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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Vertical variation of optical properties of mixed Asian dust/pollution plumes according to pathway of airmass transport over East Asia" *by* S.-K. Shin et al.

Anonymous Referee #1

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General comments

This present study investigates optical property variations of mixed Asian dust with anthropogenic pollution according to the pathways and vertical distributions during long-range transport. The authors find a decrease of the linear depolarization ratio of the mixed dust/pollution plume in dependence of transport time if the pollution layer travelled over China at low heights, i.e., below approximately 3 km above ground. We can separate aerosol types as anthropogenic pollution particle, smoke particle, sea-salt and dust in the atmospheric aerosol study. However, the mixed aerosol is observed in the many cases, especially in Asian dust. Asian dust particles, which originate from

desert areas in the Asian continent, can be mixed with polluted aerosols that contain black-carbon and/or smoke particles while they are transported over industrial regions. This mixture of dust particles with anthropogenic particles causes changes in optical properties of dust layers. The increased radiative forcing exerted by East Asian dust plumes can be largely attributed to the presence of highly light-absorbing anthropogenic particles that are mixed in dust layers. However, the vertical structure and the degree of vertical mixing between dust and pollution layers during transport are poorly understood, primarily because of the lack of vertically resolved observations of aerosol pollution. In this respect, the results presented in this study are expected to be able to help the understanding of the degree of mixing of dust. In general, this manuscript is well organized and the results are valuable for improving our understanding of the dust particles and the mixing status of dust and pollution particles. The manuscript should be published in "Atmospheric Chemistry and Physics". But it requires some minor revision before to be published.

Comments

Line 59 : 63±9 sr at 355 nm and 62±8 sr at 532 nm, respectively -> 63±9 and 62±8 sr at 355 and 532 nm, respectively

Line 85, 87 : Change the order of references by year.

Line 128 : Add "at 532 nm" after "depolarization ratio"

Line 137 : Please denote the minimum observation altitude of extinction coefficient.

Line 142, 146 : Authors used "co-polarized and cross-polarized" in line 142 to explain depolarization ratio. But, "perpendicular and parallel" were also used in line 146. Those expressions are different? If those intend to deliver the same meaning, Please consider using just one of them throughout the manuscript or try to define them together.

Section 2.2 : What is the threshold level of depolarization ratio to identify dust layer?

Line 182 : as low -> low as

Line 214-215 : Insert the standard deviation for each mean value.

Section 3.1, line 238-241 : The sentence is hard to understand. How do you classify the dust layers as two episodes? Dose the sentence from line 255 to 261 account for two episodes? If yes, move that sentence to the front of this section and then reorganize the sentence.

Line 292 : What kind of the model do you use? You just mentioned “model results”.

Line 307-310 : Remove those sentences. The sentences are same with the sentences in line 216-218.

Line 437 : Instead of “high altitudes”, display the correct altitude.

Table 1, 2, 3 : Lidar ratio -> Lidar ratio (sr)

Figure 2 : VDPR, PDPR, LR532, LR355, Bsc. Ang. 355/532 -> Use the symbol in the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 3381, 2015.