Response #3

We want to thank the reviewer for their time spent in reviewing this manuscript. Several important changes have been made to address the concerns put forth, and we believe these changes have significantly improved the overall manuscript.

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).

Table 1 has been broken down into the three sub-components in roughly the manner you describe. Thus, Table 1a contains the results from previous research, Table 1b contains our results using the GOCART regions, and Table 1c contains our results using the Kaufman regions. The description of the study regions is located in the latter part of the methodology section. Section 4.1 in general has been revised to better reflect the layout of Table 1. Values listed in the text were also double-checked against those in the table to ensure consistency. Additional discussion of previous studies has been added to the introductory section as well.

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?

The reviewer makes a good point with respect to "temporal variability" and we have revised its discussion to better reflect the importance of changes in seasonal sampling to the reported values. As part of these revisions, greater emphasis was placed on defining variability vs. uncertainty. We realize that the distinction was not always clear in portions of the text. Finally, the statement referenced in the conclusions was removed from the text.

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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.

The introduction has been revised to state the purpose of this research more clearly.

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.
  This has been revised.

2. Pg. 29774, line 14, Abstract: CC is not yet defined.
  CC replaced with BC and OC, which have been 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 proper- ties 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 over- estimating 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.
  Thank you for pointing out this reference. It would appear our results using Collection 5 MODIS data are indeed consistent those reported by Redemann et al. [2006]. These results are now referenced in the text when discussing possible differences between Terra and Aqua FMF values.

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.).
  A brief discussion of Kaufman, Bellouin, etc was added to the Introduction section to improve the overall background discussion and better relate that to the research being presented. We elected to leave the details of the datasets in the Data section as we believe they do not fit well into an introductory type discussion. They are still discussed well before results are presented.

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

       "These questions…" has been removed.

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

       "these differences.." have been removed and the sentence revised.

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

       This period represented the only time when a full year of CERES-SSF data processed using Collection 5 MODIS data were available with OMI-AI data. Ideally, we would have liked to include more years, but that required CERES-SSF data were not yet available.

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

       The cloud fraction product used by this research is than present within the MOD04 product and represents a combination of threshold and spatial variability techniques.

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?

       Only data with QC value equal to 0 were used and this is now stated.

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.

       As noted in the major comment above, the text and Table 1 have been revised to improve overall readability in the manner suggested in the major comment above.

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.

       This statement has been revised accordingly.

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

       Corrected

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

       Corrected.

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.

These thoughts are now mentioned in the Introduction section as well as the conclusions.

15. Grammar issues corrected where found.