

## ***Interactive comment on “Relationships between columnar aerosol optical properties and surface particulate matter observations in north-central Spain from long-term records (2003–2011)” by Y. S. Bennouna et al.***

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### General comments:

First of all, the authors acknowledge that the manuscript focused in excess about the influence of desert dust to the point that the first sentence of referee 1 is textually "The paper presents analysis of EMEP PM and AERONET AOD datasets to discuss the occurrence of desert dust events in the north-central area of Spain". However, there is a misunderstanding here, because this is actually not the aim of the article. Therefore,

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some parts of the text of the article have been substantially modified in order to clarify this point.

Regarding the influence of desert dust on the variability of ground or column aerosol loading, the referee is indeed right that it is not clearly demonstrated here. Actually the authors should acknowledge that desert dust outbreaks might only partly explain the seasonality of the surface measurements (Querol et al., 2009; also reported in Cachorro et al., 2013). However, the authors believe they cannot ignore completely a number of works focusing on Spain and the Mediterranean basin which have already explored the fact that the PM<sub>x</sub> and AOD monthly statistics present a desert dust signature in their seasonal cycle. Among the most recent works, we would like to recall in particular those of Querol et al. 2009, Pey et al. 2013 and Toledano et al., 2007.

As mentioned by the referee the use of a lidar would be useful to explore the differences in vertical profile that may in turn explain differences in AOD and PM annual cycle. With this respect it should be noted here that there are no ground lidar data available in this area. However, satellite data such as those of CALIPSO may provide more insight to this issue. The CALIPSO climatology dataset (Winker et al., 2013) is mentioned in the conclusion section in the view of possible future work. Besides, in our opinion we must investigate the behavior of air masses at three levels (500 m, 1500 m, 3000 m) in order to explain the differences between PM<sub>x</sub> and AOD cycles. The results of an analysis relying on air masses have been added in additional material, and these results are used in the discussion on the climatological cycles.

For more details on all aforementioned aspects, please see also answers to general comments of referee 2.

Regarding the possible use of AERONET inversion products (size distribution, asymmetry parameter), it should be noted that after the inversion process only 30% of the microphysical data are retrieved, as shown in the paper of Prats et al., 2010 (see below reference) whereas it is of about 90% for AOD and Ånström Exponent parame-

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ters. Indeed, for the retrieval SSA (single scattering albedo) the inversion requires that the AOD is higher than 0.4, therefore it is not of suitable use for such a study. Moreover, in the new version, the reference to the inventory of Cachorro et al., 2013 and the use of related results have been completely removed.

Prats, N., V.E. Cachorro, A. Berjón, C. Toledano, A.M. De Frutos, Column-integrated aerosol microphysical properties from AERONET Sun photometer over southwestern Spain. *ACP*, 11,12353-12547, 2011, doi:10.5194/acpd-11-12353-2011.

Specific comments:

Page 5830, lines 24-25: As correctly pointed out by the referee, health impact is indeed related to both particle size and particle chemical composition, but the authors wanted here to start focusing on the size aspect. For clarification, some text has been added ( Page 5830, lines ...) and changed (Page 5830, lines ...).

Page 5842, lines7-15: These lines are not included in the new version because all parts of the manuscript relying on the results of the desert dust inventory obtained in Cachorro et al., 2013 have been removed. For details, please see answers to referee 2.

Page 5842, lines19-23: For information, although the inventory of desert dust events in the region is based on a conference proceedings of Cachorro et al. (2013) written in spanish, it is important to note that the method applied in this study for the detection of desert dust events is the same as that used in a previous published paper Toledano et al., (2007b) focusing on the southwestern part of Spain with data from the AERONET site of El Arenosillo. The details on this method are already fully described in this peer-reviewed publication. However, as referee 2 and 3 do not agree with the fact to refer to the conference proceedings of Cachorro et al., 2013 written in spanish, the authors decided to remove all the parts of the manuscript (text, Figures 6b and 7) relying on the results of this desert dust inventory. For this reason, there is no answers to the following comments (see page-line list below) which concern parts that are not included in the

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new version:

Page 5843, lines 1-3

Page 5848, Lines 11-14

Page 5846, lines 16-18: This is a general statement referring to .... Therefore the authors do not understand the question of the reviewer "How this classification has been obtained?". However the sentence has been slightly modified to link with the analysis of airmasses.

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Interactive comment on *Atmos. Meas. Tech. Discuss.*, 7, 5829, 2014.

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