**Sensor Description**

- **Manufacturer/Model:** IQAir AirVisual Pro
- **Pollutants:**
  - PM$_{2.5}$
  - PM$_{10}$
  - CO$_2$
  - VOC
- **Type:** Optical
- **Time Resolution:** 10 second

**Evaluation Summary**

- Overall, the three IQAir AirVisual Pro sensors showed low accuracy. They overestimated the FEM GRIMM PM$_{2.5}$ measurements for a concentration range between 0 to 250 µg/m$^3$.
- The three IQAir AirVisual Pro sensors exhibited high precision for all T/RH combinations tested in the environmental chamber.
- IQAir AirVisual Pro sensors (units IDs: 4VW9, WLL6, X44P) showed low intra-model variability in the field deployment as well as in the laboratory testing.
- IQAir AirVisual Pro sensors had good data recovery (>98% for 5-min average in the field, and 100% for 1-min average in the laboratory).
- For PM$_{2.5}$, the IQAir AirVisual Pro sensors showed strong correlations with the reference instrument from the field ($R^2 \sim 0.70$) and very strong correlations with laboratory studies ($R^2 > 0.99$).

**Field Evaluation Highlights**

- Deployment period 08/02/2017–10/05/2017: the three IQAir AirVisual Pro sensors (units IDs: 4VW9, WLL6, X44P) showed strong correlations with PM$_{2.5}$ concentration change as monitored by FEM BAM.
- The units showed >98% data recovery as well as low intra-model variability.

**Coefficient of Determination ($R^2$) quantifies how the three sensors followed the PM 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$_{2.5}$)

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

<table>
<thead>
<tr>
<th>Steady State</th>
<th>Sensor mean (µg/m$^3$)</th>
<th>GRIMM (µg/m$^3$)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21.3</td>
<td>10.9</td>
<td>5.2</td>
</tr>
<tr>
<td>2</td>
<td>69.0</td>
<td>33.5</td>
<td>-6.2</td>
</tr>
<tr>
<td>3</td>
<td>154.6</td>
<td>79.3</td>
<td>5.0</td>
</tr>
<tr>
<td>4</td>
<td>288.6</td>
<td>153.0</td>
<td>11.4</td>
</tr>
<tr>
<td>5</td>
<td>440.0</td>
<td>228.5</td>
<td>7.4</td>
</tr>
</tbody>
</table>

Accuracy was evaluated in a concentration ramping experiment at 20 °C and 40%. The sensor’s readings at each ramping steady state condition are compared to those from the reference instrument.

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$_{2.5}$)

<table>
<thead>
<tr>
<th>Low PM$_{2.5}$ Conc.</th>
<th>Medium PM$_{2.5}$ Conc.</th>
<th>High PM$_{2.5}$ Conc.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relative Humidity 15%</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>95 96 97 98 99 100</td>
<td>95 96 97 98 99 100</td>
</tr>
<tr>
<td></td>
<td>99 98 97 96 95 90</td>
<td>99 98 97 96 95 90</td>
</tr>
</tbody>
</table>

Sensor’s ability at 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

The three 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 minimal effect on the IQAir AirVisual Pro sensors’ precision. At the set-points of RH changes, IQAir AirVisual Pro reported spiked changes in concentrations.

Observed Interferents

N/A

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