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1 Microphysical aerosol parameters from optical data

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Microphysical aerosol properties and the single scattering albedo as a key parameter in climate forcing are very important input parameters for climate models. In Ref. [1] and [2] those parameters were estimated from multiwavelength lidar data. After the retrieval of the volume distribution in a first step a mean complex refractive index was determined in a second step.

The most critical parameter estimation is that of the total number concentration in Ref. [1]. The estimation of the imaginary part of the refractive index in Ref. [2] shows a large error in some cases, too.

Therefore, we present in this paper improvements for both parameter estimations. In the latter case we use additional information, namely, the absorption coefficient which can be provide, e.g. by nephelometer measurements. The absorption coefficients fulfil a first kind Fredholm integral equation in a similar way as the backscatter- and extinction coefficients fulfil in dependence on the particle size distribution. The extended inverse ill-posed problem is more sensitive to the refractive index and therefore, the retrieval results are improved.

The improvement of the retrieval of the number concentration works as follows. We suppose here a known refractive index. First, we solve the ill-posed problem by regularization as in Ref. [1]. Second, in an additional step we improve the retrieved size distribution by a fit to a proper type of a usual size distribution function after a visual check. The total number concentrations are improved without any remarkable lost of accuracy in the retrieval of the other parameters.

[1] C. Böckmann, Hybrid regularization method for the ill-posed inversion of multi-wavelength lidar data in the retrieval of aerosol size distribution, Applied Optics 40 (2001) pp. 1329-1342.

[2] C. Böckman et al, Microphysical aerosol parameters from multiwavelength lidar, J. Opt. Soc. Am. A 22 (2005) in press.