

Reply to Anonymous Reviewer #1:

We appreciate the reviewer's comments on the manuscript. All comments are highly valuable and helpful for us to improve our manuscript. We have studied them carefully and have addressed them in the revised manuscript. Below are point-by-point responses to the reviewer's comments.

Comments from the reviewer:

General comments:

1. Section 2.2 on pages 6-7. I would recommend the authors make a table to list the data information including the sources, time period, time resolution, and so on. Also, it is necessary and useful for authors to provide the accuracy of the observation data used in this study based on previous literatures.

Thank you for the professional suggestion. We have added a table (Table 2 in the manuscript) presenting the detailed information regarding the data information including the sources, dataset name, resolution, and time period.

Table 2. Summary of datasets used in this study.

Instrument/Product	Dataset name	Resolution	Period
AERONET	AOD; AE; SSA	15 min, Site	2001.10-2020.5
MODIS	Deep_Blue_Aerosol_Optical_Depth_550_Land_Best_Estimate	Daily, 0.1°×0.1°	2002.7-2020.5
MERRA-2	MERRA2_400.tavgM_2d_aer_Nx	Monthly, 0.625°×0.5°	2002.7-2020.5
CALIPSO	CAL_LID_L3_Tropospheric_APro_CloudFree-Standard-V4-20	Monthly, 5°×2°	2006.6-2020.5
ERA-5	10m v-component of wind; 10m u-component of wind	Monthly, 0.25°×0.25°	2002.7-2020.5
GDAS	Global Data Assimilation System 1°×1°	Daily, 1°×1°	2005.1-2020.5

Also, we have mentioned the table in the 'study area' section. In addition, we have added descriptions about the accuracy of the data used in the introduction for each dataset.

MODIS:

Line 113-117: "Sayer et al. (2014) showed that the MODIS Deep Blue (DB) algorithm can retrieve ~1.6 times more AODs than the Dark Target (DT) algorithm with more than 82% of AOD retrievals falling within the expected error envelopes and with small root mean squared error (0.07) over Oceania. As the MODIS Terra and Aqua sensors are near identical, and the same retrieval algorithms are used to generate AODs, DB algorithm shows very similar performance for the two sensors (Sayer et al., 2013)."

MERRA-2:

Line 129-132: "The monthly MERRA-2 and AERONET AOD showed good agreement with correlation coefficients (R) between 0.59 and 0.94 at nine sites over Australia (Fig. S1). Moreover, the root mean squared error (RMSE) were smaller than 0.05, which indicated that the monthly MERRA AOD products showed good performance over Australia."

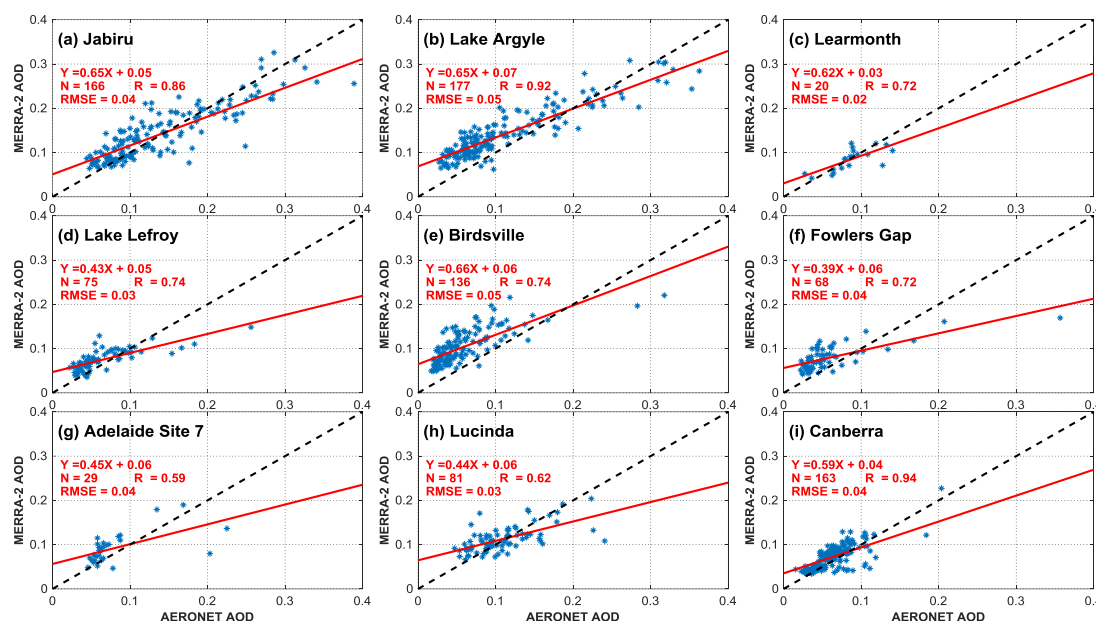


Figure S1. The comparisons of monthly MERRA-2 and AERONET AOD at nine AERONET sites over Australia during 2002-2020. Linear regression is shown as a solid red line and all the linear relationships are statistically significant at $\alpha = 0.01$. The black dashed line is the 1:1 line.

CALIPSO:

Line 139-142: “Omar et al. (2013) investigated the performance of CALIPSO AOD data and found that when cloud cleared and extinction quality controlled CALIPSO data was compared with AERONET data with AOD less than 1.0, the mean relative difference between the two measurements was 25% of AERONET AOD. In addition, they found that the CALIPSO AOD has good correlation ($r=0.65$) with AERONET AOD at Lake Argyle in northern Australia”

Specific comments:

- Line 10, please spell out AERONET for this first time appearance
Thank you for pointing it out, the correction has been done.
- Line 53, “There have been” should change to “There are”
Thank you for your suggestion. We have corrected ‘There have been’ as ‘There are’.
- Line 54, Since the dry season is not clearly defined, I would suggest the authors directly show the months instead of using “dry season”, or they need define the dry season here.
Thank you for your suggestion. We have defined the period (typically April - November) of the dry season for this first-time appearance.
- Line 63, please just keep one for “In addition” and “also”.
Thank you for pointing it out, ‘also’ has been deleted.
- Line 85-90, some references are needed.
Thank you for your suggestion. We have added reference in this paragraph. More detail please see the revised manuscript.
- Line 92, “it” can be deleted.
Thank you for pointing it out, ‘it’ has been deleted.
- Line 95, “are exactly” should be “is exactly”
It has been changed as ‘is exactly’.

9. Line 102-103, I would suggest mentioning the AOD source using “The uncertainty of the AOD from AERONET is ...”
We have corrected this sentence based on the suggestion.
10. Line 111-112, “Levy et al. (2013) showed that the expected errors of the L2 MODIS AOD product are about $\pm(0.05+15\%)$ ”, it is the MODIS DT AOD, not the data used in this study (i.e., “Deep_Blue_Aerosol_Optical_Depth_550_Land_Best_Estimate”). Please delete this sentence and add the relevant reference.
We agree with the reviewer. We have deleted the old reference and added new reference to describe the accuracy of MODIS DB AOD in the revised manuscript: “**Sayer et al. (2014) showed that the MODIS Deep Blue (DB) algorithm can retrieve ~1.6 times more AODs than the Dark Target (DT) algorithm with more than 82% of AOD retrievals falling within the expected error envelopes and with small root mean squared error (0.07) over Oceania. As the MODIS Terra and Aqua sensors are near identical, and the same retrieval algorithms are used to generate AODs, DB algorithm shows very similar performance for the two sensors (Sayer et al.,2013).**” (Line 113-117).
11. Line 121, “includes” should be “include”
Corrected.
12. Line 124, “AODs” should be used instead of “AOD”
Corrected.
13. Line 160, I wonder what method is used for the trend analysis in this research? Linear analysis?
The authors need indicate which method was used.
This is a good question. In this study, we used the linear trend analysis to present the trend of AOD and AE over Australia. We have mentioned this method in the revised manuscript in Line 168: “**The annual variations and linear trends of AOD, AE at the nine sites over Australia are shown in Fig. 3.**”
14. Line 169, “investigated” might be more suitable than “discussed”
We have changed “discussed” as “investigated”.
15. Line 172, “the size of aerosol particles” is more reasonable
Corrected.
16. Line 188, “zone” should change to “zones”
Corrected.
17. Line 208, “lead to” should be “led to”
Corrected.
18. Line 254, “suggest” should change to “suggested”
Corrected.
19. Line 269, “compared to other sites” should change to “compared to Birdsville”
Corrected.
20. Line 270, delete “the” from “the their”
Corrected.
21. Line 323, “are” should be “were”
Corrected.
22. Line 344, “was” should be “were”
23. Corrected.
24. Line 430, “is” should be “was”

Corrected.

25. Page 43, Please enlarge the label in Figure 13(a)

The labels have been enlarged.

26. Page 44-45, “Seasalt” should be “Sea salt” in Figures 16 and 17

Corrected.