**Sensor Description**

Manufacturer/Model: Davis Instruments - AirLink

Pollutants: PM$_{1.0}$ (field evaluation only), PM$_{2.5}$, and PM$_{10}$ (field evaluation only) mass concentration

Time Resolution: 1-min

**Evaluation Summary**

- The accuracy of the AirLink sensors for PM$_{2.5}$ was 92.3% to 97.8% in the lab. The AirLink sensors overestimated PM$_{2.5}$ at lower concentrations and underestimated PM$_{2.5}$ at higher concentrations compared to the Teledyne T640x in the lab.
- The AirLink sensors exhibited high precision for all conc., T/RH combinations for PM$_{2.5}$.
- The AirLink sensors showed low to moderate intra-model variability for PM$_{2.5}$ in the lab.
- Data recovery in the field and lab was ~ 100% from the three units tested.
- AirLink sensors showed strong correlations with GRIMM and T640 in the field for both PM$_{1.0}$ ($R^2$: 0.88-0.89) and PM$_{2.5}$ (0.76-0.82), very weak to weak correlations with reference instruments in the field for PM$_{10}$ ($R^2$: 0.26-0.33), and very strong correlations with the reference instruments in the laboratory studies ($R^2 > 0.99$ for PM$_{2.5}$).
- All of the same AirLink units were tested both in the field (1st stage of testing) and in the laboratory (2nd stage of testing) against reference PM instruments.

**Field Evaluation Highlights**

- Deployment period 04/02/2021 - 06/01/2021: the three AirLink sensors showed strong correlations with the PM$_{1.0}$ and PM$_{2.5}$ mass concentration as recorded by GRIMM and T640, and very weak to weak correlations with the corresponding GRIMM and T640 data for PM$_{10}$.
- The units showed data recovery was ~100%.

### Coefficient of Determination ($R^2$)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>$R^2$ Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{1.0}$</td>
<td>0.88 &lt; $R^2$ &lt; 0.89</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>0.76 &lt; $R^2$ &lt; 0.82</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>0.26 &lt; $R^2$ &lt; 0.33</td>
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</tbody>
</table>

Coefficient of Determination ($R^2$) quantifies how the three sensors followed the PM$_{1.0}$, PM$_{2.5}$, or PM$_{10}$ 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$_{2.5}$)

Accuracy was evaluated by a concentration ramping experiment at 20 °C and 40% RH. The sensors’ 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.

<table>
<thead>
<tr>
<th>Steady State</th>
<th>Sensor Mean (µg/m$^3$)</th>
<th>FEM T640x (µg/m$^3$)</th>
<th>Accuracy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.74</td>
<td>9.05</td>
<td>96.5%</td>
</tr>
<tr>
<td>2</td>
<td>51.14</td>
<td>47.50</td>
<td>92.3%</td>
</tr>
<tr>
<td>3</td>
<td>103.57</td>
<td>97.71</td>
<td>94.0%</td>
</tr>
<tr>
<td>4</td>
<td>192.09</td>
<td>196.31</td>
<td>97.8%</td>
</tr>
<tr>
<td>5</td>
<td>273.76</td>
<td>296.41</td>
<td>92.4%</td>
</tr>
</tbody>
</table>

Precision (PM$_{2.5}$)

Sensors’ 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

From the laboratory studies, temperature and relative humidity had minimal effect on the AirLink sensors’ precision.

The AirLink sensors showed very strong correlations with the corresponding FEM PM$_{2.5}$ data ($R^2 > 0.99$) at 20 °C and 40% RH. At the time of lab testing, the reference monitor did not report PM$_{1.0}$. The AirLink sensors’ field performance did not qualify it for PM$_{10}$ testing in the lab.

Climate Susceptibility

Observed Interferents

N/A

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