Reply to comments from Referee #1 Alain Sarkissian

We would like to thank Alain Sarkissian for the very positive and constructive comments which are addressed individually in the response below. The reviewer's comments are included in italics with the responses in blue.

General Comments

This paper presents a very good application of ground-based zenith sky DOAS observation using the Colour Index. Scientific objectives are very well introduced as well as the instrumentation used, the methodology and modelling. Discussion of the influence of tropospheric clouds, by presence and by extend show cases that can be extended further.
The use of several wavelength ranges can help solving existing uncertainties and the radiative model simulations are very useful for it.
The two stations explored for this analysis, one in Antarctica the second in the Arctic are very well identified for PSC detection, and more, extended to volcanic aerosol detection, as discussed in this paper.
Conclusion reflects well the work done in this paper and the abstract also. The choice of putting appendices for the algorithm and for supplementary figures looks good for me.

Special comments

No comments for the language

Paragraph starting l-241: The authors have a discussion later in the text, please state it at the end of this paragraph

In accordance to the remarks of the second referee, we have added a discussion point on the sensitivity of the PSC detection (l. 246 in the revised manuscript):
"Nonetheless, investigations of the sensitivity of the CI to different PSC properties as discussed in detail at the example of the simulation results indicate an under- rather than an overestimation of the detected PSC cases. It is, however, possible that particles of similar optical properties add to the PSC detection."
At the end of the section, the discussion is then only summarised.

Figure 7: very good presentation

Thank you!

Figure 10: Remove DOAS from Neumayer and Kiruna titles of the figures because it is not only DOAS and put it in the UV DOAS and visible DOAS in legends

Done.

Figure 13: ...The triangles represent, I propose -> the black triangles at the bottom represent

Done.

Figure A1 and Appendix A could be in the main text, just before conclusion

We have decided to keep the appendix since the discussion of the tropospheric cloud filter algorithm is important to the overall evaluation of the data quality and helps the interpretation, but it is not beneficial to the readability of the manuscript in this detail. Therefore, in the main part only the principal findings are stated with reference to the detailed description at the end of the manuscript for interested readers.

Figures A2 to A4: I assume it should be Figures B1 to B3

Done.

Appendix B: please more text, the legends of the figure could be ok

A description to the figures in the appendix was added (l. 448 in the revised manuscript):
“In Fig. B1 the height-dependency of the CI in case of a confined PSC (2° x 2°) is shown. The influence of different extents of a PSC layer is discussed in the respective subsection of Sect. 3.1. Figure B2 depicts different Henyey-Greenstein (with asymmetry parameter g) and the calculated Mie scattering phase functions. Details on the computation are given at the end of Sect. 3.1. The effect of changing the simulation parameters is depicted in Fig. B3.”