

Interactive comment on “CALIPSO observations of stratospheric aerosols: a preliminary assessment” by L. W. Thomason et al.

L. W. Thomason et al.

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I would like to thank the reviewers for their detailed and exceptionally helpful comments. I am fully aware that taking time to provide in-depth reviews is a sacrifice and I greatly appreciate it. Below I have reply to the comments of the reviewers and revised text and figures have been provided. I have made an additional significant change by including corrections for molecular and ozone 2-way attenuation (not previously possible). These effects are larger than I expected and the overall quality of the CALIOP backscatter data is significantly better than I concluded based on my earlier analysis. I have updated the figures and text to reflect his change. I apologize to the reviewers that such a significant change was made. However, once it was available it was apparent that I had to include the correction.

Reviewer: Frank Weinhold Specific Comments: P 5599, ll 15-24, and p 5603, ii 7-9:

I see the reviewers point on the wording of this sentence. I meant to say that most of the aerosol lies between 5 km of the tropopause and not that the backscatter ratio decreases above that height. I have clarified this in the manuscript.

p 5600, ll 4-6 I admit this is a not the most coherent passage in the paper. I have changed the comparison to SAGE II optical depths to 1020-nm to be consistent with later comparisons. I prefer to use the SAGE II 1020-nm channel in this case because it is far more robust than the 525-nm channel particularly at low levels. At 1020 nm, the measurements is roughly half molecular and half aerosol whereas at 525 nm the fraction of the measurement due to aerosol scattering is no more than 10% and often much less than that.

P 5602, ll 18-19: The 10 to 20 str extinction to backscatter ratio comes from a value of ~ 50 str for 532 extinction to backscatter (from Jager and Deshler) and 525 to 1020-nm extinction ratios of 3 to 5 (as measured by SAGE II. I have clarified this in the manuscript.

P 5605, ll 20-21 To a greater extent, the ability to infer the stratospheric aerosol backscatter levels and validate them will also control the ability to improve the calibration so these two products of CALIOP data processing are closely linked. Measurements by ground-based facilities would be useful in establishing how well the aerosol analysis is performing as would any source of spaceborne data though averaging and conversion between measurement types will be an issue. I have included some discussion of how I think I need to proceed in this regard.

P 5609, ll Table 2, lowermost two rows: The lowest altitude range runs from -3. to -0.5 km. It is correct in the manuscript and may have been broken in the conversion process. I will make sure that it is correct in the final version.

P 5611, Fig. 2: This figure was not produced as I believed and its description has been updated to reflect the correct methodology.

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P 5612, Fig 3: This figure has changed substantially from the previous version and I think the issue is no longer relevant.

Technical corrections: I have made all the technical corrections suggested by the reviewer.

Reviewer #1 General Comments: Since the manuscript was originally submitted, I have answered some of the questions that were left open in the original text. I hope that the reviewer will find that the analysis is more complete than the original. While there are still significant open questions in what is still an early analysis, the data is much closer to demonstrating that it will be useful than in the original draft. I appreciate comments, several pointed to gaps in the manuscript that I needed to address.

P5600/l24 Changed to 'Coarser averaging' to indicate that the lack of available data from other sources substantial averaging of the CALIOP data.

P5600/l29 done

P5601/l27 done

P5602/l14 Sentence has been rewritten but this comment is reflected in the new text

P5602/l16 Done (excellent suggestion)

P5602/l23 I don't have an effective mechanism for removing very thin clouds at this point. In fact, I found that I wasn't happy with my PSC filtering at this point and have removed that until I have a more robust algorithm. It is basically related to a very long positive tail on the noise statistics that must be dealt with carefully to avoid producing biased mean statistics. I have however, checked into the thin tropical layer and it is clearly non-depolarizing and seems unlikely to be an ice (or other solid) cloud. I have noted this in the text. This is a god point that I had not shared with the readers.

P5604/l7 done

P5604/l22 This sentence has been removed

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Comment

P5604/I23 I have removed this discussion but the GEOS-4 error is on the order of several degrees in the Antarctic winter middle stratosphere and is likely to cause at least some trouble to the CALIPSO calibration process. I am unaware of any similar problems in GEOS-4 data at other altitudes/latitudes.

P5604/I6 This is a problem that I have acknowledged in this version of the manuscript. Ground-based and balloon-based data may be helpful. Data from other spaceborne sensors would be as well but is unlikely to be available in the near future and would of course reduce the need for this data.

P5605/I21ff If we believed that absolutely nothing was or will happened to stratospheric aerosol properties between end of the SAGE II mission and the end of the CALIPSO mission, historical data may be sufficient. However, aerosol levels can be highly variable and on-going changes in the processes that control stratospheric aerosol levels make new data of significant interest. My use of the older data set was really just to test how well the new data set looked in this first analysis.

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