AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
Aeroqual
Model AQY v0.5

Pollutants:
NO_2 (V2)

Measurement Range:
0 - 500 ppb

Type: Gas Sensitive Electrochemical (GSE)

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

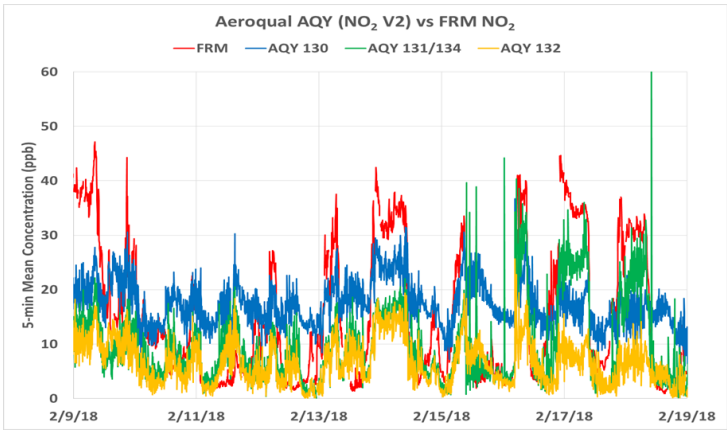
Evaluation Summary

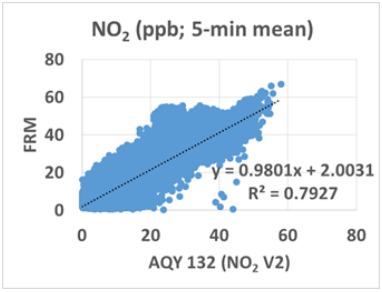
- Overall, the three Aeroqual AQY sensors (Units 130, 131 and 132) showed low accuracy in the laboratory studies. They underestimated the FRM NO_2 measurements for a concentration range between 0 to 150 ppb.
- The three Aeroqual AQY sensors exhibited high precision for most of the tested T/RH combinations in the environmental chamber, except at low NO_2 concentration under all T/RH combinations, in which precision could not be determined.
- The Aeroqual AQY sensors (Units 130 and 132) showed low intra-model variability in the field deployment and low to moderate intra-model variability in the laboratory testing (Units 130, 131 and 132).
- The Aeroqual AQY sensors had good data recovery (> 97 % for 5-min average in the field, and 100% for 1-min average in the laboratory).
- For NO_2, the Aeroqual AQY sensors (Units 130 and 132) showed strong correlations with the reference instrument in the field (R^2 ~ 0.77) and very strong correlations with the FRM instrument in the laboratory studies (R^2 ~ 0.99; Units 130, 131 and 132)).

Field Evaluation Highlights

- Deployment period 12/22/2017- 03/27/2018: the Aeroqual AQY sensors (units IDs: 130 and 132) showed strong correlations with NO_2 concentration change as monitored by the FRM instrument.
- The units showed > 97% data recovery and low intra-model variability.

R^2 ~ 0.77





Coefficient of Determination (R^2) quantifies how the two sensors (units 130 and 132) followed the NO_2 concentration change measured by the FRM instrument.

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

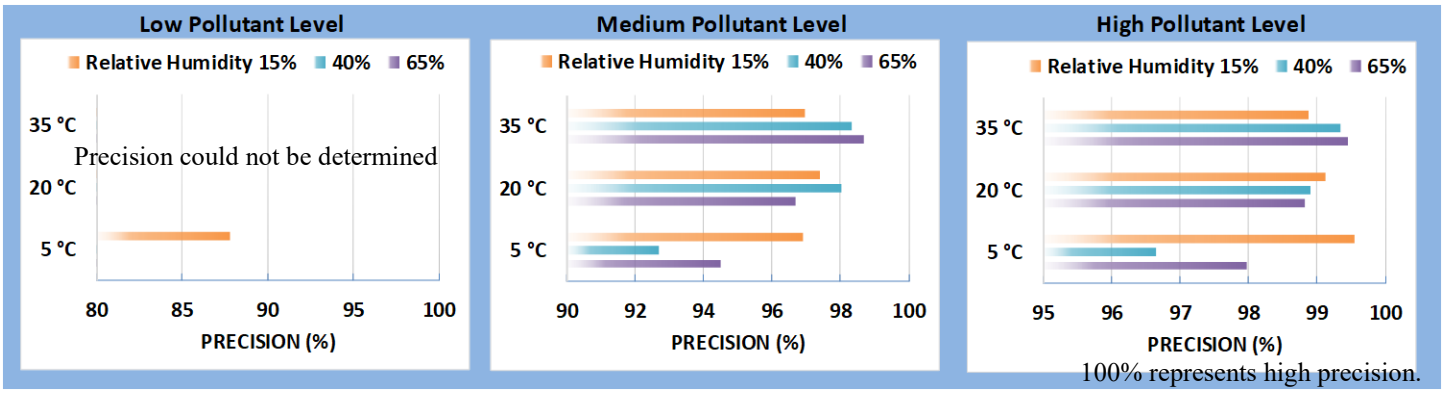
$$A\,(\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

Steady State (#)	Sensor mean (ppb)	FRM (ppb)	Accuracy (%)
1	4.0	14.4	27.5
2	7.7	34.1	22.7
3	18.3	75.9	24.1
4	28.5	123.0	23.1
5	39.8	170.0	23.4

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

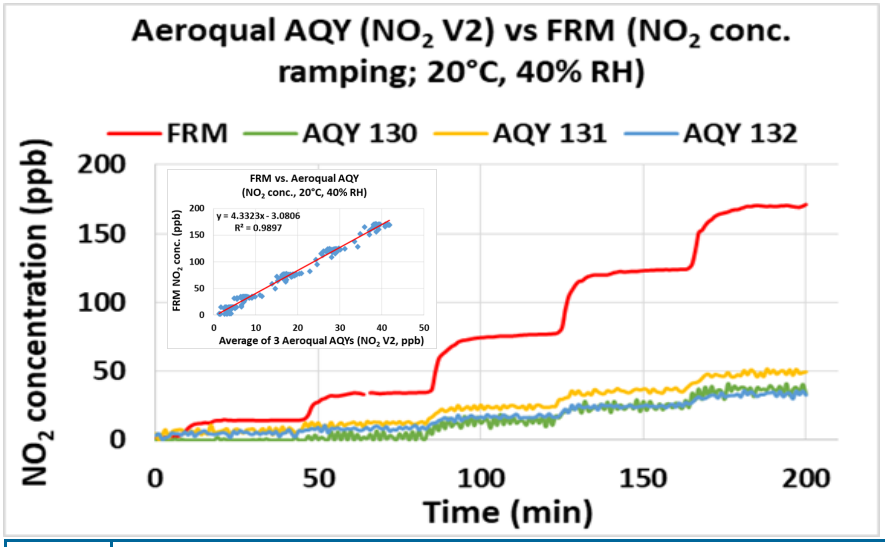
Precision (NO_2 V2)



100% represents high precision.

Sensor's ability of generating precise measurements of NO_2 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 three Aeroqual AQY sensors showed very strong correlations with the corresponding FRM data (R^2 ~ 0.99) at 20 °C and 40% RH.

Climate Susceptibility (R^2)

R^2	5 °C	20 °C	35 °C
15%	0.933	0.974	0.985
40%	0.823	0.989	0.992
65%	0.939	0.975	0.992

Observed Interferents

Ozone interfered with the NO_2 measurement