Dear Editor,

We appreciate the prompt reviews and would like to thank the reviewer for insightful comments and suggestions on our manuscript entitled "Contributions of meteorology and anthropogenic emissions to the trends in winter $PM_{2.5}$ in eastern China 2013–2018" (MS No.: acp-2022-304). We have carefully considered all comments and suggestions. Listed below are our point-by-point responses to all comments and suggestions of this reviewer (Reviewer's points in black, our responses in blue).

Anonymous Referee #2

This is a very interesting paper analyzing the causes of $PM_{2.5}$ trends observed in eastern China. The research topic is highly important from air pollution control point of view and, although this topic has been studied quite intensively during the recent years, this paper manages to provide new insight into it. The paper is clearly organized and relatively well written. I could not find any scientific errors, even though I do feel being an expert on trend analysis. I have a few minor issues to be considered before accepting this paper for publication:

Response:

We appreciate the encouraging comments, particularly from an expert on trends.

Specific comments

(1) Please explain how ASI is defined. Based on Figure 1 it seems to be dimensionless variable but this has not been explained anywhere. This is particularly important because related to Arctic sea ice, most often the concept "Arctic sea ice area" is used in a scientific literature.

Response:

We adopted the Arctic Sea Ice index (ASI) suggested by Wang et al. (2015), i.e. the area-averaged sea ice fraction in the region of north 45°N. Its dimension is fraction.

ASI was calculated from the Hadley Centre (HadISST1: Hadley Centre Sea Ice and Sea Surface Temperature data set, https://www.metoffice.gov.uk/hadobs/hadisst) with 1° × 1° resolution for 1870–2022 (Rayner et al., 2003).

(2) Similarly, please explain explicitly what is meant by "emissions" appearing in Figures 1 to 5. Are they simply primary PM emissions taken from the emission inventory, or do they also include precursors that form secondary aerosol matter?

Response:

The 'emissions' are composed of PM_{10}, $PM_{2.5}$, SO_2, NH_3, NOx, black carbon, and organic carbon in three sets of emission inventories (PKU inventory, MEIC inventory and PRD-EI inventory). These emission inventories only conclude primary emissions, precursors forming secondary aerosols are not taken into consideration. Data and calculation methods for emissions are presented in Section 2.1.

As an example, Figure R1 shows the temporal variation of three emission inventories in PRD. They show generally consistent variations during overlapping periods.

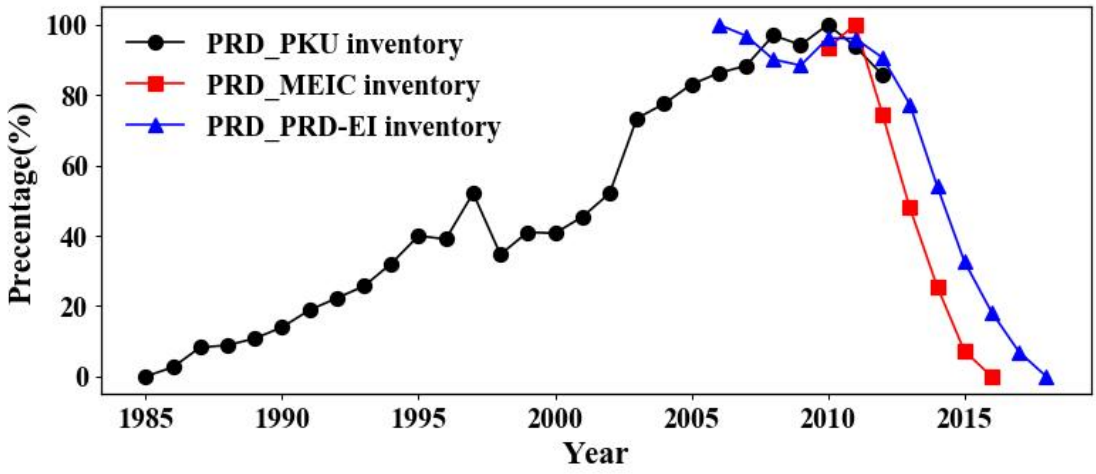

Figure R1. PKU emission inventory for winter 1985–2012, MEIC emission inventory for winter 2010–2016 and PRD-EI emission inventory for winter 2006–2018 for PRD. The raw data are normalized to the difference of the maximum value and minimum value.

(3) Describing what was done or observed, is usually written in a past tense. Please check out this throughout section 2. Past tense is also preferred in the following places: … were crucial (line 35), … was the most (line 37), … carried out (lines 111 and 128).

Response:

Thanks. We have checked and corrected the tense problems according to your suggestion in the revised manuscript.

(4) Section 3.2. Please reformulate the title of this section (e.g. "Comparing the MLR results…). Starting the section by referring to "the second question" is not a good practice, as the reader need to find out from the earlier text what is this question. I would recommend repeating this section e.g. by writing "The answer to the question whether Table 1 or 2 is correct is that neither of them is correct, for the following …"

Response:

Thank you for the suggestions. We have reformulated the title of Section 3.2 to be "Comparing the MLR results to mechanistic models". We also revised the beginning statement of Section 3.2 as you suggested "The answer to the question whether Table 1 or 2 is correct is that neither of them is correct, for the following reasons"

References:

Rayner, N. A., Parker, D. E., Horton, E. B., Folland, C. K., Alexander, L. V., Rowell, D. P., Kent, E. C. and Kaplan, A.: Global analyses of sea surface temperature, sea ice, and night marine air temperature since the late nineteenth century, J. Geophys. Res. Atmos., 108(14), https://10.1029/2002jd002670, 2003.

Wang, H. J., Chen, H. P., and Liu, J.: Arctic Sea ice decline intensified haze pollution in Eastern China, Atmos. Oceanic. Sci. Lett., 8(1), 1–9, https://doi.org/10.3878/AOSL20140081, 2015.