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Atmospheric Measurement Techniques Discussions

Interactive comment on "Determination and analysis of spectral aerosol optical properties by a multi-instrumental approach" *by* S. Segura et al.

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We thank the reviewer for the nice summary of our paper and the positive comments. In the following, we will respond to each comment separately, as listed below.

1872.1 – change where to were

Done

Fig. 2 caption. The sentence beginning, "We see . . ." should not be in the figure caption.

Done, please see below.

Fig. 2 general. Make it a 2 panel figure combining panels a&b and c&d. This will make the panels larger, make the comparisons easier, and allow the variations in c&d to be compared directly. With the different scales it appears that there is more variation in d than in c. Isn't the large change in b_abs above a loading of 4 a bit troubling?

As suggested, we have modified Fig.2 (see Fig. 1 below) into two panels: MAAP and Aethalometer, showing the difference between the non-compensated and compensated data. The scales were unified. The caption was edited and shortened. The large change is b_abs above the loading of 4 μg/cm2 is due to the heavy loading of the MAAP filter, affecting the performance of the instrument beyond this point.

The captio now is:

Fig. 2. Average attenuation and absorption coefficient vs. loading of the spot: (a) the non-compensated MAAP attenuation coefficient batn,MAAP, and the compensated, Eq. (4), MAAP absorption coefficient babs, MAAP; (b) the Aethalometer attenuation coefficient bATN, and the compensated, Eq. (7), Aethalometer absorption coefficient b_abs.

1881.24. "The result . . . is that b_atn is . . ."

Done

1881.27. ". . . these compensation factors . . ."

Done

Table 1. The caption refers to row labels (100, M) which do not appear in the table.

Done

1882.1-5. Even though the slope is zero isn't the large variation 0.5-1 about the intercept troubling, or is this normal?

We believe this comment relates to 1883.1-5. Generally, the analysis of the loading

effect by looking at the dependence of the absorption coefficient on the loading of the spot should take into account a meteorologically homogeneous period with aerosols not varying in composition drastically. However, while the site is dominated by urban aerosol, the investigated urban aerosols were quite heterogeneous during the campaign, especially if we consider the location of the site. Resuspended soil, local mineral dust and Saharan dust impacted the measurement site as well – please see Section 2.1 and Lyamani et al., 2010. We interpret the variations around the intercept being caused by this heterogeneity – it exhibits a similar behavior for both filter photometers. We strived to analyze a meteorologically homogeneous period in summer, but the Saharan dust episode came as an interesting event during the campaign, we could not influence the local contributions of mineral dust. We modified the text relating to the Fig. 2 to read:

1879.22-27 and 1880.1-10 . . . To check the compensation, we plot (Fig. 2a) the average value of the MAAP attenuation and absorption coefficient in a spot loading bin (with width 0.3 μgcm$-$2) as a function of the loading of the spot with BC between a clean filter (no loading) and the BC value with enough data in the campaign to gather enough statistics (just above 5 μgcm$-$2). The slope of the compensated MAAP absorption coefficient is half of that of the uncompensated ones, proving that the compensation reduces the loading effects. Another feature which is informative is the intersect of the fit: this is the uncompensated MAAP attenuation coefficient (7.83Mm$-$1; Fig. 2a) or the compensated absorption coefficient (6.94Mm$-$1; Fig. 2b) characteristic for the campaign. We propose to use the difference between the intersect 6.94Mm$-$1 (that is compensated absorption coefficient, representative for the campaign) and the campaign average absorption coefficient 7.25Mm$-$1 as an additional internal criterion for the "efficiency-of-compensation" with an empirical limit of 5%. The compensation of the MAAP data using the reflection measurements, rather than the raw MAAP data, satisfies this criterion, and we use the compensated MAAP absorption coefficient for comparison with the Aethalometer attenuation and absorption coefficients.

1883.1-6: The effect of the compensation of the Aethalometer measurements is shown in Fig. 2b. The slope reduces significantly to a value which is non-distinguishable from 0 – the compensation is efficient in eliminating the loading effects. The difference between the intersect 7.14Mm$-$1 (the compensated absorption coefficient, representative for the campaign) and the campaign average absorption coefficient 7.10Mm$-$1 satisfies the empirical 5% criterion. Additionally, the value lies extremely close to the average and the intersect determined from the analysis of the MAAP compensation (Sect. 3.1).

1887.14. Is it 3.42 and 4.59, or 3.39 and 4.35 (as in Table 1 and in the conclusions) at 370 and 950 nm?

Indeed, the values in Table 1 were not correct. The values are 3.42 and 4.59 at 370 and 950 nm, respectively and were corrected in the revised manuscript

1887.17. . . . than at near . . .

Done

1887.28. . . . around 72% . . .

Done

1888.20-22. How does Fig. 4 differ from the Table 3 rows on b_abs? The single scatter albedo measurements would also be more usefully displayed in a box-whisker plot. Is Table 3 necessary?

We presented both Figure 4 and Table 3 with different purposes. Figure 4 was included to show that the applied compensation for all seven Aethalometer channels agrees with the MAAP data (in red) as b_abs has a known exponential spectral dependence. On the other hand, Table 3 was presented as a quantitative summary of the statistics obtained for the different parameters calculated. However, following the advice of the referee we have deleted Table 3 and represented the single scattering albedo as a boxplot (Figure 2 below). Also, the caption has been changed to include this new

figure:

“Figure 4. Whisker boxplot of: a) the Aethalometer (black) and MAAP (red) compensated absorption coefficients (babs), and b) single scattering albedo (ω0) for the 7 aethalometer channels. The square inside the boxes represents the average; the central line corresponds to the median; the edges of the box are the 25th and 75th percentiles; the whiskers correspond to 5th and 95th percentiles; and horizontal lines outside the boxes, maxima and minima.“

1889.4. Here again the text and tables do not agree. Why? The minimum b_abs in Table 1 is 5 at 950 nm. The text claims 6.

The correct value is 5 Mm-1 and this was changed accordingly in the revised manuscript

1889.10-14 and Table 3. One significant figure is too few for single scatter albedo mean, and median. These should be two, as quoted in the text. With the numbers given in the table why are they repeated in the text. Use the text for making notable comments, not re-reporting of the values.

This point is no longer necessary as the authors, following the referee comments above, have decided to delete Table 3 and include a boxplot with the single scattering albedo data.

Fig. 5. I don’t seen any red lines indicating hourly averages at 950 nm. In some figures there are gray lines. The figure panels are not labeled with a, b, c, . . .

Panels have been labeled.

We don’t see the gray lines the referee refers to, however, the caption and legend of the figure have been modified to include a better explanation of the different lines and symbols in the different graphics.

The red lines we refer in the text appear in panels a, b, and d, and correspond to hourly

(a and d) and daily (b) averages for the specific property at 950 nm.

1889.22. Delete presents.

Done

Fig. 7. Why are only three panels labeled with letters? The figure captions by letter do not fully explain the panels.

All panels have been now labeled with letters and the figure caption has been modified.

1893.1-5. The following text is not consistent with the figure, which shows trajectories at 500, 1500, and 3000 m, nor if the 300 m in the text is changed to 3000 m, does it make sense. “Another event was detected on 20 (day 202) and 21 (day 203) July. HYSPLIT back trajectories arriving on the 20 July at 1500 and 300ma.g.l. reached Granada proceeding from the Atlantic Ocean, entering the Iberian Peninsula from the Northwest, while at 500ma.g.l. they came again from the Mediterranean Sea between Spain and North 5 Africa (Fig. 6b).”

Note there is no mention of the 3000 m trajectory coming straight off the Atlantic, while the 1500 and 500 m trajectories are virtually identical.

The referee is completely right. This error is due to the fact that in the first version figures 6a and 6b corresponding to the back trajectories of the two periods chosen were changed, Figure 6a corresponded to 21 July and Figure 6b to 29 June; however, the text was not updated to include this change. This mistake has been corrected adding a new description of the correct back trajectories:

“Another event was detected on 20 (day 202) and 21 (day 203) July. HYSPLIT back trajectories arriving on the 21 July at 500 and 1500 m a.g.l. reached Granada proceeding from the Mediterranean Sea, along North Africa’s coast, although they have their origin in Western France. At 3000 m a.g.l. they originate from the Atlantic Ocean (Fig. 6b).”

1893.9-10. “This includes North African air masses, loaded with mineral dust, and air masses from regions affected by fires.” How do the authors arrive at this conclusion. None of the trajectories are coming from North Africa. In fact I don’t see how the trajectory modeling supports the evidence.

The reviewer is correct. The way this sentence is written can lead to misunderstandings. However, we didn’t base our conclusions in this case on the back trajectories. The NAAPS model shows the presence of dust and smoke at ground level, and LIDAR measurements show aerosol particles up to 4000 m agl, which can be related to mineral dust. However, back trajectories don’t show any evidence of mineral dust intrusions. To clarify this part of the manuscript we changed the following:

Page 1894, lines 8 – 10 have been replaced by: “The temporal evolution of RCS at 532 nm obtained from lidar measurements (Fig. 8b) shows the presence of aerosol particles up to 4000 m a,s,l, and especially high concentrations are measured up to 2000 m a.s.l. Based on the NAAPS model and lidar measurements, aerosols measured at the surface are considered to be affected by wood smoke and mineral dust.”

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 1871, 2014.

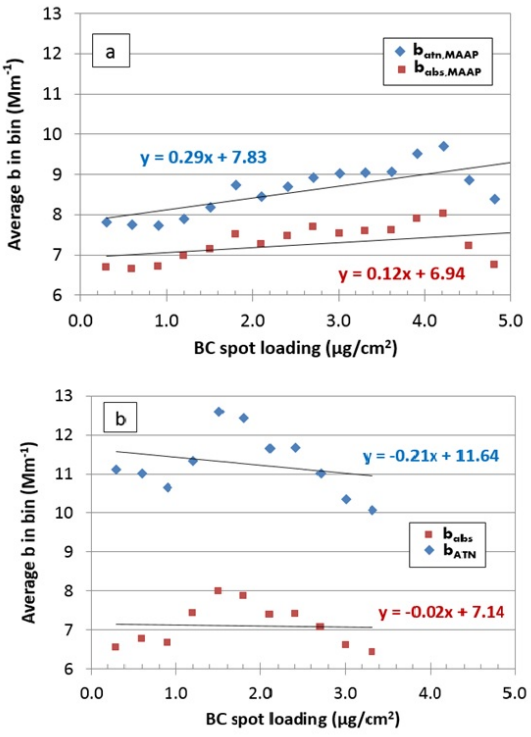

Fig. 1. Figure 2.

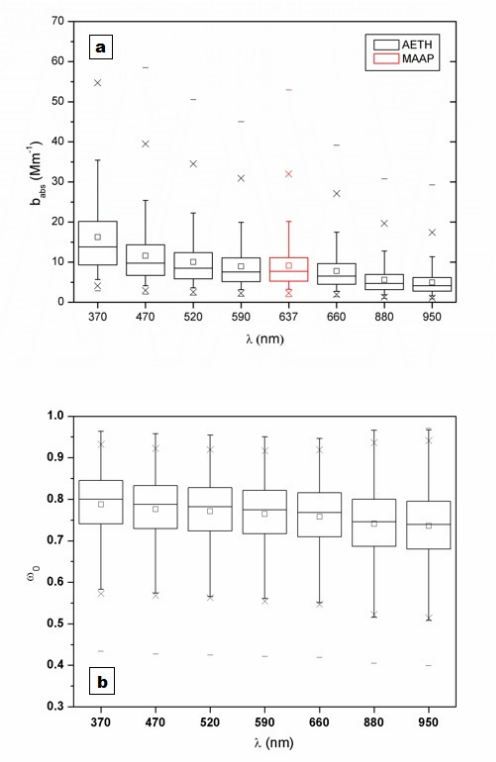

Fig. 2. Figure 4.