We thank the reviewers for their valuable comments. We have made efforts to improve the manuscript accordingly. This document is organized as follows: the referees' comments are in **Bold black**, our responses are in plain black text, and the revisions in the manuscript are shown in blue. The line numbers in this document refer to the updated manuscript.

Anonymous Referee #1

General comments

This manuscript attempts to distinguish contributions from meteorology and emissions reduction to $PM_{2.5}$ trends from 2013 to 2018 in five target regions in China. A multiple linear regression model (MLR) is developed using de-seasonalized (by taking 10-day average of hourly data) and detrended (by subtracting 50-day moving average of 10-day average from 10-day average) $PM_{2.5}$ observations and corresponding five meteorological variables. The coefficients and intercepts obtained for each season and grid are applied to de-seasonalized but not detrended anomalies of meteorological variables (i.e., 50-day moving average minus 6-year average) to calculate $PM_{2.5}$ anomalies attributable to meteorology. Consequently, residual anomalies are attributed to other factors, mainly changes in emissions. The attempt is valuable as the research question, contribution from meteorology to the $PM_{2.5}$ trend, is crucial to East Asian countries. Overall, the results with the MLR is acceptable. I would support publication of this manuscript with minor revision mostly asking clarification.

Specific comments

1) L25 'minor but significant': ambiguous expression. Can you add more explanation?

Thanks. We have rephrased this part to:

The meteorology-corrected $PM_{2.5}$ trends after removal of the MLR meteorological contribution can be viewed as driven by trends in anthropogenic emissions. The mean $PM_{2.5}$ decrease across China is -4.6 μg m^{-3} a^{-1} in the meteorology-corrected data, 12% weaker than in the original data. The trends in the meteorology-corrected data for the five megacity clusters are: …

2) L26 'residual anthropogenic trends': anthropogenic emissions?

We have rephrased this sentence to:

The trends in the meteorology-corrected data for the five megacity clusters are: …

3) Section 2.3: You may consider adding another variable for grid. For now, *i* represents both season and grid which made me difficult to follow at first. Explicit description of $Y_{a,i}(t)$ is needed. It is not clear to me whether the anomaly is $Y_{a,i}(t)$ = 50-day moving average – 6-year average at the grid or $Y_{a,i}(t)$ = 10-day averge – (50-day moving average – 6-year average) at the grid.

Thanks for pointing this out.

$Y_{a,i}$ = 10-day average – 6-year average of 50-day moving average;

An explanation in brackets (Line 134) is added to explain the way to obtain the $PM_{2.5}$ anomaly $Y_{a,i}$: Consider now the $PM_{2.5}$ anomaly $Y_{a,i}$ for grid square and season *i* obtained by deseasonalizing but

not detrending the $PM_{2.5}$ data (by removing the 6-year means of the 50-day moving averages), in the same way as for the meteorological variables.

4) Figure S2: How come $PM_{2.5}$ anomalies are greater than deseasonalized and detrended $PM_{2.5}$? It makes sense if $Y_{a,i}(t)$ is as the second definition as I mentioned above.

$PM_{2.5}$ anomalies ($Y_{a,i}$) can be greater than deseasonalized and detrended $PM_{2.5}$ ($Y_{d,i}$).

$Y_{a,i}$ = 10-day average – 6-year average of 50-day moving average;

$Y_{d,i}$ = 10-day average – 50-day moving average.

From above we can see that trends are not removed from $Y_{a,i}$, and that both trends and seasonal variations are removed from $Y_{d,i}$. Therefore, the difference between $PM_{2.5}$ anomalies and deseasonalized and detrended $PM_{2.5}$ is that $PM_{2.5}$ anomalies contain trend information. This is clarified in the manuscript in Line130 as: "The anomalies calculated in this manner are deseasonalized but not detrended".

Technical corrections

L131 K. Li et al. (2019): Couldn't find this reference. Did you mean Yi et al. (2019)?

Thanks for pointing this out. We have added this reference in the reference section:

Li, K., Jacob, D. J., Liao, H., Shen, L., Zhang, Q., and Bates, K. H.: Anthropogenic drivers of 2013-2017 trends in summer surface ozone in China, Proceedings of the National Academy of Sciences, 116, 422-427, 2019.