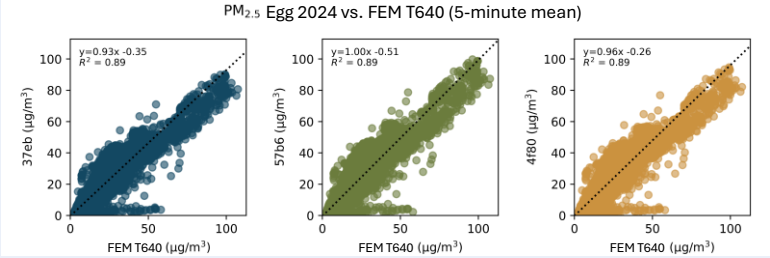
Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

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

Parameter	Time Resolution	FEM T640 (mean ± SD)
$PM_{2.5}$	5-minute	0.89 ± 0.00
	1-hour	0.90 ± 0.00
	24-hour	0.92 ± 0.00

Timeseries of a 1-week subset of the 9-week evaluation



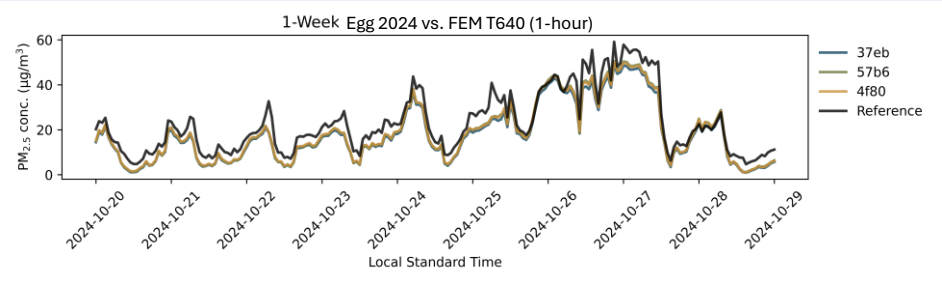


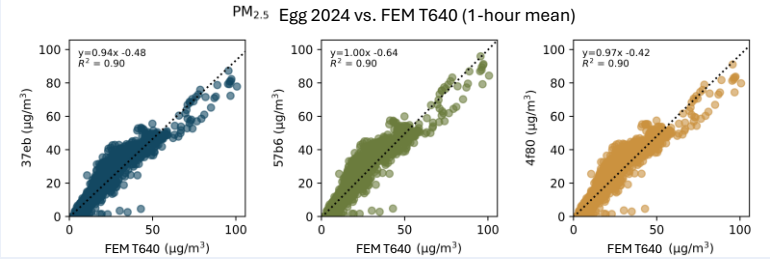
Interpretation: The Egg 2024 units showed strong correlation with the corresponding FEM T640 data ($0.89 < R^2 < 0.90$) for 5-minute averaging.

Section 7: $PM_{2.5}$

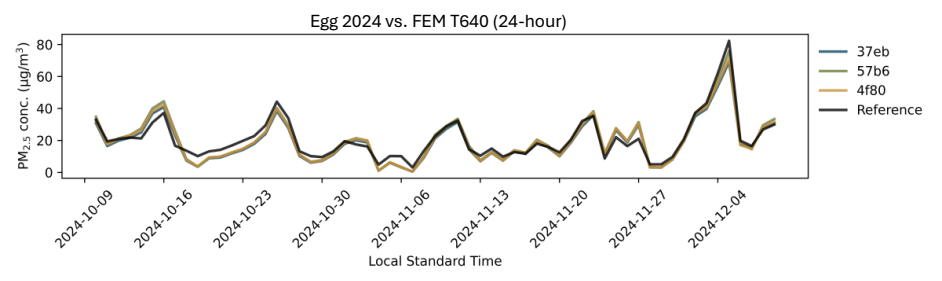
Section 7.4: Linearity (R^2)

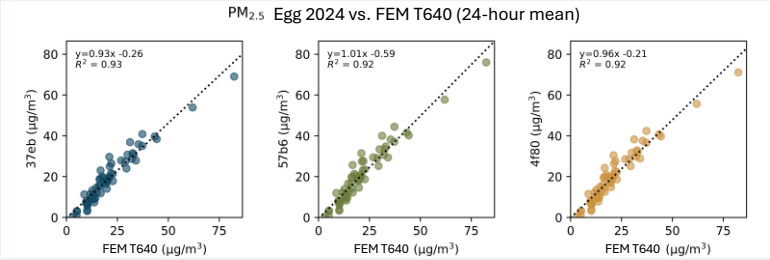
Timeseries of a 1-week subset of the 9-week evaluation





Interpretation: The Egg 2024 units showed very strong correlation with the corresponding FEM T640 data ($0.90 < R^2 < 0.91$) for 1-hour averaging.



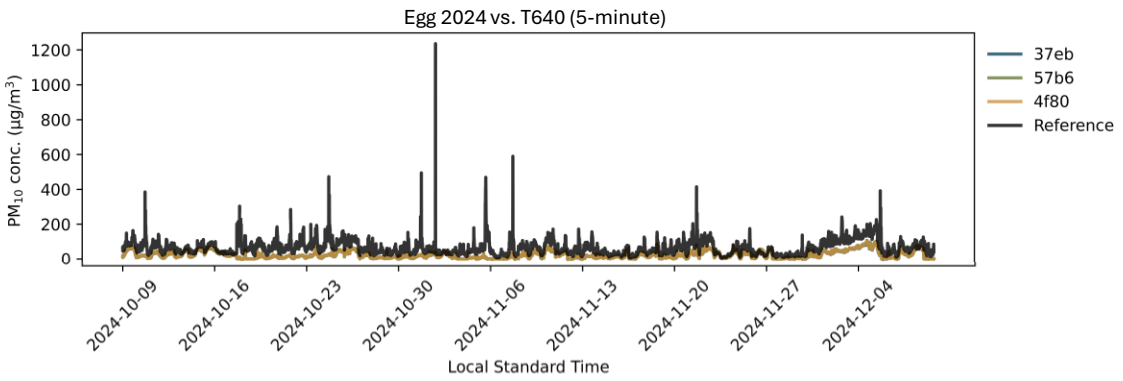


Interpretation: The Egg 2024 units showed very strong correlation with the corresponding FEM T640 data ($0.92 < R^2 < 0.93$) for 24-hour averaging.

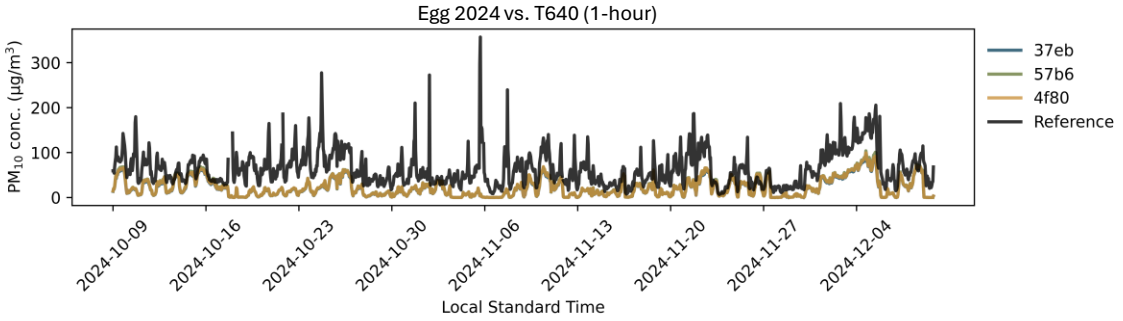
Section 8: PM_{10}

Section 8.1: Data Overview

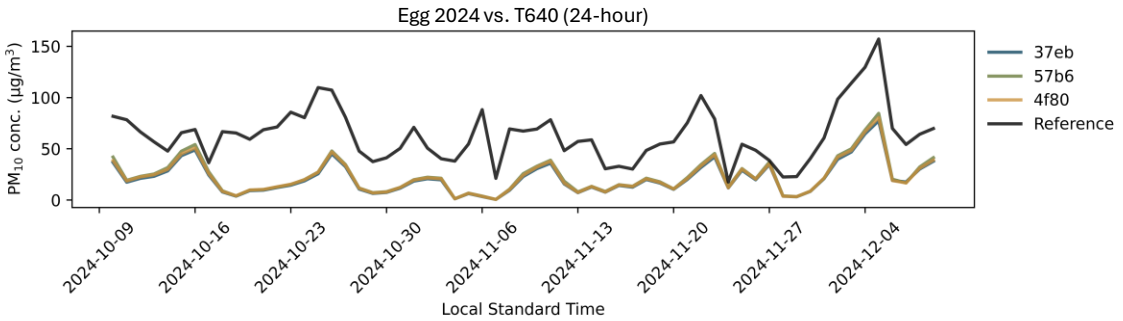
Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Timeseries of the 9-week evaluation



Section 8: PM_{10}

Section 8.2: Data Recovery

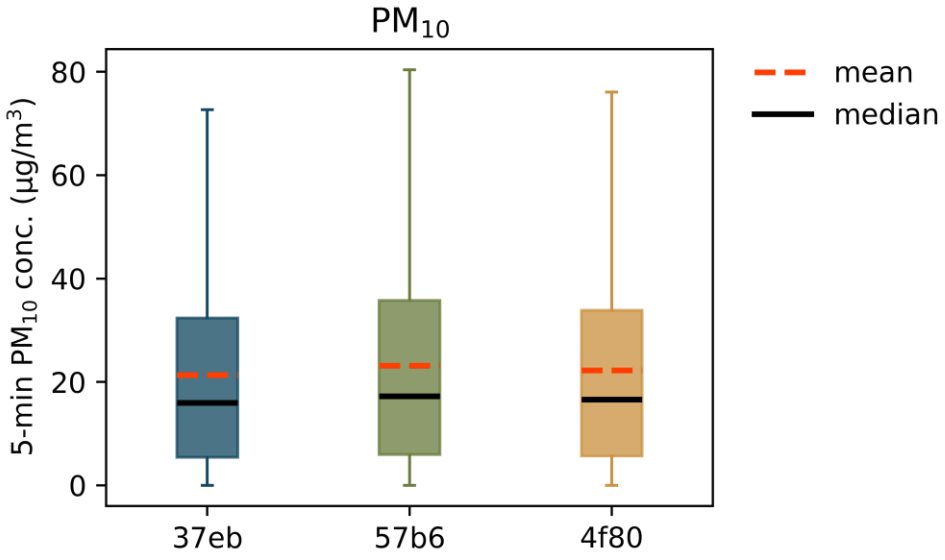
Basic QA/QC procedures such as removal of duplicate records was performed. Nulls, negatives, out of instrument bounds as specified by the manufacturer, and values flagged as invalid by the sensor were considered invalid. Data recovery was calculated as the percent of valid readings through the entire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

Parameter	37eb	57b6	4f80
PM_{10}	99.0%	97.3%	99.8%

Section 8.3: 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}	0.8	3.6



Interpretation: Two out of three Egg 2024 units had similar pollutant distributions.

Section 8: PM_{10}

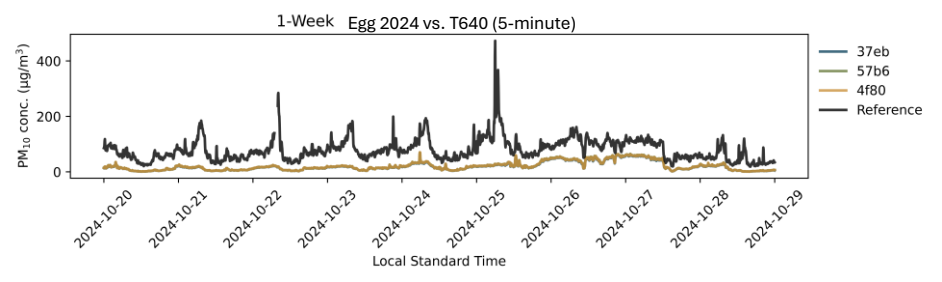
Section 8.4: Linearity (R^2)

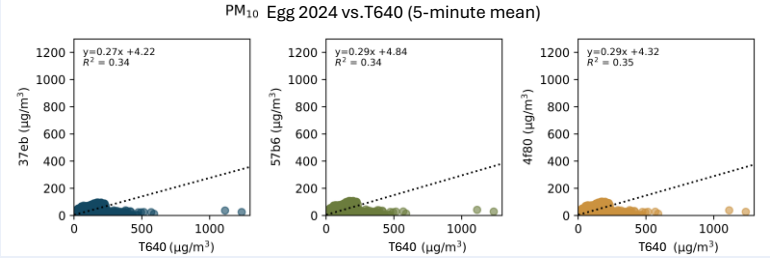
Basic QA/QC procedures were used to validate the collected data (i.e., obvious outliers, negative values, readings flagged by the sensor, and invalid data-points were eliminated from the data-set).

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

Parameter	Time Resolution	T640 (mean ± SD)
PM_{10}	5-minute	0.34 ± 0.01
	1-hour	0.40 ± 0.01
	24-hour	0.51 ± 0.01

Timeseries of a 1-week subset of the 9-week evaluation



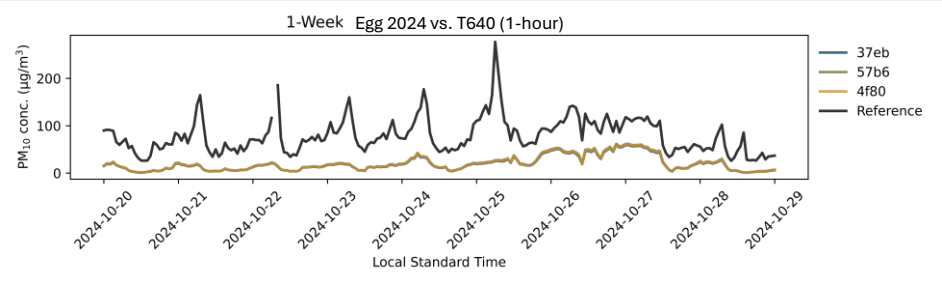


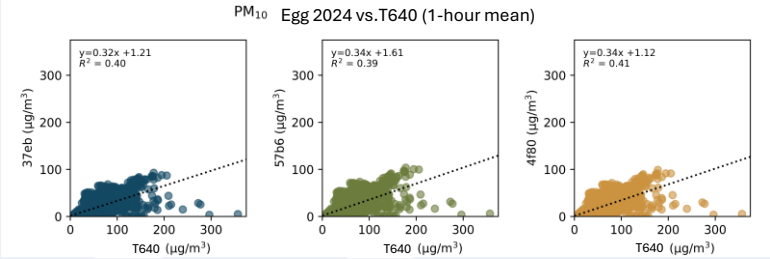
Interpretation: The Egg 2024 units showed weak correlation with the corresponding T640 data (0.33 < R^2 < 0.35) for 5-minute averaging.

Section 8: PM_{10}

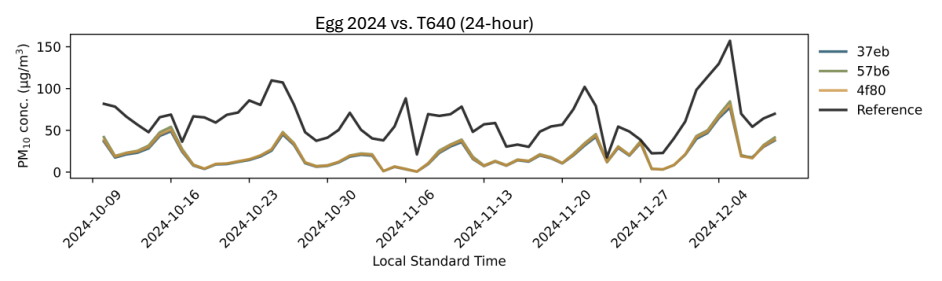
Section 8.4: Linearity (R^2)

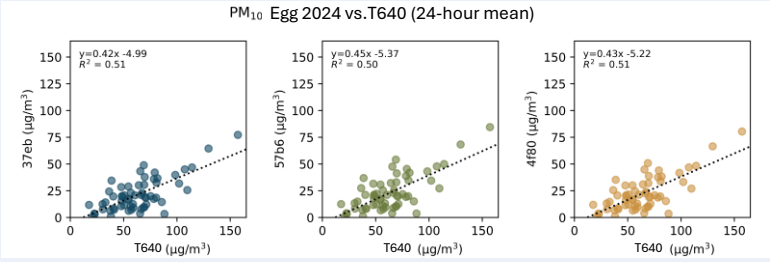
Timeseries of a 1-week subset of the 9-week evaluation





Interpretation: The Egg 2024 units showed weak correlation with the corresponding T640 data (0.39 < R^2 < 0.42) for 1-hour averaging.





Interpretation: The Egg 2024 units showed moderate correlation with the corresponding T640 data (0.50 < R^2 < 0.52) for 24-hour averaging.

Section 9: Summary Metrics

		CO		
		5-minute averages	1-hour averages	24-hour averages
Egg 2024	Average*	486.36	486.84	487.91
	SD*	295.34	292.11	211.48
	Range*	2.20 to 2166.40	7.40 to 2045.82	48.53 to 1033.36
	Abs. IMV*	30.2	29.2	32.3
	Rel. IMV (%)	6.2	6.0	6.6
	CV (RSD, %)	60.73	60.00	43.54
FRM Horiba	Average*	449.20	459.88	443.53
	SD*	320.08	316.25	190.79
	Range*	78.54 to 2050.64	102.17 to 1750.46	150.71 to 968.58
	CV (RSD, %)	71.26	68.77	43.02
Egg 2024 vs. FRM Horiba	Pearson R^2	0.38 to 0.75	0.38 to 0.76	0.80 to 0.92
	Spearman ρ	0.73 to 0.87	0.74 to 0.88	0.90 to 0.95
	Kendall τ	0.55 to 0.70	0.56 to 0.71	0.75 to 0.81
	Slope	0.56 to 0.81	0.57 to 0.81	1.03 to 1.06
	Intercept*	89.23 to 230.58	84.51 to 220.02	-19.42 to 50.73
	MBE*	4.85 to 72.08	-2.26 to 55.28	9.14 to 72.45
	$nMBE_{mean}$	0.01 to 0.16	-0.00 to 0.12	0.02 to 0.16
	$nMBE_{range}$	0.00 to 0.04	-0.00 to 0.03	0.01 to 0.09
	MAE*	125.08 to 207.58	122.05 to 201.28	53.01 to 79.26
	$nMAE_{mean}$	0.28 to 0.46	0.27 to 0.43	0.12 to 0.18
	$nMAE_{range}$	0.06 to 0.11	0.07 to 0.12	0.06 to 0.10
	RMSE*	163.31 to 299.74	157.21 to 288.69	69.00 to 100.36
	$nRMSE_{mean}$	0.36 to 0.66	0.34 to 0.62	0.16 to 0.23
	$nRMSE_{range}$	0.08 to 0.15	0.10 to 0.18	0.08 to 0.12

*Units in: ppb

Section 9: Summary Metrics

		NO_2		
		5-minute averages	1-hour averages	24-hour averages
Egg 2024	Average*	54.66	54.70	54.79
	SD*	20.72	20.44	9.80
	Range*	1.28 to 114.43	6.35 to 108.11	33.46 to 78.67
	Abs. IMV*	1.8	1.8	1.6
	Rel. IMV (%)	3.3	3.3	3.0
	CV (RSD, %)	37.89	37.34	17.89
FRM T200	Average*	19.36	19.83	18.89
	SD*	13.65	13.55	8.36
	Range*	1.35 to 56.66	1.99 to 53.19	4.05 to 38.46
	CV (RSD, %)	70.50	68.34	44.24
Egg 2024 vs. FRM T200	Pearson R^2	0.80 to 0.81	0.81 to 0.82	0.80 to 0.86
	Spearman ρ	0.87 to 0.88	0.89 to 0.90	0.87 to 0.90
	Kendall τ	0.69 to 0.70	0.71 to 0.72	0.70 to 0.74
	Slope	1.24 to 1.42	1.24 to 1.42	0.96 to 1.12
	Intercept*	26.14 to 28.17	26.51 to 28.67	32.61 to 36.07
	MBE*	32.92 to 36.20	33.43 to 36.91	33.65 to 36.91
	$nMBE_{mean}$	1.68 to 1.86	1.67 to 1.85	1.78 to 1.95
	$nMBE_{range}$	0.60 to 0.65	0.65 to 0.72	0.98 to 1.07
	MAE*	32.92 to 36.20	33.43 to 36.91	33.65 to 36.91
	$nMAE_{mean}$	1.68 to 1.86	1.67 to 1.85	1.78 to 1.95
	$nMAE_{range}$	0.60 to 0.65	0.65 to 0.72	0.98 to 1.07
	RMSE*	34.17 to 37.82	34.57 to 38.40	33.88 to 37.08
	$nRMSE_{mean}$	1.74 to 1.95	1.72 to 1.93	1.79 to 1.96
	$nRMSE_{range}$	0.62 to 0.68	0.68 to 0.75	0.98 to 1.08

*Units in: ppb

Section 9: Summary Metrics

		O3		
		5-minute averages	1-hour averages	8-hour averages
Egg 2024	Average*	46.30	46.30	46.29
	SD*	9.12	9.04	7.41
	Range*	23.16 to 110.81	27.48 to 107.33	30.65 to 87.32
	Abs. IMV*	3.2	3.2	3.3
	Rel. IMV (%)	7.0	7.0	7.1
	CV (RSD, %)	19.56	19.39	15.91
FEM T400	Average*	27.12	25.94	26.02
	SD*	21.52	21.27	17.08
	Range*	0.00 to 112.22	1.73 to 107.56	2.29 to 69.71
	CV (RSD, %)	79.34	82.02	65.65
Egg 2024 vs. FEM T400	Pearson R^2	0.56 to 0.74	0.57 to 0.75	0.53 to 0.73
	Spearman ρ	0.70 to 0.83	0.70 to 0.83	0.68 to 0.86
	Kendall τ	0.51 to 0.65	0.51 to 0.64	0.49 to 0.67
	Slope	0.25 to 0.43	0.25 to 0.43	0.26 to 0.44
	Intercept*	36.16 to 38.09	36.13 to 38.19	35.92 to 38.61
	MBE*	16.29 to 22.57	17.13 to 23.26	16.56 to 22.97
	$nMBE_{mean}$	0.61 to 0.83	0.67 to 0.90	0.64 to 0.88
	$nMBE_{range}$	0.15 to 0.20	0.16 to 0.22	0.25 to 0.34
	MAE*	18.91 to 22.83	19.54 to 23.48	17.52 to 22.97
	$nMAE_{mean}$	0.71 to 0.84	0.77 to 0.91	0.67 to 0.88
	$nMAE_{range}$	0.17 to 0.21	0.18 to 0.22	0.26 to 0.34
	RMSE*	23.29 to 26.27	23.76 to 26.77	21.23 to 25.26
	$nRMSE_{mean}$	0.88 to 0.97	0.94 to 1.04	0.82 to 0.97
	$nRMSE_{range}$	0.21 to 0.24	0.22 to 0.25	0.31 to 0.37

*Units in: ppb

Section 9: Summary Metrics

		PM_1		
		5-minute averages	1-hour averages	24-hour averages
Egg 2024	Average*	11.74	11.76	11.74
	SD*	9.57	9.45	7.42
	Range*	0.00 to 49.25	0.00 to 46.53	0.24 to 36.83
	Abs. IMV*	0.4	0.4	0.4
	Rel. IMV (%)	3.5	3.5	3.6
	CV (RSD, %)	81.53	80.37	63.17
T640	Average*	16.82	16.82	16.81
	SD*	15.34	15.20	12.72
	Range*	0.52 to 98.21	0.56 to 92.36	1.74 to 74.37
	CV (RSD, %)	91.20	90.33	75.66
Egg 2024 vs. T640	Pearson R^2	0.88 to 0.89	0.89 to 0.90	0.93
	Spearman ρ	0.98	0.99	0.99
	Kendall τ	0.90	0.91 to 0.92	0.93
	Slope	0.57 to 0.60	0.57 to 0.60	0.54 to 0.57
	Intercept*	1.68 to 1.94	1.68 to 1.94	2.14 to 2.38
	MBE*	-5.59 to -4.84	-5.61 to -4.84	-5.56 to -4.82
	$nMBE_{mean}$	-0.33 to -0.29	-0.33 to -0.29	-0.33 to -0.29
	$nMBE_{range}$	-0.06 to -0.05	-0.06 to -0.05	-0.08 to -0.07
	MAE*	4.96 to 5.66	4.90 to 5.65	4.82 to 5.56
	$nMAE_{mean}$	0.29 to 0.34	0.29 to 0.33	0.29 to 0.33
	$nMAE_{range}$	0.05 to 0.06	0.05 to 0.06	0.07 to 0.08
	RMSE*	8.53 to 9.20	8.40 to 9.12	7.50 to 8.23
	$nRMSE_{mean}$	0.51 to 0.55	0.50 to 0.54	0.45 to 0.49
	$nRMSE_{range}$	0.09	0.09 to 0.10	0.10 to 0.11

*Units in: $\mu g/m^3$

Section 9: Summary Metrics

		$PM_{2.5}$		
		5-minute averages	1-hour averages	24-hour averages
Egg 2024	Average*	19.93	19.96	19.92
	SD*	17.13	16.96	13.68
	Range*	0.00 to 99.78	0.00 to 95.96	0.49 to 76.03
	Abs. IMV*	0.6	0.6	0.6
	Rel. IMV (%)	3.0	3.0	3.2
	CV (RSD, %)	85.98	84.93	68.67
	PM_c Conc.*	2.12 to 2.57	2.13 to 2.57	2.12 to 2.54
	Fine Fraction	0.89 to 0.92	0.89 to 0.92	0.91 to 0.92
FEM T640	Average*	20.99	20.99	20.99
	SD*	16.76	16.56	13.62
	Range*	1.58 to 107.39	1.78 to 100.65	3.12 to 82.32
	CV (RSD, %)	79.86	78.91	64.89
	PM_c Conc.*	42.23	42.24	42.28
	Fine Fraction	0.32	0.32	0.32
Egg 2024 vs. FEM T640	Pearson R^2	0.89	0.90	0.92 to 0.93
	Spearman ρ	0.95 to 0.96	0.96	0.95 to 0.96
	Kendall τ	0.83	0.83 to 0.84	0.82
	Slope	0.93 to 1.00	0.94 to 1.00	0.93 to 1.01
	Intercept*	-0.51 to -0.26	-0.64 to -0.42	-0.59 to -0.21
	MBE*	-1.76 to -0.54	-1.77 to -0.55	-1.74 to -0.46
	$nMBE_{mean}$	-0.08 to -0.03	-0.08 to -0.03	-0.08 to -0.02
	$nMBE_{range}$	-0.02 to -0.01	-0.02 to -0.01	-0.02 to -0.01
	MAE*	4.19 to 4.34	3.99 to 4.15	3.14 to 3.29
	$nMAE_{mean}$	0.20	0.19 to 0.20	0.15 to 0.16
	$nMAE_{range}$	0.04	0.04	0.04
	RMSE*	5.73 to 5.87	5.38 to 5.56	3.90 to 4.08
	$nRMSE_{mean}$	0.27 to 0.28	0.26	0.19
	$nRMSE_{range}$	0.05 to 0.06	0.05 to 0.06	0.05

*Units in: µg/m³

Section 9: Summary Metrics

		PM_{10}		
		5-minute averages	1-hour averages	24-hour averages
Egg 2024	Average*	22.26	22.30	22.23
	SD*	20.26	20.06	16.16
	Range*	0.00 to 107.27	0.01 to 103.77	0.53 to 84.57
	Abs. IMV*	0.8	0.8	0.9
	Rel. IMV (%)	3.6	3.6	3.8
	CV (RSD, %)	91.01	89.95	72.67
	PM_c Conc.*	2.12 to 2.57	2.13 to 2.57	2.12 to 2.54
	Fine Fraction	0.89 to 0.92	0.89 to 0.92	0.91 to 0.92
T640	Average*	63.21	63.22	63.27
	SD*	41.91	38.22	26.55
	Range*	5.14 to 1236.23	6.60 to 356.99	17.61 to 157.13
	CV (RSD, %)	66.31	60.46	41.96
	PM_c Conc.*	42.23	42.24	42.28
	Fine Fraction	0.32	0.32	0.32
Egg 2024 vs. T640	Pearson R^2	0.34 to 0.35	0.39 to 0.41	0.50 to 0.51
	Spearman ρ	0.69 to 0.70	0.69 to 0.71	0.56
	Kendall τ	0.51 to 0.52	0.51 to 0.52	0.40 to 0.41
	Slope	0.27 to 0.29	0.32 to 0.34	0.42 to 0.45
	Intercept*	4.22 to 4.84	1.12 to 1.61	-5.37 to -4.99
	MBE*	-41.86 to -40.30	-41.98 to -40.38	-41.90 to -40.19
	$nMBE_{mean}$	-0.66 to -0.63	-0.66 to -0.63	-0.66 to -0.64
	$nMBE_{range}$	-0.03	-0.12	-0.30 to -0.29
	MAE*	40.68 to 42.08	40.74 to 42.18	40.19 to 41.90
	$nMAE_{mean}$	0.64 to 0.66	0.64 to 0.66	0.64 to 0.66
	$nMAE_{range}$	0.03	0.12	0.29 to 0.30
	RMSE*	53.05 to 54.19	50.37 to 51.60	44.32 to 45.91
	$nRMSE_{mean}$	0.83 to 0.86	0.79 to 0.81	0.70 to 0.73
	$nRMSE_{range}$	0.04	0.14 to 0.15	0.32 to 0.33

*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