

Interactive comment on “Evaluation of IASI derived dust aerosols characteristics over the tropical belt” by V. Capelle et al.

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Received and published: 21 May 2014

Atmos. Chem. Phys. Discuss., 13, C12222–C12223, 2014 www.atmos-chem-phys-discuss.net/13/C12222/2014/ © Author(s) 2014. This work is distributed under the Creative Commons Attribute 3.0 License. Atmospheric Chemistry and Physics Open Access Discussions

Interactive comment on “Evaluation of IASI derived dust aerosols characteristics over the tropical belt” by V. Capelle et al. YB Balkanski (Editor) yves.balkanski@lsce.ipsl.fr
Received and published: 14 February 2014

The major points raised by the reviewers that will need to be addressed are listed

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below:

- Provide an evaluation of the AOD bias. @ The bias issue is now addressed in several sections of the paper: - Abstract, - 3. Method (a ~1 page paragraph added), - 4. Results (new paragraph : Åñ4.1.1 IR/Vis AOD coarse-mode site ratiosÅž) - 5. Discussion). - An Appendix (5 pages: 3 pages text, 4 figures) has been added to explain the difficulty of addressing the AOD bias. For the AOD, such a comparison raises the problem of the difference between the two spectral domains used: infrared (IASI) and visible (AERONET). The IR (10 µm) /Vis (500 nm) AOD coarse-mode ratio essentially depends on the refractive index, on the width of the size distribution and on the effective radius. All these parameters, varying from one site to another (and possibly throughout the time period for a given site), there is no one common factor reconciling the two observation metrics. Size distribution parameters are not a serious issue for this evaluation because they are provided, at each site, by the AERONET database. We show, in Appendix A, that the crucial parameter governing the conversion of the AOD from the visible domain to the infrared domain, is the refractive index, substantially varying with the type of aerosol considered. Unfortunately, an obvious lack of measurements of dust refractive index in the infrared precludes determining an accurate theoretical IR/Vis AOD coarse-mode site ratio. However, it is also shown that the “empirical” IR/Vis AOD coarse-mode ratio determined a posteriori follows relatively well the theoretical ratio and can still be interpreted as a marker of the aerosol situation observed. - Altitude biases are now given and discussed.

Answer the following remarks from the reviewers: " - As I understand it, the evaluated IASI AOD is corrected by multiplying multi-annual ratios of IASI (far-IR) AOD to AERONET(vis) AOD. "

@ It is the AERONET coarse mode AOD which is scaled by a site ratio prior to the evaluation of the IASI AOD. The IASI AOD is left unchanged. The scaling ratio is detailed and discussed in Section 3 (Method) and in the Appendix. It is somewhat analogous to the “Angstrom exponent” used in the visible, allowing to “translate” AOD at

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one frequency into AOD at another one. The problem here is that this site-ratio strongly depends on the refractive index, in particular, its infrared part, much less smooth than in the visible, and still quite poorly known. Minor point: IASI measures in the thermal and near infrared; not in the far-IR as said by Reviewer 1.

" - What is the IASI AOD, if there is no AERONET station to scale to? "

@ IASI AOD is given at 10 μm , globally, for the whole period covered here, exactly as are given MODIS, MISR or PARASOL visible AODs at several wavelengths. This is an important point for climate studies.

" - Then there are these very coarse scales (monthly and $1.5^\circ \times 1.5^\circ$), which brings up contaminating issue with regional representativity or averaging. "

@ Answer to Reviewer 1: From a review of papers dealing with remote sensing of aerosols, the $1.5^\circ \times 1.5^\circ$ resolution cannot be called "very coarse". Here, the aim is to somewhat increase the signal to noise ratio with the risk, the Reviewer is right, to bring some contamination, potentially masking the real performance of the method. One has, however, to keep in mind the fact that AERONET data are obtained daytime, when IASI data are obtained nighttime (at present). Research advancing step by step, we are already starting working on the daily issue, at a higher spatial resolution. It must also be pointed out that monthly results at such a space resolution (current IASI aerosol products resolution is $1^\circ \times 1^\circ$) are still considered as very useful for climate research (study of climate variability and evolution). These data need being evaluated.

" - Issue of daily data, which via more numerous samples would be also more meaningful." @ Certainly yes for aerosol research, and this is the reason why we are actively working in that direction. Less obvious for climate research.

" - Use of correlations to demonstrate skill without really looking into the meaning of such correlations. " @ Answer to Reviewer 1 : This remark is surprising: there is no mystery in the meaning of a correlation. However, to avoid any ambiguity, mention is

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now made of the "temporal correlation".

" - When a satellite product is evaluated, then answers are expected for data coverage and data accuracy, where the accuracy should address bias, spatial and temporal variability." @ Answer to Reviewer 1 : We agree. The bias issue is now extensively addressed. Temporal correlations, together with the normalized standard deviation of IASI (representative of the amplitude of the seasonal cycle at each site), are given and discussed throughout the paper. The latter has been added to the results presented in Tables 2-4. Moreover, the time series, given as Supplementary Material, inform on the space (sites) and time (period covered) variability of the IASI results compared to that of the AERONET measurements. As suggested by the Reviewer, and if the Editor recommends it, we will move this material to the main paper.

@@ All other questions/comments by the Reviewers have been answered

Yves Balkanski

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 30143, 2013. normalized standard deviation of IASI (last column). In the following, the normalized standard deviation will be referred to as "amplitude", as often representative of the amplitude of the seasonal cycle.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 30143, 2013.

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