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Atmospheric Chemistry and Physics Discussions

Interactive comment on "AIRUSE-LIFE +: Estimation of natural source contributions to urban ambient air PM_{10} and $PM_{2.5}$ concentrations in Southern Europe. Implications to compliance with limit values" *by* Evangelia Diapouli et al.

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General Comments This paper deals with desert dust outbreaks in southern Europe, more specifically with the contribution of natural aerosols to mass concentrations measured in five urban environments in Southern Europe. This is an interesting work, well written and very well conducted, with results properly presented and examined (with the exception of the uncertainties on measured and calculated values). In this respect, I really appreciated the sensitivity analysis on the estimation of African dust contributions. However, if this study addresses some relevant scientific questions, many

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Discussion paper

aspects of desert dust outbreaks in the Mediterranean environment have been broadly studied in recent years (e.g. Stafoggia et al., Environ. Health Perspect., 124 (4), 413-419, 2016 and references therein or Calastrini et al., Advances in Meteorology (2012), http://dx.doi.org/10.1155/2012/246874 and references therein). Therefore, the novelty of this work is limited anyway and it is difficult for me to assess the real contribution of this study to a better knowledge of the Mediterranean atmospheric environment. As the authors pointed out, in the studied urban areas, the natural contribution to the atmospheric particulate load during days in exceedance is very limited, except in Athens, which is not really new (see for example Grivas et al., STOTEN, 389 (2008) 165-177). From a general appraisal point of view, I suggest to the authors to strengthen their discussion about uncertainties in the quantification of the natural contributions, to reinforce their conclusions, before considering publication of this work in a high ranked journal as ACP.

We would like to thank the reviewer for highlighting the interesting aspects of this work and we will try to respond to the comment on uncertainty estimation in the specific comments below. We have to point out that despite the numerous studies addressing African dust outbreaks, this study is one of the few that is based on an organized annual campaign simultaneously in 5 urban areas and also performs an innovative sensitivity analysis of the calculated African dust loads.

Specific Comments Page 4, lines 9 to 13: Please add references about the BSC-DREAM8b and FLEXTRA models.

A reference has been added for each model.

Page 5, line 13: Equation (2) is not the correct formula reported in the Marcazzan's study! In Marcazzan et al. (2001), the mineral dust concentration is reconstructed from: Mineral Dust = 1.15(1.89Al + 2.14Si + 1.67Ti + 1.4Ca + 1.2K + 1.36Fe). Please check your "Min-Stoch" data to verify if they have been obtained with the equation (2) or with the original Marcazzan et al. (2001) formula.

We agree with the reviewer. A modified formula has been used for the calculation of the mineral dust concentration in the current work. Marcazzan et al. (2001) noted that only the part of K and Fe of natural origin is included in the calculation of mineral dust concentration. Taking this into account, and considering that Ca, K and Fe have shown to have in the study areas some anthropogenic sources (industrial, construction fugitive sources, traffic and biomass burning), these three elements were replaced in the calculation formula through their typical crustal ratios with respect to Al. For that reason, in the formula we used, Al is multiplied by 3.79 instead of 1.89 (as in the formula proposed by Marcazzan et al., 2001). This methodology has been initially proposed by Nava et al. (2012) and was also adopted in Amato et al. (2016). In the revised text this is better explained and two more references (Nava et al., 2012 and Mason, 1966) were added to Marcazzan et al. (2001), thus clarifying the calculation algorithm used in the present work.

Table 2 (page 16) and Table 3 (page 17): Please report uncertainties regarding mass contributions (g.m-3) and relative contributions (

The uncertainties of the contributions of the different natural sources have been calculated and are reported in Tables 2 and 3. The text has been also modified in order to include information on the methodology used for calculating uncertainty and to comment on the estimated relative uncertainties.

Figures 6 to 9 (pages 22 to 24): They are clearly intercepts different from 0 in some reported regression lines, which are not considered in the regression equations: Could the authors examine and discuss the impact of these simplifications on their conclusions?

We agree with the reviewer. The intercepts were very low (below 10

Page 9, lines 4 to 6 and Figure 12 (page 25): They are undoubtedly no correlation between measured and calculated dust concentrations for concentrations below 10 g.m-3. I suggest to the authors to clearly indicate that in their discussions on the use

of the SKIRON and BSC DREAM8b v2.0 models.

The phrase has been modified according to the reviewer's suggestion and it is now stated that no correlation was observed between net dust loads and modelled dust concentrations for values below 10 μg m-3, as shown in Figures 12a and b.

Technical corrections - Page 4, line 27: please change Al for Al in brackets for the non-sea salt Na calculation.

Corrections have been made to equations (1) and (2).

- Page 22: Fig.6 not Fog.6

The correction has been made.

- Page 25, Fig.11: please, use a log-scaling for the y axis (Mass Fractions), as in Fig.12, for example.

A log-scale is already used for the y axis.

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