Sensor Description

Manufacturer/Model: Aeroqual/S500 Particulate Matter Head

Pollutants: PM$_{2.5}$ and PM$_{10}$ mass concentration

Time Resolution: 1-min

Type: Optical

Field Evaluation Highlights

- Overall, the accuracy of the Aeroqual S500-PM sensors was fairly constant (~30% to 53%) over the range of PM$_{2.5}$ mass concentration tested. Overall, the Aeroqual S500-PM sensors overestimated PM$_{2.5}$ measurements from FEM GRIMM in the laboratory experiments at 20 °C and 40% RH.

- The Aeroqual S500-PM sensors exhibited high precision for all T/RH combinations and all PM concentrations.

- The Aeroqual S500-PM sensors (IDs: 1, 2 and 3) showed low to moderate intra-model variability for the field and laboratory evaluations.

- Data recovery was ~ 100% from all units in the field and laboratory evaluations.

- For PM$_{2.5}$, the Aeroqual S500-PM sensors showed weak to moderate correlations with the corresponding FEM GRIMM and FEM T640 data in the field evaluations (0.46 < R$^2$ < 0.70) and very strong correlations with FEM GRIMM in the laboratory evaluations (R$^2$ > 0.99 for PM$_{2.5}$). For PM$_{10}$, the sensors showed very weak correlations with the corresponding GRIMM and T640 data (0.19 < R$^2$ < 0.31).

- The same three Aeroqual S500-PM units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing).

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

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.
Accuracy (PM$_{2.5}$)

\[
\Delta (\%) = 100 - \frac{|X - R|}{R} \times 100
\]

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% 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 Aeroqual S500-PM sensors showed very strong correlations with the corresponding FEM PM$_{2.5}$ data ($R^2 > 0.99$) at 20 °C/40% RH.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the Aeroqual S500-PM sensors’ precision. At the set-points of RH changes, the sensors showed spiked conc. changes for all PM levels at 5 °C and showed significant concentration variation for all PM levels at 5 °C/65% RH.

Observed Interferents

N/A