

Reviewer #1

Comment [1-1]: General comments: This paper installs a multi-lidar system that can measure aerosol extinction coefficient, wind direction, wind speed, and temperature on a vehicle and measures meteorological phenomena that can affect changes in PM_{2.5} concentration in real time in major cities in China. This is an analysis paper. Through analysis of observation results, the researchers revealed that T-NPES (Transport-Nocturnal PM_{2.5} Enhancement by Subsidence) is a relatively common and important pathway causing PM_{2.5} pollution in the surface layer of China's winter plains. It is believed that the above research results were possible thanks to the multi-lidar system. It is considered to be academically meaningful to reveal that T-NPES is the main cause of high concentration PM_{2.5}. However, the main content of the paper is a simple structure that repeats the analysis of observation results, and no new results were found other than T-NPES. This is disappointing considering the long observation period and observation area.

Although this paper is judged to have low academic value to be published in this journal, it is ultimately judged that it can be published in this journal because it is a research result that can only be observed using a multi-lidar system.

Response [1-1]: We thank Prof. Noh for the comments and suggestions. All of them have been implemented in the revised manuscript, such as adding a more detailed description of the measurement system, and more discussion about the nocturnal PM_{2.5} enhancement in Plain regions in China. Please see our itemized blue responses below for more details.

Comment [1-2]:

1. It is deemed necessary to add essential information about the multi-lidar system.
2. ex) In 3D visual scanning micro pulse lidar, information on measurement wavelength and lowest observable altitude must be added

Response [1-2]: We have added the essential information about the multi-lidar system in Table S1 (attached below). And we improved the description of the multi-lidar system as follows:

Line 107: “The 3D lidar used an Nd: YAG laser to emit a 532 nm laser beam at a repetition frequency of 2500 Hz, which is scattered by aerosol particles in the atmosphere.”

Line 112: The Doppler wind profile lidar: “It emits a rotating 1545 nm laser beam using a 10 kHz repetition rate fiber-pulse laser and measures the Doppler shift produced by the laser’s backscattered signal as it passes through airborne particles such as dust, water droplets in clouds and fog, polluted aerosols, salt crystals, and biomass-burning aerosols to derive the horizontal and vertical wind speeds at any height.”

Line 118: The Raman temperature profile lidar: “Operating at a 532 nm wavelength by an Nd: YAG laser at a repetition frequency of 20 Hz, it has a temporal resolution of 5 minutes and a vertical resolution of 60 m.”

Table S1. Detailed parameters for the multi-lidar system

Lidar	Variable	Wavelength	Spatial and time resolution	Lowest observable altitude
3D visual scanning micro pulse lidar	Extinction coefficient, depolarization ratio	532 nm	15 m/1 min	30 m
Doppler wind profile lidar	Wind speed and direction profiles	1545 nm	50 m/1 min	40 m
Raman temperature profile lidar	Temperature profiles	532 nm	60 m/5 min	60 m

Comment [1-3]: Figure 6 is difficult to read, so resolution, etc. needs to be improved.

Response [1-3]: Thanks for your suggestion. We have made the following adjustments to improve the comprehensibility of Figure 6 and attached below:

1. We add the illustration to show the plain area at the bottom of Figure 6.
2. We change the color of the background and the arrows to make the picture more vivid.
3. We remove the “1 km” and use the “Altitude” to make the vertical axis clearer.
4. We use the “Particulates” instead of “Aerosol” more accurately describe the subject of the study, and improve the legend of the transport of “Particulates” and the “Particulates layer”.
5. We add the description of the key T-NPES process as “PM_{2.5} enhancement by subsidence behind the cold front”
6. We use a gradual change legend to represent the passage of the cold front better.
7. We add “3 steps” to better summarize the steps of the T-NPES event and improve the comprehensibility of the conceptual scheme.

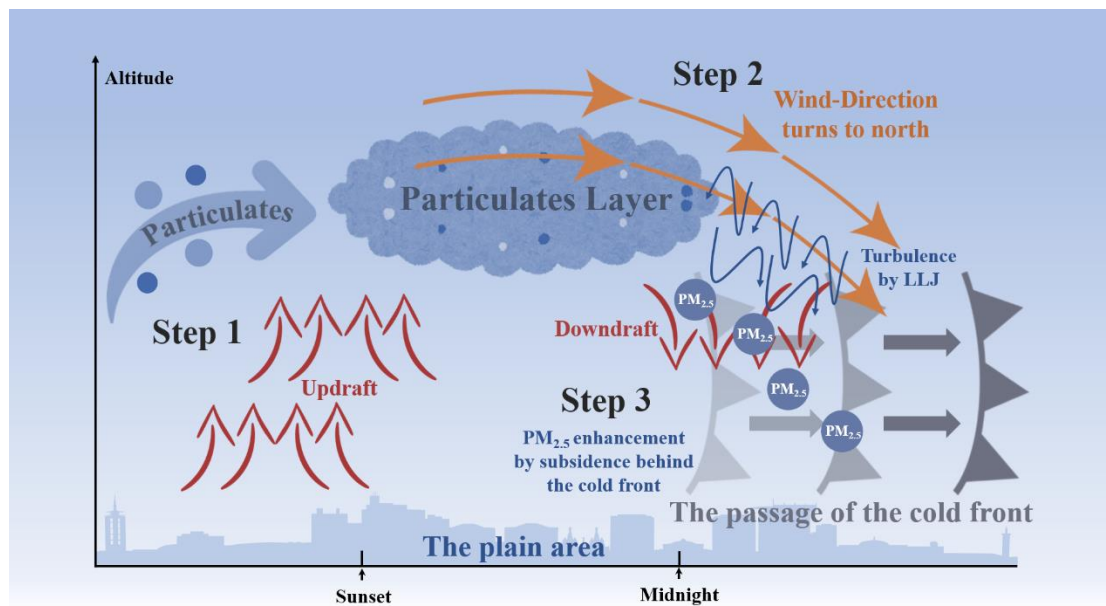


Figure 6. Conceptual scheme of the T-NPES events