Interactive comment on "Aircraft vertical profiles during summertime regional and Saharan dust scenarios over the north-western Mediterranean Basin: aerosol optical and physical properties" *by* Jesús Yus-Díez et al.

Answer to anonymous Referee #2 by the authors.

On behalf of all the authors, we thank the Reviewer for the positive comments and careful review, which helped improve the manuscript.

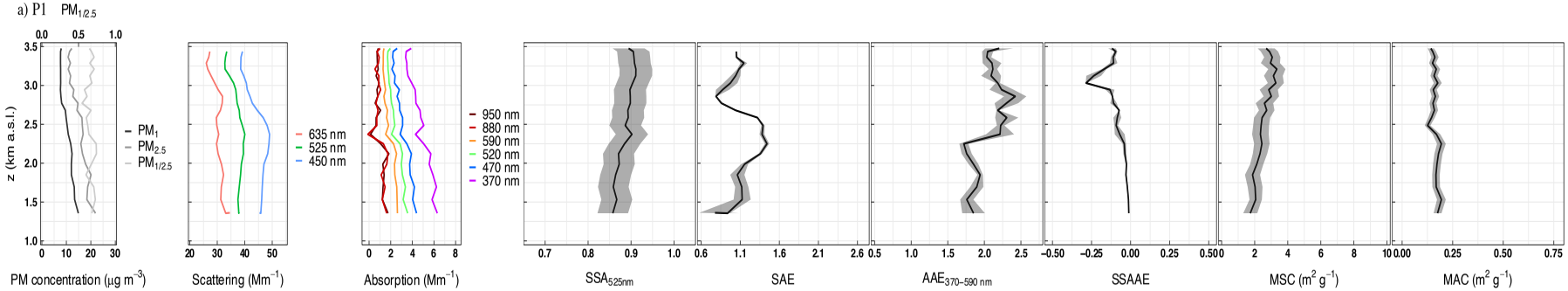
Hereafter we reply to the Reviewer's comments. Any minor comment as typo or writing corrections will be directly corrected in the manuscript.

General comments

- We thank the Reviewer for the positive comment regarding the work done by our research group and regarding the scientific significance of the present manuscript.

-My main qualm with the paper is that Figure 7 and 8 are quite difficult to read. It is as if the ratio of the figures is off; they should be slightly wider. I realize the challenges associated with presenting this much information at once- and I see the logic behind how these figures are organized. If the individual plots can be widened slightly or maybe if the legends could be moved to inside the plots to allow them to get bigger, that might help the reader. But the paper could be published with the figures as is if necessary.

We have taken into account the suggestion and modified the figures so that these are now a bit wider. Below an example of the new format for P1. Also, we would like to point out that in the conversion from the discussion manuscript to a 2-column text, there will be more space to increase the size of the figure.


a) P1 PM1/2.5
z (km a.s.l.)
PM1
PM2.5
PM1/2.5
PM concentration (µg m−3)
635 nm
525 nm
450 nm
Scattering (Mm−1)
950 nm
880 nm
590 nm
520 nm
470 nm
370 nm
Absorption (Mm−1)
SSA525nm
SAE
AAE370–590 nm
SSAAE
MSC (m2 g−1)
MAC (m2 g−1)

Technical comments

Line 216: Please specify if aethalometer data were further corrected or if the manufacturer 2-spot correction was the correction used

The AE33 data were corrected online for filter loading effect by the instrument dual-spot correction algorithm (Drinovec et al., 2015) and were presented at ambient standard pressure and temperature. The absorption was derived from the BC concentrations using the MAC (λ) for the AE33 and the multiple scattering correction factor C=3.15 from Drinovec et al. (2015).

Line 216: Were any corrections applied to the MAAP data?

The MAAP absorption reported in this study was measured at 637 nm, whereas the nominal MAAP wavelength is 670 nm. As shown in Muller et al. (2011) this difference in the wavelength can be taken into account by multiplying the absorption data provided by the MAAP by 1.05, as we did in this work. In order to clarify this point, the following sentence was added to the second paragraph on Section 2.2.1.

"MAAP data in this work were reported at 637 nm by multiplying the MAAP absorption data by a factor of 1.05 as suggested by Muller et al. (2011)".

Lines 307-309: It sounds like AAE was calculated using different wavelength pairs for different legs. What is the effect of this on your results? Why not use a wavelength pair available in all flight leg data records so you have consistency?

For some profiles, the absorption measurements at longer wavelengths were slightly negative due to the very low particles absorption properties measured at high altitudes at these wavelengths. Since AAE can only be derived when absorption coefficients are positive, different wavelength ranges were chosen for the calculation of the AAE. In this study, the AAE was used to identify different atmospheric conditions (dust versus regional episodes) as well as to distinguish different layers within the same flight. Consequently, we think that the wavelength pair used is not that relevant since the focus was kept on the variability of AAE rather than on its absolute vale. Thus, the effect of using different wavelength pairs on AAE is out of the scope of this manuscript. For all the profiles, except the flight P3, the first 4 wavelengths were used. For the sake of clarity, the wavelength pair used in each flight has been included in the figures, as well as in the main text.

"For the vertical profiles reported here, the AAE was calculated using the AE33 wavelengths for which the absorption measurements were positive along the profile. For most profiles, except for P3, which had all seven wavelengths available, the AAE was calculated from 370 to 590 nm."

Line 536: How was the PBL estimated?

It was inferred from both the ceilometer profiles and the potential temperature and relative humidity measurements obtained by the aircraft during the vertical profiles.

"The lower AAE measured at MSA and MSY stations compared to the AAE in the free troposphere measured during P1, P2 and P3 was due to the increased relative importance of BC particles close to the ground and within the PBL (estimated from the observation of the pollutant concentrations, the ceilometer profiles and the meteorological conditions: potential temperature and relative humidity in Fig. S3)"

Bibliography

1. Drinovec, L. *et al.* The 'dual-spot' Aethalometer: An improved measurement of aerosol black carbon with real-time loading compensation. *Atmos. Meas. Tech.* **8**, 1965–1979 (2015).

2. Müller, T. *et al.* Characterization and intercomparison of aerosol absorption photometers: Result of two intercomparison workshops. *Atmos. Meas. Tech.* **4**, 245–268 (2011).