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Atmospheric Measurement Techniques Discussions

Interactive comment on "Development of a new data-processing method for SKYNET sky radiometer observations" *by* M. Hashimoto et al.

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Author's response to interactive comment on "Development of a new data-processing method for SKYNET sky radiometer observations" by M. Hashimoto et al.

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Dear Reviewer, We thank the reviewer for their useful comments. Below please find our answers to the reviewer's comments.

Sincerely yours, Makiko Hashimoto

——————————— Author's response ———————————

[Comment 1] I do think that another retrieval technique should not be the standard of comparison for single scattering albedo and that comparisons to in situ methods of measuring SSA under low ambient humidity conditions may be preferable if it can be arranged.

[Answer 1] We appreciate the reviewer's comment. We focus on the investigation of error causes on single scattering albedo (SSA) in the retrieval process and quality control of observation data to develop a retrieval process and its estimation accuracy in this study. It is true that the comparison of remote sensing algorithms is not the true validation of an algorithm. So, we added the statement in L.16 on P.4366 as 'The purpose of this study is to perform sensitivity studies of various aspects of the present SKYNET algorithms, though the true validation of the algorithm should be done through comparison with in situ measurements which should be our next task.'

[Comment 2] P. 4364, line 22 radiations → irradiances

[Answer 2] We corrected the expression.

[Comment 3] Figure 1: Compare simultaneous data on a scatter plot of say SKYNET vs AERONE; this plot does not convey clear information for either AOD or SSA.

[Answer 3] It is difficult for us to make such a plot because we did not coordinate the sampling time of SKYNET so as to match to that of AERONET. So, we like to keep the figure as it is. Although it may be less informative than a scatter plot, the time series plot is useful to show temporal correlation of the SSA tendency and differences between the two network results. On the other hand, other reviewer suggested the interpolation of the values by wavelength and we calculated interpolated values of AOT and SSA at 0.5 μm in wavelength, as the reviewer suggests, using the following equations as attached (File name is "attached_equation1.pdf", Fig.1).

[Comment 4] By the way, AOT refers to (AOD X airmass) and I suspect you are talking about AOD referred to unit airmass. This is defined by the WMO.

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[Answer 4] Yes, we are referring to optical thickness as the normal optical thickness which is same as the optical dpeth according to the definition by Chandrasekhar (Radiative Transfer, Dover, 1960). Historically the normal optical thickness is simply called the optical thickness in many researches, WMO GAW expert workshop report, WMO TD No. 1287; Introduction of ISCCP project (Rossow and Schiffer, 1999, BAMS); Introduction of world's aerosol satellite remote sensing (King et al., 1999, BAMS) and so on. We also have been following these references and want to keep the terminology. In order to make it clear we added the following sentence to the manuscript: "We refer to the normal optical thickness as optical thickness for normal incidence (Chandrasekhar, 1960)."

[Comment 5] Also, some aerosols have very little absorption at these wavelengths and SSA could be close to 1 so I do not think that you should exclude SSA's near1 unless you have some a priori information about the aerosols.

[Answer 5] We agree with the reviewer's comment. We also don't think that SSA close to unity is not always wrong results from the retrieval algorithm. Nonetheless, sometimes we had cases of SSA very close to 1 unnaturally, judged by other information, such as CALIOP aerosol type classification and existence of cirrus layers, that is our point to be raised. We added the following statement in the revised manuscript: ' There are several aerosol types with SSA value close to 1. It is, however, claimed that the SKYNET SSA some times becomes unnaturally close to unity, ...', at L.8 on P.4365 for the present manuscript.

[Comment 6] P. 4377, lines 19-19 Could you elaborate on the statement that a lack of large particlesãĂĂcauses 'overestimation' of radiance values at all observation angles. I believe that large particles increase the forward scattering lobe so radiances near the sun would have lower values if you eliminate the large aerosols, correct? Did you mean 'underestimation'?

[Answer 6] We forgot to describe the range of scattering angle. For SKYNET sky

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radiometer measurement, measured minimum angle of diffused sky irradiance is 3 degree. We have added in the manuscript that “The minimum scattering angle is 3 degrees.”, and “ The intensity of forward scattering near 0 degree increases with increase in particle size, but the simulation shows that the diffused intensity without over 10μm particles is larger than that with over 10μm particles in the region of measured scattering angles (> 3 degree) in the same condition of AOT. Hence, a lack of large particles (> 10μm radius) causes “overestimation” of radiance.”

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 4361, 2012.

$$\ln \tau_{0.5\mu m} = \frac{\left(\ln \tau_{0.675\mu m} - \ln \tau_{0.44\mu m}\right)\left(\ln \lambda_{0.5\mu m} - \ln \lambda_{0.44\mu m}\right)}{\left(\ln \lambda_{0.675\mu m} - \ln \lambda_{0.44\mu m}\right)} + \ln \tau_{0.44\mu m}$$

$$\tau_{0.5\mu m} = \exp\left(\ln \tau_{0.5\mu m}\right)$$

$$\tau_{scattering} = \omega \cdot \tau_{extinction}$$

$$\tau_{s0.5\mu m} = \exp\left[\frac{\left(\ln \tau_{s0.675\mu m} - \ln \tau_{s0.44\mu m}\right)\left(\ln \lambda_{0.5\mu m} - \ln \lambda_{0.44\mu m}\right)}{\left(\ln \lambda_{0.675\mu m} - \ln \lambda_{0.44\mu m}\right)} + \ln \tau_{s0.44\mu m}\right]$$

$$\omega_{0.5\mu m} = \frac{\tau_{s0.5\mu m}}{\tau_{0.5\mu m}}$$

Fig. 1. the interpolation of the values by wavelength and we calculated interpolated values of AOT and SSA at 0.5 μm in wavelength

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