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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Dust altitude and infrared optical depth from AIRS" *by* C. Pierangelo et al.

Anonymous Referee #2

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This is an interesting and original study for which I recommend publication. The reader would certainly like to learn more details regarding the retrievals and some of the assumptions. Before publication I would like to request the authors to i) clarify what aerosol altitude they retrieve (the altitude of the dust layer top or some kind of average altitude of the layer) and ii) better document the sensitivity of their retrievals to the assumed dust refractive index, size distribution, and vertical profile in case of multi-layers of dust.

Other specific comments:

Page 3334, line 8: relies?

Page 3334, line 14: "in agreement with current knowledge on transport seasonality".

Page 3334, line 20 and following: the terminology "infrared", "thermal infrared", "terrestrial and atmospheric infrared" radiation deserves to be clarified and used consistently

in the manuscript. This does not seem to be the case at the moment.

Page 3336, line 25 and following: it would help to know the average/typical geometric thickness of layers in the 4A model. More generally speaking, more details on the RT calculations are needed here.

Page 3336, line 27: “the ASSUMED vertical distribution ”

Page 3337, line 19, “dust size distribution radius” à “mean dust radius”

Section 2: a bit more details should be given to the readers, in particular the size distributions and refractive indices used for the retrieval. How these have been chosen? A sensitivity to dust refractive index should be conducted as this is a very uncertain parameter. OPAC may not be the best aerosol model, although I agree that data on dust refractive index are very scarce in the infrared.

Page 3339, line 23: maybe replace “computed” by “synthetic” if this is the meaning.

Page 3340, section 3.3: this paragraph is not clear. More explanations (and a plot?) are needed. What is the meaning of the retrieved dust altitude if the layer has a geometric height of several kilometers. Is it the altitude of the top of the layer or an average altitude?

Page 3341, lines 11-12: it is not true at all that background aerosols such as sea-salt have a weak temporal variability. The sea-salt loading is very much related to the wind speed at the surface. The possible contamination of the dust retrievals by sea-salt would deserve to be examined properly.

Page 3342, line 4 and Table 3: MODIS has different algorithms for detecting cloud cover. It would be useful to give more details on the MODIS cloud cover product which is used, beyond the product number! I assume that the authors look at simultaneous and co-located scenes, but this should be clearly mentioned. Another study that shows that dust can be mistaken as cloud in the MODIS cloud product is:

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M. Doutriaux-Boucher and I. Chiapello, Analysis of cloud cover differences between POLDER-2 and MODIS instruments, *European Geophysical Union 1st General Assembly*, Nice, 25-30 April 2004.

Page 3342, line 6: "The total MODIS cloud coverage is 90.7%": this is an inexact statement. 90.7% of the 1°x1° pixels are declared as cloudy or partly cloudy in MODIS. But the cloud coverage would be smaller!

Page 3342, lines 8-12: I am not sure that the two arguments given for the MODIS-AIRS discrepancy in cloud cover are not in fact a single one.

Page 3342, line 26: replace "by night" with "at night" or "with night-time data". Replace "by day" with "during day time"

Page 3343: can the authors elaborate why their algorithm retrieves the "dust AOD" rather than the total AOD? This holds only under the assumption of a background aerosol with weak temporal variability. Since this is not the case, I see no reason why the retrieved AOD would not include other aerosol types if these are present in significant amounts. But I agree that an average background AOD has been removed from the retrieved quantity.

Page 3343: note that there can be (significant?) differences between MODIS and AIRS due to different sampling (daytime vs night-time, different swaths, different cloud masking).

Page 3344, line 10: The 7.3 μm threshold for atmospheric transport looks somewhat arbitrary to me.

Page 3344, line 12: I assume the authors plotted the monthly-average dust altitude weighted by dust AOD. Please confirm or not.

Page 3344, line 25 and following: in case of multiple dust layers, the dust retrieval must either be rejected or correspond to some sort of equivalent layer. Clearly sensitivity studies are needed here to understand how the retrieval scheme behaves (see also

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my previous comments).

Page 3346, line 16: replace “gives” with “provides a measure of”.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 3333, 2004.