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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Saharan dust infrared optical depth and altitude retrieved from AIRS: a focus over North Atlantic – comparison to MODIS and CALIPSO" *by* S. Peyridieu et al.

Anonymous Referee #1

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The paper describes an exciting new method of determining aerosol parameters from satellite using the AIRS instrument. The technique is based on the detection of brightness temperatures in the IR range combined with the use of look-up-tables (LUT): one set of AIRS channels and one LUT are used for determining the state of the atmosphere, after which another set of channels and a second LUT are used to retrieve aerosol optical thickness (AOT) at 10 μm and median aerosol layer altitude. The spatial and seasonal patterns of the retrieved AOT data are compared to those of monthly averaged MODIS AOT at 550 nm, and good agreement is found. The spatial and seasonal patterns of the retrieved aerosol layer altitude is presented and compared with the seasonal pattern of monthly averaged CALIOP lidar data. Again, reasonable

agreement is found.

I think the authors are very convincing, and I have only some minor and textual comments. Two comments are general, and apply to the manuscript as a whole: 1. Please keep sentences shorter. Long sentences are often confusing. 2. Several figures (in particular Figs. 4, 5, and 8) are too small; the details and the text are mostly lost to the reader.

Specific comments (referee comments marked by either -> or ==)

Page 21200

line 5: Look-up-Tables -> look-up-tables

l. 21: sounders at low altitudes -> sounders for low altitudes

l. 21: These results however... ==there is no contradiction. Please remove the "however".

l. 26: if aerosol forcings -> although aerosol forcings

P. 21202

l. 7: Aqua train -> A-train

P. 21203

l. 3 : "Look-up-Tables" -> LUTs (no apostrophes)

l. 13: herein -> therein (several times in manuscript)

l. 20-24: This instrument... measurements (...). ==This is a very long, confusing sentence in which the word "sun-photometer" appears twice (with different spelling). Please rephrase

l. 26: How may sampling artefacts influence the comparison of monthly averages? For example, MODIS aerosol retrieval uses a very strict cloud filter.

l. 27: Let us remind -> Please note

P. 21204

l.10-13: Please mention here the poor global coverage of CALIOP

l. 13: from space = not necessary, please leave it out.

l. 16: At the time we are writing this paper -> At the time of writing

l. 20: at a spatial resolution -> at a horizontal spatial resolution (as apposed to vertical)

P. 21205

l. 1: with low sensitivity to a complex layering of the dust. ==What is meant here? "Low" sensitivity or "no" sensitivity? Doesn't the algorithm assume only one aerosol layer? In that case I think "no sensitivity" would be more accurate here.

l. 11: "highly" confident -> "highly confident"

l. 21: in the accumulation mode as well as large spherical -> in the accumulation mode, large spherical

l. 23-24: In the next, the non-spherical component is directly related -> In the following, the non-spherical component is assumed to be directly related

P. 21206

l. 10: "atmosphere-Look-Up-Tables" -> atmosphere LUTs

l. 20: situations with N<5 are rejected ==why?

P. 21207

l. 20: "aerosol-Look-Up-Tables" -> aerosol LUTs

l. 25: (linearly or not) ==please be more specific – if not linear, then what? Otherwise leave this bit out.

l. 27-28: Given an observed set ... is first selected. -> For each measurement, the aerosol LUT with the view angle closest to the real view angle is selected.

l. 28: observed BTs is compared to similar... -> observed BTs from the eight AIRS channels is compared to...

P. 21208

l. 1: sets extracted... -> sets of BTs extracted...

Please reformulate the above sentences (P. 21207, l.27-28 and P. 21208, l.1), as they are quite unclear.

l. 7: aod (in equation) -> AOD

l. 9: selected channels, the second -> selected channels. The second

l. 12: and 140-134 (Pi2004), and Nspot stands for... -> and 140-134 (Pi2004). Nspot stands for...

l. 20: stacked: please explain this term

l. 23: and set for allowing... for averaging. ==Please rephrase, I do not know what is meant here.

P. 21209

l. 2: The standard deviation is partly determined by the variability of the aerosols, too. Or is that meant here?

l. 12-14: I am not familiar with the Volz or MITR models. How large are the differences in refractive index between those models? In other words, how sensitive is the AIRS retrieval to errors in refractive index? It is also intriguing that the errors in aerosol layer altitude and AOD – which are very different quantities with different effects on BTs – are the same for all studied cases. Is this a coincidence?

P. 21210

l. 8-13: Point (3) is not ... last five days (Reid et al., 2003). ==What do the findings of Reid et al. have to do with point (3), the frequent occurrence of clouds?

l. 27: herein -> therein

P. 21211

l. 4: herein -> therein

P. 21212

l. 1-22 / Fig. 4: The shape of the plume coming from the Sahara also looks different (straight from west to east for MODIS, bending southward for AIRS). Is that due to particle size, to MODIS cloud mask, AIRS removal of low-lying aerosol layers, or something else?

l. 10: indicating these particles -> indicating that small particles

l. 14: by roughly one month =looks more like three months to me (March vs. June)

l. 25 / Fig. 5: It would be helpful if the regions were drawn on a map.

P. 21213

l. 23: tendancy -> tendency

l. 26-29: The transition... sensitive to dust. ==This is not a very convincing explanation, because AERONET (Fig. 7) only shows one peak corresponding to the MODIS maximum, not a broad or a secondary peak.

P. 21214

l. 5: Altogether, during the dust season, ... ==is this only for area (d), or for all?

l. 8: For region (a)...dust compositions (Koven and Fung, 2006). What are the implications for particle size? Could this be a reason for the variability found between the different sites? Are the found particle sizes in agreement with assumptions?

l. 20: As for the AODs... Indian Ocean. =This is a very confusing sentence, please rephrase. Do not start the sentence with “As for...”

l. 26: These results bring into evidence: -> Fig. 8 shows:

P. 21215

l. 1: herein -> therein

l. 10: the blank areas south of the SAL ==are these gaps due to persistent cloud cover?

l. 26: in the statistics -> for the statistics

P. 21216

l. 8: AIRS altitudes are lower than CALIOP altitudes ==what could be the reason? Sampling differences?

l. 9: about 500 m and agree better outside. -> about 500 m; better agreement is found outside of the main dust season.

l. 16: particularly satisfactory -> do you mean “good”?

l. 24-25: not obviously adapted -> do you mean “not ideally suited”?

l. 25: AOD do not show -> AOD does not show

P. 21217

l. 8-9: AIRS mean altitude although the comparison -> AIRS mean altitude when the comparison

l. 15-16: Here, retrieved altitudes lower than 1 km have been discarded. ==What fraction of all cases have altitude < 1km?

l. 19: are to be conducted -> will be conducted

l. 23: LMD ==abbreviation is not explained in the text

P. 21217

l. 1: datasets from several satellite-based observations -> datasets from different satellite-based instruments

l. 3: algorithm do not make exception -> algorithm is no exception

l. 3: condition -> conditions

Table 2. Look-Up Table -> look-up-table

Table 3. A map would be more illustrative

Fig. 6. Please show region (c) from Fig. 5 as a box in Fig. 6 (or zoom in on it), and add the location of the AERONET site

Fig. 9. Please explain in the figure caption what the magenta error bars are, this is now only mentioned in the text. And why are the CALIOP lines dotted in winter as well?

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