Atmos. Chem. Phys. Discuss., 7, S4247–S4250, 2007
www.atmos-chem-phys-discuss.net/7/S4247/2007/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Multiwavelength and polarization lidar measurements of Asian dust layers over Tsukuba, Japan: a case study" *by* T. Sakai et al.

Anonymous Referee #1

Received and published: 21 August 2007

General:

The authors present complex aerosol observations (one case with a strong desert dust impact, one with less dust) obtained with an advanced multiwavelength polarization lidar. The strong part of the paper is the discussion of the optical properties of the two cases in terms of Angstrom exponents and depolarization ratio. The main part of the paper, however, deals with the retrieval of microphysical properties of the aerosols. This part is rather weak, based on rather simplified and thus questionable assumptions (and no error analysis of the products is given). The results and comparisons with model calculations are highly speculative and thus of rather low scientific value.

The paper must be rejected.

Details:

P10179, Abstract: elastic backscatter lidar

P10183, Ismail et al. 1998, in the references 2000

P10183, backscatter calibration in the stratosphere (10-15km height) after Russell et al, 1979, 1982 is no longer appropriate for the years after 2000 (see Jager publications after 2000 in GRL and JGR). Use of continental aerosol model (lower troposphere after Ackermann) is not appropriate for the stratosphere.

P10183, 6% uncertainty at 735nm, but 25%, 50%, and 50% at the other three wavelengths is surprizing. How can you obtain such a high accuracy at that comparably long wavelength (difficult Rayleigh calibration when compared to 355 and 532nm)?

P10184, depolarization calibration is a rather important point when discussing desert dust/urban haze/maritime aerosol mixtures, but nothing (zero) is mentioned regarding a careful, quality assured retrieval and calibration of the depolarization ratio. As I understand, the authors use different telescopes for the parallel and the cross-polarized signal components. This sounds rather strange, and I think, calibration is a very difficult task. Did you use lambda/2 plates or polarizing filters to check cross talk in the different polarization channels?

Results in sections 4 and 5:

P10184, I do not see any correlation between k and depol. Error bars are missing in the plots for the Angstrom values.

P10185, differences in the aerosol optical properties may also depend on the dust source and thus on chemical composition, aspect ratio, degree of non sphericity.

P10185, Ansmann et al. 2002, I cannot find what you mention..., wrong paper?

ACPD

7, S4247–S4250, 2007

P10186, depolarization ratios >10% do not indicate spherical particles.

P10186, again, negative correlation? seems to be somehow speculative (error bars are missing).

P10186, imaginary part of 0i is unrealistic.

P10186, only one (and fixed) value for sigma_g of 1.66 for sulfate particles is unrealistic, may vary, thus simulations with different values are required (at least as part of an uncertainty analysis).

P10186, again only one (and fixed) value for sigma_g of 2.00 for dust particles is unrealistic, may vary.

P10187, with all the fixed input parameters the computations are trivial and rather questionable.

P10187, the derivation (from Eq.(2) to Eq.(3)) should be provided, same for Eq.(4), at least references should be provided.

P10187 and follwing pages, the discussion is nothing else as speculation based on questionable results. The lidar wavelengths do not cover the coarse mode (>1micron particles), thus the coarse mode cannot be retrieved from lidar data. The Sun photometer does not allow a trustworthy retrieval of the column size distribution in the presence of maritime and urban particles (in the PBL and even higher up) and dust. Nothing is mentioned to the Sun photometer wavelengths and the wavelengths at which the scattering phase function is measured (is that measured? is this information considered in the retrieval?), what procedure is used to retrieve the size distribution (including all the artefacts, three mode distribution), do you use the Dubovik code (see papers from 2002 and 2006)? The model computations of the aerosol microphysics, on the other hand, are based on these simple assumptions (mentioned above) and many fixed input parameters. The impact of the omnipresent maritime aerosol is completely ignored.

This is not tolerable.

ACPD

7, S4247–S4250, 2007

So, the results in sections 4 and 5 are at all questionable, errors are certainly larger than 100%, but an error analysis is not provided.

The paper must be rejected.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 10179, 2007.