Atmos. Chem. Phys. Discuss., 12, C12174–C12178, 2013
www.atmos-chem-phys-discuss.net/12/C12174/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The global 3-D distribution of tropospheric aerosols as characterized by CALIOP" *by* D. M. Winker et al.

D. M. Winker et al.

david.m.winker@nasa.gov

Received and published: 31 January 2013

Response to Reviewer Comments on acp-2012-632

Anonymous Referee #1

1) Specific comments: Fig.1 needs some explanations: what means best case, worst case, day-low (80 km) etc.

Additional description of Figure 1 added on page 24851 after line 25: "Curves depict detection sensitivity during day and night for horizontal averaging of 5 km and 80 km. Daytime curve represents sensitivity for low solar background conditions such as cloudfree scenes over ocean." Mention of "best case, worst case" deleted.

2) p.24852 ln.3. "Because the lidar ratio of smoke is much larger than that of marine aerosol, lower levels of aerosol extinction can be detected for marine aerosol" But from fig.1 we can conclude that the threshold for marine aerosol is higher. It should be explained.

The plots for marine and smoke were inadvertently reversed. Caption has been corrected to identify smoke figure on the left and marine figure on the right.

3) Fig.8. The legends on the right and the left panels should be done in the same manner. The line colors corresponding cloud-free cases should be the same.

Figures 8a and 8b were reformatted to be consistent. Also, we noticed errors in the latitudes listed in the caption, which have been corrected.

4) Fig.13. In the capture to the figure we see "61 N–82 N" while in the text - 60-82 N.

Text was corrected to be consistent with caption.

5) I am not sure that Appendix is needed. No information from Appendix is actually needed for understanding of the manuscript.

See reply to similar comment from Reviewer #2.

Anonymous Referee #2.

1) Figure 2: why error bars at about 4 km are so large for both profiles?

These profiles are constructed from the orbit tracks crossing a relatively small region during one month. Aerosol was typically confined below 3.5 km and was observed above 3.5 on just one orbit, resulting in large extinction uncertainty between 3.5 and 4 km. A comment on this has been added to the text.

2) Page 24854 (line 27): the authors report that "To avoid underestimating the lowest part of the aerosol profile, when the base of the lowest aerosol layer is above the local surface but lower than 2.46 km, the "clear air" samples between the surface and the

aerosol layer are ignored when averaging." The authors should explain how the 2.46 km threshold has been selected.

The 2.46 km threshold was chosen to be consistent with the altitude threshold used in the aerosol 'base extension' algorithm implemented in Version 3. This choice was convenient, but somewhat arbitrary. A study is now being performed to see if the shape of the extinction profiles is sensitive to the value of this altitude threshold.

3) Page 24858 (line 12-13): authors discuss differences between daytime and nighttime extinction profiles below 1 km of altitude. This is a low altitude range, probably often below the maximum surface altitude within the grid. Authors should explain how they have treated data below the maximum surface altitude consistently with what reported in the Lidar L3 Aerosol Profile Quality Statement. Because this can have a strong impact on the AOD; this should be clearly explained.

Additional details on data averaging added on page 24854 at line 23: "Likewise, when surface elevation varies within a grid cell, averaging of each altitude bin is based only on samples located above the Earth surface."

4) Page 24864 (line 8): Figure 15 (in place of Figure 14).

Figure number was corrected.

5) Appendix: probably this is not really necessary. The authors are suggested to provide in the paper the link to all these information available at the Langley ASDC.

Neither reviewer thought the Appendix was necessary. The Appendix was added to answer questions I've received from several other researchers who wished to know the best method for computing regional-mean aerosol profiles from CALIOP Level 2 data. Choices in data screening and filtering can have significant impacts on the magnitude and shape of the extinction profiles. The Appendix was added to document the method in detail for those wishing to duplicate our results or to compare with their own. This information is more detailed than required for the more general user and I thought

would detract from the flow of the paper. I hesitate to reference information posted on website as they tend to not be archival. We are currently performing a study to determine the sensitivity of the profiles to the various criteria and attempt to optimize the screening. Information posted on the ASDC website will evolve to represent our best current thinking. Therefore, I would like to retain the Appendix to document the procedures used to produce the results shown here.

In addition to the reviewer comments, we also received comments directly from several researchers which we thought should be addressed in the revised manuscript.

In response to a discussion with the MODIS aerosol team on AOD trends, a comment was added at line 12 of page 24856 on the linear trend of AOD seen in Fig 4: "Linear fits to de-seasonalized timeseries of daytime, cloudfree AOD give trends of -0.00042 and -0.0080 per decade for global ocean and global land, respectively. The much larger trend for global land is due to large anomalies during 2010-2011 and the relatively short length of the timeseries, though neither of these trends is statistically significant. The long-term stability of the global ocean timeseries is indicative of the stable calibration achieved using the upper atmosphere as a reference target (Winker, et al. 2009)."

which replaces the original text: "Simple linear fits to these timeseries, based on 60 months to minimize effects of intra-annual variability, give trends of -0.0016 and -0.0017 per decade for daytime cloudfree ocean and land, respectively. Neither of these trends is statistically significant. The long-term stability of the global mean AOD timeseries is, in part, due to the stable calibration achieved using the upper atmosphere as a reference target (Winker, et al. 2009)."

A comment has been added at line 2 of page 24862 describing a data artifact which has recently been uncovered: "The sudden decrease of extinction just above the surface, which can also be seen in Figures 8 and 17, is unrealistic and has recently been traced to an instrument artifact producing occasional large negative signals just above the Earth surface. A correction for this effect is being developed, which will be applied to

future data releases."

The most significant of the comments we received directly were from the developers of the SODA AOD product, which we used in producing the results shown in Figure 17. They made us aware that the results shown in Figure 17 contain subtle but systematic biases and uncertainties. These complicate comparisons between the SODA and Level 3 profiles, requiring additional lengthy explanation/digression. Therefore, we have replaced the figures comparing SODA and Level 3 profiles with a new set of figures comparing Level 3 with full-column retrievals using constant aerosol lidar ratios. This approach allows us to address the accuracy of the Level 3 profiles more directly. The new text, replacing the original text discussing SODA, and the new Figure 17 plots are contained in two of the other attachments.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 24847, 2012.