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Atmospheric Measurement Techniques Discussions

Interactive comment on "Daytime aerosol extinction profiles from the combination of CALIOP profiles and AERONET products" *by* C. Marcos et al.

Anonymous Referee #1

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General comments.

The main objective of this paper is the improvement of daytime CALIOP retrieval that are limited by low SNR. The second objective is "to supplement column integrated measurements from AERONET sun photometers with information about the vertical distribution of aerosols". About this second objective, I don't see it as a strictly separate achievement: it seems a little tautological, to some extent, because those AERONET sites will anyhow have aerosol profiles during CALIOP overpasses. The method proposed in the paper, is based on coupling the CALIOP data with the AOD from ground stations. Because AOD data from the AERONET network are quality assured and also

because the network covers a growing portion of the planet, it's of interest if those data can give an improvement on lidar profiles from space. This approach is not entirely new, although the authors shows a long record of measurements and then some statistic are also presented. They compared their results with the CALIOP L2 extinction profiles, but probably somewhere should be remembered that, strictly speaking, is the aerosol backscatter the main (vertical resolved) parameter that can be extracted from a backscatter lidar without scanning capabilities. The overall methodology adopted for data processing appears correct, although not always the results obtained are sufficiently commented and some revision should be made also in Tables and Figures. Sometimes claims on the performances of the C+A method seems questionable and not entirely convincing. Generally there is no strong evidences that the C+A results are inherently better than the L2 retrieval (see also Specific and Technical comments). When (and if) there are the conditions that makes it meaningful, an improvement would be the comparison of the C+A results with the nighttime products from Barcelona Raman lidar. The Saharan dust case is interesting because, from the presented results and referenced literature, seems that the aerosols classification adopted by CALIOP is less accurate, at least for this particular site. Only one of those Saharan dust case is reported: I think that a more complete analysis of all cases could reinforce, if confirmed, that point.

Specific comments:

p3991, r4-8. Have you verified somehow how good is the cloud screening criterion adopted?

p3990, r10; p3991, r11. You describe in details the criterion adopted for the averaging area, but no numbers are given about the acceptable SNR taken as reference.

p3992, r1. What is impact of the uncertainty on Angstrom exponent on the overall

uncertainties?.

P3996 r19-25. Could the impact of the 70sr limit on L2 retrieval be assed? You know the LR used by you and the ones used by CALIOP in each case.

P3996, r25: Anyway seems that the annual LR value by Sicard(2011) concur with L2 better.

P3997, r16-17. Especially in Fig.4 and Fig.5, seems that lidar profiles exhibits details not less than 400/500m, so apparently the resolution seems coarser than 60m.

Fig.4 and Fig.6. Are you confident about the very first hundred meters of the C+A profiles?

P3997, r25. Here and also in other pages of the paper. I think that too much emphasis is posed to weak profile details that have a relative uncertainties of about 100 percent (as seems to be from vertical profile viewgraph). The CALIOP L2 algorithm could have cut those details also because the too high error.

Sect 5.2.1. Significant differences on parameters are simply stated and not critically commented. Why linear regression results are not inserted for RSLAB vs. CALIOP L2?

P3999, r14. Fig.8 should be Fig.7. The uncertainties on CALIOP L2 data should be inserted in Fig.7 as it was done for C+A vertical profiles in Fig 4-6. The lower part of the L2 profiles needs to be cut at some meaningful altitude. Could deep blue color on tha aerosol classification figures gives hints on the lower cut for CALIOP L2 profiles?

Sect 5.2.3. The better agreement of C+A in case B seems quite marginal: AOD is within 10 percent, LR is quite similar and I already said my opinion about weak details in the profile. Is not clear to me how strong AOD differences could directly explain the better R2 in Barcelona respect to Kampur.

Sect 5.3. In Fig.12 several (5 or 6 over 23 cases) CALIOP L2 AOD values at BUR site are quite low(<0.02) compared to corresponding AERONET BUR values (about 5-10 times higher). Can you give more insight on that? What about CALIOP L2 profiles in those cases? Those CALIOP L2 low AOD data have a non marginal impact on some numbers in Tables for BUR site.

P4004 r13. The relative vertical distribution differences are not that strong.

Conclusion. See above and General Comments.

Technical comments:

The captions associated to Tables need to be more clear. Es. in Table 4, it's not clear what parameters are referred both RMSD and R2.

Typo: The subscript N2 in all tables, probably should be L2.

For better reading the results, it would be helpful to put few grid lines in figures with vertical profiles.

p3992, r8. A typo, I think: 0.15 should be 0.015.

P3995, r2: in Sect. 3.2 you determine only the AOD (Did you meant Sect. 4?).

Sect 5.2. In my opinion is better to have a single paragraph for each case study vs. RSLAB, without splitting into C+A and CALIOP L2.

P3998, r4. "between both cases". It's probably better write instead something like: "...between the aerosol extinction profiles...".

P4000, r6. If I understand well, Fig.6 should be Fig.10 and so "obtained with RSLab and level 2 data" should be changed in "obtained with RSLab, level 2 and C+A data".

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