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Atmospheric Measurement Techniques Discussions

Interactive comment on "Year-round stratospheric aerosol backscatter ratios calculated from lidar measurements above Northern Norway" *by* Arvid Brand et al.

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(Author responses are in blue. In the tracked changes version deleted sequences are marked red. New text is marked in blue.) General Comment: We want to thank the three reviewers for the detailed reviews with many useful ideas and suggestions which, we think, have significantly increased the quality of the manuscript. We have rewritten a substantial portion of the manuscript. We restructured the outline of the manuscript. Section 2, formerly named "ALOMAR RMR Lidar" is now called "Instrument and Method" with subsections 2.1 "Processing of the raw data", 2.2 "Calculation

of backscatter ratios" and 2.3 "Identification of the stratospheric aerosol layer". Section 3, formerly named "Methodology" is now named "Calculating the backscatter ratio under daytime conditions". Section 4 contains the results of the paper. A "Summary and Conclusion" can be found in section 5. The nomenclature for the calculation of the backscatter ratio and the color ratio was changed. Therefore, sections 2.2 and 3 have been completely rewritten. The figures have been updated to account for the new symbols.

The paper is appropriate for AMT, but not in a good shape. Major revisions are needed. The paper is much too long. Basic lidar stuff is unnecessarily presented in large detail. A compact version is needed.

Introduction: The importance of the SSA is presented in large detail! Why? One paragraph would be sufficient! On the other hand, one has to read the entire paper to get an idea: What is new here? What is the motivation to write this paper? Figures 9 and 10 tell the reader finally what the step forward is.

The manuscript was rewritten in large parts. We think that the novelty of the method and the motivation for the paper is now clear.

Please provide the motivation right in the beginning (second paragraph of the introduction): precise and compact. The shorter the introduction the better.

We now mention the motivation at the end of the introduction. We tried to shorten the introduction and also tried to take the other referees comment into account.

Maybe mention also that CALIOP observations are available to monitor SSA as well, but the disadvantage is. . ..

We did not include more discussion here as CALIOP does not provide stratospheric backscatter ratios at 1064 nm (Vernier et al., JGR, 2009). A detailed comparison of CALIOP and ground based lidar is given in Khaykin, ACP, 2017.

Section 2: . . .is much too long. One paragraph and good references would be fine.

Section 2 could be even left out..., could be the introductory part of Section 3 (Method).

As described in the general comment, the section has been completely rearranged and also shortened.

There are many sentences that must be simply improved: The detection system is capable to detect wavelengths? Simply bad wording. . . The lidar detects backscatter signals at different wavelengths. There so many, many more examples throughout the paper. . .. , e.g., P5, L5:We use an inelastic counter for the denominator of Eq 2. . . unbelievable wording. So bad! So low quality of precise thinking! Did any of the co-authors (including the director . . .) read the manuscript?

The whole manuscript has been revised.

P5, L5: The reference is Raman, 1928! I could not believe what I read! Please provide a proper Raman LIDAR (!) reference here. The same for Rayleigh, 1871, 1899. Please provide a proper Rayleigh lidar reference.

The section “Calculation of backscatter ratios” has been reworked completely.

Eq.(3), Eq(4): Please note! Quantities in equations are presented as ONE letter (a, b, c, T , p, that’s why we use so often alpha, beta, gamma, ... and lambda, and then with index. . . if needed). So, please improve Eqs. 3 and 4 accordingly.

Done. The whole nomenclature for the derivation of the backscatter ratio was reworked.

P5, L29: . . .data is reduced to altitudes above the tropopause. . . another example of bad wording. . .

Rephrased

Section 4: I give up. . .! . . .. only a few remarks : purple drawn profile . . . or drawn as a red shade. . .. Please avoid ‘drawn’!... In many cases, you can leave it simply out, some- times one may use: . . . is shown as purple curve, or given as red profile etc. . .

The section “Results” has been reworked completely.

So, this new procedure should be already briefly explained in the Intro section.

Done