Response to Anonymous Referee #1

The manuscript is well-written and clearly structured. Furthermore, the spectral analysis method used to evaluate the data is novel in the context of low-cost sensors. To criticize, the study does not yield scientifically significant new findings. The main conclusion is that the sensor response is source dependent and that without proper calibration, there is a high risk of data misinterpretation. This is the same conclusion that has been made in most, if not all, studies investigating low-cost sensors.

I recommend publication of this study because I consider the approach used to evaluate sensor data valuable. Furthermore, I encourage the authors to consider the following points to strengthen the impact of the research.

We sincerely appreciate the reviewer for dedicating their time to provide detailed feedback. Below, we have addressed each of the specific comments in blue text.

1. The manuscript lacks a clear statement of the limitations of the study. This would be useful for readers to contextualize the findings.

Response: We agree with this suggestion and have included the following paragraph in the manuscript to address the study's limitations.

This study has a few limitations. Firstly, the study is limited to one city, and the low-cost air quality sensor network used in the study is not perfectly co-located with the EPA monitoring sites. This can introduce uncertainties in the analysis due to differences in local air properties and pollution sources for the two data sets. Secondly, the placement of the low-cost sensors relative to local built-structures could affect its measurement performance and increase data uncertainty, but this information is not available to us. Thirdly, we did not have access to local traffic-related information or industrial activity, restricting our ability to strongly relate frequency components to specific emission sources. The likely variability of the local emission sources at the different Purple Air and EPA sites adds uncertainty in quantifying the differences in the short-term responses of the two networks.

2. The authors suggest that the results of their analysis will provide guidance in devising new approaches to calibrate data from low-cost sensors, but it is unclear what specific recommendations are being made . A more explicit discussion of the implications of the study's findings for future research and policy decisions would have strengthened the overall impact of the article.

Response: We have included the following paragraph in the conclusion of the manuscript to discuss the implications of the study's findings for future research and policy decisions.

This study clearly demonstrates that low-cost sensor PM data has non-uniform contribution of different PM sources. Any field calibration of these sensors using simple regression models cannot correct
for this non-uniform contribution. As best practice, it is recommended that calibration models from field data should report, at a minimum, the distribution of different PM emission sources at that location, and ideally also, the particle size distributions.
Given the periodic signatures of many sources, frequency-based scaling approach should be explored towards the development of more robust calibration models that account for the wide range of emission sources common in urban environments. Accuracy of such models will scale with time periods of calibration. Considering the source-dependent response of low-cost sensors, calibration models developed using land-use data might be an advance over simple regression models.

3. Line 89 foe;d typo?

Response: We thank reviewer for pointing out this typo, we have fixed it in the manuscript.

4. 1 Consider adding a scale for the map and units for the population density.

Response: We have added the scale and units of population density in figure.

5. Local correction model; justify the use of both temperature and relative humidity in multiple linear regression. These variables are correlated with each other which can be problematic as the independent variables in MLR should be independent .

Response: We have included the following justification of using relative humidity and temperature in the model to manuscript.

Typically in MLR models, we would only consider independent variables and it could be argued that temperature and relative humidity are not entirely independent. But from a particulate matter perspective, the differing impact of these parameters make them independent of each other. Relative humidity directly affects particle size and hence measurements by low-cost sensors, such as PA. Temperature, however, has a more complex connection to particle properties. Temperature directly affects particle size and composition by modulating condensation/evaporation, which can affect PM measurements by both EPA and low-cost sensors. Temperature also indirectly affects PM properties at a location through its relation to local meteorology, especially wind direction, and hence the distribution of sources at the measurement
location. To establish the independence of these parameters, we calculated the Variance Inflation Factors (VIFs) for temperature and relative humidity and these were found to be below 5. These small VIF values indicate a low level of multicollinearity for the two parameters(Ros-Gálvez, 2017) and permit their inclusion in the MLR model.

6. Line 294 “Our analysis clearly demonstrates for the first time that the PA network’s very different sensitivity to different sources.” I suggest you remove the “first time” part here.

Response: We have removed the “first time” from our manuscript.