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Atmospheric Chemistry and Physics Discussions

Interactive comment on "An accuracy assessment of the CALIOP/CALIPSO version 2 aerosol extinction product based on a detailed multi-sensor, multi-platform case study" *by* M. Kacenelenbogen et al.

Anonymous Referee #3

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Review of "An accuracy assessment of the CALIOP/CALIPSO version 2 aerosol extinction product based on a detailed multi-sensor, multi-platform case study" by Kacenelenbogen et al.

General Comments: The authors present in the paper their assessment study of the CALIOP version 2 aerosol extinction product. Such a study is relevant, timely, and required, because, while the CALIOP level 2 products are being widely used, they (es-

pecially the extinction retrieval) are not validated completely (an ongoing task). The authors first compare the CALIOP aerosol optical depth (AOD) with corresponding MODIS AOD and then perform an extensive case study based on multiple coincident measurements made on different platforms. The case study is particularly useful to the readers or potential users of the CALIOP level 2 data by providing a detailed step-by-step illustration of the impact of all possible error sources on the extinction retrieval. The coincident HSRL measurement used, which has a high SNR and provides direct measurements of aerosol extinction and lidar ratio, provides an excellent chance to diagnose the CALIOP feature detection, scene classification, and extinction retrieval.

However, the paper is lack of a quantitative assessment for the possible contribution of each error source in a more general sense. The comparison presented in Fig.1 shows a general underestimation of the MODIS AOD by 66% by CALIOP. However, the paper is failed to quantify the contributions of the uncertainties involved in the MODIS and CALIOP retrievals (even failed to give a general idea about who (MODIS vs. CALIOP) contributes more to the discrepancies), though this is a quite challenging task. To focus on the assessment of the CALIOP retrieval uncertainties, it would seem that the authors should select a geographical region over ocean for comparison, which may reduce the uncertainty in the MODIS retrieval due to the incorrect correction of the surface reflectance by 5-20%, based on the error budgets provided in this paper for the MODIS retrieval. If further screening out the MODIS data with large cloud fraction (therefore reducing the possible cloud contamination), it may reduce the MODIS AOD uncertainty by another 0-10%. In general, the authors successfully present in the paper a more complete picture of the possible error sources in the CALIOP extinction retrieval based on the extensive case study, which is very useful to the readers/users. The paper is publishable after revision. A weakness of the paper is the lack of quantitative assessments of the contributions of different error sources in a more general sense.

I agree with the most of comments made by reviewers #1 and #2. My additional technical comments are provided in below.

Technical Comments 1. The assessment of the CALIOP extinction retrieval presented in this paper is obviously for the daytime measurement and at the 532 nm wavelength. The quality of the CALIOP extinction retrieval is quite different for measurements made during day and night and at 532 nm and 1064 nm. This should be mentioned in the abstract and probably also in the title.

2. P27969, line 5: should be "30 m at 532 nm and 60 m at 1064 nm . . ."

3. P27969, line 16: "assumed extinction-to-backscatter ratio . . ." could be changed to "extinction-to-backscatter ratio . . . selected based on the subtype classified for each detected aerosol layer." Sa value is not simply "assumed" in the CALIOP data processing, instead, it is selected or determined based on the type classification information and a set of aerosol models developed based on the AERONET measurements.

4. P27974, line 14: only the ozone absorption is corrected in the CALIOP data processing.

5. P27975, line 18: what is "the error on the SNR" referred to? Is it the error in the estimation of SNR, or the error in the extinction retrieval due to the scattering signal noise?

6. P27976, line 4: "(1) one measuring the backscatter . . ." is not clear. Does this channel measure the orthogonal polarization component of total backscatter signal (aerosol + molecular)? Why the backscatter in this channel is "predominantly aerosol"? A spherical aerosol particle can reduce no orthogonal polarization component.

7. P27978, line 15: a minimum layer thickness of 2.4 km seems to be too large. The thickness of many boundary aerosol layers is smaller than this number.

8. P27979, line 7: is the slope of the regression line a proper/representative parameter (rather than the AOD itself) to compare to assess the CALIOP extinction retrieval?

9. P27987, line 22: the HSRL measured Sa shows a large variability (29-83 sr) in Fig. 5. Did you estimate the contribution of noise to the variability in the HSRL retrieved

Sa? This would provide useful information to assess if the large Sa variability is due only to the nature variation of the aerosol layer.

10. P27990, line 14: what is the purpose to apply a sliding average before averaging all valid profiles in the 40 km segment? This does not appear to make a sense to me.

11. P27990, Fig.6: it would provide a clearer view to separate the four curves in one figure into two panels (e.g., two curves in each).

12. P27993, line 12: "-40km*" should be "@40km*"?

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 27967, 2010.