

Interactive comment on “Long-term multi-source data analysis about the characteristics of aerosol optical properties and types over Australia” by Xingchuan Yang et al.

Anonymous Referee #3

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This study performed a comprehensive analysis of aerosol properties in Australia using multiple observation and reanalysis datasets. It discussed the spatial distribution, trends and seasonality of major aerosol types, combined with an analysis of potential sources using back trajectory simulation. The paper is also well presented and easy to follow. I think this is a good study, offering insights of aerosol variability in Australia, especially the less populated regions of central Australia. I only have a few minor comments and questions:

1. I have a couple of questions regarding the data. In Line 105, I understand that Level 1.5 data from AERONET has much large volume. But it also shows higher uncertainty.

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I wonder if any quality control on this data is performed? Actually, keeping all quality screen criteria from AERONET Level 2 algorithm except the AOD threshold will keep most of the data. 2. Section 2.2.2: is there a particular reason that MODIS Terra AOD is not used? 3. Section 2.2.3: the aerosol type analysis is primarily based on MERRA 2 data. I wonder if there is any validation of the MERRA 2 aerosol types, considering that there can be uncertainties in the model simulations? 4. Section 3.1.1: the significance level of all trends should be provided here, especially that most trends are rather small. 5. 3.2.2: I have two questions here. First, I wonder how the back trajectories are clustered? Which method is used? Is it subjective or objective? Second, I think the aerosol source analysis needs to be combined with aerosol type analysis, i.e., what are the potential sources of each aerosol type at each site? For this purpose, I suggest the authors separate the trajectory analysis by aerosol type or by season, according to the results of Figure 15. 6. I am curious about how aerosol properties change during the extremely intense wildfire in late 2019/early 2020. It seems that AOD has greatly increased over Victoria and Australian Capital Territory. Did the authors see other changes in aerosol properties, e.g., AE, absorption, aerosol type, etc? Btw, the location of Australian Capital Territory is not marked on Figure 1. 7. My final comment is that there is lack of a comparison with previous studies. What are the major new findings of the current study as compared with previous studies on aerosol properties in Australia? Is the analysis of aerosol type in this study supported by previous in-situ measurements? Some discussion should be added.

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