Reviewer 2:

Review of the second revision of the manuscript "Lidar derived Aerosol properties from Ny-Ålesund, Svalbard during the MOSAiC spring 2020" by Jonas Dube et al. submitted to Remote Sensing

I find that the authors have considerably improved the manuscript, including its conclusions, and recommend its publication after a minor revision addressing a few specific comments pointed out below.

Thank you for your review and your suggestions. We gratefully considered them carefully, see below.

Remaining inconsistencies in citing

Throughout the manuscript there are citations without mentioning the authors names, except for:

- Line 36-37: However, Warneke *et al.* [16] showed by aircraft measurements over Alaska that biomass burning also contributes to *Arctic Haze*. → However, it has been shown by aircraft measurements over Alaska that biomass burning also contributes to *Arctic Haze* [16].

Thank you, has been corrected.

- Line 113-114: For a better comparison also the values for 2019 are shown in grey, which were evaluated by Rader *et al.* [29]. → For a better comparison also the values for 2019 are shown in grey, which were evaluated by Rader *et al.* [29]. → For a better comparison previously published values for January-March 2019 are also shown [29].

Thank you corrected.

Details about the plotting (e.g. color) should be in the caption.

OK to be answered

- Line 118-119: This is effected by a higher aerosol concentration in the stratosphere due to wildfire smoke, which is already described by Engelmann *et al.* [6]. → This is effected by a higher aerosol concentration in the stratosphere due to wildfire smoke [6].

Thank you, corrected.

- Line 259-261: Zieger *et al.* [37] found, based on in-situ measurements, that in Ny-Ålesund already relative humidities around 50 % are sufficient for hygroscopic growth of the aerosol. → Based on in-situ measurements it was found that in Ny-Ålesund relative humidities around 50 % are already sufficient for hygroscopic aerosol growth [37].

Thank you – corrected.

Figure and table captions

- Figure 1-3: I recommend that all the text from the first paragraph of Section 3 that describes the figures (e.g. colors of lines, etc.) is moved into figure captions.

Thank you. We revised all figure captions and tried to improve them.

- Table 1. Median of the lidar ratio *LR* for different altitude ranges and month separated for all high and small backscatter events. In the brackets also the 25. and 75. percentile are indicated. → Table 1. Median of the lidar ratio (*LR)* for different altitude ranges and months in 2020 separately presented for all high and small backscatter events. The 25. and 75. percentile are indicated in the brackets.

Thank you. Corrected.

- Table 2. Median and in brackets the 25. and 75. percentile of different optical parameters for the 3 days in February with the highest backscatter and the rest of February. → Table 2. Median of the retrieved optical parameters shown separately for the 3 days in February 2020 with the highest backscatter and the rest of February. The 25. and 75. percentile are indicated in the brackets.

Thank you, corrected.

- Figures 5 and 6: I recommend that the text from the first paragraph of Section 4.1 that describes the details of the figures (e.g. colors of lines, etc.) is moved into figure captions. As it is, the details break the red line of the manuscript, they are only needed when looking at the plots.

Thank you. As again a change in the plots was required, we changed this and put the description of colors in the figure captions.

Other

- Lines 160-162: Please rephrase the starting paragraph of Section 4, perhaps like:

As already mentioned above events with a high backscatter coefficient and with a high lidar ratio have to be distinguished. To get more information about the similarities and differences between the aerosols at both occurrences we investigated two case studies. → To get more information about the similarities and differences between the aerosols in the events with a high backscatter coefficient and with a high lidar ratio two representative cases are presented in detail.

Thank you very much. This is a much better wording indeed.

- Arctic Haze is written in a haphazard way throughout the paper, including: Arctic Haze, *Arctic Haze, «Arctic Haze»* - it may be a good idea to decide on one

Yes thanks we changed all to *Arctic Haze*

Conclusions

- I am still not fully happy with the conclusions section, which is a mixture of the overview of the research performed, reporting of important results (values) and the conclusions. I would recommend moving the results to the previous section, minimizing the review and focusing on the conclusions. The bullet list is fine, but please make it textually consistent (some bullets start with a capital letter, some do not, some bullets end with a punctuation mark, some do not…) As an example, I recommend the following change:

Finally, we summarize our results like follows. We found:

  - in 2020 higher backscatter than 2019 below 1.5 km and above similar and clear conditions. We found a dominance of small particles with radii clearly below 100 nm. The almost constant aerosol properties above 2 km altitude mean, if confirmed over

other sites, that in principle regional climate models might be easily fed with realistic aerosol properties above this altitude for the Arctic →

The main conclusions based on our results are:

- In 2020 aerosol backscatter below 1.5 km in similar atmospheric conditions was found to be much higher than in 2019. We found a dominance of small particles with radii below 100 nm. The almost unchanging aerosol properties above 2 km of altitude suggest, if confirmed at other sites, that in principle regional climate models might be easily fed with realistic aerosol properties above this altitude for the Arctic.

Again, honestly thanks for your improvement. We cleaned up the conclusions, unified the bullet points and took your version with one exception: Instead of:

In 2020 aerosol backscatter below 1.5 km in similar atmospheric conditions was found to be much higher than in 2019.

We are now writing:

In 2020 aerosol backscatter below 1.5km was found to be much higher than in 2019. Above that altitude clear conditions with similar aerosol properties prevailed in both years.