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Comment on acp-2021-600

Anonymous Referee #2

Referee comment on "OClO as observed by TROPOMI: a comparison with meteorological parameters and PSC observations" by Jānis Puķīte et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-600-RC2, 2021

In this paper, the new TROPOMI OClO slant column density (SCD) product developed by the MPIC group is compared to meteorological data for both Antarctic and Arctic regions for the first three winters of the S-5p satellite mission (November 2017–October 2020). A good qualitative correlation is generally obtained in both hemispheres between the OClO SCD and the selected meteorological parameters, namely the minimum polar hemispheric temperature, the polar vortex area, and the area where air temperature is below the temperature of nitric acid trihydrate (NAT) PSC particles formation. In addition, the TROPOMI OClO SCDs are also found to coincide well with PSC observations from the CALIPSO Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP) PSC observations. The various high OClO level periods observed in both Northern and Southern polar winters are discussed in terms of polar vortex activation and deactivation processes and stability.

This study fits well with the scope of ACP. Moreover, the manuscript is clearly structured and the method and results are generally presented and discussed in an appropriate and balanced way. Therefore I recommend the paper for publication in ACP after addressing the following comments:

General comment: This is a suggestion for a future study rather than a comment to address here but it would be interesting to include also the TROPOMI BrO and O_3 column data sets in the loop. Comparing those data sets with the presented OClO and PSC observations and meteorological parameters could provide a unique opportunity to investigate the relationship between halogens activation, stratospheric ozone depletion and meteorological conditions during the last three winters, especially in the Northern polar region where the polar vortex can be highly variable.

Specific comments:

Page 2, line 46: Maybe you should give the typical solar zenith angle threshold value above which the OClO abundance can be detected from passive DOAS measurements. A number for the detection limit (in molec/cm2) should be also given here.

Page 4, lines 93-97: Did you apply any filtering on cloudy pixels in the construction of your OClO SCD gridded product? Since the OClO formation is enhanced in the presence of

PSCs, how the latter can influence the quality of your OClO retrieval? Please elaborate.

Page 4, line 120: The SZA range (89-90°) used for the selection of OClO SCD should be better justified. Did you test other SZA ranges since both the altitude of the air mass probed by the TROPOMI sensor and the altitude of the maximum OClO concentration peak depend on the SZA?

Page 5, lines 135-137: In order to select meteorological quantities, it is assumed that the retrieved OClO SCDs are mostly sensitive to the 475K potential temperature level, which corresponds roughly to an altitude of 19-20km. How far this assumption is valid? It needs also to be better justified.

Technical corrections:

Page 4, line 91: 'coveradge' -> 'coverage'

Some sentences are very long and difficult to follow (e.g. first sentence of Section 3, page 5).

The color bar scale values of the subplot stratospheric $T - T_{NAT}$ (3^{rd} subplot from the top) in figures 4, 7, 10, and 13 are difficult to read.