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Atmospheric Measurement Techniques Discussions

Interactive comment on "Three-channel single-wavelength lidar depolarization calibration" *by* Emily M. McCullough et al.

Anonymous Referee #1

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The discussion paper "Three-channel single-wavelength lidar depolarization calibration" presents an interesting approach to retrieve depolarization parameters without the use of the cross-depolarization channel. The technique presented could be of interest to some lidar systems, and is clearly presented. I suggest the publication of the manuscript after some minor corrections.

General comments

The manuscript would benefit from a brief description / schematic of the lidar receiver setup. This will help the readers understand the discussion, without referring to previously published papers of the authors.

The authors use the depolarization parameter d, which is fine. Still, much of the liter-

ature refers to delta parameter of the value, and this makes it hard to evaluate if the d values presented in the study. The manuscript will benefit from few examples linking d to delta (e.g. for d=0.1, d=0.6 etc.).

The authors should explain more clearly the disadvantages of not using the cross-polarization channel for depolarization calculation. Why bother with this channel if all information can be derived equally well with just total and parallel channel?

The authors assume that there is no cross-talk between parallel and perpendicular channel. (M11 = M00, M01 = M10). Small cross-talk could be easily caused by misalignment of the polarization separation element with respect to the laser polarization plane. Consequently, the authors should provide some calculation / graph describing the effect of possible crosstalk to the accuracy of the retrieved depolarization parameters for different values. This will help the readers assess the required accuracy for implementing this setup in their system.

The comparison scheme described in Section 5.5 seems problematic. The authors exclude points with uncertainty greater than 0.2. Is this limit applied to either d1 or d2 or both? In any case this could hide regions where one of the two methods provide better results. Please consider adding in Figure 8 a scatter plot including all points (without the 0.2) threshold. The two plots combined will give a better idea of the performance of the proposed method.

The number of figures could be grouped by grouping some of them (e.g. fig 3 and 4, 15 and 16, . . .).

Minor comments Page 5, line 4: gone undergone.

Page 9, line 14: give examples of what other factor could influence the overlap function

Page 16, line 7: scan-by-scan. Do you mean profile-by-profile?

Page 17, line16: do you have any theoretical reason why a power low would fit the calibration data? Do you expect such law to work also for other systems?

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