

## ***Interactive comment on “Analysis of Influential Factors for the Relationship between PM<sub>2.5</sub> and AOD in Beijing” by Caiwang Zheng et al.***

### **Anonymous Referee #1**

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The relationship between satellites observed aerosol optical depth to PM<sub>2.5</sub> at surface is important to monitor and quantify the air pollution at ground from satellite observations which is relatively more independent and has less artificial errors than ground-based measurements. However, the physical connection between AOD and PM<sub>2.5</sub> is relatively indirect and weak thus can be affected by multiple factors. This study utilized most existing state-of-art measurements and observations of aerosol and meteorology parameters to investigate the impacts from aerosol type, relative humidity (RH), the height of boundary layer (PBLH), wind speed, wind direction and the vertical distribution of aerosol on the relationship of AOD-PM<sub>2.5</sub> in Beijing, China. This investigation is comprehensive, timing and with high scientific significance given the very serious situation of air pollution in China. I suggest to accept it for publication in ACP after minor revisions and addressing the following questions.

C1

P13, L1: Why the correlation of AOD between AERONET and CALIPSO is lower than that between AERONET and MODIS, any interpretations?

P13,L7: Any explanation about the reason of “AOD becomes small, it seems that the correlation of AOD between MODIS and AERONET also decreases.”

P13, L15-17: a lot of information contained in Table 1 and 2 needs more in-depth discussions.

P15, L1: add “for given PM<sub>2.5</sub>” before “the increase of RH can result in . . . .”

P15, L2: add “for given AOD” before “the increase of PBLH can cause . . . .”

P15,L18-21: This part of discussion need consider the impacts from horizontal atmosphere circulation in different seasons.

P16, L20: the first row of Figure 6 seems redundant with Figure 5.

P17,L4: “0.01” should be “0.1”

P18, L14: The aerosol extinction capacity should “decrease” with increasing particle size.

P19, L6: better be consistent, using “extinction capacity” ?

P19,L9-14: The information in Figure 9 is not thoroughly revealed yet: how will the size, the absorption/scattering capability impact $\eta$ ? Can the conclusion be hold in all seasons?

P20, L1 & L3: “aerosol” → “aerosol and gas-phase pollutants”. Because second order aerosol can form from gas-phase air pollutants.

P20, L20 – P21, L5: The effect of wind speed should work with wind direction, depending on the relative location of Beijing to the pollution source (i.e. upstream or downstream).

P21,L8-9: Why AOD increase with increasing wind speed slower than 3m/s?

C2

P22,L20: This is not true based on Figure 13: significant AOD were contributed by aerosols located above 500m altitude. The contribution from lower layer (<500m) is smaller comparing to that from upper layer (>500m).

P23, L1-4: Discussion here should be combined with the discussion of PBLH.

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