**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "AERONET and ESR sun direct products comparison performed on Cimel CE318 and Prede POM01 solar radiometers" *by* V. Estellés et al.

V. Estellés et al.

vestelle@uv.es

Received and published: 22 May 2012

GENERAL COMMENT:

The authors are preparing software that calculates aerosol properties: the aerosol optical depth, Angstrom exponent and columnar water vapor content. The software will be open source. The software is developed on the basis of the algorithm used in AERONET. The authors use the direct sun measurements and extract part of the code of the software used in SKYNET. This software is designed to process data from CIMEL and POM radiometers. One of the objectives of the paper is to perform synergistic studies with both networks and instruments. However, the aim has not been achieved.

C2814

AUTHOR RESPONSE:

We thank the anonymous reviewer for the specific comments that helped us correcting or improving the paper.

However, in this specific comment the reviewer says that one of the objectives of the paper is "to perform synergistic studies with both networks and instruments". This is missunderstood. The objective of the paper is to present and validate the new ESR software in comparison to AERONET, and show that this software can be applied on both Cimel and Prede instruments indistinctly.

In the paper we stated that "one of the objectives of ESR is to perform synergistic studies with both networks and instruments". This could explain the reviewer misunderstanding. In this sense, we already performed synergistic studies of both networks and instruments, see Campanelli et al. (2011) (to be updated in the reference list). Therefore, the paper objectives were achieved.

REVIEWER COMMENT:

The authors give a few examples from the literature that show the differences between the measurements of the two sun-photometers. The differences of the simultaneous measurement series, which operate according to different algorithms, are not analyzed here.

AUTHOR RESPONSE:

Perhaps we do not fully understand the sense of this comment, as the study is completely devoted to compare the simultaneous measurement series of both instruments operating under different and same algorithms.

REVIEWER COMMENT:

CIMEL and POM instruments are calibrated in a different way. CIMEL calibration is based on comparison with the reference radiometer, while SKYIL method is used to

C2815

calibrate the POM. The authors wrote that ESR network does not have any instrument as a reference while the entire paper is based on calibration coefficients taken from AERONET.

AUTHOR RESPONSE:

For the ESR network operativeness, calibrations will be provided via an improved in situ method (SKYIL) for both instruments. This method was already described by Campanelli et al. (2004 and 2007).

However, the objective of this paper is not to validate the calibration method (this is the subject of a future paper in preparation) but to compare the AOD and CWV algorithms with AERONET, assumed AERONET as a reference. Therefore, we used the available calibration given by AERONET, in order to separate the effect of the algorithms and the calibration in the AERONET-ESR differences.

REVIEWER COMMENT:

By transferring these coefficients match between CIMEL radiometer and POM is forced. Therefore, I see no point in comparing data from the CIMEL with data from sun-photometer POM prepared in this way.

AUTHOR RESPONSE:

As the calibration transfer is performed for the direct sun readings, the direct sun readings are forced. However, we do not force the AOD or CWV results.

We compare the AOD from Cimel and Prede with a transferred calibration because one of our paper objectives to show that the Cimel and Prede AOD measurements are equivalent when the calibration is equivalent. The conclusion is that we can use both Cimel and Prede instruments in the same network by using the same package, without appreciable differences in the AOD. Although it was an expected result, we think it is important for us to state these results clearly for future reference.

REVIEWER COMMENT:

Additionally, the authors use a special version of POM, where 400nm channel was replaced to 440nm, so that these instruments were the most similar. What should be the calibration coefficients to use the software developed for radiometer POM, where there is no CIMEL calibrated at the station?

AUTHOR RESPONSE:

We do not need accompanying Cimels in the ESR stations to get the calibration from.

As it has been stated in a previous response, for the normal working flow of ESR, the calibration of the sunphotometers will be obtained by the improved in situ SKYIL method, for both Cimel and Prede. The SKYIL method can be succesfully applied to get the calibration also at 400 nm, as it was already shown in Campanelli et al. (2004). For the current comparison, however, we asked for a special 440 nm filter in order to compare the AOD from both algorithms and instruments(*). But the standard 400 nm filter can be used also with this software. Actually, any wavelength configuration in the UV, VIS and NIR can be used, although only the AERONET channel configuration is tested in this study.

(*) One of the aims to install a 440 nm filter was to avoid any a different channel configuration to apply and study the inversion codes in the Cimel and Prede instruments, as it was stated in the bibliography as a possible cause of deviation between SKYNET and AERONET retrievals (Che et al., 2008).

REVIEWER COMMENT:

The authors have put great effort to program the AERONET algorithm, almost from the ground. The question arises whether the use of software for POM radiometers was really necessary and whether the analysis of data from POM brought something new. Do the authors suggest transferring calibration coefficients taken from reference CIMEL to any POM radiometer on ESR network and generally on SKYNET, instead of

the original SKYIL method?

AUTHOR RESPONSE:

As previously stated, for the usual work flow in the network, the SKYIL method will be used. However, for isolating the effect of the algorithms in the retrieval of the AOD, we have used the same calibration sets for both instruments. In a future paper we expect to show the performance of the SKYIL method in both Prede and Cimel instruments, and the calibration effect on the AOD difference. But previously, we needed to state the differences due solely to the algorithms that will be used in the network.

We have modified the manuscript in order to make clearer this distinction.

SPECIFIC COMMENTS

SPECIFIC COMMENT:

1.[P4347, L8] and [P4347, L9] How do the authors understand the term 'stable days'? How the stable days are selected?

AUTHOR RESPONSE:

For the selection of the "stable days" we visually inspect the variation of the direct readings and the resultant AOD. If strong variations of the solar direct irradiance is found, the data is not used. A comment has been added in the revised manuscript.

SPECIFIC COMMENT:

2.Information on the adjustment of the Sun - Earth distance [P4351, L12] is omitted in the earlier description [P4347, L17]

AUTHOR RESPONSE:

The reviewer is right. We have included it in the previous description and table. The method used was that of Skyrad for mode 1 and Michalsky (1988) for mode 2.

SPECIFIC COMMENT:

3.[P4353, L11] Could the authors further explain the reasons for greater differences in the UV?

AUTHOR RESPONSE:

We are not sure about the reason for a higher deviation in the UV. Actually, AERONET expects a higher uncertainty for these channels. The uncertainty source seems to be related to the calibration of UV channels (straylight or filter leaks).

In our case, these should not be an issue, as we are using the AERONET calibration factors and comparing the AOD obtained with different algorithms. Other factors can be the filter transmission shape description, the algorithms for accounting for gas absorption, or differences in the absorption coefficients. In future versions of the software we plan to include other gases absorption and newer absorption coefficients, so we expect to come back to this issue and further improve the results. But the current results are good, anyway.

SPECIFIC COMMENT:

4.[P4350;L21] Is the equation for thermal corrections really necessary?

AUTHOR RESPONSE:

We accept the reviewer suggestion and will remove the equation from the manuscript.

SPECIFIC COMMENT:

5.Fig.1 Does this plot brings something important to the paper? Description of the calibration procedure should be sufficient.

AUTHOR RESPONSE:

We accept reviewer's comment and will remove this plot from the manuscript.

SPECIFIC COMMENT:

6.Fig.2 Instead of presenting a series of AOD it would be better to make histograms of

the differences. This would help to analyze the differences contained in the Tab 3, 4 and 5.

AUTHOR RESPONSE:

We consider the AOD difference series interesting as, for example, point out at seasonal effects such as in the case of Figure 3, or differences due to the change of the Cimel sunphotometer unit. However, we will include new plots to show further details of the comparison. More specifically, we will include scatterplot diagrams.

SPECIFIC COMMENT:

7.Tab 3, 4 and 5. Following the aerosol optical depth for each wavelength, AE and CWV should be separated.

AUTHOR RESPONSE:

In order to avoid adding new horizontal lines in the table (that could be confusing) to separate AE and CWV, we have explicitly written the name of the variable in the parameters column and removed the variable name in the header.

SPECIFIC COMMENT:

8.Tab 3, 4 and 5. No information on the wavelengths used for calculation of the Angstrom exponent.

AUTHOR RESPONSE:

The wavelengths used to derive the Angstrom exponent in mode 1 were 440 and 870 nm. In mode 2, the linear regression used channels from 440 to 870 nm. This information has been added to the manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 4341, 2012.