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Atmospheric Measurement Techniques Discussions

Interactive comment on "Characteristics of aerosol vertical profiles in Tsukuba, Japan, and their impacts on the evolution of the atmospheric boundary layer" *by* Rei Kudo et al.

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General Comments

In this paper, the authors apply an inversion method that combines radiometric and lidar measurements and obtain vertical profiles of multiple aerosol optical and microphysical properties. The climatological behavior of these properties is then examined. Moreover, some of these products are used as input to an 1D atmospheric model in order to investigate the effect of the aerosol presence as well as their vertical distribution to the boundary layer height. In general the paper, is rather interesting and well organized. My main concern, however, is about the uncertainties of the inversion method applied, especially for cases where the aerosol load is small. Typically such inversion

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Discussion paper

methods require a certain level of confidence to the input parameters. This is usually achieved for the columnar properties when a sufficient amount of aerosol is present in the atmosphere. The lidar profiles, on the other hand, always include regions where the extinction coefficient is low, e.g. the last part of the profile. How accurate is the inversion for those cases? For example, are the retrievals for an extinction coefficient below 0.02 kmˆ-1 (Figures 2,3 and 4) trustworthy? This issues should be discussed in the manuscript. If the error of the retrieval has not been quantified, then the authors should consider applying thresholds to the AOD and extinction coefficients in order to exclude profiles, or parts of the profiles with potentially high uncertainties from their analysis.

Specific Comments

Section 2.1.2 (page 4, lines 11-12)

Why do you use the wavelet covariance transform (WCT) at 532nm instead of 1064nm for the cloud and aerosol base retrievals when both are available during the day? The aerosol layers tend to appear more clearly in the 1064nm channel.

Section 2.2.1 (page 5, lines 18-22)

It is mentioned here that "we determined the optical properties between 532 and 1064 nm by linear interpolation and used the optical properties at 532 and 1064 nm for wavelengths of less than 532 nm and greater than 1064 nm". Is this true for all the aforementioned optical properties? The aerosol extinction coefficient, in particular, usually has a strong wavelength dependence, even within the visible spectrum. Since the spectral range is much larger here, the authors should consider applying a correction, e.g. with the use of a constant angstrom exponent, for the extinction profiles in wavelengths below 532nm and above 1064nm.

Section 3.1.1 (page 6, lines 22-23)

The authors mention that "In all the seasons, the extinction coefficient was large in

three layers: from the surface to 1.5 km; from 1.5 to 3.5 km; and from 3.5 to 6 km altitude." The upper layer, however, only appears during winter and spring (Figure 2). Please rephrase. Since only the boundary layer is provided in the figures the discussion should be focused mainly on the differences between the free atmosphere and the boundary layer.

Section 3.1.1 (page 6, lines 31-32)

The number of daily mean profiles is considerably lower during summer (only 7 days - Figure 2). Is this related to cloudy or rainy conditions? The constant rainy conditions could explain the lower extinction values.

Section 3.1.2 (page 8)

Please provide specific values from the analysis (Table 2). A short comparison with estimates from other scientific studies would be interesting here as well.

Figure 4

The winter profiles exhibit high extinction and high SSA values while the summer profiles show low extinction and low SSA values. During spring both kinds of profile are observed. Do you observe any specific seasonal pattern within the spring months. For example, do the winter-like profiles tend occur in early spring while the summer-like profiles in late spring?

Technical Comments - Suggestions

Table 1

Consider defining abbreviations for the table properties in the caption and include the variability with +- in the same line with the mean value. Currently, each table property occupies 2 lines and sometimes this is difficult to follow.

Figure 6

A small height versus time plot per trajectory could be included along with the map. Regions where the trajectories pass closer to the ground are more probable to affect the layer aerosol content.

Section 3.1.1 (page 7, lines 14-15)

Add citation

Section 3.1.1 (page 7, lines 23-24)

typo - replace "almost same values" with "almost the same"

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