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Atmospheric Measurement Techniques Discussions

Interactive comment on "Investigation of the accuracy for single scattering albedo retrieval from global UV irradiance measurements" *by* S. Kazadzis et al.

Anonymous Referee #1

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Review for Atmos. Meas. Tech.

Title: Investigation of the accuracy for single scattering albedo retrieval from global UV irradiance measurements

Authors: S. Kazadzis, J. Grobner, A. Arola, and V. Amiridis

General Comments:

This paper presents some useful analysis of the issue of calibration of UV flux measurement instruments and how that impacts the retrieval of aerosol single scattering albedo. However there are other sources of error besides calibration in the measure-

ment of total (or global) UV irradiance, most notably the cosine response error of the instruments. All instruments that measure irradiance have non-perfect cosine response and this impacts the accuracy of measuring total flux since the both the direct and diffuse flux (especially at high AOD) will be underestimated at times. The direct component measurement will be biased low at larger solar zenith angles and the diffuse component contribution that results from large incidence angles will be biased low at all solar zenith angles. The authors need to include discussion of this issue in the paper, since as it is currently written the suggestion is that the SSA retrieval from the QASUME instrument data is accurate and unbiased. Additionally it should be emphasized more that accurate measurement of AOD that is coincident in space and time with the flux measurements is necessary for the retrieval of SSA from cloudless sky UV irradiance data, and that accuracy in AOD needs to be much better than 0.05 if SSA are to be retrieved for moderate AOD levels such as 0.4 to 0.8 in the UV wavelengths.

Also you should clearly state in your conclusions that the method of Krotkov et al. (2005) which is based on direct-diffuse ratio has a significant advantage over the technique of using total UV irradiance, due to the large uncertainty in irradiance measurement resulting from calibration uncertainty.

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

Specific Comments:

Page 1305, section 15: The Holben et al. (1998) reference should be included after the reference to the AERONET website, which is an acronym for Aerosol Robotic Network, not Aerosol Network as currently written in your paragraph.

The following sentence should be modified to correct inaccuracies to: "It is based on the retrieval of aerosol optical and microphysical properties using inversion techniques applied to observations of the angular distribution of spectral sky radiances and spectral AOD at visible and near infrared wavelengths as demonstrated by Dubovik et al.

(2002)."

Page 1306, sections 5 - 10: You need to state that these methods of inferring the SSA at UV wavelengths require that the sky be completely cloudless since the radiative transfer model calculations are made for cloudless conditions. Completely cloudless sky conditions are not a common occurrence at many geographical locations, and obviously the data must be screened to eliminate partial cloud cover situations. This cloud screening of scattered clouds (low cloud fraction) is not easy or trivial.

Page 1307, section 10: You should give some summary information on the 27 UV spectroradiometers, such as were they of different types or manufacturer, and with different cosine response errors. Simply referring to the Grobner et al. (2005) paper is not sufficient information for the reader to be able to judge possibly important differences between instruments.

Page 1308, section 15: "So the uncertainty of the GSI method decreases foe higher SZA'a and AOD's and for lower SSA's." This statement ignores the fact that cosine response errors are larger at larger SZA, which would bias the UV irradiance measurements and therefore bias the SSA retrieval at higher SZA. Also this sentence has 2 typos: foe and SZA'a.

Page 1308, section 25: Please define the wavelength range in Fig. 2 for the UVA and UVB spectral measurements. Is it the same spectral range or all 27 instruments?

Page 1309, section 5: Please give a brief summary (from the Bais and Grobner papers) of the main reasons for differences in instrument deviations.

Page 1309, section 20-25: Please discuss the issue of AOD spectral variation and that extrapolating from visible wavelengths into the UV spectral region by the Angstrom exponent relationship is not accurate enough due to non-linearity in the ln AOD versus ln WL relationship (see Eck et al., 1999).

Page 1310, Results and Conclusions: Include some discussion that the retrieval of

SSA from the reference instrument is likely to be biased due to cosine response error. The measured UV irradiance is very likely lower than true values especially at large SZA, resulting in lower inferred SSA than true values of SSA.

Page 1311, section 15-20: Calibrated sunphotometers can provide much higher accuracy than 0.05 for AOD measurement. Eck et al. (1999) showed that AERONET instruments measure AOD to an accuracy of 0.01 – 0.02 (with the higher errors of $\sim$0.02 in the UV).

Page 1311, section 20: You need to discuss the need for a methodology to select appropriate values of spectral asymmetry factors that are representative of differing aerosol size distributions such as coarse mode desert dust or fine mode pollution or mixtures of the two.

Page 1312, section 15: I think you possibly mean to say a POSITIVE feedback, since lower AOD and lower SSA would result in higher UV irradiance. I find the current wording of this sentence to be confusing so perhaps this can be clarified.

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 1303, 2010.