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Atmospheric Chemistry and Physics Discussions

Interactive comment on "CALIOP near-real-time backscatter products compared to EARLINET data" *by* T. Grigas et al.

Anonymous Referee #2

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General comments:

The paper "CALIOP near-real-time backscatter products compared to EARLINET data", by T.Grigas, M.Hervo, G.Gimmestad, H.Forrister, P.Schneider, J.Preißler, L.Tarrason, C.O'Dowd describe a technique to filter the data and improve the correlation between EARLINET and CALIOP backscatter data over a period of three years. The proposed technique deals with a straightforward separation of the Troposphere into a PBL and a FT region in order to distinguish the aerosol contributions in the two regions. The technique allows to improve the understanding of the different top-down and down-top signal attenuations experienced by the satellite and ground-based lidar systems. I have little criticisms about the clearness of the content and its description. There are few inaccuracies that I point out in my technical comments below. My major

concern is the relatively low scientific relevance that this paper can have on the state of the art. I have wondered whether this concern should be a reason to reject a paper and I think it is not. I am then in favor of the publication of this paper as it brings anyway a clear description about how to improve the interpretation of the CALIOP data by highlighting the limitations related to the downward measurements and helps separating the PBL from the FT advected aerosol layers.

Technical comments

The abstract could be improved, the last part where the authors state the relevance of their work should highlight clearly the novel/important aspects of their study. A relative increase of 5% in the correlation coefficient would probably not be enough.

Pg 1, ln 28: incoming and reflected solar Radiation

Pg 2, ln 2: from the depolarization channel. . .

Pg 2, ln 21: several comparison of ground-based LIDAR data with. . .

Pg 2, ln 26: remove the brackets at the beginning of the sentence

Pg 2, ln 28-29: explain why only measurements with independent extinction calculation were retained for the study.

Pg 2, ln 33: remove the brackets at the end of the line.

Pg 2, ln 32-33: Please state which kind of EARLINET product was compared to CALIOP, Attenuated Backscatter?

Pg 3, ln 6: remove brackets when you refer directly to a citation throughout the entire manuscript.

Pg 3, ln 25: dropped by 54% . . .

Pg 4, eq.1: if represents the uncertainty of the attenuated backscatter at the bin μ, than N should be the number of individual Level 1 lidar profiles, no?

Pg 5, ln 8: provide the definition of total as sum of aerosol plus molecular rather at the beginning of section 2 than here.

Pg 5, ln 20: from the lidar to the outer atmosphere and back down . . .

Pg 6, ln 13: are the LIDAR ratios values used in eq.6 to calculate the EARLINET extinction coming from CALIOP or from independent calculation of the EARLINET algorithm?

Pg 6, ln 27: As the authors compare two LIDAR measurements I think the word "comparison" is more appropriate.

Pg 7, eq.9: what is the advantage of including a -0.5 term? Could not the FoE simply vary within [0-1]?

Pg 8, ln 1-2: this has been said already on pg 7, ln 21-22.

Pg 9 ln 8: I suggest to slightly modify the structure of Sections 3.2, 3.3 and 3.4 to a more straightforward structure. Section 3.2 deals with all the dataset for the overpasses with distances < 100km, then a separation of the dataset is performed in Sect. 3.3 in order to separate the contribution of PBL and FT always keeping d < 100km and finally in 3.4 a filtering of the separated PBL and FT dataset is performed. As I see this, it would make more sense to have Sect. 3.2 "EARLINET-CALIOP comparison with ground track distance $\leq$100 km", Sect. 3.2.1 "PBL and FT with ground track distance $\leq$100 km" and Sect. 3.2.2 "Filtered PBL and FT with ground track distance $\leq$100 km".

Pg 9-10, ln 29-2: no need to repeat the criteria of selection, these are the same as before.

Pg 10, ln 9-10: replace by "The aerosol layers in the free troposphere are often characterized by smaller horizontal variability compared to the PBL, it is then likely that a higher EARLINET-CALIOP correlation can occur in the FT".

Pg 10, ln 11: one may argue this statement simply based on the definition of the PBL as the atmospheric region where aerosols get homogeneously mixed. I suggest to re-

place by "On the other hand, the boundary layer, especially during convective periods, undergoes higher temporal and spatial variability due to continuous PBL updraft and FT downdraft. Moreover, local sources of aerosols inside the PBL may not appear in the CALIOP profile due to its distance from the source."

Pg 10, ln 11-12: I don't see the relation with the considerations made in ln 9-11. I suggest to cut this sentence and replace with "When an aerosol layer occurs in the FT, it attenuates the CALIOP lidar signal that will have less energy to penetrate further down into the PBL."

Pg 10, ln 21: the author statement "with aerosol layers present in both the PBL and FT" is redundant, the PBL is by definition the region with aerosols. I'd change it to "with aerosol layer occurring in the FT above the PBL"

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/15/C1278/2015/acpd-15-C1278-2015-supplement.pdf

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