

# Development and Evaluation of Correction Models for a Low-Cost Fine Particulate Matter Monitor: Final Author Response

Brayden Nilson<sup>1,2</sup>, Peter L. Jackson<sup>1</sup>, Corinne L. Schiller<sup>1,2</sup>, Matthew T. Parsons<sup>2</sup>

<sup>1</sup>Department of Geography, Earth and Environmental Sciences, University of Northern British Columbia, Prince George, V2N 4Z9, Canada

<sup>2</sup>Air Quality Science – West, Meteorological Service of Canada, Environment and Climate Change Canada, Vancouver, V6C 3S5, Canada

## Response to Referee #2 Report

1. Line 23: missing 2.5 subscript.

Subscripted 2.5 here.

2. Line 37: ...ensures FEM observations are equivalent to reference monitoring methods [at 24-hr averages]. -suggest inserting end of sentence. At least in the US FEMs are only evaluated against 24-hr FRM measurements. There may be more uncertainty in 1-hr measurements from FEMs.

Add “at 24-hr averages” to this sentence.

3. Line 41-43: FEM monitors can be one of multiple potential sensor [measurement] types; each of which measures PM<sub>2.5</sub> using different techniques (such as beta attenuation, gravimetric, and/or broadband spectroscopy). These sensors [FEMs] are rigorously tested and compared with 24-hour average reference measurements from Federal Reference Monitors (FRM) to ensure comparability. -I think you started referring to FEMs as sensors here. Recommend not using sensors to refer to FEMs for clarity.

Clarified throughout the document that we are referring to the internal observation device when we say “sensor” (ie. Plantower PMS5003 for the purpleair) and to the actual unit (including sensors, wifi cards, dataloggers, etc) when we say “monitor”. So for FEM we say monitor for the most part, but here we are discussing the sensor types between monitors.

4. In some places you refer to PA sensors and in other places PA monitors. Recommend being consistent with terms and sticking with PA sensors throughout.

See above comment – clarified this in the paper in multiple locations.

5. Line 115: “of each other” I think you mean “of an FEM”

Replaced “of each other” with “of a FEM”

6. Line 151: It would be helpful to put these plots in the SI. Do you think this is due to differences in sensor performance? Or due to not a true collocation/localized sources?

Added “These relationships were most likely the result of the PA not actually being colocated outdoors at the site.”

7. Eqn 6-8: Can you define all your variables (modi, obsi)

Defined each variable in these equations.

8. Figure 2: Impossible to see the dotted 1:1 line in the ~0-150 ug/m<sup>3</sup> range. Consider using a different color (red?) so it is more visible.

Changed the lines to red here and drew them on top of the data (instead of behind).

9. Figure 2: Also I don't think you discussed general additive models in the text anywhere. It seems like it would be more straight forward to plot linear regression or one of the other equations 2-5 you plan to test. Why didn't you consider general additive models as one of your equations if you are using them as lines on this plot?

Added "used as opposed to a linear model to provide a general overview of site PA/FEM comparability". We found GAM's tended to overfit when provided multiple sites, so they were not used, but felt that they gave a good general representation site-by-site.

10. Line 256: "PA concentrations tended to be biased increasingly higher as humidity increased; this was not the same case for the FEM monitors..." Do you have a figure or other analysis (e.g. correlation) documenting this?

This comment was directed at Figure 3 – rephrased it a bit to make that more clear that was the case.

11. Table 2: Model 5 needs to be updated to cf\_atm

Updated model 5 in table 2.