

Interactive comment on “Fine particulate matter (PM_{2.5}) trends in China, 2013–2018: contributions from meteorology” by Shixian Zhai et al.

Anonymous Referee #2

Received and published: 2 July 2019

In this study Zhai et al. use a combination of PM_{2.5} observations and multiple linear regression modelling to analyse the trend in PM_{2.5} concentration across mainland China during 2013–2018 and to quantify the meteorological contribution to this trend. Overall the paper is well thought-out and written, and figures are well presented. The topic of the study is interesting and well within the scope of ACP. I recommend publication once the comments below (mostly regarding the processing of the data) have been addressed.

1. Abstract, L25: I suggest specifying that the contribution is “statistically” significant, otherwise the sentence reads a bit odd.

2. Abstract, L26: I think the statement “reduces the uncertainty on the emission-driven trends” needs more explanation in the abstract. Earlier in the abstract you refer to the

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difficulty of trend attribution because of the meteorologically driven interannual variability in PM_{2.5} concentrations. However, it is not immediately clear what you mean by “uncertainty on the emission-driven trends”. (It is worded more clearly in the conclusions section).

3. Introduction, L52: Please add an explanation to why the PM_{2.5} concentration is correlated to V850, particularly in the NCP.

4. Introduction, final paragraph: References to a few papers that have identified/quantified recent trends in PM_{2.5} concentrations across China seem to be missing from the introduction (Ma et al., 2019; Silver et al., 2018; Liang et al., 2016).

5. Section 2.1, L88: Can you give any example references here for these previous studies?

6. Section 2.1, L90: Why was 70% chosen? It seems quite low to me. Please add some justification. Did you do any sensitivity tests changing the threshold to a higher percentage?

7. Section 2.1, L90–91: As above, can you add some justification for the coarse grid chosen? Is this recommended by Tai et al. (2012)? Did you test any other grid resolutions?

8. Section 2.1: I see that you removed severe outliers from the observation dataset but what did you do about repeating consecutive values in the dataset (e.g. identified in Rohde and Muller (2015)) and day-to-day repeating sequences of values (e.g. identified by Silver et al., 2018)? If these were not removed, please at least acknowledge that data issues are likely remain in the dataset.

9. Section 2.1: If each year of data and each station were considered separately when applying the 70% data threshold, what does the introduction of more stations/data towards the end of the sampling time period (as more stations come online) do to the trends? I realise the data is averaged over large grid cells, but introduction of

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many stations later in the time-series (that are not consistent) may impact the trends calculated. Please add some explanation. Did you attempt to calculate the trends based only on data from stations that were online in 2013?

10. Section 2.2 and 2.3: I am slightly confused by the explanation of the de-seasonalizing and detrending process. Perhaps the explanation could be reworded slightly? I have understood it as: the data is de-seasonalized and detrended by taking the 50-day moving average from the 10-day means; whereas the anomalies are de-seasonalized (but not detrended) by taking the 6-year mean 50-day moving average from the 10-day means; is this correct?

11. Section 3.1: I think this section is really nice and gives some good explanations (with references) for the drivers of the changes in pollutants and/or emissions. However, there is no comparison with previous studies that have calculated trends in PM_{2.5} concentrations over similar time periods (e.g. Ma et al., 2019; Silver et al., 2018; there may be others). Are the calculated trends consistent between studies, despite differences in the data or data processing? I understand that the trends are all calculated over slightly different time periods, but at least a qualitative comparison should be added to the text.

12. Conclusions: this section is a nice summary of the main points of the paper. However, it would make the results even clearer if the percentage difference from the original trend was quoted here again as in the abstract and it also might be worth explaining again here what is meant by meteorologically corrected data.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-279>, 2019.