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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Optical, physical and chemical characteristics of Australian Desert dust aerosols: results from a field experiment" *by* M. Radhi et al.

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Reply to Anonymous Referee #2. In addressing both referees' comments we have added some new material, and modified/clarified material in other places. These changes are indicated at the relevant places below.

Introductory/general remarks We have significantly improved the connection between the remote sensing part of the paper, and the field work part. We have done this by firstly comparing with similar remote sensing observations from other dust source regions, and secondly by comparing with the generic Australian size distributions obtained by Qin and Mitchell. We believe that this allows us to extend all of our results

in time, and (to a lesser extent) in space, significantly improving their usefulness. We have modified our comments on the agreement between AERONET and MOUDI size distributions to read "Given these caveats, and the errors associated with both approaches, we consider the agreement to be as good as could be expected". Note that is for a single case only. We found the comments on "the dominance of dust coarse mode somewhat confusing (see Abstract, Sections 4 and 7)", quite puzzling. Firstly, there is no direct reference to the dominance of either mode in the Abstract, while Section 7 refers to PM2.5 as the 'dominant fraction'. Secondly, the appropriate definition of fine mode fraction is either PM2.5/TSP (46%), or PM1/TSP (31%), depending on preference. We acknowledge that PM2.5 is the normal definition for air quality purposes, but we prefer PM1 in this study, as we indicated. (The major reason for this choice can be seen in Figure 6, which shows a clear minimum around 0.5 μm radius, or 1.0 μm diameter.) We have modified the comments in both Sections 4 and 7 to remove any confusion.

Specific comments 1. The abstract. We have added material, especially on the ion chromatography results, which were too brief. We also noted that the Fe/Al ratio ($\sim$0.8) is higher than Northern Hemisphere values (0.4-0.6): material added in Section 7. We have changed "weak seasonal cycle" to "clear though moderate seasonal cycle" (parts of northern Australia, more strongly affected by biomass burning, show an even stronger signal), and also in Section 7. In Section 4 we have noted the potential for greater uncertainty in size distribution retrievals from low optical depth data. Bimodal character of the size distributions. The results in Table 2 only give the fine/coarse breakdown, but say nothing about the structure of the size distribution. We have changed [line 24, p.25094] to read "The mass size distribution during this period was essentially bimodal, but with a doubled coarse mode peak".

2. We have added two paragraphs in the Introduction giving information of what is currently known of Australian dust, and dust aerosol, especially for the Lake Eyre Basin. Also a paragraph and Table have been added in Section 7 (collected in a new Table 5)

comparing Fe/Al ratios to other locations (see point 1 above).

3. Correcting MOUDI radii. These corrections have not been made, as it is not totally clear what factor to use (not all particles are mineral dust). Instead we have made it clearer what approximate change might be appropriate (for mineral dust), and also that we have not made such a correction. Dissolving material in a known volume of pure water is standard practice with ion chromatography. We have added some material in section 2.3 discussing the error levels in both the ion beam analysis, and ion chromatography, results (including this directly in either the Tables or Figures would probably be confusing).

4. Atmospheric conditions: We have added material to Table 1 covering wind speed (mean, max and min); wind (mean) direction; and dust conditions. (Note that the back trajectories in Fig 10 are also relevant here.)

5. AERONET/MOUDI comparisons: As noted above, the final sentence of the relevant paragraph now reads “Given these caveats, and the errors associated with both approaches, we consider the agreement to be as good as could be expected”.

6. We have added information in section 6.2 (and section 7) to the effect that gypsum is moderately soluble.

7. Nitrate reactions: Agreed. Section 6.3 now notes this as a “possible mechanism”.

8. Potassium: This section (6.4) has been significantly modified/enlarged to address these valid concerns. Salts, some containing potassium, accumulate in drainage basins such as Lake Eyre, providing a ‘crustal’ source of soluble potassium.

9. Although the main focus of the paper is on mineral dust aerosol, it is certainly true that our samples contain other components. We have therefore changed the title to ‘Continental Aerosols’.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 25085, 2009.