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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterisation of episodic aerosol types over the Australian continent" *by* Y. Qin and R. M. Mitchell

Anonymous Referee #1

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General Comments:

This paper responds to a call for better characterization of aerosol types over the Australian continent, especially dust aerosol with the Australian continent the major dust source for the southern hemisphere. The objectives are the identification of major episodic aerosol types, their source characterization, optical properties, and radiative forcing. The analysis takes advantage of data from a network of sky radiometers associated with AERONET that has been enhanced over the past decade. The nature of the remote sensing observations preclude reliable retrievals of aerosol properties at low optical depths, therefore, episodic events with higher optical depths are addressed. A cluster analysis is used to identify the major, climatically relevant aerosol types occurring over the background aerosol and the microphysical, optical, and radia-

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tive properties of these aerosol types as well as their likely sources are summarized.

The paper is well written and clearly presented. The results are relevant for improving the understanding of aerosol radiative forcing over the Australian continent and applications for improving satellite remote sensing retrievals and aerosol forcing in climate models. It is recommended that the paper be published with consideration of the comments below.

Specific Comments:

P 18804, L 4: The abstract states the cluster analysis was performed on microphysical properties while text states that optical properties were used - change microphysical properties to optical properties or to optical properties calculated from retrieved from microphysical properties.

P 18808, L 24-26: Is there a reference for the value of ˜0.03 as the background aerosol? How was a threshold chosen for the observations that were included in this analysis? I.e., what does significantly greater mean when choosing a threshold for observations that are considered in the analysis?

P 18809, L 3-8: What was the motivation for removing this relatively large number of outliers - large relative to the number of observations in some of the reported clusters? Are they all assumed to be the result of measurement error? If they are valid observations they may be radiatively significant and important in the characterization of the spread in particular aerosol types.

P 18809, L 21-25: Discussion here as to why these specific parameters were chosen for the clustering would be beneficial - additional optical properties are summarized in Table 3 so why were some chosen to be included in the clustering and others not - would be helpful to readers to be explicit about your logic in the analysis design.

P18811, L 11 & Table 3: The list of selected optical properties in Table 3 is limited – why not include optical depth and asymmetry parameter in this table? I agree

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with the logic of reporting radiative forcing efficiencies here, however, the characterization of optical depths for these aerosol types may be of interest/use to modelers or for estimating regional radiative forcing. While Figure 3 gives these values and their uncertainties with respect to the clustering algorithm, it is also of interest to know the natural variability or spread in these parameters as this also becomes a source of uncertainty in forcing calculations when central values only are represented in models.

P18811, L 11-13 & Table 3: Spatial variability is defined as the standard deviation of the parameter within a particular class for each site and among all sites then expressed as a percent in Table 3 – definition of spatial variability needs to be clarified. Is this plus and minus the specified percent of the reported value over all sites? Again, this spread in the properties is of particular interest to modeling and estimating forcings and their uncertainties.

Table 3: New optical properties are introduced in Table 3 - Angstrom exponent alpha and fine mode fraction fv - but have not been defined in the text. Figure caption defines fv but not alpha. Would suggest that these be presented and defined in the text and their importance/relevance to radiative forcing might be briefly mentioned.

P 18820, L 21: column water vapor 4.2 g cm-2 seem high for Australian average

Table 5: reports forcing efficiencies but the column headers denote the defined forcing (deltaF) - would suggest removing deltaF and leaving the column headers as TOA, SUR, and ATM

P 18822, L28– : You suggest in the abstract that this analysis will be used to improve aerosol in climate models but there is no discussion of this application in the paper. Can a statement be added to the discussion of improving satellite retrievals here that addresses how this information might be relevant for improving climate models?

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 18803, 2008.

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