PurpleAir PM2.5

Contents

Device Information

Ten devices were deployed:

- Four were kept in Manchester for the whole study.
- Three devices were in Manchester -> London -> Manchester
- Three devices were in Manchester -> York -> Manchester

This report aims to show how well the devices have performed throughout the study and how they were effected by different locations (urban background and roadside).

The calibration performed by the manufacturers was completed on:

- 10/12/19

Urban Background

Manchester

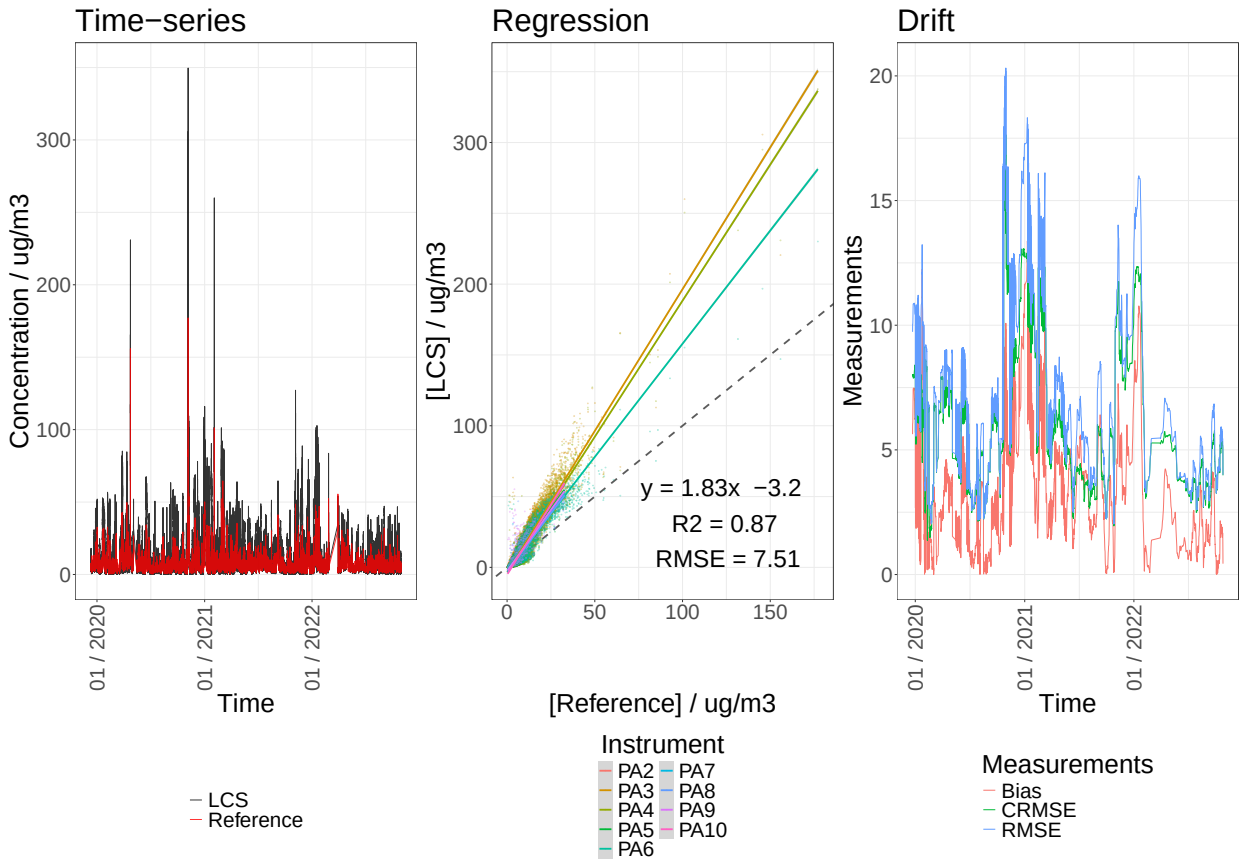

Figure 1: Manchester quantiative evaluation. Column 1: Time-series plot of the LCS measurements (black line) vs the reference measurements (red line). Column 2: Regression plot against reference data. The grey dashed line represents y=x. Column 3: Measure of drift plot (blue line indicates root mean squared error, the red line represents the mean bias and the green line shows the centered root mean squared error).

London

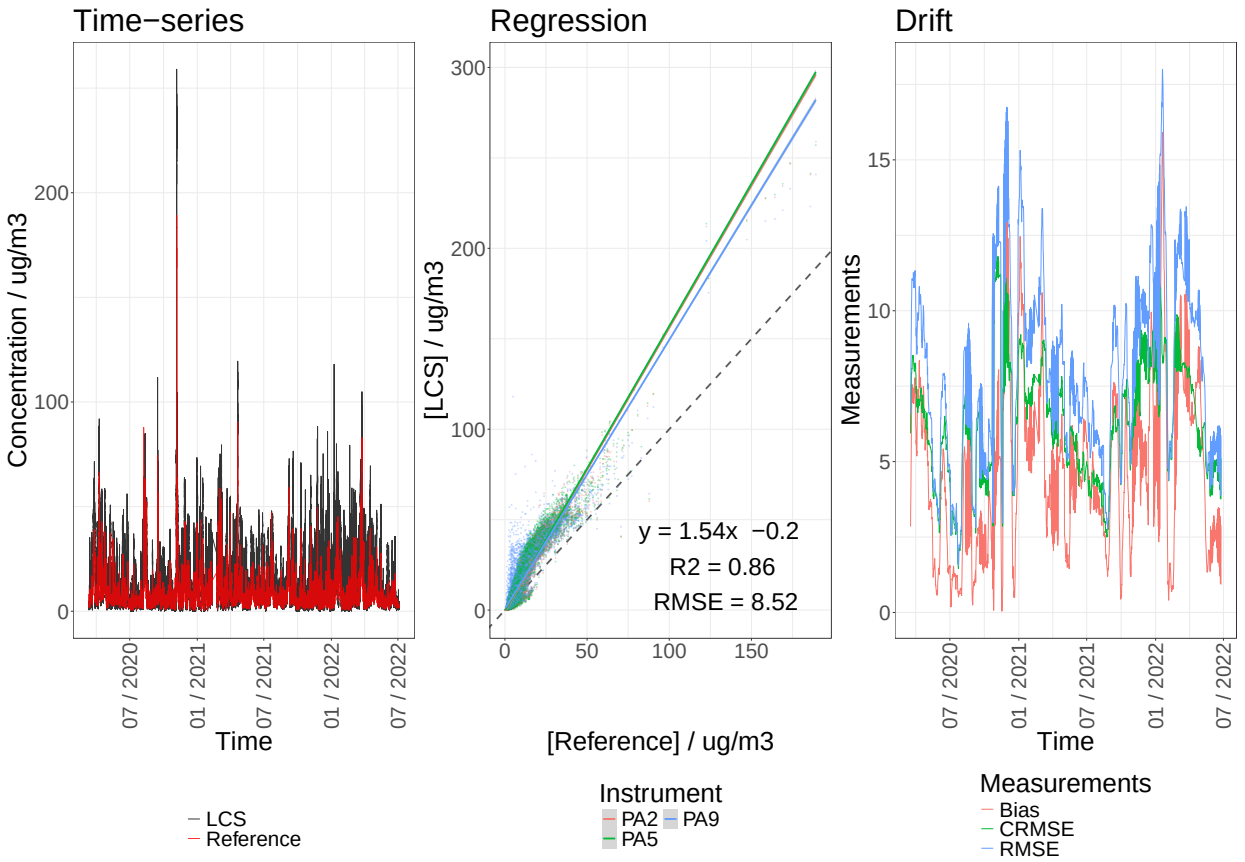

Figure 2: London quantiative evaluation. Column 1: Time-series plot of the LCS measurements (black line) vs the reference measurements (red line). Column 2: Regression plot against reference data. The grey dashed line represents y=x. Column 3: Measure of drift plot (blue line indicates root mean squared error, the red line represents the mean bias and the green line shows the centered root mean squared error).

Interpreting the data

- Time-series - the darker red colour shows the overlap betweeen the lcs measurements and the reference measurements taken.
- RMSE - the closer the value is to 0, means that the reference values closely matched the tested sensors values.
- Bias - the difference between average sensor measurements and the average reference measurements
- CRMSE - similar to the RMSE but with the bias subtracted. This measures error around an average.
- R-squared (r2) - a value closer to 1 indicates the regression predictions fit more accurately.
- Drift - a gradual increase shows a larger effect of RMSE, CRMSE or bias that the device possesses.

Equations Used

$$\text{cRMSE(R, L)} = \sqrt{\text{mean}(L_i - R_i - \overline{L} + \overline{R})^2}$$

- R_i = reference measurement at time i for measurements 1 to n
- L_i = LCS (low cost sensor) measurement at time i for measurements 1 to n
- $\overline{L}$ = mean LCS measurement
- $\overline{R}$ = mean reference measurement

$$\text{RMSE}(R,\ L) = \sqrt{\text{mean}(R_i - L_i)^2}$$

- R_i = reference measurement at time i for measurements 1 to n
- L_i = LCS (low cost sensor) measurement at time i for measurements 1 to n
- n = number of measurements

$$\text{Bias}(R,\ L) = |\overline{L} - \overline{R}|$$

- $\overline{L}$ = mean LCS measurement
- $\overline{R}$ = mean reference measurement

Roadside (York Fishergate)

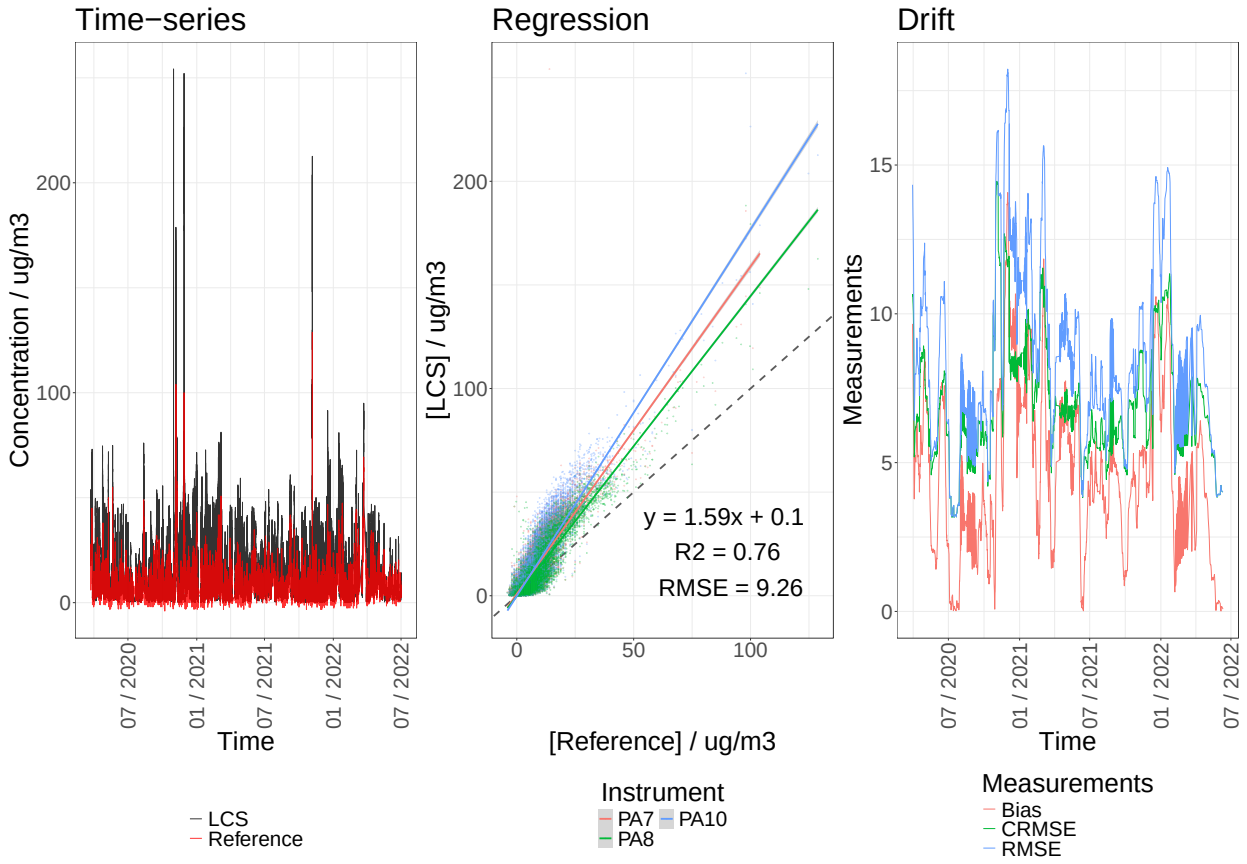

Figure 3: York quantiative evaluation. Column 1: Time-series plot of the LCS measurements (black line) vs the reference measurements (red line). Column 2: Regression plot against reference data. The grey dashed line represents y=x. Column 3: Measure of drift plot (blue line indicates root mean squared error, the red line represents the mean bias and the green line shows the centered root mean squared error).