

Interactive comment on “Satellite remote sensing of Asian aerosols: a case study of clean, polluted and dust storm days” by K. H. Lee and Y. J. Kim

Anonymous Referee #1

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GENERAL COMMENTS: The paper “Satellite remote sensing of Asian aerosols: a case study of clean, polluted and dust storm days” using cluster analysis on AERONET data to better define aerosol types/models in East Asian region and apply the models for the aerosol retrieval in the region using an LUT approach. To objective is to improve the aerosol retrieval in East Asian region with more accurate aerosol model assumptions since aerosols compositions in the region are much more complex so that more representative aerosol models should be used in aerosol retrieval. The surface treatment is also somewhat different from the standard MODIS approach by using Eq. (5). These specific considerations are the valuable parts of the study and need to be addressed in the abstract and conclusion, which I didn’t see in the current version. The organization of the paper needs to be improved, for example, it would be better to put

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Sensitivity Study section right before the Look-up Table section. A lot of descriptions are not accurate in the text and the English is also poor. The authors should have the manuscript professionally edited before submission to improve the English. Most important, a detailed description of the retrieval procedures outlined in Figure 4 should be added since it is critical for readers to really understand the algorithm. Considering AERONET retrieval for dust aerosols does assume non-spherical particles and this paper is try to better characterize the aerosol properties for improving aerosol retrieval, using spherical assumption for dust aerosols in category 6 is a negligence that cannot be accepted (see item 16 bellow for how to make some improvement). More itemized comments and suggestions are proved below. I suggest a major revision on the paper before accepting for publication.

ITEMIZED COMMENTS: (1) Page 2652, Abstract, line 3: replace “during” with “for”.

(2) Page 2652, abstract, lines 7-8: change “However, it is still difficult to retrieve . . .” to “However, there are still some difficulties to accurately retrieve . . .”.

(3) Page 2652, Introduction, line 23: insert “various” right before “optical properties”.

(4) Page 2652, Introduction, line 24: insert “caused by human activities” right after “climate change”.

(5) Page 2653, Introduction, lines 3-4: change “Not only knowledge of the microphysical and optical properties of aerosols on the radiative transfer is needed for the retrieval of the aerosols but also exact estimation of surface reflectance provided a way to retrieve reasonable aerosol characteristics.” to “Not only the knowledge of the microphysical and optical properties of aerosols on the radiative transfer but also the accurate estimation of surface reflectance is needed to retrieve reasonable aerosol characteristics.”

(6) Page 2653, Introduction, line 6: replace “conducted” with “studied”.

(7) Page 2653, Introduction, line 7: replace “studied” with “obtained”.

(8) Page 2653, Introduction, line 11: remove “As a measure value of aerosol loading” since it is redundant with “AOT is directly related to the atmospheric load” on line 17.

(9) Page 2653, Introduction, line 21: insert “aerosol” in front of “sources” and “transformations”.

(10) Page 2653, Introduction, lines 26-29 (the last two sentences): It would be more accurate to say “To date, aerosol retrieval over East Asia has been actively studied due to unique aerosol characteristics in the region. This paper is also an attempt along this line.”

(11) Page 2654, Introduction, lines 1-11 (the 1st paragraph): It would be better to write this paragraph as “This study presents an aerosol retrieval based on interactive look-up tables (LUTs). We develop LUTs by means of statistical classification method, which is introduced in previous work (Omar et al., 2005). In this classification, aerosol optical properties were obtained from AERONET sun-sky radiometer data archive (AERONET, 2010). Aerosol retrieval is then processed by a step forward from the classified aerosol models and has the advantage of representing more accurate aerosol properties in the retrieval. The retrieved AOT from the 1 km resolution MODIS L1 calibrated reflectance data using this method is compared with MODIS Level 2 and AERONET AOT measured from the ground for validation.”

(12) Too many problems on the text and in the English that needs to be fixed. I will stop list them from now on. The authors should have the revised manuscript professionally edited before submission to improve the English.

(13) Figure 2 and discussions on page 2656, line 21: The highest absorption (lowest SSA) was shown for category 3-4. The author should indicate that when AERONET performs retrieval of SSA, the absorption properties for fine and coarse models are assumed the same. Thus, for the cases either fine mode (categories 1-2) or coarse mode (categories 5-6) dominates, AERONET retrieved SSA is more accurate than the cases (categories 3-4) when the two modes are comparable.

(14) Page 2656, line 25: Since categories 5-6 can be considered as dust aerosols, categories 1-2 can also be considered as pollution aerosols and categories 3-4 as the mix of pollutions and dust.

(15) Page 2658, line 1: Is the AOT values at 550nm are used for the 11 AOT interval values in the LUTs?

(16) Following Fig. 3 and related discussions on Page 2657 (2nd paragraph), it would be better to show the phase function distributions (versus scattering angles) for 6 aerosol models (especially in back scattering angles) since it is very important for the satellite aerosol remote sensing. For the dusty aerosols in category 6, non-spherical assumptions should be used and the corresponding phase function can be inserted into the radiation transfer model to generate LUTs. In this simple way, non-spherical property of dust particles can be reasonably included in the retrieval. Considering the AERONET retrieval for dust aerosols does assume non-spherical particles and this paper is try to better characterize the aerosol properties for improving retrieval, using spherical assumption for dust aerosols in category 6 is a negligence that cannot be accepted.

(17) Page 2659, line 3: MOD35 cloud screening approach is used in current algorithm to determine clear-sky radiances used for aerosol retrieval. It had been pointed out by Martins et al. (2002; GRL) that MOD35 cloud screening is not sufficient for aerosol retrieval. This is because MOD35 cloud screening is mainly designed and optimized for cloud parameters retrieval and tends to be cloud conservative. Thus only using MOD35 cloud screening may result in evident cloud contamination in aerosol retrieval. This is why the standard MODIS aerosol retrieval adds more screening criteria to the MOD35 cloud screening scheme to reduce cloud contamination in the aerosol retrieval (see Martins et al., 2002; GRL).

(18) Page 2660, line 13 (Fig. 4): More descriptions are needed for Fig. 4. For example, in the box with LUT, what $\tau_{Aer}(470) \rightarrow \tau_{Aer}(550) \rightarrow \tau_{Aer}(660)$ really means?

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Please provide step by step descriptions for Fig. 4 so that readers can really understand the algorithm.

(19) Page 2660, Section 5: This section 5 should be moved to ahead of Look-up tables section. As shown in Fig. 2, size distribution, SSA, and g are very different for the 6 aerosol models. It is worth to add sensitivity study for size distribution aside from SSA and g .

(20) Page 2661, line 19: It would be more accurate to perform linear fit in the logarithmic coordinate.

(21) Table 2: R is mean radius or median radius? They are different in definition.

(22) Table 3: For polluted case, MOD04 compares slightly better with AERONET than MSTAR does. Any explanation?

(23) Fig 6: More info is contained in this plot that needs to be discussed. For example, maximal AOT in the LUT of standard MODIS retrieval is 2. AOTs larger than 2 are treated as missing data and this is why there are no (AOT and FMF) data for MOD04 in the dust plume center. The MSTAR indicates the dust plume as category 1 aerosol type (red), which is evidently wrong. These detailed features should be discussed in the text (page 2662, 2nd paragraph of section 6).

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