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Atmospheric Measurement Techniques Discussions

Interactive comment on "Desert dust satellite retrieval intercomparison" *by* E. Carboni et al.

Anonymous Referee #1

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Review of "Desert dust satellite retrieval intercomparison" by Carboni *et al.*, submitted to *Atmos. Meas. Tech. Discuss.*

The manuscript compares a large number of satellite aerosol retrievals for a mineral dust event in Africa. The paper is well written and present interesting results in well chosen figures. The focus on monthly means is particularly commendable. However, I feel that the story is not complete. The conclusion is too short and lacks the discussion that the abstract promises. More user guidance would also be welcome.

I recommend major revisions to address the main comments below.

1 Main comments

- The paper does not live up to its goal. The abstract states that the "*aim is to identify and understand the differences between current algorithms*". The identification of differences is there, but the understanding is lacking. The conclusion reads "*for SEVIRI ORAC the main issue is a bias over desert in clean conditions, which is attributed to error in the modelling of surface properties*". This is interesting and gives an idea of how an algorithm can be improved, but what about the other sensors?

In addition, the introduction states (page 694, line 13) that "*the interpretation of [visible and near-infrared measurements] becomes difficult over bright surfaces such as deserts. To overcome these difficulties more recent algorithms make use of additional information available from certain instruments.*" Later, page 721 line 18, the conclusion mentions the "*need to improve dust optical properties and surface characterization over land*". Those two statements at opposing ends of the paper strongly suggest that the additional information provided by other instruments has not been enough. A discussion on that point would be very useful.

A possible line of discussion is synergies, as mentioned page 722, line 6. The results of this study suggest that a simple synergy made of some combination of satellite products is not enough (see comment on the averaged dataset below). What seems to be needed is synergy at the algorithmic level, where inputs from several sensors help to better constrain a single retrieval scheme. The authors are well placed to give recommendations on this subject.

Another useful discussion is to give guidance to a potential user. Let's imagine a MODIS aerosol retrieval user who has grown used to not having retrievals over the Sahara. Reading this paper, he may think that other sensors do not bring much to the table: poor or incomplete retrieval of aerosols over that region, lack of coverage, large differences between instruments. Why should our user be interested in the datasets described here, and how should they choose the dataset they need?

- The description of the different datasets is useful, but should be made more consistent between datasets. For example, the current manuscript describes cloud-screening procedures for some datasets, but not others. Same for quality flags. I suggest having a common structure for each description, starting with techniques and assumptions (e.g. prescribed parameters, prior aerosol models), followed by cloud screening and quality flagging, and ending with a list of parameters retrieved for those algorithms that retrieve more than the AOD only. It seems unnecessary to mention validation results at this stage.

- Section 6. I'm not sure what the authors conclude with this averaged dataset. Is it a good idea, in spite of the standard deviation suggesting it is not? Does the land/sea continuity happen purely by chance or is there some underlying reason why it should happen?

2 Other comments

- Page 694, line 4: Mineral dust is not a good CCN, unless it is heavily coated with other materials. However, it is a good ice nucleus, and can affect precipitation and atmosphere dynamics through its semi-direct effect alone.

- Page 696, line 9: It may be useful to give the AIRS retrieval wavelength as 11 microns.

- Page 707, line 14: Any reason why MODIS is not represented here by both its standard inversion algorithm over dark surfaces and the Deep Blue algorithm over more reflective surfaces?

- Page 716, line 17: This statement is unclear. Are the authors saying that mineral dust flows around Tamanrasset, and dust conditions are therefore very different there?

- Page 718, line 3: A more likely reason why comparisons against AERONET are more successful than comparisons against other instruments is that AERONET mea-

surements are only used in coincident and cloud-free conditions where satellite retrieval algorithms are likely to do a good job. This is a weakness of validations against AERONET: the more numerous cases where satellite measurements are cloud-contaminated are essentially not validated.

- Page 718, line 26: which transport model? What do the authors mean by "assimilate"? Data assimilation requires a matrix of observational errors, which the authors say is not available for the averaged dataset.

3 Technical comments

- Page 702, line 15: Typo: "extrapolated".

- Page 710, lines 6 and 21: The subsection numbering should be 2.7.3.1 and 2.7.3.2.

- Page 716, line 7: Typo: "Banizoumbou".

- Page 717, lines 1 and 5: Typo: "than".

- Page 717, lines 14: CC and RMSD have already been used at line 7 and should be defined there. No need to define them again at line 16.

- Caption of Figure 13: Typo: "than".

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 691, 2012.