

AQ-SPEC

Air Quality Sensor Performance Evaluation Center Evaluation Summary

Sensor Description

Manufacturer/Model:
Sensirion/
SPS30

Pollutants:
PM_{1.0}, PM_{2.5} and PM₁₀
mass concentration

Time Resolution:
1-sec



Additional Information

Field evaluation report:

<http://www.aqmd.gov/aq-spec/evaluations/field>

Lab evaluation report:

<http://www.aqmd.gov/aq-spec/evaluations/laboratory>

AQ-SPEC website:

<http://www.aqmd.gov/aq-spec>

- Overall, the accuracy of the Sensirion SPS30 was > 95% when PM_{1.0} mass conc. were < 100 µg/m³ and decreased to ~77% when PM_{1.0} mass conc. were > 100 µg/m³ for the PM_{1.0} mass conc. range tested and was fairly constant (81% to 96%) for the PM_{2.5} mass conc. range tested. Overall, the Sensirion SPS30 sensors overestimated PM_{1.0} and PM_{2.5} measurements from GRIMM in the laboratory experiments at 20 °C and 40% RH.
- The Sensirion SPS30 sensors exhibited high precision for all T/RH combinations and all PM concentrations.
- The Sensirion SPS sensors (IDs: 7CE8, D038 and 5455) showed low intra-model variability.
- Data recovery was 100% from all units in the field and in the laboratory.
- For PM_{1.0}, the Sensirion SPS30 sensors showed very strong correlations with the corresponding GRIMM data; and showed moderate to strong correlations with the ref. instruments from the field for PM_{2.5} ($0.64 < R^2 < 0.85$) and very strong correlations with GRIMM in the laboratory studies ($R^2 > 0.99$ for PM_{1.0} and PM_{2.5}). For PM₁₀, the Sensirion SPS30 sensors showed very weak correlations with the ref. instruments from the field ($0.10 < R^2 < 0.25$).
- The same three Sensirion SPS30 units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing).

Field Evaluation Highlights

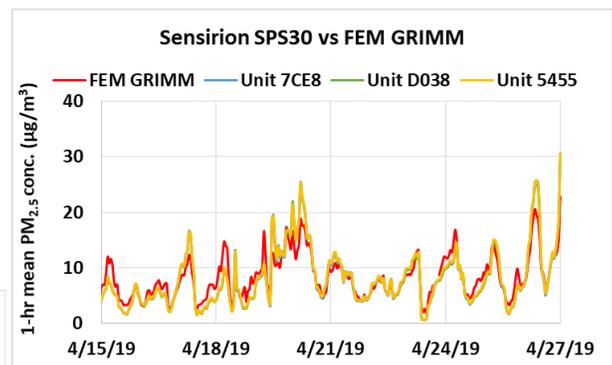
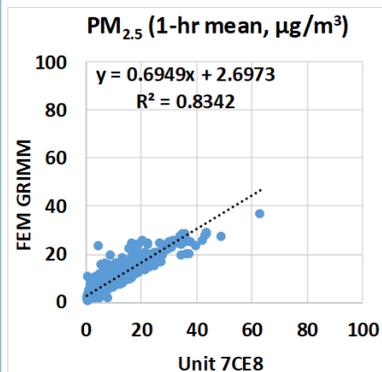
- Deployment period 03/07/2019 - 05/14/2019: the three Sensirion SPS30 sensors showed very strong correlations with the corresponding ref. data for PM_{1.0}, moderate to strong correlations for PM_{2.5} and very weak correlations for PM₁₀.
- The units showed low intra-model variability and data recovery ~ 100%.

1-hr mean, all ref. inst.

PM_{1.0}: ~ 0.92

PM_{2.5}: $0.64 < R^2 < 0.85$

PM₁₀: $0.10 < R^2 < 0.25$



Coefficient of Determination (R^2) quantifies how the three sensors followed the PM_{2.5} concentration change by the reference instruments.

An R^2 approaching the value of 1 reflects a near perfect agreement, whereas a value of 0 indicates a complete lack of correlation.

Laboratory Evaluation Highlights

Accuracy (PM_{2.5})

$$A (\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

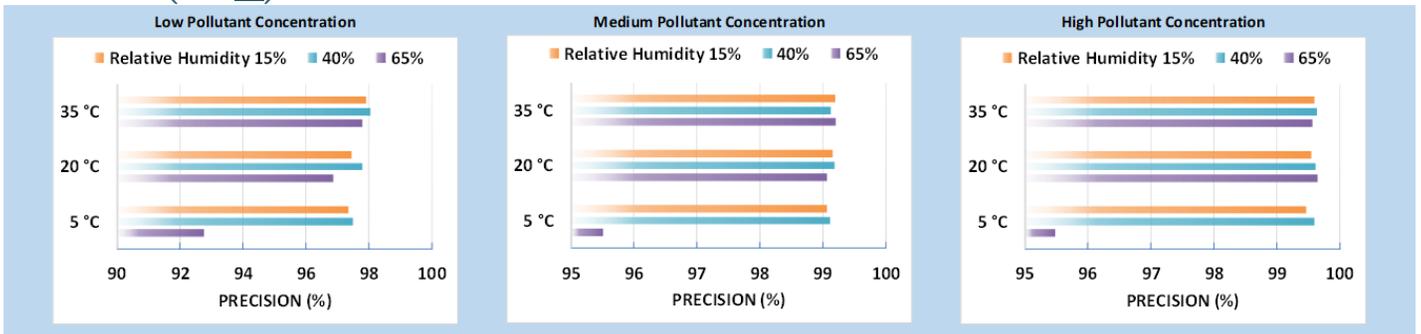
Steady state #	Sensor Mean (µg/m ³)	FEM GRIMM (µg/m ³)	Accuracy (%)
1	6.7	6.5	96.2
2	13.3	11.4	83.4
3	41.1	34.8	81.8
4	120.8	108.8	89.0
5	218.8	193.5	86.9
6	359.4	302.7	81.3

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40%. The sensor's readings at each ramping steady state are compared to the reference instrument.

A negative % means sensors' overestimation by more than two fold. The higher the positive value (close to 100%), the higher the sensor's accuracy.

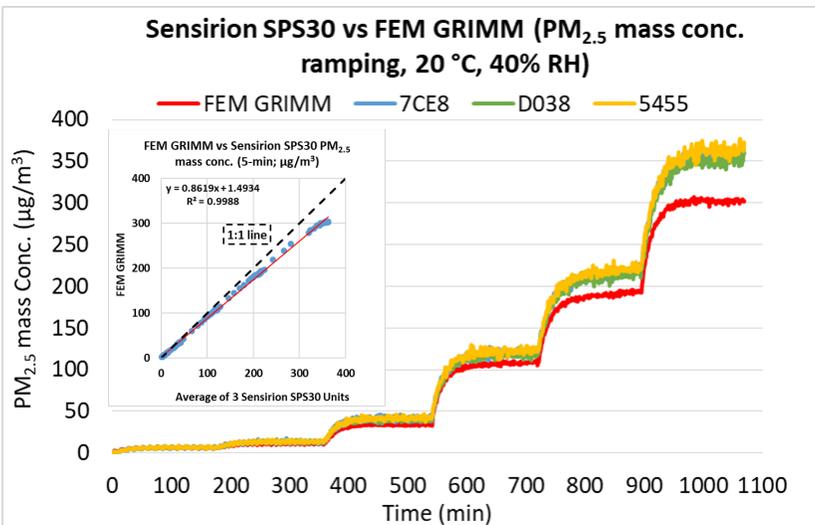


Precision (PM_{2.5})



Sensor's ability to generate precise measurements of PM_{2.5} concentration at low, medium, and high pollutant levels were evaluated under 9 combinations of T and RH, including extreme weather conditions like cold and dry (5 °C and 15%) cold and humid (5 °C and 65%), hot and humid (35 °C and 65%), or hot and dry (35 °C and 15%).

Coefficient of Determination



The Sensirion SPS30 sensors showed very strong correlations with the corresponding FEM PM_{2.5} data ($R^2 > 0.99$) at 20 °C/40% RH. For conc. ramping experiments of PM_{1.0}, please see the lab report.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the Sensirion SPS30 sensor precision. At the set-points of RH changes, the sensors reported spiked changes in concentration and showed significant conc. variation at 5 °C/65% RH.

Observed Interferents

N/A



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