

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Evaluation Summary

Sensor Description

Manufacturer/Model:
Ecomasure/EcomSmart

Pollutants:
NO₂

Time Resolution:
1-min

Type: Electrochemical



- The accuracy of the Ecomasure EcomSmart sensors ranged from -290% to 48%. Overall, the sensors overestimated the NO₂ measurements from FRM T200 in the laboratory experiments at 20°C and 40% RH.
- The Ecomasure EcomSmart sensors exhibited high precision for all T/RH combinations and all NO₂ concentrations.
- The Ecomasure EcomSmart sensors (IDs: 0531, 0532, 0533) showed low intra-model variability in the field and laboratory evaluations.
- Data recovery was ~96% - 100% from all units in both field and laboratory evaluations.
- The Ecomasure EcomSmart sensors showed weak to moderate correlations ($0.38 < R^2 < 0.56$, 5-min mean) with the corresponding FRM T200 data in the field evaluation and strong correlations with the FRM T200 in the laboratory evaluations ($R^2 \sim 0.89$).
- The same three Ecomasure EcomSmart units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing). Note that Unit 0531 did not transmit data during the NO₂ evaluation.

Field Evaluation Highlights

- Deployment period 03/10/2022 to 05/10/2022 : the three Ecomasure EcomSmart sensors showed weak to moderate correlations with the corresponding FRM NO₂ data.
- The units exhibited low intra-model variability and data recovery for NO₂ measurements was ~96% from all units.

Additional Information

Field evaluation report:

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

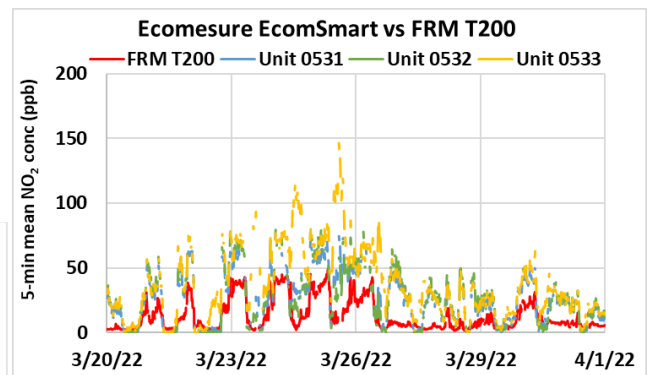
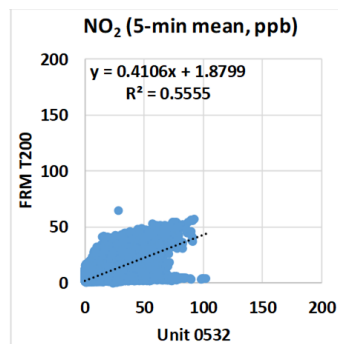
Lab evaluation report:

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

AQ-SPEC website:

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

5-min mean
 $0.38 < R^2 < 0.56$



Coefficient of Determination (R^2) quantifies how the three sensors followed the NO₂ 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 (NO₂)

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

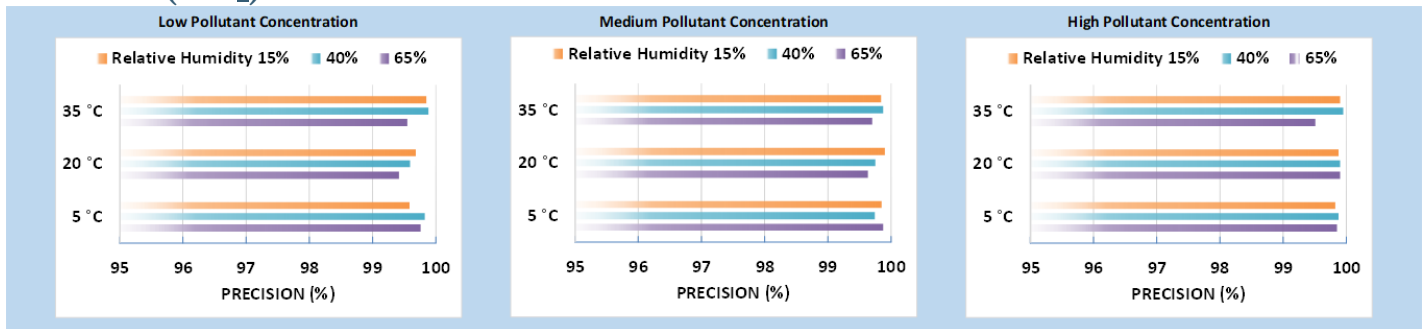
Steady State (#)	Sensor Mean (ppb)	FRM T200 (ppb)	Accuracy (%)
1	135.1	27.6	-290.0
2	139.6	49.6	-81.5
3	154.3	71.3	-16.4
4	187.9	102.6	16.9
5	320.6	210.9	48.0

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.

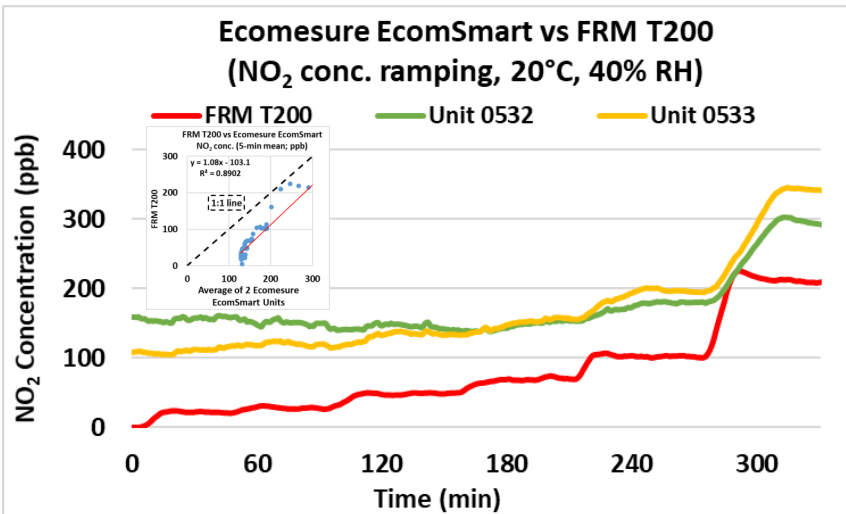
Precision (NO₂)



100% represents high precision.

Sensor's ability to generate precise measurements of NO₂ 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 Ecomasure EcomSmart sensors showed strong correlations with the corresponding FRM T200 NO₂ data ($R^2 \sim 0.89$) at 20°C and 40% RH.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the Ecomasure EcomSmart sensors' precision.

Observed Interferents

RH



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