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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Characterization of dust aerosols in the infrared from IASI and comparison with PARASOL, MODIS, MISR, CALIOP, and AERONET observations" *by* S. Peyridieu et al.

S. Peyridieu et al.

alain.chedin@lmd.polytechnique.fr

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Answers to Referee # 2

There is a hint of this on page 23104, where the authors use Mie code to calculate the ratio they would expect to see between the IASI 10 μm AOD and the PARASOL NSCM AOD at 865 nm, but the authors do not describe what they have done, or what the implications of the theoretical calculations are to there observations.

→ Pg 23102, Ln 10, a paragraph has been added for clarification .

Specific points:

1. Pg 23095, Ln 24: While it is true that it is unusual to use thermal infrared measurements for the retrieval of tropospheric aerosol properties, the algorithm presented in this work is by no means unique. See the work of Carboni et al., “Intercomparison of desert dust optical depth from satellite instruments”,Atmos. Meas. Tech., 5:1973âAËĞT2002, 2012, and references within. This study includes three separate aerosol retrieval schemes which utilise thermal infrared measurements, including a retrieval from the AIRS spec- trometer.

→ See answer nb. 2 to Referee #1

2. Pg 23095, Ln 25: Reword this sentence: “Yet not only is knowledge of the effect of aerosols on terrestrial radiation needed for their total radiative forcing, but infrared remote sensing also provides a way to retrieve other aerosol characteristics...”

→ Sentence reworded; now reads : “Indeed, from infrared remote sensing a coherent ensemble of aerosol characteristics can be retrieved simultaneously: AOD, mean altitude and size; moreover, the impact of aerosols on terrestrial radiation can be quantified.”

3. Pg 23097, Ln 1âÌĘAËĞT8: This sentence is far too long, please reword into at least two separate sentences.

→ sentence reworded : “Section 3 presents the results from IASI and comparisons with other aerosol products. For the AOD, these products are derived from the Moderate Resolution Imaging Spectro-radiometer (MODIS/Aqua and Terra), from the Multi-angle Imaging SpectroRadiometer (MISR), from the Polarization and Anisotropy of Reflectances for Atmospheric Science coupled with Observations from a Lidar (PARASOL), and from the AErosol RObotic NETwork (AERONET). For the altitude, comparisons are done with the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP/CALIPSO). Finally, the radius is compared with AERONET coarse mode radius.”

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Pg 23097, Ln 14: “detail” not “details”.

→ done

4. Pg 23097, Ln 25: Capitalise “radius” (first word of the sentence).

→ done

5. Pg 23098, Ln 13-16: I am not clear on the meaning of this paragraph. Do the authors mean that lookup table vertices are calculated using the 4A/OP-DISORT code, and intermediate values interpolated?

→ Yes. Sentence clarified : “In this Table, the entries in bold face correspond to LUTs BTs calculated using the forward coupled radiative transfer model 4A/OP-DISORT (Scott and Chédin, 1981; Stamnes et al., 1988, http://4aop.noveltis.com). The other entries correspond to LUTs BTs interpolated linearly or quadratically.”

6. Pg 23098, Ln 26: The statement describing the CALIOP measurement should be a separate sentence. “CALIOP, which is also part of the A-train, provides a measure of the aerosol vertical distribution.”

→ done.

7. Pg 23099, Ln 4: Replace “samples” with “channels”.

→ done (note that “sample” is often used for interferometers).

8. Pg 23099, Ln 7: Readers might also like a description of the spatial resolution and coverage of IASI.

One sentence added line 6: “Iasi provides a near global coverage twice a day at a spatial resolution of 12 km at nadir.”

9. Pg 23099, Ln 11âÌĘAËĞT14: The sentence beginning “Despite this temporal shift...” doesn’t really make sense.

→ sentence reworded. Now reads :

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"...Its data products are widely used in the aerosol community (Tanré et al., 1997; Remer et al., 2005, 2008). Aqua (Terra) crosses the Equator at 01:30 a.m. (10:30 a.m.) on its descending node. This temporal shift with IASI is not significant at the monthly scale."

10. Pg 23100, Ln 12: Replace "interpret statistically" with "statistically interpret".

→ done

11. Pg 23102, Ln 14, 16, 24: The sentences giving the "scaling factor" for each comparison are superfluous and should be removed.

→ see the first answer and the new paragraph introduced Pg 23102, Ln 10. All expressions "scaling factor" have been replaced by : "IR/VIS ratio" or equivalent.

12. Pg 23103, Ln 4: "source" not "sources".

→ done

13. Pg 23104, Ln 10: I don't understand the statement "show the same sharp transition in May/June when PARASOL NSCM lies significantly below IAIS outside the summer months". Any comment on the PARASOL fitting better during summer months is nonsense, as the authors have chosen to to scale the PARASOL values so that they fit best during summer!

→ General comment : Pg 23104 has been clarified; → Sentence shortened. Now reads: "...show the same sharp Spring transition in May/June."

14. Pg 23104, Ln 21: Another possible explanation is that the observed discrepancy is just due to the fact that the authors have chosen to scale the PARASOL result to agree during the peak AOD period. The presence of a 10% fine mode AOD in the peak IASI AOD would go some way to explain the difference seen outside of the dust season.

→The presence of a 10% fine mode AOD in the peak IASI would only have a 1% impact on the IASI AOD.

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→ Sentence rewritten.

15. Pg 23104, Ln 24: “On a theoretical basis” – please describe what was actually done for these calculations. I think I can guess, but I shouldn’t have to.

→ text added to clarify what has been done. Two sentences suppressed Pg 23104, Ln 23-28.

16. Pg 23105, Ln 17: Does the spatial average include results over land for those products which provide it?

No. Sentence clarified : “Space average is made over an area $\pm 1.5^{\circ}$ in latitude and longitude, centred on each site; pixels flagged “land” are excluded.”

17. Pg 23106, Ln 2: The IASI AOD is never higher than the other measurements; this is just an artefact of the fairly arbitrary scaling applied to the other products!

This scaling offers a simpler visual comparison. → one word added (visible AODs): “. . .At the site of Barbados, far from the sources, IASI AOD decreases less rapidly after July; at this site, the AERONET AOD is substantially smaller than the other visible AODs, a result also observed. . .”

18. Pg 23106, Ln 23: The claim that the change in the IASI AOD is more in phase with the MODIS Angstrom exponent gradient is dubious. I might believe it for Barbados, but I would suggest that, if anything, PARASOL NSCM shows better agreement in La Parguera.

→ Sentence modified : “. . .appearing more in phase with the MODIS Angström exponent gradients, particularly at Barbados.”

19. Pg 23106, Ln 28: Four to five year averages over a 3x3âŮę latitude-longitude box is not “small scale” in anyone’s book, especially for aerosol measurement!

→ Figures redrawn at a resolution of +/- 1.5° with similar results. See also answer nb. 5 to Referee #1.

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20. Pg 23107, Ln 11: This statement requires further explanation. The CALIOP data shows no missing values, only the IASI. If I understand correctly, the IASI retrieval provides a height for all retrievals, so how are the authors determining which heights should go into the comparison?

Caliop only measures at nadir with a quite long repetition cycle when IASI has an almost full coverage twice a day. Two modifications: - Added pg 23100, line 10: ", a near-nadir viewing instrument, " - sentence pd. 23107, line 11 modified: ÂńFor IASI, months with no data correspond to an insufficient number of items in the statistics mostly due to cloudiness or to rejections from the algorithm. Region WA is not shown for the same reason."

21. Pg 23107, Ln 21: If the authors want to use the monthly standard deviation of the aver- age layer height here, they need to introduce and describe it separately, perhaps even including error bars in Fig. 9a. Introducing the values here just makes the sentence confusing.

The sentence has been modified. Now reads: → ". . .,(ii), the variability associated with IASI and CALIOP altitudes during the summer peak season (of the order of 800 m and 1 km, respectively), these values..."

Adding error bars (we did it) does not really help (see, for example, fig. 10 of Peyridieu et al., 2010).

22. Pg 23108, Ln 22: The sentence starting "The first is measured..." is superfluous and should be removed.

This is line 8. → Sentence modified and clarified:

"As reported in Pierangelo et al. (2005), the sensitivity of infrared BTs to the particle size is a few tenths of Kelvin, an order of magnitude smaller than their sensitivity to either AOD or altitude, making it only slightly larger than the IASI radiometric noise."

23. Pg 23109, Ln 26: Frankly, as both retrievals are dependant on the particular aerosol

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models chosen, it would be amazing if there wasn't a bias.

→ the comment is for page 23108. OK, but still not explained satisfactorily.

24.Pg 23110, Ln 5: Either show the results for Tenerife in Fig. 11, or don't mention them. Also, what happened to the Karachi site?

→ the comment is for page 23109. All six sites are now shown.

25. Pg 2311, Ln 11: The statement that the difference between the IASI AOD and the shortwave estimates is roughly equal to the differences between the shortwave estimates themselves is wrong. Adding a something like "neglecting a regionally constant scaling factor" would fix this problem.

→ the comment is for page 23110 Two modifications : - see first answer concerning Pg. 23102 (in section 3.2) and the clarification of the scaling factor used here; - statement modified; now reads: " Differences between IASI AODs and the properly scaled (see section 3.2) 0.55 μm AODs are of the same order of magnitude as between them."

26. Pg 2311, Ln 25: The sentence starting "Another explanation..." doesn't make sense.

→ the comment is for page 23110 The sentence has been reworded more in accordance with what is said page 23104, line 22 and another reference added. Now reads: "Another explanation could come from the presence of large, more spherical, polluted dust particles, including the hygroscopic growth of the fine mode particles (Smirnov et al., 2002, Eck et al., 2008, Basart et al., 2009), not fully accounted for in the NSCM AOD."

Basart, S., Pérez, C., Cuevas, E., Baldasano, J. M., and Gobbi, G. P.: Aerosol characterization in Northern Africa, Northeastern Atlantic, Mediterranean Basin and Middle East from direct-sun AERONET observations, Atmos. Chem. Phys., 9, 8265-8282, doi:10.5194/acp-9-8265-2009, 2009.

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27. Pg 2312, Ln 10âAËĞT13: I think the relevance of this statement to this paper is rather tenuous and it should be removed.

→ The last sentence page 23112: “IASI NG will aim at increasing IASI performance twofold, a promise for fruitful future works.” has been modified. It now reads :

“IASI NG will improve the IASI performances by a factor of two in both the spectral resolution and radiometric noise, leading to major improvements in the accuracy of retrieved aerosol characteristics: AOD, altitude, and, particularly, effective radius.”

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 23093, 2012.