AQ-SPEC

Air Quality Sensor Performance Evaluation Center

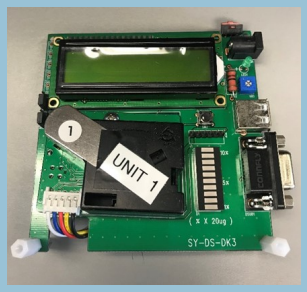
Sensor Description

Manufacturer/Model:
Samyoung S&C/
SY-DS-DK3

Pollutants:
$PM_{2.5}$ mass concentration

Time Resolution:
1 second

Type: Optical



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

Evaluation Summary

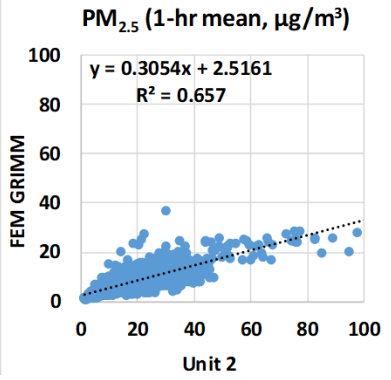
- Overall, the accuracy of the Samyoung S&C (Model SY-DS-DK3) sensors was negative at lower $PM_{2.5}$ mass conc. and increased from ~ 35% to 65% as PM conc. increased from ~ 100 to 300 µg/m³. The sensors overestimated $PM_{2.5}$ mass conc. from FEM GRIMM in the laboratory experiments at 20 °C and 40% RH.
- The Samyoung S&C sensors exhibited high precision for all T/RH combinations and all PM concentrations.
- The Samyoung S&C sensors (IDs: 1, 2, and 3) showed moderate intra-model variability in both the field and laboratory evaluations.
- Data recovery was ~ 85% and 100% from all units in the field and laboratory evaluations, respectively.
- For $PM_{2.5}$, Samyoung S&C sensors showed moderate to strong correlations with the FEM BAM, FEM GRIMM and FEM T640 from the field ($0.54 < R^2 < 0.72$). The Samyoung S&C sensors showed very strong correlations with the FEM GRIMM in the laboratory studies ($R^2 > 0.98$ for $PM_{2.5}$).
- The same three Samyoung S&C units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing)

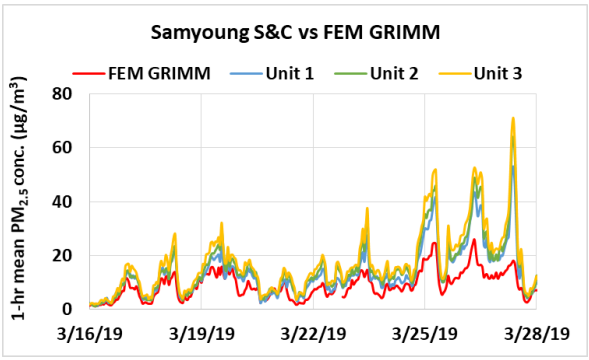
Field Evaluation Highlights

- Deployment period 03/07/2019 - 05/14/2019: the three Samyoung S&C sensors showed moderate to strong correlations with the corresponding FEM BAM, FEM GRIMM and FEM T640 $PM_{2.5}$ mass concentrations
- The units exhibited moderate intra-model variability and data recovery for $PM_{2.5}$ was ~ 85% from all units.

1-hr mean, all ref. instr.

$PM_{2.5}$: $0.54 < R^2 < 0.72$





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 ($PM_{2.5}$)

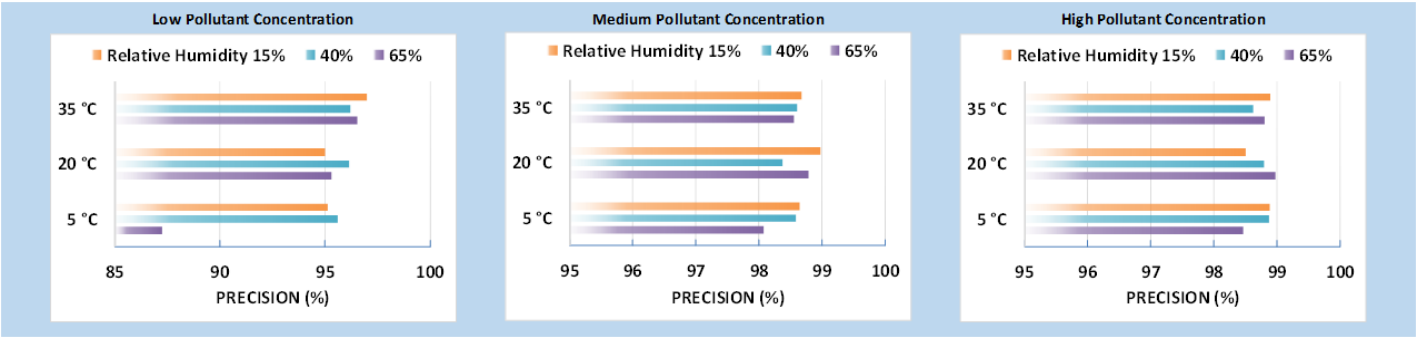
$$A\,(\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

Steady state #	Sensor Mean (µg/m³)	FEM GRIMM (µg/m³)	Accuracy (%)
1	14.6	6.5	-27.0
2	30.2	11.4	-64.6
3	82.1	34.8	-36.0
4	179.2	108.8	35.2
5	271.7	193.5	59.6
6	407.0	302.7	65.5

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.

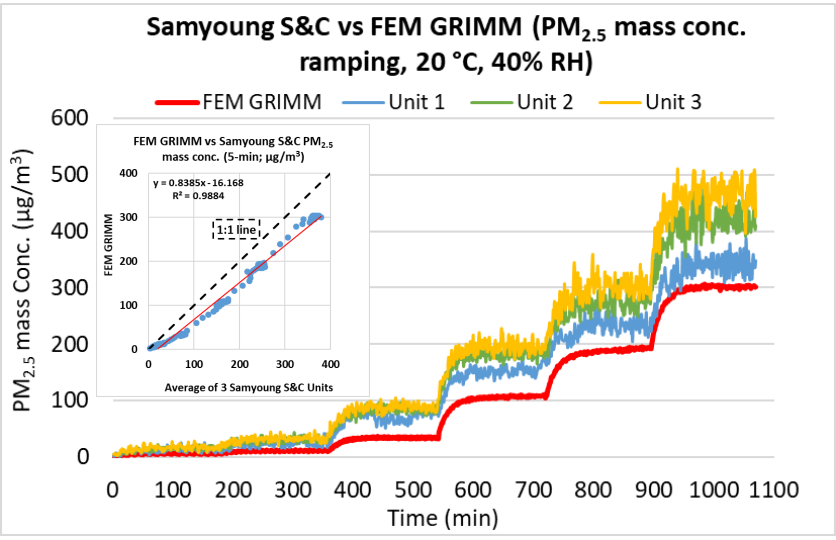
Precision ($PM_{2.5}$)



100% represents high precision.

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 Samyoung S&C sensors showed very strong correlations with the corresponding FEM GRIMM $PM_{2.5}$ data ($R^2 > 0.98$) at 20 °C and 40% RH.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the Samyoung S&C sensors; at the set-points of RH change, the sensors showed some small spiked conc. changes.

Observed Interferents

N/A