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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Feedback effects of boundary-layer meteorological factors on explosive growth of $PM_{2.5}$ during winter heavy pollution episodes in Beijing from 2013 to 2016" *by* Junting Zhong et al.

Anonymous Referee #1

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The precise cause of the explosive growth of PM2.5 levels during heavy aerosol pollution episodes in China is an interesting topic. The study utilized hourly PM2.5 monitoring data and vertical meteorological data to characterize typical explosive growth of PM2.5 during different stages of heavy pollution episodes occurred in Beijing since 2013, and attempted to quantify the effect of meteorological factors on such growth. The topic is certainly suitable for ACP, the methods are appropriate, and the analysis and the results are generally reasonable. This paper can be considered for publication after the following issues are addressed.

General comments:

One of my concerns with this paper is that the title is appropriate. What is the exact meaning of "feedback effects"? Do they represent the effects of worsening meteorological conditions on pollutant accumulation, or the feedbacks of cumulative pollutants on worsening meteorological conditions? Also, it seems that the "feedback effects" only occurred during the cumulative explosive growth processes, right? I think "feedback effects" is somewhat misleading and thus unsuitable. Thus I would suggest the author to consider another title.

Another concern is that it would benefit if the paper can be more quantitative as a whole. There are many places when the author stated a conclusion, but did not back it up sufficiently with a number. For example in Line 237-238, Sect. 3.2.2, "the mass concentrations of soluble organic aerosols, sulfate, nitrate, and ammonium rapidly increase with RH (Figure S1)".

The methods look a bit simple. First, what is the representative of the air quality monitoring data and vertical meteorological data used in this study? It should be noted that these data have different spatial and temporal resolution. Can they represent the urban conditions in Beijing? Also, the atmospheric vertical observations are twice daily at 0800 h and 2000 h. Are they sufficient to capture the rapid changes during the explosive growth stages? It would be nice if the readers could see a brief discussion of the representative. For example, a figure displaying the locations of the observation stations is helpful. Second, even though references are given for the PLAM index, it would be easier for readers' understanding if more information given in this manuscript.

Specific comments:

Line 201-203: A more formal citation to the model results should be used, rather than "personal communication with Dr. Hong Wang". Some model details should be added in the methods, perhaps.

Line 247 and Line 436: The in-text citation and the reference for “Y. Liu et al., 2008” is in the wrong format.

Line 260: “100 to 50” - units should be added.

Line 299-301: Why the PLAM index can be used to approximately quantify the atmospheric feedback on the growth? Can they fully represent those meteorological causes of the cumulative explosive growth mentioned in this study?

Figure 7: (1) Are the plots just for the cumulative explosive growth processes? But it seems that in February 2014 (b) there is no cumulative explosive growth process, only the convergent explosive growth process? (2) What’s the temporal resolution of the PLAM index and PM2.5 concentrations? Hourly or 12 hours?

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