Atmos. Meas. Tech. Discuss., 3, C1162–C1165, 2010
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Atmospheric Measurement Techniques Discussions

Interactive comment on "Aerosol Optical Depth measurements at 340 nm with a Brewer spectrophotometer and comparison with Cimel observations at Uccle, Belgium" *by* V. De Bock et al.

Anonymous Referee #2

Received and published: 13 August 2010

Review for Atmos. Meas. Tech.

Title: Aerosol Optical Depth measurements at 340nm with a Brewer spectrophotometer and comparison with Cimel observations at Uccle, Belgium

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General Comments:

This paper presents some useful analysis of the measurement of AOD in the UV from

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a Brewer spectrophotometer. The authors have demonstrated that a careful calibration and analysis approach yields instantaneous measurements of 340 nm AOD that compare very closely with AERONET Cimel measurements at Uccle (the AERONET site name is Brussels). However the cloud screening of these data is simplistic and suspect. I made a comparison of monthly mean 340 nm AOD derived from their algorithm for the Brewer measurements in Brussels that show very large differences to monthly means determined from the AERONET instrument. For example for April 2008 the monthly mean 340 nm AOD from AERONET was 0.41, while from the Brewer data and cloud screening it was 0.74 (see page 2756), a very large difference given the excellent agreement in instantaneous values, which suggests strong biases in the cloud screening. Similarly large differences ($\sim$0.20 to 0.25) in monthly mean AOD were found for June 2007 and April 2009. Comparison of the AERONET monthly means to the author's computed monthly means should be added to the manuscript, in order to quantify the problems with the newly developed cloud screening methods applied to the Brewer data.

I detail several other specific technical issues and details below that need to be addressed in a revised manuscript.

I suggest that a revised version of this manuscript may be acceptable for publication, after modifications with respect to consideration of the comments and suggestions given.

Specific Comments:

Page 2744, Abstract: The intensities at 340 nm due to lower ozone absorption are larger as compared to what? Additionally, it is too general to state that the monthly and seasonal variability in Brewer AOD's are 'consistent with other studies.' Do you mean consistent with other studies in Europe in amplitude of seasonal variation?

Page 2747, line 4-6: Please define the difference between direct sun ozone measurements and sun scan measurements. Is this only a difference in wavelength or are there

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other differences in the measurement methodology? (Same comment applies to Page 2749 lines 4-7)

Page 2748, after line 21: You need to state that the accuracy of the AERONET measurements of AOD at 340 nm is 0.02 [Eck et al., 1999].

Page 2749, line 14: In equation (1) the sec(z) is only an approximation for the optical air mass. I am surprised that you did not use a more accurate computation such as Kasten and Young (1989). I suggest that you take his into account in future work.

Page 2751, line 3: What is the justification for removing data when air mass is above 3? Air mass changes more rapidly in time in the range from 5 to 3 (morning Langley) making it easier to meet the necessary criteria of a temporally stable atmosphere. Many researchers have typically made Langley analyses from air mass 5 to 2 or 5 to 3 using morning data at Mauna Loa, mainly for this reason. By using your criteria of only air mass less than 3 you insure only a small air mass range (since in some seasons the air mass minimum is $\sim$2 or higher at Uccle) and also increase the likelihood of atmospheric instability since the time period of the Langley sequence is longer and since atmospheric convection intensifies towards mid-day.

Page 2751, lines 7-8: It is much more important to place a minimum range limit on the optical air mass rather than the solar zenith angle range (SZA), since the same SZA range for different seasons yield different ranges of air mass. Air mass range is really the more important parameter (as compared to SZA) in maintaining the quality control of Langleys.

Page 2751, lines 25-27: What default constant AOD value do you assume? Also in line 27 do you mean aerosol optical depth or cloud optical depth?

Page 2752, line 10: Again you need to give a justification for selecting the air mass threshold of 3.

Page 2752, lines 11-12: Again, same comment as for Page 2751, lines 7-8 (see above).

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Page 2753, lines 4-6: Were there any AERONET Cimel observations (Level 2) with AOD > 2 during the times that Brewer observations were made at Uccle?

Page 2753, lines 13-14: Only Level 2.0 AERONET data should be used for publication, since Level 1.5 data may contain observations with instrumental or calibration problems.

Page 2753, lines 17-18: The use of a simple Angstrom exponent to extrapolate to AOD at 320 nm will typically lead to overestimates of AOD at 320 nm since the AOD spectral variation (in logarithmic coordinates) is often non-linear (see Eck et al., 1999). A second order fit of ln AOD to ln λ using the AERONET data from 500, 440, 380, and 340 nm will provide a much more accurate estimate of AOD at 320 nm.

Page 2753, lines 23-25: The term 'cloudless days' is somewhat misleading, perhaps it would be more accurate to say 'calibration quality clear days'. Also you state that the mean calibration factor was 18.579 +-0.084, which implies an uncertainty in AOD due to the variability. Please compute the uncertainty in AOD due to this calibration uncertainty. Also do you use the mean value for the entire data record or interpolate in time between calibration dates. Was there any temporal trend in the calibration?

Page 2755, Section 4.2.1: I strongly suggest adding a plot of daily average AOD values over the entire measurement record.

Page 2759, line 1: I think that perhaps 'AOD retrieval method' should be changed to 'AOD calibration method.'

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 2743, 2010.