Sensor Description

Manufacturer/Model: Aeroqual
Model AQY v0.5

Pollutants: PM$_{2.5}$

Measurement Range: 0 - 1000 µg/m$^3$

Type: Optical

Evaluation Summary

- Overall, the three Aeroqual AQY sensors (Units 130, 131 and 132) showed low to moderate accuracy in the laboratory studies. They overestimated the FEM GRIMM PM$_{2.5}$ measurements for a concentration range between 0 to 400 µg/m$^3$.
- The three Aeroqual AQY sensors exhibited high precision for all T/RH combinations tested in the environmental chamber.
- The Aeroqual AQY sensors (units IDs: 130 and 132) showed low intra-model variability in the field deployment as well as in the laboratory testing (Units 130, 131 and 132).
- The Aeroqual AQY sensors had good data recovery (>99% for 5-min average in the field, and 100% for 1-min average in the laboratory).
- For PM$_{2.5}$, the Aeroqual AQY sensors (Units 130 and 132) showed strong correlations with the reference instrument from the field ($R^2 > 0.84$) and very strong correlations with the reference 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 good correlations with PM$_{2.5}$ concentration change as monitored by FEM GRIMM and FEM BAM.
- The units showed > 99% data recovery as well as low intra-model variability.

Field evaluation report: http://www.aqmd.gov/aqspec/evaluations/field

Lab evaluation report: http://www.aqmd.gov/aqspec/evaluations/laboratory

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

R$^2$ ~ 0.86

Coefficient of Determination ($R^2$) quantifies how the two sensors (Units 130 and 132) followed the PM$_{2.5}$ concentration change by FEM GRIMM.

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 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. The higher the positive value (close to 100%), the higher the sensor’s accuracy.

<table>
<thead>
<tr>
<th>Steady State (°)</th>
<th>Sensor Mean (µg/m³)</th>
<th>FEM GRIMM (µg/m³)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28.2</td>
<td>17.0</td>
<td>34.6</td>
</tr>
<tr>
<td>2</td>
<td>50.1</td>
<td>34.7</td>
<td>55.6</td>
</tr>
<tr>
<td>3</td>
<td>109.6</td>
<td>69.8</td>
<td>42.9</td>
</tr>
<tr>
<td>4</td>
<td>188.0</td>
<td>117.0</td>
<td>39.4</td>
</tr>
<tr>
<td>5</td>
<td>407.0</td>
<td>244.0</td>
<td>33.2</td>
</tr>
<tr>
<td>6</td>
<td>581.4</td>
<td>366.5</td>
<td>41.4</td>
</tr>
</tbody>
</table>

Sensor’s ability of generating precise measurements of PM 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

Accuracy (PM$_{2.5}$)

From the laboratory studies, temperature and relative humidity had minimal effect on the Aeroqual AQY sensors’ precision. At the set-points of RH changes, Aeroqual AQY sensors reported spiked changes in concentrations.

The three Aeroqual AQY sensors showed excellent correlation with the corresponding FEM PM$_{2.5}$ data ($R^2 > 0.99$) at 20 °C and 40% RH.

Climate Susceptibility

From the laboratory studies, temperature and relative humidity had minimal effect on the Aeroqual AQY sensors’ precision. At the set-points of RH changes, Aeroqual AQY sensors reported spiked changes in concentrations.

Observed Interferents

N/A