

Interactive comment on “Insights into particulate matter pollution in the North China Plain during wintertime: Local contribution or regional transport?” by Jiarui Wu et al.

Anonymous Referee #1

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Using a modified version of the WRF-Chem model, this paper utilizes a source apportionment method to examine particulate matter characteristics during a wintertime pollution event in China. The authors first compare the model output to chemistry and aerosol observations from ground-based sites and conclude that the model generally performs well. Then, the authors aim to explore the relative contributions of local and non-local emissions on air quality in various regions of China – a topic that is very important for emission regulations. Their findings suggest that for Beijing and Tianjin, local emissions tend to dominate when the air quality is excellent and good; however, the impact of non-local emissions becomes more pronounced as air quality decreases.

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I think that the results stemming from this work are interesting and worthy of publication. In general, the paper is well written and the authors do a satisfactory job explaining their findings. However, I do have a few comments regarding several topics on which the authors could further elaborate. Overall, I recommend that the paper be accepted for publication once the authors address my comments. My major and minor concerns are described below, and my grammatical recommendations are provided in an associated PDF document.

Major/general comments: 1. Pollution event meteorology: In the context of this study, the transport of pollution is strongly dependent upon regional meteorology (e.g., advection of particulate matter by the mean wind). However, the authors do not put nearly enough emphasis on this topic. How do the large-scale meteorological conditions evolve over the course of the month? Surely, there was some variability; even just looking at Fig. 5a, one can hypothesize that there is some synoptic-scale influence. Please add a figure showing this evolution, perhaps near-surface pressure, winds, and temperatures at various snapshots during the event that correspond to the peaks and valleys in Fig. 5a. Moreover, the only discussion of wind flow is surrounding Fig. 6 and some other brief sections in the text. In Fig. 6, it appears as though the authors plot mean wind arrows for the pollution event. How do you calculate average wind direction during the time period? Do you think that it is valid to show a planview of average winds over a month-long period? Many of the regions show calm winds, but there is likely much variability over the course of the entire event. Showing a time series here of observed and/or modeled winds should help clarify. Additionally, regarding L210-212: Do you hypothesize that this is going on here? Are you able to use the surface measurements to determine if the modeled wind field is a major issue for this particular case? Again, perhaps a time series of wind speed/direction would help. Regarding L272-275: Did this occur during the case study examined here? The wind arrows in Fig. 6 suggest not, but it is difficult to tell since they are averages.

2. Figure 5: Because there are so many sites, it would be nice to see the spread

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among sites. Is the model doing well at all of the sites? Or are many sites under- and over-predicted to “average out” and make it look like they are doing well? Does the model do well in one region over another? I suggest that you add a figure with panels showing scatter plots of these chemical species that compare observations and model for all sites and color by region.

3. Source apportionment uncertainty: Are you able to quantify the uncertainty in your source apportionment calculations? For instance, in Tables 2-5 and Figs. 9 and 10, can you add some information that helps understand the error in your estimates? For instance, add ranges in the tables and error bars on the bar plot figures.

Minor/specific comments: 1. L97-100: At the end of section 1, please provide a brief description of what you will present in the following sections.

2. Figure 1: I do not see any “blue circles”, maybe you mean to say “circles”.

3. Figure 1: What is the total number of sites considered in the analysis? This would be important to know also for Fig. 5.

4. L199-200: Do you allow for model spin-up? Table 1 says that the model start time is 05 December 2015, but you show results starting on this day.

5. Figures 6 and 8: What about the diurnal variability in the spatial distributions?

6. L225: Do you have evidence of cloud coverage during this event?

7. L232-233: Why do you choose to focus on the NCNST site?

Grammatical/wording recommendations: Please see the attached PDF.

Please also note the supplement to this comment:

<https://acp.copernicus.org/preprints/acp-2020-597/acp-2020-597-RC2-supplement.pdf>

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, <https://doi.org/10.5194/acp-2020-597>, 2020.

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