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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 #2

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General comments

The paper shows comparison between the standard automatic CALIPSO extinction retrieval (level 2) and a different retrieval based on the combination of CALIPSO and AERONET data. The main objective is demonstrating that the C+A retrieval gives more accurate results during daytime respect to the standard ones. The method is not original and new, but if assessed, this would be of great interest for the community because AERONET is widely distributed world-wide and moreover the same retrieval could also use other AOD data as MODIS ones.

For demonstrating this method advantages, the authors compare the two retrievals against ground-based lidar measurements. The ground based lidar used in this work is a Raman lidar, but only its elastic capability is used here because limited to daytime measurements. So that measurements that are considered as reference in this evaluation (RSLAB) are actually affected by a large uncertainty because of the lidar ratio assumption. The RSLAB extinction profiles are obtained using the same method applied for C+A: forcing the lidar profile to result in a columnar optical depth as provided by AERONET using a lidar ratio constant with the altitude. RSLAB and C+A extinction profiles are therefore based on the same assumptions: S constant with the altitude and AOD equal to the AERONET one. Because of this, I would expect better agreement between these 2 retrievals rather than between CALIPSO lev 2 and RSLAB. Actually RSLAB and C+A profiles are not completely independent.

However I do not see significant improvement of the agreement against RSLAB data: Table 6 shows similar results for the 2 retrievals when compared to RSLAB. More interesting is the analysis of dust cases even if, it should be supported by all the info available from the Raman lidar measurements available for Barcelona About dust cases, the authors state that they "noticed relevant differences between cases where air masses came from Northern of Africa and the rest of the cases". This, I think, is related to the altitude-independent S assumption in C+A retrieval: this assumption can be suitable if there are not intense lofted layers, but it is probably far from the truth when a significant aerosol load is present above the PBL. More suitable is the CALIPSO lev 2 approach in these cases: different S for different aerosol types, even if the assumed values could be improved.

In synthesis, the idea of combining CALIPSO and distributed AERONET data is great, but its performances should be better analyzed and major revisions are needed. Authors have the opportunity to use their nighttime measurements as reference for more reasonable assumptions on S profile (no constant values) for the daytime observations. These improved daytime RSLAB measurements would be independent from the C+A

profiles and more reliable as ground-based lidar profiles to be used as reference for the comparison. An evaluation on dust cases-related deviations should be done in terms of S assumptions, AOD values and layer altitudes. This could provide information about the application limits of the proposed method.

Specific comments

Pp 3984: as referee 1 noted, info about vertical distribution of aerosol is anyhow available from CALIPSO even if not combined with AERONET data.

Pp 3986lines 21-pp 3987line 11: it is not clear which kind of CALIPSO data are used here.

pp3990 line 19: this quantity depends on the place, period of the year and conditions. It should be stated clearly that this is a typical / average value and for what region/period is obtained.

Pp 3992: equ. 4: the error 3 is a maximum error and cannot be combined with a statistical error in this way. The final maximum error should be 3 times the instrumental error plus the error of equ 3

Pp3993 and here after: S instead of LR would be preferred. It is more widely used in the community.

Pp 3996line 24: actually the agreement is better with lev2.

Pp3997, lines 12-15: here you are using results from C+A for the RSLAB inversion. So that they are based on 2 common assumptions (see general comments) and RSLAB is dependent in some way on C+A

Section 5.2: not clear, within the text, RMSD on which parameter is evaluated.

The results should be discussed respect to the Raman Barcelona measurements available for the same period, if they are, or from the values collected at that station so far.

All RSLAB profiles have clearly a larger than 60m effective resolution. This should be discussed comparing small structure and values

Values of linear fit should be reported in text and tables (intercept and slope). Maybe weighted fit it would be more suitable

pp 4000: Figure 10 instead of 6.

Pp 4001: lines1-2: this better agreement is on the base of R2? Actually in this case the slope is different from 1, so the agreement/disagreement should be better discussed.

Pp 4002, 2nd paragraph: the correlation analysis between S profiles case-by-case sounds really strange: they are constant with the altitude (C+A) and constant within the layers (lev 2) profiles.

Pp4003: figure 16 shows data for a different day. Check it.

Pp 4003-4004: see general comments about dust cases

Pp4004 line 23: three cases are not sufficient for proposing a methodology

Conclusion section: all this section should be rewritten on the light of considerations reported in the general comments.

Pp 4005, line 5: a correlation for r2 of 0.65 is very low.

Table 6 is a simply repetition of table 4 and 5. Remove it. There are already too many tables. Table 3 4 and 5 could be rearranged in just one table summering the 3 cases. Also table 7-8-9 could be combine din a unique table.

Figures: put errors on all the quantities.

Figure 12: this figure is too briefly discussed within the text . AOD is one of the key parameter for aerosol studies. Differences between the CALIOP retrieval and the AERONET measurements should be discussed in more details.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 3983, 2013.