M. Claeys et al.

General comments :

We thank the referees for their constructive reviews. Our replies to the two referees are given below. The main changes to the manuscript include :

- We added a figure (Figure 2) representing the reconstructed PM10 mass.
- We added a figure (Figure 4) representing a correlation plot between chemical components, PM1 and PM10 mass concentration and wind speed and direction.
- Figure 3 (Figure 2 in the previous version) was modified, and two time series were added : PM1 and PM10 mass concentrations.
- A correction for truncation was added on nephelometer scattering coefficients. Figure 13 was then modified, as well as Table 4.
- The abstract has been shortened, with more emphasis on PMA, and the results/discussion part has been reorganized. Parts 3.2.3 and 3.3.1 have been merged, as well as Parts 3.2.4 and 3.3.2.

Reply to referee 1

M. Claeys et al.

We thank referee 1 for the evaluation of our manuscript. Our point-by-point responses to the comments are given below.

Despite the fact that the instrumental set up has been described in details, providing also information for calibration and quality control where necessary, it is not clear if the MAAP was sampling through a PM1 (P.5, l. 7) or PM2.5 (P.7, l. 9) inlet. This information could be addressed along with the first reference to MAAP (P.4, l.1-3).

The MAAP was sampling through a PM2.5 inlet, this information has been added with the first reference to MAAP (P3, l.31)

The addition of the TEOM PM10 and TEOM PM1 plot as part of Figure 2 or as supplementary material would be substantial.

The mass concentrations of TEOM PM1 and PM10 have been added to Figure 3 i) and j) (previously Figure 2).

The reconstructed PM10 could also be included, since all these parameters are examined thoroughly in the manuscript (section 3.1).

Rather than adding the reconstructed PM10 mass as a time series we present it as a scatterplot as a function of the TEOM PM10 mass concentration (Figure 2).

Also a description of AOD at 500 nm is described (P. 15, l. 1-5) related to Figure 12a presenting the AOD temporal variability during the campaign at 440 nm and 870 nm. These two wavelengths are useful for the demonstration of the spectral dependence; nevertheless the authors could consider including the AOD time series at 500 nm also and indicate the different

color code in the caption of the figure.

The caption with color code has been added for the AOD and nephelometer scattering coefficient. The AOD time series at 500 nm has also been added.

In accordance with the previous comment, the means and standard deviation for each parameter conserning the total period could be added to the summary on Table 4.

These values have been added on Table 4 for the ADRIMED period (total period of the field campaign).

A diurnal variability of AE for the second part (July) of the campaign was revealed under the impact of biomass burning (P. 17-18). Nevertheless, an explanation or references of similar variability are not provided. Were the factors controlling the observed diurnal pattern investigated?

The Angstrom exponent is highest during the day and lowest during the night, and is probably related to the diurnal cycle of the boundary layer height, as the site is situated at ~ 600 m.asl altitude.
Similar behaviors of diurnal variations of aerosol properties have previously been observed in high altitude sites (Venzac et al., 2009; Freney et al., 2011). Higher concentration of accumulation particles was recorded during daytime.
However, the number concentration of aerosols and the mass concentration of BC, organics or pollution tracers (Fig. 3 of the manuscript) do not show the same behavior. Therefore, we do not dispose of independent confirmation, and can not conclude on this diurnal variability

Which is the contribution of nss-ions on the total ionic level overall and for each period independently? Increased nss-ions during dust and biomass burning comparatively to marine influenced period could be additionally used as indication for the presence of other sources at the site apart from marine.

We thank the referee for this comment. Indeed, the study of the nss mass concentration compared to the total PM10 mass concentration reveals that there is an increase of nss-ions during Dust and BBP period compared to PMA period.
The contribution of nss ions to the total ionic level is 82 ± 14 % during the ADRIMED period, 92 ± 3 % during Dust period, 84 ± 5 % during BBP period, which are much higher than 53 ± 11% during PMA period.

This information has been added in the paper (p.9, l.27) :
« Furthermore, while the contribution of PMA to PM_{10} mass concentration is high during PMA period, the mass contribution of nss-ions to the total ionic content is relatively low during the PMA period (53 ± 11 %). In comparison, the mass contribution of nss-ions to the total ionic content is 84 ± 5 % for the ADRIMED field campaign, and is 82 ± 14 % and 92 ± 3 % for the Dust and BBP periods respectively. Furthermore, the Ca^{2+} concentration measured during the PMA period (up to 2 μg m^{-3}) indicates the presence of dust particles, probably related to strong winds lifting soil/dust in the vicinity of the Ersa station (Arndt et al., 2017). However, unlike the Dust period, they do not represent the dominant aerosol influence during the PMA period.”

P 14, l. 5: taking into account that the PMA is analyzed in that section it would be more appropriate to comment the low or high marine aerosol concentration instead of the presence

or not of marine aerosol. Unless the comment refers to all periods.

P15, l.10 :
We have replaced « whether they contain PMA or not, aged or fresh » by « whether they contain low or high PMA concentration, aged or fresh » .

Technical corrections

P. 5, l. 27-31: The information about the nephelometer is duplicated. It has already been described in pages 3-4. The comment about the scattering coefficient relation to aerosol size and concentration could be transferred in that point.

Thank you for pointing this out. We have deleted the information on page 5 and added the following text on page 3, l.32 :
« The nephelometer provides the scattering coefficient (not directly linked to the concentration of particles), associated to an indication of the size of aerosols through the spectral dependence of the scattering coefficient between two wavelengths. The nephelometer data were corrected for truncation according to Anderson and Ogren (1998) for the total aerosol population. A correction factor of 1.29, 1.29 and 1.26 was respectively applied to the scattering coefficients at the wavelengths 450, 550 and 700 nm. »

Figure 2: I would recommend to authors to check the plots a-k. Please pay attention on the caption and axis labels as well, especially for plots i-k. Namely: Plot i demonstrates very low wind speed. Under my opinion it is not valid. In P.10, l. 3-4 the authors refer that "At the Ersa site, during the dust outbreak, around 19 June, the wind speed reached 15 m s−1". Plot j is probably wind speed instead of wind dir (according also to figures 7 and 8, wind speed is up to 20 m s-1). Please indicate what is monitored in plot k. It seems to be wind dir. Furthermore, according to P.8, l. 23-24, BC highest concentration encountered on July 5 was equal to 0.75 µg m-3. Based on Figure 2g the maximum BC concentration was at the range of 2.5 µg m-3 (same date) or BC is actually depicted in Figure 2h. Plots e and g seem to be the same.

We thank the reviewer for pointing out these errors in the manuscript. The axes were corrected, and PM1 and PM10 mass concentrations were added to Figure 3 (previously Figure 2).

Typing errors:
P. 13, l.6: in function instead of "in fonction"

This has been modified.

P. 18, l.31: SW DRF at TOA is depicted in Figure 13 a, not b.

This has been modified.

References

Anderson, T. L., & Ogren, J. A. (1998). Determining aerosol radiative properties using the TSI 3563 integrating nephelometer. *Aerosol Science and Technology*,*29*(1), 57-69.

Arndt, J., Sciare, J., Mallet, M., Roberts, G. C., Marchand, N., Sartelet, K., Sellegri, K., Dulac, F., Healy, R. M., and Wenger, J. C.: Sources and mixing state of summertime background aerosol in the northwestern Mediterranean basin, Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-1044, in review, 2017.

Carslaw, D.C. and K. Ropkins, (2012). openair — an R package for air quality data analysis. Environmental Modelling & Software. Volume 27-28, 52-61.

Cros, B., Durand, P., Cachier, H., Drobinski, P., Frejafon, E., Kottmeier, C., Perros, P., Peuch, V.-H., Ponche, J.-L., Robin, D., et al.: The 30 ESCOMPTE program: an overview, Atmospheric Research, 69, 241–279, 2004.

Di Iorio, T., di Sarra, A., Sferlazzo, D., Cacciani, M., Meloni, D., Monteleone, F., Fua, D., and Fiocco, G.: Seasonal evolution of the tropospheric aerosol vertical profile in the central Mediterranean and role of desert dust, Journal of Geophysical Research: Atmospheres, 114, 2009.

Di Sarra, A., Di Biagio, C., Meloni, D., Monteleone, F., Pace, G., Pugnaghi, S., and Sferlazzo, D.: Shortwave and longwave radiative effects ofnthe intense Saharan dust event of 25–26 March 2010 at Lampedusa (Mediterranean Sea), Journal of Geophysical Research: Atmospheres,116, 2011.

Dubovik, O., Smirnov, A., Holben, B. N., King, M. D., Kaufman, Y. J., Eck, T. F., and Slutsker, I.: Accuracy assessment of aerosol optical properties retrieval from AERONET Sun and sky radiance measurements, J. Geophys. Res., 105, 9791–9806, doi:10.1029/2000JD900040, 2000.

Dubovik, O., Holben, B., Eck, T. F., Smirnov, A., Kaufman, Y. J.,King, M. D., Tanré, D., and Slutsker, I.: Variability of absorption and optical properties of key aerosol types observed in world-wide locations, J. Atmos. Sci., 59, 590–608, doi:10.1175/1520- 0469(2002)059<0590:VOAAOP> 2.0.CO;2, 2002.

Gantt, B., & Meskhidze, N. (2013). The physical and chemical characteristics of marine primary organic aerosol: a review. *Atmospheric Chemistry and Physics*, *13*(8), 3979-3996.

Garcıa, O. E., Dıaz, J. P., Expósito, F. J., Dıaz, A. M., Dubovik, O., Derimian, Y., ... & Roger, J. C. (2012). Shortwave radiative forcing and efficiency of key aerosol types using AERONET data. *Atmos. Chem. Phys*, *12*, 5129-5145.

Guerrero-Rascado, J. L., Olmo Reyes, F. J., Avilés-Rodríguez, I., Navas-Guzmán, E., Pérez-Ramírez, D., Lyamani, H., and Alados-Arboledas, L.: Extreme Saharan dust event over the southern Iberian Peninsula in september 2007: active and passive remote sensing from surface and satellite, Atmospheric Chemistry and Physics, 2009

Mallet, M., Dulac, F., Formenti, P., Nabat, P., Sciare, J., Roberts, G., ... & Denjean, C. (2016). Overview of the Chemistry-Aerosol Mediterranean Experiment/Aerosol Direct Radiative Forcing on the Mediterranean Climate (ChArMEx/ADRIMED) summer 2013 campaign. *Atmospheric Chemistry and Physics*, *16*(2), 455-504.

Meloni, D., Di Sarra, A., Di Iorio, T., and Fiocco, G.: Direct radiative forcing of Saharan dust in the Mediterranean from measurements at Lampedusa Island and MISR space-borne observations, Journal of Geophysical Research: Atmospheres, 109, 2004.

Pey, J., Querol, X., and Alastuey, A.: Variations of levels and composition of PM10 and PM2.5 at an insular site in the Western Mediterranean, Atmos. Res., 94, 285–299, doi:10.1016/j.atmosres.2009.06.006, http://dx.doi.org/10.1016/j.atmosres.2009.06.006, 2009.

Sellegri, K., Gourdeau, J., Putaud, J.-P., and Despiau, S.: Chemical composition of marine aerosol in a Mediterranean coastal zone during the FETCH experiment, J. Geophys. Res., 106, 12 023, doi:10.1029/2000JD900629, 2001.

Tang, I. N., 1997 : Thermodynamic and optical properties of mixed-salt aerosols of atmospheric importance. Journal of Geophysical Research : Atmospheres, 102 (D2), 1883–1893.