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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Statistical uncertainty of top of atmosphere cloud-free shortwave Aerosol Radiative Effect" *by* T. A. Jones and S. A. Christopher

Anonymous Referee #1

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Overall comments:

The manuscript "Statistical uncertainty of top of atmosphere cloud-free shortwave aerosol radiative effect" by Jones and Christopher discusses the statistical uncertainty that is related to datasets of aerosol optical thickness and shortwave (SW) aerosol radiative effect. In their analysis the authors question the validity of the arithmetic mean and the standard deviations that are widely used as a reference when comparing different studies and they mention the importance of evaluating additional statistical measures in describing global data sets.

The manuscript is quite well written, although repetitions between sections 3 and 4

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exist. Overall, the manuscript is publishable in ACP if a more in depth discussion regarding the clear-sky retrievals and their biases will be included.

Detailed comments:

1. A significant amount of discussion is spent on the “statistical uncertainty’’; however this is never defined. A detailed description of how exactly they define this phrase would be very useful.

2. Page 3560 - line 4: It is not clear to me what the authors mean when they say that: “...gridding ensures a uniform distribution’’.

3. Page 3560 - line 28: The authors state that “...mathematical limitations in this algorithm result in cases where one or two aerosol types may not exist.’’ This has nothing to do with mathematical limitations but with reasonable representation of the reality. Please elaborate.

4. Page 3562 - line 6: The authors state “Clear-sky is defined as cloud and aerosol-free regions...’’ that are determined by the cloud fractions. I do not understand how the cloud fraction implies that these regions are aerosol-free. Please clarify.

5. Page 3565 - lines 2-5. I strongly disagree with the authors’ statement. It is well known that the direct effect of aerosols on SW flux, even of the same species, depends on the solar zenith angle. Please revise appropriately.

6. Page 3565 - line 19: Could you please clarify what do you mean by “ To overcome the problem of spatial inhomogeneities, raw data pixels binned into a uniform grid ’’?

7. Page 3565 - lines 23-24: It is not clear to me what the authors mean by saying that: “... it forces a spatially homogeneous dataset from data that was previously non-uniformly distributed.’’

8. Section 3.5: I don’t really understand where the problem with the inclusion or not of missing aerosol components is. Indeed, inclusion or not of such components will result

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in different statistics. However, this decision is a strong function of what one is trying to find, as also pointed out by the authors. I think this section overstates the significance of such decisions. Please elaborate.

9. Page 3569, section 4.1: Since the analysis of the gridded data is done in section 4.2 why do the authors refer to gridded data in section 4.1?

10. How do figures 2-5 compare to each other? A more detailed discussion is very important to be included here.

11. Page 3569, line 14: The authors state "...MODIS cloud fraction for all (clear and cloudy) data''. Please clarify.

12. Section 4.3 - last paragraph: It is really hard to understand what the authors mean. Please elaborate.

Minor comments:

1. Page 3559, line 25 - ..."Christopher and Zhang (2002)" rather than ... "Christopher and Zhang (2004)''.

2. Page 3560, line 18 and elsewhere - Kaufman et al., 2005 is referenced also as Kaufman et al., 2005a and Kaufman et al., 2005b. Please make it consistent.

3. Please provide references for Bellouin et al. (2005), Fan et al. (2005a) and Li et al. (2004).

4. Figures 1, 6-9: What do the vertical lines and the values noted on each plot represent?

5. Figure 1 - ..."Probability density functions (open symbols) of non-gridded, global AOT (a) and SWRE (b) with idealized Gaussian (normal) distributions (continuous line) overplotted'' ... rather than ..."Probability density functions of non-gridded, global AOT (a) and SWRE (b) with idealized Gaussian (normal) distributions overplotted''.

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6. Figure 10 - Please make the text consistent with the figure.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 3557, 2007.

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