**Atmospheric
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Discussions**

Interactive
Comment

Interactive comment on "A reanalysis of MODIS fine mode fraction over ocean using OMI and daily GOCART simulations" *by* T. A. Jones and S. A. Christopher

Anonymous Referee #3

Received and published: 3 February 2011

The paper by Jones and Christopher deals with the quantification of MODIS-derived fine mode fraction (FMF) for individual aerosol species. It is highly relevant for ACP, as a quantification of such FMF will lead to a quantification of anthropogenic aerosol optical depth (AOD), FMF and radiative effects. The use of a GCM model and incorporation of OMI data into the aerosol type classification scheme are good ideas and in connection with the scientific rigor of the study make the paper well worth being published.

In my opinion, there are some problems with the presentation of results. The paper lacks a specific statement about its purpose, it lacks logic in the order of presented results in section 4.1, and it has too many inconsistencies between results provided in

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the text and in Tables and Figures. If fixed, the readability of this manuscript could be improved greatly. Hence, I would suggest that the paper is acceptable for publication after revisions. The list below describes my specific comments and suggestions for improvements to the manuscript. My detailed comments are provided in the order the relevant sections appeared in the text.

General (major) comments:

1. Section 4.1 is impossible to follow in detail. It is unclear in which order the results in Table 1 are being presented or how the studies and different sections of this table relate. A description of the study regions for each of the studies in Table 1 is not provided until section 4.1.3. This description needs to be moved to the front of section 4 and it needs to be accompanied by a detailed explanation of how the studies compare/relate. Table 1 needs to be broken down into three sections (apparently this was planned as some of the text in the initial manuscript referred to a Table 1a). I would suggest titles of "previous research", "Our analysis for regions defined by Kaufman et al.", "Our analysis for GOCART-defined regions" for the three sections in Table 1. More care must be taken when presenting results. There are erroneous references to tables and inconsistent values given in the text when compared to the tables (see detailed comments below).

2. There is a disturbing mingling of the interpretation of uncertainties and variability (see pg. 29785, line 13-18). The standard deviations are indeed not measures of uncertainty, but they are also not only measures of spatiotemporal variability, as stated. They are instead measures of different "sampling" convolved with spatiotemporal variability. This distinction should be noted, because the GOCART defined regions of aerosol type predominance change from season to season. Hence, it makes no sense to speak of temporal variability, if the sampling uses different locations. Please rephrase this section. Also, in light of your own assertion that the standard deviations are not measures of uncertainty, I question

your statement on pg. 29793-29794 that the values in this study differ from JC07 "within observed uncertainties". Do you mean variability/sampling?

3. Your study is lacking a statement about the purpose of your paper. The fact that referee 1 and 2 have different views about the contents of your paper should make it obvious that you have not made the purpose of your paper clear enough. Your statement on pg. 29775 about a follow-up to a previous analysis is insufficient.

Detailed comments:

1. Pg. 29774, line 5, Abstract: You state that you estimate aerosol concentration and size, yet your manuscript is only about a proxy that depends on both of these quantities, i.e., FMF. Please correct.

2. Pg. 29774, line 14, Abstract: CC is not yet defined.

3. Pg. 29774, line 20 and throughout: There is a publication that deals with the differences in MODIS-Terra and MODIS-Aqua retrievals of dust (Redemann et al., Assessment of MODIS-derived visible and near-IR aerosol optical properties and their spatial variability in the presence of mineral dust, Geophys. Res. Lett., 33, L18814, doi:10.1029/2006GL026626, 2006). MODIS-Aqua was shown to perform less well than MODIS-Terra, at least for C4, with MODIS-Aqua overestimating Angstrom exponents more than MODIS-Terra. This is in line with your findings of higher FMF from MODIS-Aqua and is likely due to the problems with the MODIS-Aqua 1.6um channel or the fact that at 13:30 equator crossing time, MODIS-Aqua sees a very different part of the dust phase function. Please comment.

4. Pg. 29774, line 16: A description of the differences in data sets considered needs to be provided early on in the manuscript (e.g.: CERES-SSF vs. L2 Aqua, this study vs. Bellouin, vs. Kaufman et al.).

5. Pg. 29776, line 14: "These questions...". There were no questions in the previous section. Please rephrase.

6. Pg. 29777, line 1: "...these differences...". No differences were mentioned. Please rephrase.

7. Pg. 29777, line 10: Please justify your choice for the studied time period of June 2006 to May 2007.

8. Pg. 29778, line 12: Which MODIS cloud fraction product was used (MOD35 or the aerosol cloud mask)? Please state and justify your choice.

9. Pg. 29779, line 21: be specific about OMI cloud flags. Values of 0, 1 and 2 indicate different levels of cloud contamination (ranging from minimal to likely). What flag value did you use?

10. Pg. 29785, line 12: there is no reference to Terra data in Table 2. Do you mean Table 1? See also general comments below. It would help to structure Table 1 in the order of results discussed or change your discussion to the order results appear in the table. I can see little logic to the order of your presentation of results.

11. Pg. 29785, line 25: I find the use of a large scale model to assess the spatial variability in aerosol characteristics untenable. Modeled spatial variability is only as high as grid resolution will allow and likely an underestimate of true variability. Please strike or rephrase your statement.

12. Pg. 29788, line 17: "..(0.36 ...". Table 1 states 0.37. Please correct.

13. Pg. 29791, line 5: "... AOT is 0.55 (Table3).". Table 3 states 0.53. Please correct.

14. Pg. 29795, lines 13-19: I would move these thoughts into the section and mention them as part of the motivation for this paper.

15. Fix grammar or spelling here:

Pg. 29776, line 15-16; Pg. 29777, line 3 ("on" instead of "to"); Pg. 29781, line 23; Pg. 29782; Pg. 29782, line 22; Pg. 29783, line 28; Pg. 29785, line 25; Pg. 29787, line 10

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 29773, 2010.