Review of 'CALIOP near-real-time backscatter products compared to EARLINET data' by T. Grigas et al., manuscript sent to ACP

This article describes an evaluation of (lev 1.5) attenuated backscatter profiles from the CALIOP space lidar with EARLINET ground-based lidar profiles, based on a 3 years dataset from 2010-2012. It investigates the agreement of profiles depending on the ground-track vs EARLINET station distance, the altitude of aerosol layers, the aerosol type and separate for the planetary boundary layer (defined as the lowest 2.5km) and the free troposphere. Two specific cases are discussed in detail. The topic is relevant and interesting for ACP readers, because this CALIOP data product at present is the only mature operationally available near-real-time aerosol profile information with global coverage, suitable for assimilation into global forecast models. The article is well structured, understandable and fits well into the MACC special issue. Many of the conclusions are sound but some of them are not yet convincing. Particularly the discussion requires considerable improvement, stating the significance, consequences and applicability of the results for the development of NRT aerosol profile assimilation. Therefore, I recommend that some significant revisions are done before it is published in ACP (minor revisions).

Methodology:

1. I understand that you adapt CALIOP and EARLINET profiles in the vertical (60m layers) but not in the horizontal and that 'synchronicity' means that EARLINET and CALIOP profiles are at the same time, neglecting wind drift between both. CALIOP is averaged over ~20-100 x 20 km, but I do not find a specification over how many minutes (??) EARLINET profiles are averaged. Air-masses and scales would probably be closer comparable if the EARLINET profiles were drift-corrected and averaged over a similar scale as CALIOP, both with wind speed (e.g. estimated from the trajectories) → see discussion. For example 50km average spatial distance corresponds to ~1.5h temporally at 10 m/s wind-component along the station track-center axis. Keep in mind that EARLINET lidars are often located in or close to large towns with corresponding horizontal gradients. Regarding the limited number of 48/27 coincident overpasses, this seems feasible.
2. The section about data filtering addresses a relevant question but is not yet convincing. The results from this approach are not really discussed and I wonder whether they are significant. Attenuation errors should clearly reduce when attenuation(layers) are excluded. But I can't really take this message from figs 8-11. It seems to me that simply the data at small values are missing when large values (layers) are filtered out.

You often use the acronym 'FT' where I'm not sure whether the stratosphere isn't included. I found no other indication of the upper altitude range than on P6047L19, where it is 20km.

Specific comments:

Abstract L7: should this read '…included a valid aerosol type classification…'?

Main text:
P6044L20pp.: To most readers it won't be obvious how a product, which is available within 6-30h, is used for operational forecasting. There is little information on that in (Powell et al, 2013). Any other reference. If not, please explain briefly.

P6045L15: level → levels

P6048L7: tempus: correspond

P6050L15/16 and annotation Fig2: colors for different aerosol types can hardly be distinguished → spread the color scale

P6051, L9pp: another reason for the discrepancy could be an invalid type classification (e.g. some Sahara dust plumes are mixed with fire smoke) which affects the lidar ratio and the calculated attenuation. The layers' AOD can be roughly calculated to ~0.2 (with a dust LR 50-60), but ~0.3 with a dust/smoke LR around 60-100). This would result in too small attenuation re-scaling of the EARLINET profile. Do the EARLINET observations exclude this possibility?

P6051,L11: can a cross-track variability of this layer be confirmed by the EARLINET observation, as a variability in time, due to the cross-wind component that is evident in the trajectory plot?

P6051, l13: wouldn't difficulty to detect layers at all require an enormous AOD of the upper layer? Was there a thick Ci cloud above? Which AOD can typically be transmitted by CALIOP @ 532 nm?

P6052, L8pp: This should be expected, but for me is not obvious from Fig 6, where many points with large distance (red) match quite well but particularly around CALIOP=2$Mm^{-1}sr^{-1}$/EARLINET=3$Mm^{-1}sr^{-1}$ and also below the 1:1 line several data points with small distance show large deviation as well.

P6052 L16: Does this mean your 'FT' includes the stratosphere or what is the upper altitude range? The choice of the threshold separating FT and PBL domains has considerable impact on the correlation of profiles, because errors due to the deviations of the highly variable PBL height are assigned to either the FT or the PBL analysis. 2.5 km will mostly be too high (particularly during night), such that the majority of PBL height issues will feed into the PBL analysis and reduce the correlation.

P6053 L23pp: The larger neg bias of CALIOP profile averages vs. (more locally influenced) EARLINET profiles seems to me a matter of representativeness. (see comment on averaging above)

P6053 L21:The 'corespondingly' only holds for the first part of the sentence not the second → e.g. replace 'and they deceased…' by 'but they decreased…'

P6053 L24-28: doesn't this only repeat (with zero criterion) the previous filtering according to the threshold?

P6054 L21/22: why should the quantifyability of a particle layer depend on its mixing state? Because of the uncertain lidar ratio?

P6055 L14-17: I'm not convinced of that by the analysis you show (cf. comment on methodology 2)

Figures:

Figs 5-11: move statistical parameters into the plot instead as headline (I needed some time to recognize them)

References:

Is there any more specific source of information about the Lev 1.5 data product than Powell, 2010?