AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Sensor Description

Manufacturer/Model:
Vaisala/AQT530

Pollutants:
NO_2

Time Resolution:
1-min

Type: Electrochemical

Additional Information

Field evaluation report:
http://www.aqmd.gov/aq-spec/evaluations/criteria-pollutants/field

Lab evaluation report:
http://www.aqmd.gov/aq-spec/evaluations/criteria-pollutants/laboratory

AQ-SPEC website:
http://www.aqmd.gov/aq-spec

Evaluation Summary

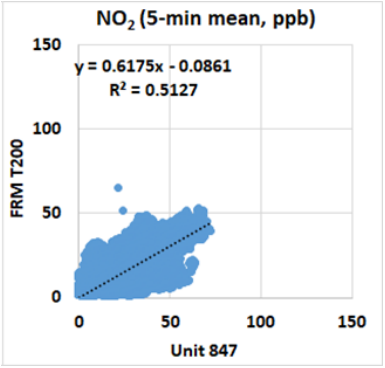
- Overall, the accuracy of the Vaisala AQT530 sensors ranged from 61.8% to 89.9%. Overall, the sensors overestimated the NO_2 measurements from FRM T200 in the laboratory experiments at 20°C and 40% RH.
- The Vaisala AQT530 sensors exhibited high precision for all T/RH combinations and all NO_2 concentrations.
- The Vaisala AQT530 sensors (IDs: 673, 885, 847) showed low to moderate intra-model variability in the field and laboratory evaluations.
- Data recovery was ~94% - 98% from all units in both field and laboratory evaluations.
- The Vaisala AQT530 sensors showed weak to moderate correlations ($0.38 < R^2 < 0.61$, 5-min mean) with the corresponding FRM T200 data in the field evaluation and very strong correlations with the FRM T200 in the laboratory evaluations ($R^2 > 0.96$).
- The same three Vaisala AQT530 units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing).
- NO was not evaluated in the laboratory because the sensors reported saturated values.

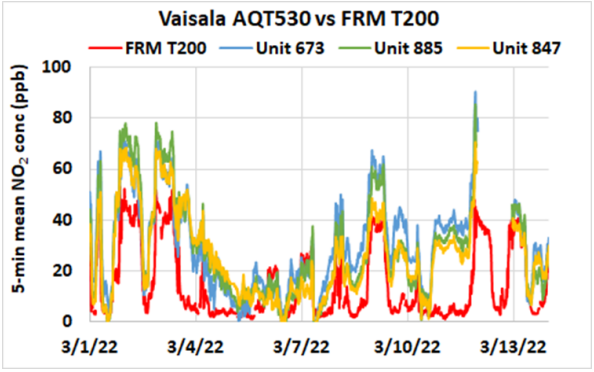
Field Evaluation Highlights

- Deployment period 01/14/2022 to 03/25/2022 : the three Vaisala AQT530 sensors showed weak to moderate correlations with the corresponding FRM NO_2 data.
- The units exhibited low intra-model variability and data recovery for NO_2 measurements was ~94 - 98% from all units.

5-min mean

$0.38 < R^2 < 0.61$





Coefficient of Determination (R^2) quantifies how the three sensors followed the NO_2 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 (NO_2)

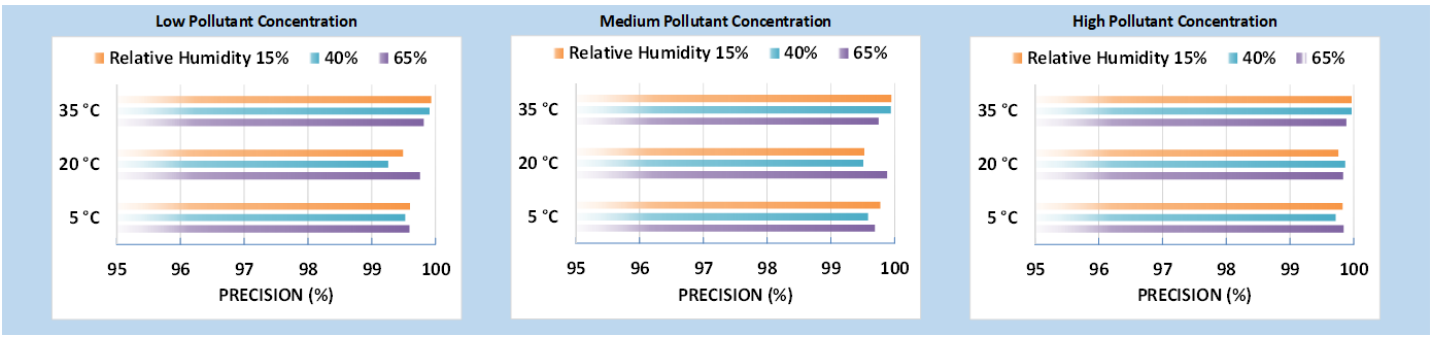
$$A\,(\%) = 100 - \frac{|\bar{X} - \bar{R}|}{\bar{R}} * 100$$

Steady State (#)	Sensor mean (ppb)	FRM T200 (ppb)	Accuracy (%)
1	24.8	27.6	89.9
2	64.9	49.6	69.2
3	98.6	71.3	61.8
4	141.4	102.6	62.2
5	261.1	210.9	76.2

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40% RH. 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.

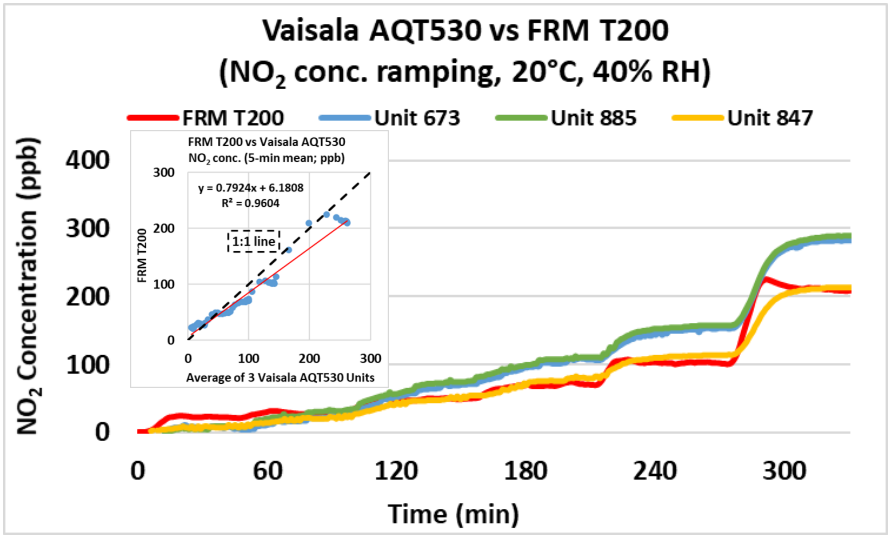
Precision (NO_2)



100% represents high precision.

Sensor's ability to generate 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% RH) cold and humid (5°C and 65% RH), hot and humid (35°C and 65% RH), or hot and dry (35°C and 15% RH).

Coefficient of Determination



The Vaisala AQT530 sensors showed very strong correlations with the corresponding FRM T200 NO_2 data (R^2 > 0.96) at 20°C and 40% RH.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the precision of the Vaisala AQT530 sensors' NO_2 measurements. The sensors' NO_2 readings increased as RH increased.

Observed Interferents

RH