

Comment on acp-2020-1273

Anonymous Referee #1

Referee comment on "Lidar vertical observation network and data assimilation reveal key processes driving the 3-D dynamic evolution of PM_{2.5} concentrations over the North China Plain" by Yan Xiang et al., Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2020-1273-RC1>, 2021

Summary and general comments:

This manuscript reports the evolution characteristics of PM_{2.5} concentration in different dimensions (surface-layer, vertical-distribution and three-dimensional) under four different phases (an early phase, a transport phase, an accumulation phase, and a removal phase) of heavy pollution process in North China Plain. The authors used data from an observation network consisting of 13 aerosol lidars and more than 1000 ground observation stations, combined with a data assimilation technique, to conduct a comprehensive analysis of an extreme heavy aerosol pollution over the North China Plain from November–December 2017. Meanwhile, the regional transport of PM_{2.5} over different transport channels was quantified, including PM_{2.5} concentration, transport flux and transport flux intensity. Moreover, the authors also captured the regional transport of air pollutants stretching over 1000 km, proving the necessity and importance of the joint prevention and control of regional air pollution.

These results could significantly improve our understanding on the key processes driving the 3-D dynamic evolution of PM_{2.5} concentrations. The scope of this manuscript is well suited to ACP, and the data obtained by the authors are valuable. The data set is meaningful to further verify or constrain the representation of aerosols in air quality model and satellite remote sensing. This paper is very well-written and should be considered for publication after addressing my comments below.

List of minor comments:

- Page 4, Line 10: The map information shown in Fig. 1a and Fig. 1b is too duplicate with that shown in Fig. 1c and Fig. 1d respectively. It is suggested to delete Fig. 1c and Fig. 1d or put them in the supporting material.

- Page 5, Line 5: The time resolution of 3-10 minutes refers to the time resolution of the original data or the smoothed data. If it is original, please describe clearly; if it is smooth, please give a detailed smoothing method in the manuscript.
- Page 5, Line 6: The semicolon should be changed to a comma.
- Page 5, Line 17: Please provide the WRF Chem version used in the manuscript.
- Page 6, Line 26: A space needs to be added between 1 and km to be consistent with other contents of the manuscript.
- Page 9, Line 7: Xintai should be Xingtai.
- Page 12, Line 5: What is the meaning of white color in j, k and l of Figure 6? Does it mean that the current moment is missing data? Or is it deleted due to low SNR? Please add a clear description to the manuscript.
- Page 16, Line 4: Why choose 1.5 km to calculate the total amount of PM₅ transportation. Why not 1 km or 2 km, 3 km? Please give reasons. Is it based on the height of the atmospheric boundary layer? Or is it due to the 1.5 km explained in line 9 on page 15?