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Atmospheric Measurement Techniques Discussions

Interactive comment on "Use of the CALIOP vertical feature mask for evaluating global aerosol models" *by* E. P. Nowottnick et al.

Anonymous Referee #3

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This work incorporates some very good ideas on using the CALIPSO aerosol classification to evaluate a global aerosol model (here the MERRAero model). Some points in the analysis though need some elaboration before the paper is published in AMT. First, it should be explicitly stated that the CALIPSO VFM is not constructed for aerosol classification, but for estimating the lidar ratio used in the CALIPSO backscatter and extinction retrieval. In terms of aerosol classification, the CALIPSO VFM is of good accuracy only for the dust type. The recent validation effort of Burton et al. (2013) (using collocated airborne High Spectral Resolution Lidar (HSRL) measurements during 109 CALIPSO under-flights) shows an agreement of 80% for dust particles and 62% for marine, 54% for polluted continental, 35% for polluted dust and only 13% for smoke. Include this result in the general context of your work and use it in the discussion of

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your conclusions.

Individual points for revisions are provided below.

Page 1405, lines 19-22, “Despite... timescales”: I am not aware of any work on using CALIPSO VFM to evaluate global aerosol models, but the CAIPSO VFM has been evaluated in various studies. Please mention at least the work of Burton et al. (2013) (Burton, S. P., Ferrare, R. A., Vaughan, M. A., Omar, A. H., Rogers, R. R., Hostetler, C. A., and Hair, J. W.: Aerosol classification from airborne HSRL and comparisons with the CALIPSO vertical feature mask, Atmos. Meas. Tech., 6, 1397-1412, doi:10.5194/amt-6-1397-2013, 2013.), including their conclusions presented in the beginning of this review. Moreover, you should change appropriately your conclusions.

Page 1417 lines 3-13, “Downwind... (r2=0.584)”: It does not seem that MERRAero AOD is of high accuracy. What is the impact of this? Please comment.

Page 1417 lines 14-16, “In Fig. 3... by CALIOP”: In Figure 3 the latitude range (0o -40o) does not include higher latitudes where we expect bigger variability. Provide a better test by extending the latitude range of the comparison in Figure 3 and discuss the results.

Page 1418 lines 6-15, “Figure 3... North Atlantic”: The high extinction values of CALIPSO Level 3 extinction product at low altitudes have been evaluated from Amiridis et al. (2013) (Amiridis, V., Wandinger, U., Marinou, E., Giannakaki, E., Tsekeri, A., Basart, S., Kazadzis, S., Gkikas, A., Taylor, M., Baldasano, J., and Ansmann, A.: Optimizing CALIPSO Saharan dust retrievals, Atmos. Chem. Phys., 13, 12089-12106, doi:10.5194/acp-13-12089-2013, 2013.). Include their findings here and change your conclusions accordingly (change them also in page 1430, lines 4-14: “Vertically... marine aerosol.”)

Page 1420, lines 24-29, “Comparing... (Fig. 4b – feature C)”: The presence of clouds and the subsequent attenuation of the CALIPSO signal in parts of this scene is very

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prominent. The cloudy profiles should be excluded from the analysis, since the attenuation of the signal is possible to introduce uncertainties in the layer identification and the aerosol typing from CALIPSO. If you choose to keep the profiles, please provide a proper justification.

Page 1420, line 29 and page 1421, lines 1-10, "Comparing... biomass burning": At higher altitudes the MERRAero estimated particulate depolarization ratio does not follow not only the CALIPSO volume depolarization ratio but also the MERRAero extinction coefficient. Furthermore, the MERRAero estimated particulate depolarization ratio of feature "A" seems to be much higher than the corresponding one from CALIPSO (this interpretation is by looking at the CALIPSO volume depolarization ratio, since the CALIPSO estimated particulate depolarization ratio is not provided in the figures). In order for this comparison to be more straightforward, you should include two figures for both CALIPSO and the MERRAero particulate depolarization ratio for this scene. This way any sources of discrepancy will be more obvious to the reader. Please comment and justify the discrepancies.

Page 1423, line 29 and page 1424, line 1, "These differences... types": They have to do also with the microphysical properties considered for the different aerosol components from MERRAero versus the ones considered for each aerosol type from CALIPSO. Please include this remark.

Minor revisions:

Page 1410, lines 10-15, "It should be noted... (Omar et al., 2009)": Include also the error reported for the particle depolarization ratio CALIPSO product from Tesche et al. (2013) (Tesche, M., Wandinger, U., Ansmann, A., Althausen, D., Müller, D., and Omar, A. H.: Ground-based validation of CALIPSO observations of dust and smoke in the Cape Verde region, J. Geophys. Res., 118, 1–14, doi:10.1002/jgrd.50248, 2013.)

Page 1413, lines 14-16, "Therefore... by 30% for our analysis": Increasing the depolarization ratio by 30% is somehow arbitrary. Moreover, since the dust depolarization

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ratio is not reproduced well, you should make a comment on what happens with its backscatter and extinction coefficients.

Page 1423, lines 8-12, “For example. . . respectively”: In Table 2 the percentage is 75%, is this a mistake?

Page 1423, lines 23-26, “In Table 3. . . Omar et al., 2009)”: This is not true for dust. Omar et al. (2009) used the discrete-dipole approximation technique to calculate the optical properties of dust particles. Please correct.

Page 1426, lines 17-18, “In an effort. . . analysis”: As indicated for Figure 4 as well, you should maybe consider excluding the cloudy profiles from your analysis, since the attenuation of the signal is possible to introduce uncertainties in the layer identification and the aerosol typing from CALIPSO.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 1401, 2015.