Response to reviewers' comments:

We thank Reviewer #2 for their helpful and constructive comments. In the following we give itemised answers to questions and suggestions by this reviewer.

- Discussion too succinct: The discussion of results was expanded by adding new figures and by discussing the statistics in more detail. We compared our results with other, similar studies. However, we are not aware of many long-term studies of Arctic PSCs. We included the ones we know of. Due to different stratospheric conditions we omitted a comparison with studies of Antarctic PSCs. Some comparison with CALIPSO is included in the study. The major problem we see for performing more detailed comparisons with CALIPSO is that the satellite's swaths are most often at not insignificant distances from our location. When no waves are present a comparison can be feasible (Achtert et al., 2011). With mountain lee waves present observed PSC characteristics can be very different. We contend that we pointed this out in the present study.

- Line 76: It should in principle be possible to combine radar and lidar data for studies of mountain-wave-induced PSCs. However, one has to be aware of a few obstacles. While the radar can detect wave activity up to the UTLS region, it is not set up for measurements in PSC altitudes. It cannot detect clouds directly but observed waves, winds, and turbulence. Hence, the radar can indirectly observe convective clouds, and detect vertical propagation of waves in the troposphere. The stratosphere is too well stratified to yield significant backscatter signals. Therefore, the radar cannot observe PSCs when conditions are bad for lidar measurements. Moreover, radar and lidar are appr. 30 km apart and don't observe the same volume.

- Figure 2 caption: We changed the names of PSC types to 'NAT', 'STS' and 'ice' in the caption and throughout the text to be consistent with current nomenclature.

- Figure 2: The figure was modified to show boundaries of the PSC types. Old Fig. 7 (now Fig. 8) was modified in the same way.

- Figure 2 and Figure 7: Old Fig. 7 is now Fig. 8. We contemplated using the same set of parameters as Tritscher et al. (2021) and others, but ultimately decided against it. The main reason is that doing so would require further steps of data handling which potentially could induce additional errors. Another motivation to keep the current set of parameters was to facilitate a comparison with Blum et al. (2005) whose study is based on measurements in Northern Sweden, as well.

- Figure 4 and 9: Old Fig. 9 is now Fig. 10. We normalised all plots showing height distributions. The plots now also show the total number of cloud pixels that are included in the respective plot. New figures were added (Figs. 5, 11, and 12) that show height distributions for the individual types of our PSC classification. These figures are normalised as well.

- Line 155: L. 156-157 already stated that cloud pixel that are classified as one particular type are not necessarily pure but can contain minor portions of compounds that are characteristic for other types. More explanation has been added which aims specifically at the issue of hard or fuzzy boundaries.

- Line 220 and following: We added some sentences that address mountain-wave seeding of PSCs. This, however, is not the intended subject of this study. Therefore, we want to keep this part relatively short. It is an interesting idea for a future study.

- Figure 6: Now Fig. 7. We added a line that gives the fraction of observations that are favourable for mountain waves. We think that it is still useful to have the absolute numbers, as well, therefore kept them.

- Figure 7: Now Fig. 8. Boundaries for the different PSC types were added.

- Figure 9: Now Fig. 10. New figures were added (Figs. 11 and 12) that show the height distributions of for each PSC type, both with and without mountain lee wave conditions present.

- Figure 9b: In our understanding the lifting of air parcels in the wave will happen adiabatically, hence lead to a cooling of the air parcel. The cooling makes it more likely that formation temperatures for PSCs are reached. Hence, we expect PSCs more likely to form at the wave crest. This explanation was included in the manuscript (l. 300 and following).

- Data availability: As far as we understand, the statement 'lidar data is available on request' is consistent with ACP's policies. We are aware that a doi number would be much preferable. However, while our institution wants to get there in the (hopefully) not too far future, this is currently not available, unfortunately. Nevertheless, due to Swedish regulations for governmental institutions we are obligated to provide our lidar data to anyone who is interested in them.

References

Achtert, P., Khosrawi, F., Blum, U., and Fricke, K. H.: Investigation of polar stratospheric clouds in January 2008 by means of ground-based and spaceborne lidar measurements and microphysical box model simulations, J. Geophys. Res., 116D, D07 201, https://doi.org/10.1029/2010JD014803, 2011.

Blum, U., Fricke, K. H., Müller, K. P., Siebert, J., and Baumgarten, G.: Long-term lidar observations of polar stratospheric clouds at Esrange in northern Sweden, Tellus B, 57, 412–422, https://doi.org/10.3402/tellusb.v57i5.16562, 2005.

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