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Atmospheric
Measurement
Techniques
Discussions

Interactive comment on "Assessment of the CALIPSO Lidar 532 nm version 3 lidar ratio models using a ground-based lidar and AERONET sun photometers in Brazil" *by* F. J. S. Lopes et al.

Anonymous Referee #1

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The paper 'Assessment of the CALIPSO Lidar 532nm version 3 lidar ratio models using a ground-based lidar and AERONET sun photometers in Brazil" by F. J. S. Lopes et al. presents a CALIPSO validation study based on AERONET sun photometer and ground-based single elastic backscatter lidar measurements over Brazil. This is in particular interesting as there is a lack of those studies over South America. The paper is well structured and clear.

However, there are some points the authors should address before publication in AMT.

The major point is that AERONET provides column integrated measurements form the top of the atmosphere down to the ground. Therefore only one single lidar ratio for

the whole atmospheric column can be determined (from AERONET as well as from MSP/AERONET combination). The occurrence of multiple layers of different aerosol types is frequently observed in the atmosphere. The CALIOP retrieval considers this multi-layer structure and allocates different lidar ratios to different altitude ranges if necessary. This point should be elaborated in more detail. How often did CALIOP detect a multi-layer structure? What are the differences considering the different layers? How did the authors proceed in case of a multi-layer structure? The multi-layer structure of the atmosphere is also important for the calculation of forward/backward trajectories as the flow pattern of the different altitude ranges can be quite different. Therefore using a single altitude range for the calculation of trajectories is not sufficient. The authors should discuss this point in more detail as well.

Minor comments:

Introduction:

For the discussion of influences on CALIIOP AOD the publication of Wandinger et al., 2010 (Wandinger et al., Size matters: Influence of multiple scattering on CALIPSO lightâĂŘextinction profiling in desert dust, Geophys. Res. Lett, Vol. 37, L10801, doi: 10.1029/2010GL042815, 2010) examining the influence of multiple-scattering, and of Kacenelenbogen et al. (2011) and of Burton et al. (Burton et al., Aerosol classification from airborne HSRL and comparisons with the CALIPSO vertical feature mask, Atmos. Meas. Tech. Discuss., 6, 1815-1858, doi: 10.5194/amtd-6-1815-2013, 2013.) both examining errors in the aerosol classification of CALIOP, should be considered.

Page 1148, lines 16-17: Can you give a reference for this statement?

Page 1148, line 25: '. . . LR values retrieved by the ground-based lidar system. . .'; How is the lidar ratio retrieved by a single backscatter lidar. Do the authors mean the combination of AERONET and lidar measurements?

Page 1149, line 3: Better use 'instruments' instead of 'sensors'.

Section 2.1: Please reveal that the data products of AERONET are column integrated.

Page 1150, line 21: What is $\tau g\lambda$?

Page 1151, lines 4-6: This should be better explained or referred to an explanation later in the paper.

Formula 4: The authors should give a short discussion on the uncertainties of the single scattering albedo and the phase function retrieved from AERONET.

Section 2.2: How do the authors deal with the missing 300m below the full overlap of the lidar system?

Page 1153, lines 10-15: The authors should reveal that this is not a standard in the atmosphere and that often a multiple-layer structure of different aerosol types can occur, leading to uncertainties or a limitation of the presented approach.

Page 1154, line 8: What is meant by 'iterative technique'? Please give more details here. Do you vary the lidar ratio until the retrieved AOD is in consistency with AERONET AOD?

Page 1157, line 9: calibration region zC

Section 3: Wandinger et al., 2010 already used trajectory analysis in a CALIPSO/ground-based lidar analysis to examine the same air masses. This reference is missing at this point.

Page 1163, line 13: What does the CAD scores (-50 - -100) mean?

Page 1163, line 14: Confidence of what?

Formula 14: C (center of mass) may be mistaken for C532 (calibration coefficient).

Page 1164, line 10: One trajectory for one 5km profile? Which height levels were used for the trajectory analyses? Is the flow pattern independent of altitude?

Page 1164, line 19: What does estimate mean at this point? Please be clearer.

Page 1164, line 25: What does η=1 mean? What are the uncertainties resulting from e.g. large dust particles (Reference to Wandinger?)?

Page 1165, line 1: What if not only one lidar ratio is used in the CALIOP retrieval?

Page 1165, Formula 16: γ'caliop is calculated using Scaliop. Is SAC appropriate to validate Scaliop as an independent factor?

Page 1166, line 6: '. . .data three. . .'?

Page 1168, line 1: '. . . initial lidar ratio . . .' this is not understandable without further explanation.

Page 1168, line 13ff: The authors should add a sentence that they will first compare the 100km CALIPSO mean, and then show the enhanced comparison using trajectory analysis. Can the authors give some more information about the lidar ratio variability within the 100km?

Page 1173, line 6f: What do the authors mean by 'traditional validation techniques'? What means ill-suited in this connection? Is the validation method not appropriate or does the variability of the PBL introduce uncertainties in the CALIOP averages?

Page 1174, line 1ff: Is it only/really the method (ground-based/airborne) which results in the differences in the CALIOP validations or may also the location and the time of the validation measurements cause differences?

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 1143, 2013.