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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Spatial distribution of dust's optical properties over the Sahara and Asia inferred from Moderate Resolution Imaging Spectroradiometer" *by* M. Yoshida et al.

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This paper presents some interesting results regarding spatial variability of dust optical properties over a long timescale (8 years) across northern Africa and Asia using MODIS data. Besides the relevant comments of reviewer 1, I would like to point out some comments to the authors:

1)Regarding the correlation between single scattering albedo (SSA) and aerosol optical depth (AOD). If the authors are able to show that this relationship is physical, and not spurious (as suggested by reviewer 1), this presents a very interesting point. Recent work as part of the Fennec project over the Sahara [Ryder et al., 2013] has shown that



particle size decreases with dust age during transport, connected to increases in SSA. Since larger particles contribute to a lower SSA, this would suggest an increase in SSA as dust ages, and AOD decreases, consistent with what the authors imply here. It would be interesting to expand on the physical mechanisms behind the SSA and AOD relationship a bit more.

2)Page 31109/31110, lines 20 to 7 – it should be pointed out that in addition to the references for Saharan dust optical properties cited in this paragraph, there are several more recent (and lower) measurements that should be mentioned, such as by Otto et al. [2009] who found SSA values of 0.8 at 550nm during SAMUM1, Müller et al. [2010] who found SSA values of 0.82 at 550nm, and values measured during Fennec very close to fresh dust sources where 550nm SSA values from 0.7 to 0.97 were found [Ryder et al., 2013]. Several of the aircraft measurements cited by the authors in this paragraph did not include full measurement of the coarse mode of dust, which may have elevated the SSA measurements.

3)I suggest the authors consider recent work comparing aircraft measurements to AERONET retrievals of SSA and size distribution which find that AERONET SSA values for Saharan dust may differ significantly [Johnson and Osborne, 2011; Müller et al., 2012; Müller et al., 2010], calling into question the ability of sunphotometers to provide SSA values and size distributions for dust, particularly where a substantial coarse mode of dust is present in remote desert locations, such as examined in this article. Since the authors use AERONET-derived size parameters, the uncertainties may be much larger than presented in Table 1.

4)It would be interesting to comment briefly on whether dust events on smaller timescales show any variability in dust properties either spatially or over several days as the dust event ages?

5)Figure 4 – the color bar appears to be missing?

6)Figure 7 – there appears to be an interesting contrast in the east-west SSA between

western and eastern Africa between band 9 and band 1, with more spectral variation in west Africa than eastern Africa. Are the authors able to suggest a physical/chemical mechanism for this? Is this consistent with composition differences between eastern and western Africa?

7)Are any assumptions about the vertical distribution of dust made? This can vary substantially between dust events and change as dust ages, becoming more well-mixed throughout the Saharan Boundary Layer with age.

References

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