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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Potential of polarization lidar to provide profiles of CCN- and INP-relevant aerosol parameters" *by* R. E. Mamouri and A. Ansmann

Anonymous Referee #2

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General comments

This paper discusses the potential for estimating the particle number concentrations of cloud condensation nuclei (CCN) and ice nuclei (IN) and the particle surface area concentration from the polarization lidar measurement. The estimation method of the conversion parameters from particle extinction coefficient to number and surface concentrations solely based on the ground-based Sun-sky radiometry (AERONET) measurements. It measures the sun and sky radiance at several wavelengths from which spectral aerosol optical thickness and particle volume distributions are retrieved. I think that the method is reasonable and logically consistent. However, I strongly suggest that

it should be validated by comparing with the in-situ measurements of CCN and IN concentrations (as the authors mentioned in the Conclusions) because there might have large uncertainty in the particle number concentration retrieved from the Sun-sky photometry measurements. In particular, the number concentration with radius smaller than 0.1e-6 m, which contributes largely to N_CCN, has large uncertainty (Please see Figs. 1 and 8 and Table 4 in Dubovik et al., JGR, 2000). Thus, the authors should be careful about the estimate of the uncertainty in the NCCN retrieved using the method proposed in this paper. There is one more thing that I am wondering is that it does not discuss the detection limit of N_INP that is usually an order of 1 Lˆ−1 in the real atmosphere and the contribution of the backscattering to the total backscattering coefficient is very small. Thus, I suggest the authors to add discuss these topics in the paper. After that with minor corrections, I think that it can be accepted as a regular article on the ACP. The specific comments and technical corrections are given below.

Specific comments

1) P34160, L15: Please explain how you estimate the magnitude of contribution of marine particles to the measured non-dust backscatter coefficient.

2) P34172, L27: Did you check the particle imaginary refractive index retrieved from AERONET measurements to examine the different absorption contribution to the particle extinction coefficient? Please comment on it if possible.

3) P34176, L26: To compute the continental pollution extinction coefficient, did you use a constant lidar ratio over height or vary with height between 50 and 60 sr?

4) P34176, L26: Please give the lidar ratio for marine particle in Fig. 8. In addition, please provide the lidar ratio values used for 355 nm.

5) P34177, L26: It might be helpful to refer the paper by Sakai et al. (2014) that compared the lidar observations with respective airborne in-situ observation of CCN and aerosol particles.

6) Table 3: Please provide the standard deviation for C_p50, if possible.

Technical correction

1) Fig. 9: I cannot distinguish thick and thin lines in the left panel.

References

Dubovik, O., A. Smirnov, B. N. Holben, M. D. King, Y. J. Kaufman, T. F. Eck, and I. Slutsker (2000), Accuracy assessments of aerosol optical properties retrieved from Aerosol Robotic Network (AERONET) Sun and sky radiance measurements, J. Geophys. Res., 105(D8), 9791–9806, doi:10.1029/2000JD900040.

Sakai, T., T. Nagai, N. Orikasa, Y. Zaizen, K. Yamashita, Y. Mano, and M. Murakami (2014), Aerosol Characterization by Dual-Wavelength Polarization Lidar Measurements over Kochi, Japan during the Warm Seasons of 2008 to 2010, J. Meteorological. Soc. Jpn., 91, 789–800, doi:10.2151/jmsj.2013-605.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 34149, 2015.