

Reviewer Comments

Title: Three-channel single-wavelength lidar depolarization calibration
Author(s): Emily M. McCullough et al.
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Summary

The authors describe a depolarization technique that is specific to a particular lidar, which has been equipped with a linear depolarization measurement capability (parallel and perpendicular receiver channels) by means of a Licel Polarotator. Unfortunately, the lidar system optics attenuate the perpendicular channel by a factor of 21, and so extensive signal averaging is required to get a useful SNR in that channel, which causes such low temporal and spatial resolution in the depolarization data that it is not useful for the cloud studies that the authors would like to enable.

However, the lidar also has a high-SNR polarization-insensitive receiver channel, and so the authors show how to use that channel with the parallel channel to derive the depolarization parameter. But they desire to measure depolarization in the crossover region, and the overlap functions of the two receiver channels involved are not the same, and differences are sensitive to laser beam alignment and even laboratory temperature. So, using this method would require time-consuming calibration measurements every night, which is undesirable.

The authors present an optimum approach, using low-resolution results from the Polarotator channels, which are stable, to calibrate the high-resolution results. They illustrate the benefits of their approach with the color time-height diagrams.

General Comments

The manuscript is very well written. The arguments and the formalism in the paper appear to be correct. The manuscript is very thorough, and the technique is well illustrated with the color time-height diagrams. This paper is a follow-on to a previous paper, and it is properly set in that context.

Specific Comments

Here are some corrections and suggestions:

p. 2 line 16 reads “The maximum signal in the parallel channel would be much greater than the maximum signal in the perpendicular channel, even without the partial-polarizer effects of the CRL’s receiver optics.” Well, usually. Not always, though. Maybe add the qualifier “usually”?

p. 3 line 3 might read better as “... light of all polarizations.”

p. 3 line 27 should read “... and it can be...”

p. 8 line 4 should read “...to develop an expression...”

p. 9 line 1 should read “...which cannot be...”

p. 9 line 17 should read "...known, from..." (or else delete "which found" in the next line).

p.10 line 4 should read "None of the parameters..."

p. 11 line 25 should read "It is possible to circumvent d_2 's calibration disadvantages..."

p. 12 line 8 might read better as "...is to combine these two methods..."

p. 17 line 14 should read "A number of options..." or "Several options..."

p. 17 line 15 "powerlaw" should be two words.

p. 24 line 7 "...no longer able to be discerned." would read better as "...no longer discernable."

p. 26 line 13 "...which themselves are only possible to calculate..." would read better as "...which can be calculated only in..."

p. 32 line 12 should read "...allow the depolarization..."

p. 33 line 15 "...depolarization ratio were shown produced..." should read "...depolarization ratio were produced..."

p.33 line 30 "...derived the depolarization..." should read "...derived depolarization..."