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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Variability of Lidar-Derived Particle Properties Over West Africa Due to Changes in Absorption: Towards an Understanding" *by* Igor Veselovskii et al.

Anonymous Referee #4

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This work deals with the analysis of spectral variation on lidar ratios and their relationships with spectrally dependent refractive index. The topic is very interesting in the field of atmospheric sciences because will help to further advances in constraining aerosol absorption properties from lidar measurements alone. The focus is on Saharan dust particles and which is one of the largest sources in the world of natural aerosol. Authors related quite well differences in spectrall dependences of complex refractive index with possible variability of dust composition. Actually, these results contribute to further advance in dust properties as in many previous studies with remote sensing dust have been assumed as an homogeneous specie independently of the source. The present papers also analysed mixtures of dust with biomass burning and how lidar ratios vary

in such mixtures.

The authors use an unique datasets for SHADOW-2 field campaings developed in Africa, and uses a high-quality data from LILLAS multiwavelength lidar system. The analysis presented complements previous studies carried out by the authors in Africa Currently, aerosol properties measurements in the African continent are very sparse and SHADOW-2 measurements are contributint undoubtlly to fill that gaps.

MINOR REVISIONS

I have a personal curiosity related to the paper: The authors have a lot of works on retriving aerosol microphysical properties from 3b+2a lidar measurements, even for non-spherical particles. Here, authors have the measurements for the retrieval. I would like to know why authors have decided not to do the 3b+2a inversion to retrieve aerosol refractive index. I have also follow your last papers in retrievals of aerosol microphysical properties from space-borne simulations and I would like to know if your new results can have an impact in space retrievals.

In the discussion of changes in lidar ratios for smoke with relative humidity, please take into account that they do not only depend on refractive index. Also is important the possible changes in size distribution.

Line 51-55: Please, note that spectral dependence in lidar ratio have been demonstrate useful to estimate the range of refractive index for non-spherical particles, although assuming no spectral dependence in CRI

Line 77: Please, define variables. What is Im440 and Im355.

Line 110: Why measurements are acquired at 47 degrees angle to horizon?

Equation 1: Please, give a proper reference

Line 163: I thing there is a type in 'recalculated'

Line 204: ' The backcatter Angström exponent Ab, in contrast with Az is sensitive

to the spectral dependence of the imaginary part of CRI'. Please clarify and provide references. Actually, Aa also depends on imaginary refractive index.

Line 245: Please explain futher why you assume 35% and 7% for dust and depolarization ratio or provide appropiate references.

Line 258: It is not clear why 25 sr is unrailstic lidar ratio. Please, provide references.

Line 267: Why smoke lidar ration should increase with RH ?

Line 276: the statement 'dust became less absorbing in the UV' is unclear. Are you referring to imaginary refractive index or to single scattering albedo?

Lines 338-353: Authors give a description of the 3b+3a lidar inversion. That should come earlier becase previously in Figure 13 you show size distribution from 3b+2a inversion.

Lines 333-337: It is not clear to me how you make the simulations. Table 1: How you estimated uncertainties?

Lines 465-467: Please, note the limitations in PSD variability with relative humidity in MERRA-2.

Conclusion section: 'Our study shows the impact of aerosol spectral absortion variation on the lidar-derived aerosol properties'. Do you refer to any aerosol type? I think you want to say dust and smoke aerosol.

Figure 7a. There is a blue line missing.

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