

General Comments:

The manuscript deals with aerosol micro-physical particle properties derived from sun photometer measurements using the AERONET inversion procedure. The measurements were analysed for 1 station only, but the measurements cover about 10 years. The manuscript follows previous works which investigated the aerosol optical depths (AOD) and the Angstrom exponent (AE). And it is planned to publish another paper focusing on aerosol types. It is questionable to split measurements of 1 instrument at 1 site and respective data analysis into 3 different parts and publish them separately.

Answer: It is really discouraging to read the above observation of the reviewer about the questionable splitting of 3 publications over a station. First we must say that this is not a always questionable if there is valuable scientific information to give to the research community, and second El Arenosillo station is one of the best sites in Europe as can be seen according to AERONET records and given its specific conditions the data series are ideal for detailed analysis of different topics and studies about aerosols.

Anyway, we have modified or removed the referred sentences about our planning of future works.

Specific comments

p.18351, lines 13-16: "thanks to the collaborative effort of the Atmospheric Optic Group of the Valladolid University (GOA-UVA), Instituto Nacional de Tecnica Aeroespacial (INTA) and the Laboratoire d'Optique Atmosphérique (LOA) of the University of Lille." This comment should be moved to the acknowledgement section.

Answer: This sentence is not an "acknowledgement", it just explains what institutions are in charge of the station.

p.18351, lines:19/20 "This site is representative of the regional area of Southwestern Europe." Without proof this sentence is just an assertion and should be deleted. Otherwise a reference to a proof or a proof is needed.

Answer: El Arenosillo is not representative of Southwestern Europe, only Southwestern Spain (this has been changed in the text). The AERONET AOD climatology is very similar at El Arenosillo and at other sites in the region (Evora, Caceres). Furthermore, former publications of our group have shown the relevance of dust intrusions in the region, that are successfully monitored from El Arenosillo given its location in a remote area, with minor local influence (Toledano et al., 2007, a,b). This was also shown by the comparison with MODIS retrieval over ocean (Bennouna et al., 2011). From many points of view the geographical position is very relevant for aerosol studies: it is located in the SW corner of Europe; it's on the Atlantic side of the Gibraltar Strait, which separates two very different areas: Mediterranean and Atlantic; this area is one of the closer European sites to Africa and it is in the entrance path dust outbreaks over SWEurope.

p.18352, lines 8/9 add surface area concentration to "between number and volume concentration"

Answer: This is related with a misleading in the article when we said that AE is related with "number" particle concentration. This "error" has been removed and section 4.3 has been changed substantially.

p.18352 lines 19/20/21 the sentences can be shortened. There is no need to repeat twice that El Arenosillo is surrounded by pine trees.

Done.

p 18352, lines 21/22 "giving a homogeneous and low surface albedo along the year" please point out, how the surface albedo is homogeneous if the station is close to the water shore.

Answer: You are right, it is more correct to say "a constant albedo along the year". We have changed it. We added the information that the site is 1 km away from the sea shore.

p. 18355/18356 I don't understand which inversion algorithm was used, version 1 or version 2? If only version 2 was used, the text could be shortened significantly. But if both versions were used, a discussing of potential errors introduced by the use of different versions should be done and how this affects the results.

Answer: We use only version 2, but we mentioned version 1 errors because there is no information about the estimation of errors for the algorithm inversion in version 2. We have shortened the paragraph a little bit.

p. 18358, lines 8-10 It is not obvious from figure 2 that the radius of the maximum particle concentration increases with decreasing particle distribution concentration. It is well visible for the two extremes given in the text (August and December). I am missing a discussing how the errors of the inversion procedure influence the accuracy of the size distribution and consequently on these findings.

Answer: The errors of inversion were discussed in the Dubovik's papers and, as expressed above, there exists no discussion on errors for version 2 of the algorithm. Therefore we assume version 1 error assessment as valid (this is a conservative estimation, since errors may be actually smaller for version 2 according to the improvements described in the AERONET website).

p. 18358, lines 11-13 "it is clear ... is not sufficient ... a significant correlation between these values." This sentence should be re-phrased. If the correlation cannot be determined than the behaviour is not clear. However if the authors use the word "significant" as a statistical term they have to provide the level of confidence they applied.

Answer: The sentence has been rephrased

p. 18359, line 7 "total concentration" change to "total volume concentration"

Done.

p. 18359/18360 the discussion is not complete and would benefit if the authors would discuss the influence of different aerosol types with different properties (e.g. forest fires were omitted). But the authors want to discuss aerosol types in a different paper. I recommend to re-think this intention and to include the discussion of aerosol types into this manuscript.

Answer: To include the aerosol types would mean changing the paper completely, enlarging it considerably and requiring a very different approach. We added a comment in the text (last sentence of conclusions).

p. 18362, line 12 "number or volume particle size distribution" add: surface area concentration

Answer: Already addressed as above

p. 18362, lines 19-22 "In this histogram we observe a bimodality with a minimum at $AE=0.75$, separating situations where coarse particles predominate in number ($AE<0.75$) from situations with

the dominance of fine particles ($AE > 0.75$).” This conclusion cannot be drawn! First because no analysis of particle number distribution and AE was done and included in the histogram. The provided threshold is based on AE alone. Second: although the AE is an indicator for the relative importance of coarse or fine mode particles, it cannot be concluded that the coarse mode dominates in number concentration. The statement might be almost correct for volume concentration. I don’t want to discuss the limits and accuracy of the inversion for small particles (smaller than 0.1 μm) and the influence on such a statement. But I suggest that the authors convert several volume size distribution into a number concentration distributions and verify/falsify their statement. And third, the authors argue in the following lines with the volume ratio V_f/V_t and not with the number ratio N_f/N_t .

Answer: Yes, we agree with your arguments and suggestions and section 4.3 has been re-written and changed substantially. Precisely because AE and the volume ratio V_f/V_t are two different quantities and the two current parameters given by AERONET, the idea was to correlate both in order to see the correspondence between the values of both quantities, to delimitate fine, coarse and medium size particles with both quantities.

p. 18363, lines 1-3 again, the authors comment on number concentrations but use volume concentrations as arguments. This is a mixing up between 2 different quantities. The authors should provide the number ratio if they want to discuss the predominance of coarse or fine particles in number, or alternatively the discuss the predominance of coarse and fine particles in volume and continue with the volume ratio.

Answer: Explained in the above question.

p. 18365 figures 10 and 11 are related. It seems that in figure 10 a linear function could be fitted between AE and effective radius for the total distribution. Furthermore the authors could add a comment in the final manuscript that the AE indicates the relative importance between fine and coarse mode of the total size distribution and hence a correlation between AE and effective radius or between the volume ratio V_f/V_t and effective radius can be expected but not for either fine mode or coarse mode alone.

Answer: Done

p. 18366, line 16 add surface area to "(volume and number)"

This general problem was solved in the revised version of the manuscript. The sentence was changed to “However each parameter represents the particle size distribution in a different way and hence correlations between AE and many different aerosol parameters are found in the literature”.