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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Continental pollution in the Western Mediterranean Basin: vertical profiles of aerosol and trace gases measured over the sea during TRAQA 2012 and SAFMED 2013" *by* C. Di Biagio et al.

Anonymous Referee #1

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Continental pollution in the Western Mediterranean Basin: vertical profiles of aerosol and trace gases measured over the sea during TRAQA 2012 and SAFMED 2013 By Di Biagio et al.,

The paper focuses on the analysis of aerosol and trace gas vertical profiles obtained over the sea in the Western Mediterranean Basin during the TRAQA 2012 and SAFMED 2013 summer campaigns. Even though the number of measurements presented in this paper is relatively short (23 profiles), it reasonably covers large area in

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the western Mediterranean basin providing insight of the impact of the different pollution transport regimes. I have some suggestions for a minor revision of the manuscript (see below). Specific comments Abstract Lines 8-10 page 8285: this sentence is unclear. Maybe the authors mean that during TRAQA and SAFMED campaigns the study area was under a wide range of meteorological conditions that favored the pollution export from different sources located around the basin which allowed sampling atmospheric aerosols of different origin and types. Please, rephrase this sentence. Lines 13-15 page 8285: authors state that aerosol layers not specifically linked with Saharan dust outflows are distributed ubiquitously which indicates "quite elevated levels "of background pollution throughout the Western Basin. This statement is not justified by data analysis presented in this paper. Authors do not presented the analysis of background conditions over the study area. Please clarify this point and provide information that can justify these "quite elevated levels "of "background pollution". Introduction The recently published papers by Valenzuela et al., 2014 and Lyamani et al., 2005 should be referred in this manuscript. Valenzuela et al., 2014. Aerosol transport over the western Mediterranean basin: Evidence of the contribution of fine particles to desert dust plumes over Alborán Island. Journal of Geophysical Research D: Atmospheres, 119 (24), pp. 14028-14044 Lyamani et al., 2015. Aerosol properties over the western Mediterranean basin: Temporal and spatial variability. Atmospheric Chemistry and Physics, 15 (5), pp. 2473-2486. Lines 2-3 page 8288: Please correct by "During TRAQA and SAFMED the Western Basin was under diverse synoptic conditions". Line 4 page 8288: Please provide a brief description of Mistral/Tramontane events. This will help understand the interpretations of the results. Lines 7-8 page 8288: The authors state that the main objective of the present work is to provide "extensive observations" of the vertical distribution of aerosols and trace gases. However, they only present 23 profiles. Please, be precise. Section 3.2 Line 1 page 8293: between 0.1 and 3.0 μm or between 0.11 and 4.17 μm? Please check. Line 19 page 8294: eq. (2) instead eq. (1) Section4. A brief description of the AERONET data (data level, accuracy of the data, etc.) and the instrument used should be provided. In addition, information on

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AERONET sites (characteristic, location, etc.) should be given. Please include these sites in Fig.1. This may help to make clear the interpretation of the results. Lines 19-20 page 8295: it is obvious that TRAQA campaign in 2012 was characterized by very variable meteorological conditions than SAFMED campaign because TRAQA campaign period (20 June–13 July 2012) was larger than SAFMED campaign period (24 July–1 August 2013). On the other hand, I don't understand how very variable meteorological conditions can prevent the accumulation of high levels of pollutants over the basin. Some meteorological conditions as discussed later by the authors were responsible of high pollution events during TRAQA campaign. Please clarify and rephrase this sentence. The title ("Events observed") of the last column of table 1 is not adequate. For example "Test flight" , "Follow of Barcelona pollution plumes " and "Characterization of pollution in central Italy" are activities that have been carried out and not events that were observed during these campaigns. Please correct. Line 15 page 8295: authors state that Fig. 2 show data corresponding to the period of the campaign of measurements plus 10 days before and after. However, Barcelona data (left panels) correspond to the period of the campaign plus 1 day before and after. Please check. Lines 21-22 page 8295: the aerosol optical depth was below 0.2 before the beginning of the campaign over the three analyzed AERONET sites and not over the whole basin. Please be precise. In addition, authors sate that the aerosol optical depth (AOD) increased to 0.3–0.5 (with 1 < alfa< 2) in the periods 23–26 June and 3–13 July. However, as can be seen in Fig. 2 the aerosol optical depth was in general below 0.2 over the three AERONET sites during 23–26 June. Also, the AOD was in general below 0.3 (especially at Frioul and Ersa) during 3–13 July. However, from fig2, it can be seen that the aerosol optical depth was relatively high from 30 June to 4 July which was associated with dust intrusions. Please check and correct. For clarity please reduce the y-scale of fig.2. The authors present Fig 3, but, don't discuss it. Please, discuss this figure or remove it from the paper because it does not add any significant information. Lines 4-6 page 8296: Please, specify if this export regime has occurred at all altitude levels or at specific altitude. The same should be done for the other described export regimes. This

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is because export regime can be different at different altitudes. Lines 4-6 page 8296: authors state that on 26–27 June north/north-easterly winds blew across northern Italy determining an air mass outflow towards the Gulf of Genoa. However, Fig.9 shows that the air masses on 27 June come from France and not pass over Italy. Please check and correct. Lines 3-19 page 8296: Mediterranean Sea and ship traffic are important source contributing to the aerosol loading over the Mediterranean Sea. The authors cannot a-priori exclude this important sources. Line 12 page 8296. I think that authors refer to Fig 1 and not to Fig3. Please verify. Lines 12-14 page 8296: this sentence seem to be not related to this section. To be consistent, authors should describe the meteorological/export during flight V31 as they did for the other flights. Please, explain what you mean with "moderate" Mistral episodes. 5 Results Figure 5 is poorly discussed and interpreted. More discussion and interpretation of the results presented in this figure is needed. If no more discussion and interpretation of this figure is given this figure should be removed from the paper. Section 5.1 The figures presented in fig.6 should have the same X and Y scales. Also, vertical profile of Angstrom exponent should be included in this figure. This in combination with dNAcc and dNcoarse will help to identify the type of aerosols dominant in each layer. Scattering profiles during TRAQA campaign (6 s resolution) are nosier than those observed during SAFMED (1 s resolution). Please give an explanation for this. Lines 8-10 page 8298: authors state that the profile of the aerosol scattering coefficient is mostly correlated to dNAcc., however, they not justify this statement. Please give statistical parameter that justifies this statement. Lines 16-20 page 8298: Please, provide an explanation of the cause of scattering coefficient and dNAcc maxima and minima. Lines 3-5 page 8299: authors state that the scattering coefficient and the particle concentration measured in the FT are comparable with the values observed in the BL, and in few cases even larger (V25, V26, V30). This contradicts with the results shown in fig. 5. Please check and correct. Lines 16-19 page 8299: Please, include Table comparing your results with those found in literature. Also, for better comparison (same experimental set), authors should include their results obtained over land in this table (e.g. flight V49). Lines 16-19

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page 8299: during flights V52, the scattering coefficient was very low and no pollution aerosol layer can be seen in this flight as confirmed by authors. Authors should include Table comparing the data obtained under the different main meteorological/export conditions. This will help to identify the main cause (and sources) of high pollution levels over Mediterranean Sea. Section 5.2 Lines 26-28 page 8300: please give references that support your statement. Also, include Table comparing your results with those obtained during flight over land and with those found in literature. Section 5.3 Lines 11-13 page 8302: Please provide Table comparing your results with those reported by these authors. Section 5.4. Line 24 page 8302: statistical analysis should be provided to justify the good correlation between dNAitken and dNAcc, CO, and O3. From Fig. 10 it can be seen that dNAitken and dNAcc, CO, and O3 are not correlated. Lines 7-24 page 8305: I think that this dNAitken event can be simply associated to ship emissions. Conclusion Lines 19-21 page 8307: authors state that the geographical distribution of aerosols and trace gases observed in this study appears quite homogeneous within the investigated area, suggesting a relatively similar contribution from the various sources located around the north-western basin. However, the results presented in this paper show that the aerosol and gas profiles obtained in different areas in the Mediterranean basin show very different stricture and composition. Please clarify this point.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 8283, 2015.