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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Two-way feedback mechanism between unfavorable meteorological conditions and cumulative aerosol pollution exists in various haze regions of China" *by* Junting Zhong et al.

Anonymous Referee #1

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This work tried to understand the role of two-way feedback between unfavorable meteorological condition and air pollution based on in-situ measurements on both air quality as well as reanalysis data. The authors also compared this feedback mechanism in different highly-polluted regions in China. The strength of this work is comprehensive and high-resolution observational data in multiple typical regions. However, more in-depth analysis and quantitative discussion ought to be provided while interpreting the disparities of two-way feedback in different regions and in temporal stage, as well as its relationship with other factors. Here are some issues that need to be addressed.

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Discussion paper

Major comments:

Most parts of Results and Discussion, i.e. Section 3.1-3.6, describe measurements on temporal variations in PM2.5, surface radiation, and vertical distributions of meteorological conditions like air temperature and humidity. Indeed, the literal description and full-information figures give a detailed picture of air pollution and meteorological conditions for each individual regions during these 40-day period. However, I personally think that further in-depth analysis and discussions need to be performed for the purpose of better understanding this two-way feedback in various regions and also in different stages during air pollution. For instance, the authors clearly identified different pollution stage in different regions in the manuscript, including cumulative stages, transport stage as well as clean stage. What are the quantitative differences of the two-way feedback mechanism between transport stage and cumulative stage? How the different synoptic conditions (wind, radiation, cloud and humidity) during different stages influence the pollution vertical profile and then the feedback processes?

Another, in Section 3.7 where statistical analysis is made to comprehend the disparities of the two-way feedback under different pollution conditions, more relevant parameters and quantitative results is suggested. Since that vertical differences in temperature stratification between observations and reanalysis data are presented in Fig. 14, the aerosol profile, which has been identified to play an important role in radiative effect of aerosol (Wilcox et al.,2016; Wang et al, 2018), is better to be discussed. If possible, this work will be further improved by including some measurements on aerosol extinction profiles.

Given that this work mainly probed into “two-way feedback mechanism” in the whole manuscript, it is better to clearly define this term before the result part. What are exactly the included chemical and physical processes? Does it mean aerosol self-induced pollution deterioration, or it has taken synoptic condition into account already? The authors indicated that meteorological feedback explained 60-70% pollution increase in Line 458-459. Does it mean “two-way feedback mechanism” that has already in-

cluded unfavorable meteorological condition caused by synoptic weather condition? If so, "meteorological feedback" is a little misleading.

This work focused on two-way feedback mechanism on the time period between Dec. 1 2016 to Jan. 10 2017. Please give the reasons for choosing this 40-day data since that both the air quality monitoring data and reanalysis data cover much longer period than that being used in this work.

Minor corrections:

Please define the abbreviation in the main text for the first time and do not repeatedly explain it in the following part. And abbreviations should not be included without explanations in the Abstract. It needs to be thoroughly checked. (Line 27, Line 214, Line 244...)

The title for each subsection is a little bit long. Please simplify it in the revision.

Section 2.1: The reference or data URL ought to be provided here.

Line 101-102: This sentence, which describes data utilization in this work, is better to be placed in Section 2.

Line 203-206: The authors proposed enhanced hygroscopic growth of aerosol due to increase in RH. This point could be further confirmed by the ratios of Lidar-observed aerosol extinction and PM2.5 concentration provided by air quality monitoring net work. Thus, more information is suggested to be added here.

Line 209-201: Regional transport of air pollution from Yuncheng to Xi'an is claimed here. Simple backward trajectories is recommended to be included here to clearly show the transport pathway.

References:

Wilcox, E. M. , Thomas, R. M. , Praveen, P. S. , Pistone, K. , Bender, F. A. M. , & Ramanathan, V. . (2016). Black carbon solar absorption suppresses turbulence in the

atmospheric boundary layer. Proc Natl Acad Sci U S A, 113(42), 11794-11799.

Wang, Z., Huang, X., & Ding, A. (2018). Dome effect of black carbon and its key influencing factors: a one-dimensional modelling study. Atmospheric Chemistry & Physics, 18(4), 1-29.

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