

We would like to thank the referee and the editor for their time reviewing the manuscript, and for the helpful feedback provided. The detailed responses to all referees are provided below.

Reviewer #2:

I was a reviewer of the previous version of the manuscript. In this revision, the authors have addressed most of my previous issues. I appreciate these efforts. This includes improvements to the data file format – global processing attribute metadata have been added (some other dataset-level metadata are still missing such as variable long_names, although these are documented in the paper itself, so while not ideal I think it's acceptable if it is difficult for the authors to add these without a larger-scale processing effort).

As a result, I feel the paper is acceptable for publication in ESSD pending a few minor corrections, unless other reviewers identify problems I missed. As ESSD is primarily a data set description journal I see the requirements as being a little different from e.g. AMT/ACP and think the overall level of detail is appropriate here.

I think the below could probably be handled without further peer-review but would be happy to review again if the Editor would like.

Response:

We would like to thank the reviewer for your time reviewing the manuscript and appreciate the constructive comments on our paper.

1. Line 17: “continues” should be “continuous”

Response:

Revised.

2. Line 30: This sentence is too strong, it's not right to conclude that these products are all reliable. Only AOD, Angstrom, and fine/coarse split are validated against AERONET. The other things are compared against other satellites (not a validation!) or not at all (e.g. BPDF). I would just start this sentence as "Moreover, the data set provides not just total aerosol optical depth (AOD), but ..." That is a more honest representation of what is shown in the paper.

Response:

Agree. This sentence has been revised to "Moreover, the developed POSP product includes not only total Aerosol Optical Depth (AOD), but also detailed properties of aerosol such as aerosol size, absorption, layer height, type, etc., as well as full surface Bidirectional Reflectance Distribution Function (BRDF), Bidirectional Polarization Distribution Function (BPDF), and black-sky, white-sky albedos and Normalized Difference Vegetation Index (NDVI).".

3. Line 61: "China has traditionally prioritized the development of Earth observation technologies and it has recently launched..." This statement veers into propaganda, not science (and is unsupported in any case). I suggest just starting "China has recently launched ..."

Response:

Thanks! This sentence has been revised to "China has recently launched several payloads with polarimetric capabilities.".

4. Line 64: "past" is written twice, one can be removed.

Response:

Revised.

5. Table 1: is “spectral resolution” the full width at half maximum or something else? This should be defined more clearly as there are several possible interpretations. is it correct that the bandwidth for the 1380 nm channel is 40 nm? That seems quite wide compared to historical instruments, given the water vapor absorption here is quite narrow and the usual goal for this wavelength is to get a narrow band to increase sensitivity to only high-altitude features (e.g. cirrus).

Response:

Thanks! It should be full width half maximum (FWHM), we have added it to the Table 1. For the polarimetric band, due to the relative weak energy, the bandwidth is generally wider than non-polarimetric band. For example, the FWHM of 1380 nm for 3MI is 40 nm, while it's 20 nm for VIIRS.

6. Line 160: from reading the response to reviewer comments, it's not clear to me if (for the Dubovik AERONET inversion product) only the almucantar scans are used or also the hybrid scans. The hybrid scans were implemented to increase retrieval quality and availability during the day and are in the same file format (but a different data stream) from the almucantar scans. I initially assumed both were used but from reading the response to reviewers, this is no longer clear to me.

Response:

In this study, we use the inversion product from the almucantar measurements. We have added it to the main text.

7. Line 168: please add the Deep Blue data version used.

Response:

Thanks! We use NOAA20 VIIRS Deep Blue (DB) 6 km Version 2.0 Level 2 aerosol product (AERDB_L2_VIIRS_NOAA20) (Lee et al., 2024).

Lee, J., Hsu, N. C., Kim, W. V., Sayer, A. M., and Tsay, S. C.: VIIRS Version 2 Deep Blue Aerosol Products, *Journal of Geophysical Research: Atmospheres*, 129, e2023JD040082, <https://doi.org/10.1029/2023JD040082>, 2024.

8. Line 241: I would delete the word “new” as this technique has been used for 15+ years now by GRASP. So this is not a novel aspect to this specific application of GRASP.

Response:

We removed the word “new”. Thanks!

9. Figure 16 and discussion: I’m not sure if the difference in the 2 micron band albedo is really from aerosols. At this wavelength, the aerosol contribution is small unless the coarse optical depth is high. I think that the spectral difference between 2130 (MODIS) and 2250 (POSP) nm band centers is probably the biggest factor (of course as the authors point out radiometric calibration can be important as well). This spectral difference can be quite significant because the absorption of different surfaces (and water) can vary a lot over this range. This can be seen in e.g. hyperspectral libraries (for example this soil spectrum from the ECOSTRESS library):

<https://speclib.jpl.nasa.gov/ecospeclibdata/soil.aridisol.haplargid.none.all.89p1793.jhu.becknic.spectrum.txt> and also in things like PACE OCI surface reflectance data which has SWIR bands at both these wavelengths (for example Figure 1 here):

<https://www.tandfonline.com/doi/full/10.1080/2150704X.2025.2470905#d1e924>

Response:

Thanks! We have added this discussion in the main text.