Sensor Description

Manufacturer/Model: IQAir/AirVisual Pro v1.1683
Pollutants: PM$_{2.5}$ mass concentration
Measurement Size Range: 0.3 - 2.5 µm
Type: Optical

Evaluation Summary

- Overall, the IQAir AirVisual Pro sensors showed good accuracy as compared to the reference instrument for PM$_{2.5}$, except at ~ 300 µg/m$^3$.
- The IQAir AirVisual Pro sensors exhibited high precision for all T/RH combinations and all PM concentrations.
- The IQAir AirVisual Pro sensors (IDs: TP7S, YCYL, MXC7) showed low intra-model variability.
- Data recovery was ~100% from all units in the field and in the laboratory, except for Unit YCYL which did not report data in several laboratory experiments.
- For PM$_{2.5}$, the IQAir AirVisual Pro sensors showed moderate to strong correlations with the FEM GRIMM, FEM BAM and FEM T640 from the field (PM$_{2.5}$ 0.66 < $R^2$ < 0.82). The IQAir AirVisual Pro sensors showed very strong correlations with the FEM GRIMM in the laboratory studies ($R^2$ = 0.99 for PM$_{2.5}$).
- The same three IQAir AirVisual Pro units were tested both in the field (1$^{st}$ stage of testing) and in the laboratory (2$^{nd}$ stage of testing).
- Deployment period 08/15/2018 - 10/11/2018: the three IQAir AirVisual Pro sensors showed moderate to strong correlations with PM$_{2.5}$ mass concentration as monitored by FEM GRIMM, FEM BAM and FEM T640.
- The units showed very low intra-model variability and data recovery of ~100%.

Field Evaluation Highlights

- 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.
Laboratory Evaluation Highlights

**Accuracy (PM$_{2.5}$)**

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

<table>
<thead>
<tr>
<th>Steady state #</th>
<th>Sensor Mean (µg/m$^3$)</th>
<th>FEM GRIMM (µg/m$^3$)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11.2</td>
<td>10.18</td>
<td>89.7</td>
</tr>
<tr>
<td>2</td>
<td>17.5</td>
<td>15.20</td>
<td>84.9</td>
</tr>
<tr>
<td>3</td>
<td>64.6</td>
<td>59.62</td>
<td>91.7</td>
</tr>
<tr>
<td>4</td>
<td>172.4</td>
<td>153.11</td>
<td>87.4</td>
</tr>
<tr>
<td>5</td>
<td>338.2</td>
<td>270.07</td>
<td>74.8</td>
</tr>
</tbody>
</table>

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 by more than two fold. The higher the positive value (close to 100%), the higher the sensor’s accuracy.

**Precision (PM$_{2.5}$)**

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%) 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**

The IQAir AirVisual Pro sensors showed very strong correlations 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 effect on the IQAir AirVisual Pro sensor performance at 65% RH.

**Observed Interferents**

N/A

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