Sensor
Description
Manufacturer/Model:
RTI/MicroPEM
Pollutants:
PM$_{2.5}$ mass
Measurement Range:
0 - 1 mg/m$^3$
Type: Optical

Evaluation Summary

- Overall, the three RTI MicroPEM sensors showed low accuracy, compared to FEM GRIMM for a concentration range between 0 to 250 µg/m$^3$. RTI units overestimated GRIMM’s reading.
- The RTI units exhibited good precision during various T-RH-PM$_{2.5}$ combinations, except for the case of low temperature (5 °C) and high RH (65%).
- The RTI MicroPEM showed low intra-model variability.
- Data recovery was 100% from all units.
- For PM$_{2.5}$ mass conc., the RTI MicroPEM sensors showed strong correlations with the FEM GRIMM from the field ($R^2 > 0.80$) and very strong correlations from the laboratory studies ($R^2 = 0.99$).

Field Evaluation Highlights

- Deployment period 02/10/2015 - 04/14/2015: the three RTI MicroPEM sensors showed moderate to strong correlations as compared to the PM$_{2.5}$ mass concentration monitored by FEM GRIMM and FEM BAM.
- The units showed ~80% data recovery for 60N and 72N, 30% data recovery for 65N due to reprogramming issues. The units had good intra-model variability.

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 ozone concentration change by FEM.

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

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.

Negative % means sensors’ overestimation by more than two fold. 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>20.2</td>
<td>8.9</td>
<td>-27.0</td>
</tr>
<tr>
<td>2</td>
<td>50.1</td>
<td>19.8</td>
<td>-53.0</td>
</tr>
<tr>
<td>3</td>
<td>91.3</td>
<td>37.8</td>
<td>-41.5</td>
</tr>
<tr>
<td>4</td>
<td>379.1</td>
<td>139</td>
<td>-72.7</td>
</tr>
<tr>
<td>5</td>
<td>727.1</td>
<td>241.2</td>
<td>-101.5</td>
</tr>
</tbody>
</table>

Precision (PM₂.₅)

Sensor’s ability to generate precise measurements of ozone 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 RTI MicroPEM sensors showed very strong correlations with the corresponding FEM PM₂.₅ data (R² = 0.99) at 20 °C and 40% RH from 0 - 250 µg/m³.

Climate Susceptibility

From the laboratory studies, low temperature and high relative humidity had negative effect on the precision of RTI MicroPEM sensors.

Observed Interferents

High RH.

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