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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Stratospheric aerosol measurements by dual polarisation lidar" *by* G. Vaughan and D. P. Wareing

Anonymous Referee #1

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Review of Stratospheric Aerosol Measurements by Dual Polarisation Lidar

by G. Vaughan and D.P. Wareing

The authors present a novel method to determine very thin aerosol content by analysing the depolarisation of the return signals of a powerful lidar system. Their method is restricted to the case of purely spherical aerosols (liquid droplets), which allows to use the depolarised return signal of a lidar system to determine very precisely the atmospheric density profile, as the depolarised return is depending only on the Rayleigh scattering process of air molecules. The advantage of this method as compared to the so-called Raman-method is briefly discussed and a few examples are presented. In addition the authors report the unusual observation of a polar stratospheric cloud (PSC) above the British Isles, as well as that of an unknown source of

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stratospheric aerosol. Both observations are analysed with the new method developed and thereby show clearly the advantages of the new procedure, as well as its limits. The reported method is a novel concept and a very valuable contribution to the suite of analysing procedures for lidar instruments. The advantages are clearly presented, as well as the limits. The paper is clearly written and the results are very well presented. While the method is primarily interesting for researchers using lidar instruments, the observations of a PSC above the British Isles as well as that of the unknown aerosol content are interesting also for other readers of ACP. After some minor clarifications and corrections as suggested below, this paper should be published in ACP.

Some specific comments: In the algorithm description (chapter 3), equation 1 should also be written for the special case with both polarisers set to parallel for the ease of the understanding.

At the end of chapter 3, there is only a short statement that the value of "y was found to be 0.4+-0.1%":

a) the method, of how this value was determined must be described more elaborate. Was this a one time measurement under optimal conditions or was this determined from tests done every night? How exactly was the value measured, which was used as reference height etc.

b) Is this the value y or rather the value x, defined as the instrumental depolarisation? In the conclusions, it is stated that "the system depolarisation was determined to be around 0.4+-0.04%" Why is the error smaller now?

c) It would also be interesting to know the pure laser depolarisation, in order to relate this value to contributions from the detection system and from the laser itself.

To this reviewer it appears that figure 2 (data of Dec. 11/12 2001) is not necessary to be presented and the data also do not need to be discussed in chapter 4.1. The later data are better in quality and for the presentation of the method. (The authors had

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already chosen not to mention Fig. 2 in the text anyway.)

At the introduction, when discussing the Raman method, it would be appropriate to cite a relevant source for this method.

Two technical remarks:

Chapter 4.2, first paragraph, last sentence says "February 2004", this should read Feb. 2003 ? Chapter 4.3 should make reference to Fig. 7 after the second sentence.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 6107, 2004.