

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-329

Anonymous Referee #3

Referee comment on "Sentinel-5P TROPOMI NO₂ retrieval: impact of version v2.2 improvements and comparisons with OMI and ground-based data" by Jos van Geffen et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-329-RC2>, 2022

The paper "Sentinel-5P TROPOMI NO₂ retrieval: impact of version v2.2 improvements and comparisons with OMI and ground-based data" by Geffen et al. presents the improvements made in the official TROPOMI NO₂ product. It is well written, matches the scope of AMT, and will serve as a key reference for the TROPOMI NO₂ data set which is frequently used by the community.

I recommend publication after dealing with some minor comments.

Minor comments:

Page 2 line 2: I understood that the main effect is on the tropospheric column. I would skip "and total" here.

Page 2 line 21: "over e.g.". I think that there are more similar products, especially over the US.

Page 3 line 2: As this often leads to confusion, it might be worth pointing out that the AMF depend on the profile *shape*, but not on the absolute concentration levels.

Page 3 line 5: "v1.2/v1.3": It would be helpful if the authors would add a reference to a table listing the different NO₂ product versions and what is new in 1.3/1.4/2.1.

Page 3 line 20: I appreciate that the authors explicitly provide this scaling factor. In addition, I would appreciate if the unit molec/cm² would be added at the top of all colorbars or at additional top/right axis.

Page 3 line 26: "and include information on earlier versions." I don't understand this: does this mean that the linked document includes this information? (then add an "s"). Or is this a reminder to the author to include this information here?

Page 3 line 28: Please name the institutes directly. Pointing out the country here reads like strange kind of nationalism.

Page 4: Here comes the information I was asking for above. I still think it would be helpful to have a table with the information in short version, even if this would add some redundancy.

Page 4 line 16: I have seen TROPOMI results before 30 April 2018, and as far as I am aware the quality of TROPOMI spectra was already quite good since beginning of 2018. I would highly appreciate if the reprocessing would be extended back to 1 Jan 2018.

Section 3.2: A similar outlier removal was introduced by Richter et al., <https://doi.org/10.5194/amt-4-1147-2011>. Please add a reference here.

Fig. 2: The figure illustrates that the outlier removal reduces the error, but the numbers are out of context. Instead (or in addition) of showing the difference I would propose to show the maps of SCD errors with and without outlier removal directly.

Table 3: Again, it is difficult to assess what a relative change of SCD error of 1% means, if the SCD error itself is not given. I would propose to compare the SCD error with and without outlier removal etc. directly.
Please add a footnote why the last entry for Vstrat is missing.

Page 11 line 11: "strong decrease in the SCD error and RMS error": I would like to have this "strong" decrease given in absolute numbers in the presented figures and tables.

Page 14 line 15: Please explain why a dedicated TROPOMI version for FRESCO was necessary and FRESCO+ could not be used directly.

Page 14 line 18: Does "FRESCO" here mean (a) all FRESCO versions or (b) the original FRESCO version, different from FRESCO+ and FRESCO-S?

Page 15 line 3: Please add a reference to "FRESCO-wide", or provide more detail here.

Figure 9: With the chosen color bar, it is impossible to discriminate between 100% sea ice (100), permanent ice (101), and snow (103).

I propose to use a color bar which is monochromatic from 0 to 100 (e.g. dark blue to light blue) and have additional discrete and distinctive colors for the discrete cases occurring above 100.

Figure 13: "version" should be "versus"?

Figure 15: The meaning of IP68 has to be explained in the caption.

Page 29 lines 12-17: Please check if you could be more concrete by now on these future plans.