

AQ-SPEC

Air Quality Sensor Performance Evaluation Center

Evaluation Summary

Sensor Description

Manufacturer/Model:
Ecomasure/EcomSmart

Pollutants:
O₃

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>

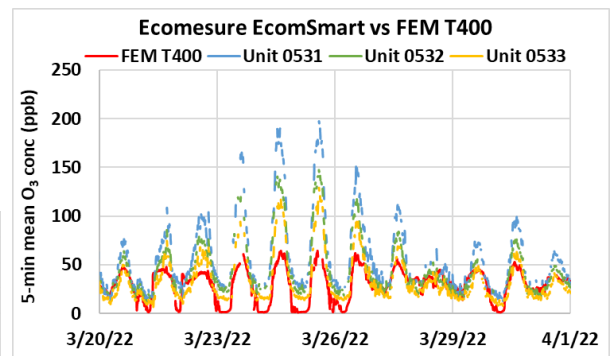
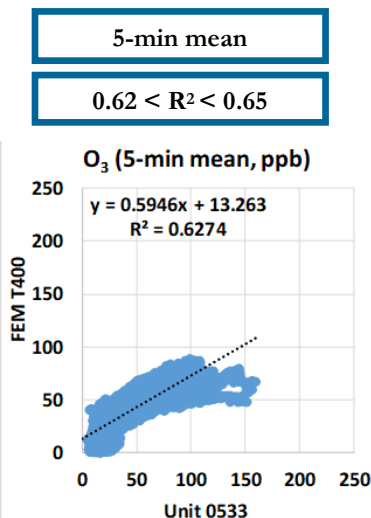
AQ-SPEC website:

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

- Overall, the accuracy of the Ecomasure EcomSmart sensors ranged from 14.6% to 93.9% and decreased as O₃ conc. increased over the tested concentration range, except at the first steady state. Overall, the sensors overestimated the O₃ measurements < 50 ppb and underestimated higher O₃ levels as compared to FEM T400 in the laboratory experiments at 20°C and 40% RH.
- The Ecomasure EcomSmart sensors exhibited high precision for all T/RH combinations and all O₃ concentrations.
- The Ecomasure EcomSmart sensors (IDs: 0532, 0533) showed low to moderate intra-model variability in the field and laboratory evaluations.
- Data recovery was ~96% - 100% from all units in both field and laboratory evaluations. Unit 0531 did not transmit data during the lab O₃ evaluations.
- The Ecomasure EcomSmart sensors showed moderate correlations ($0.62 < R^2 < 0.65$, 5-min mean) with the corresponding FEM T400 data in the field evaluation and strong correlations with the FEM T400 in the laboratory evaluations ($R^2 \sim 0.87$).
- The same three Ecomasure EcomSmart units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing).

Field Evaluation Highlights

- Deployment period 03/10/2022 to 05/10/2022 : the three Ecomasure EcomSmart sensors showed moderate correlations with the corresponding FEM O₃ data.
- The units exhibited low intra-model variability and data recovery for O₃ measurements was ~96% from all units.



Coefficient of Determination (R^2) quantifies how the three sensors followed the O₃ 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 (O₃)

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

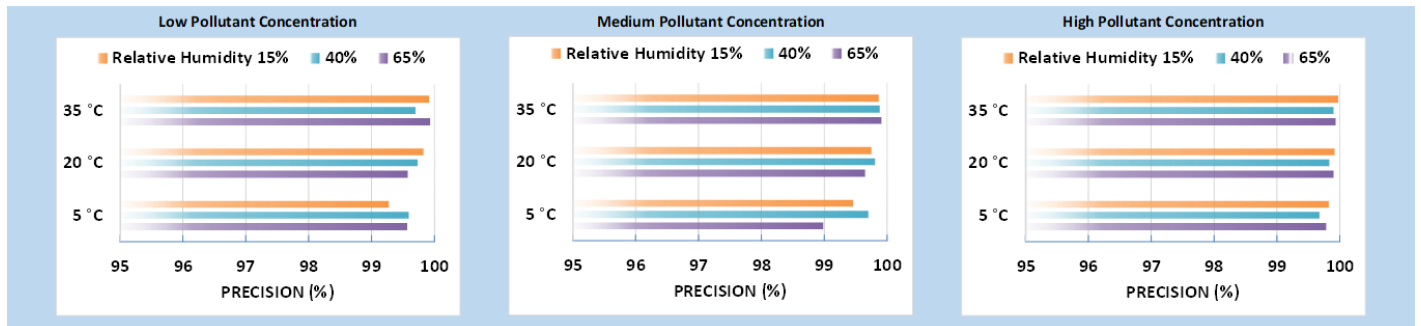
Steady State (#)	Sensor Mean (ppb)	FEM T400 (ppb)	Accuracy (%)
1	52.9	28.5	14.6
2	50.4	47.5	93.9
3	66.8	88.6	75.4
4	102.2	150.6	67.9
5	164.7	257.0	64.1

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.



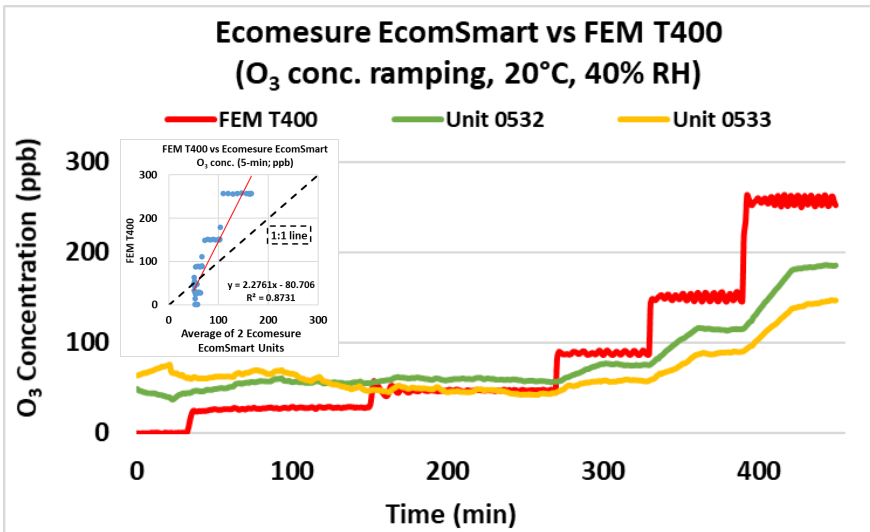
Precision (O₃)



100% represents high precision.

Sensor's ability to generate precise measurements of O₃ 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 FEM T400 O₃ data (R² ~ 0.87) at 20°C and 40% RH.

Climate Susceptibility

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

Observed Interferents

NO₂



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