

This manuscript presents a validation exercise for the GOME2-A and GOME2-B OCIO data product using OCIO SCDs measured at 9 high latitude NDACC stations. Given the range of parameters used in the different data analysis approaches undertaken by the individual research groups for each of the stations, the sensitivity tests performed as part of this study are essential for a meaningful outcome. The authors found that the total uncertainty for the OCIO data sets investigated in this study ranges from about 26% to 33% for the different stations. They furthermore found that satellite and ground-based data sets show a good agreement for the inter-annual variability and the overall seasonal behaviour at the different sites. But they also found a median bias of about  $-2.2 \times 10^{13}$  molec/cm<sup>2</sup> over all stations for both GOME-2 instruments with individual biases up to  $8 \times 10^{13}$  molec/cm<sup>2</sup>.

The validation study is comprehensible and clearly presented in the manuscript, and the authors also provide a more in-depth description of the three sensitivity tests in Appendix A2. The paper is definitely recommended for publication in AMT after the specific comments below have been addressed.

Specific comments:

Page 1, line 1: '... produced within the ...'

Page 1, line 3: Only measurements up to 2016 are discussed in this paper. Why was this study not extended to include at least some data from the most recent 5 years (2017 – 2021)?

Page 1, lines 6-13: The uncertainty for the ground-based data sets is provided in the abstract as a percentage (lines 6/7) while the bias between ground-based and satellite data is given as an absolute number (lines 11/13). It would certainly be helpful if one of the two quantities could be provided as both, percentage and absolute value. That would make it easier to understand and interpret the information provided in the abstract, and it would put the retrieved bias and the uncertainty into context.

Page 1, line 7: '... data analyses ...'

Page 2, line 19: '...associated with strong ...'

Page 2, line 35: '...its Amendments.'

Page 3, line 51: delete 'study'

Page 3, line 57: '... mostly for a few ...'

Page 3, line 59: 'In this paper, ...'

Page 3, line 60: Add space between 'AC' and 'SAF'

Page 3, line 63: '... comparison method.'

Page 4, line 92: Replace comma with space after 'orbit'

Page 4, lines 90-93: Would be great, if you could give the reader an idea here regarding how big the amount in this bias correction is compared to actual OCIO amount? E.g. how does this amount compare with the median bias quoted in the abstract.

Page 5, Figure 1: It would really help with the readability of the plot if the text and legend would be bigger. Also add 'SCD' after 'OCIO' in the caption.

Page 5, line 96: Add comma after 'circumstances'

Page 5, lines 103 & 105 & 107: Capitalize 'Hemisphere' when its used in combination with 'Southern' or 'Northern'.

Page 5, lines 106 – 108: Not sure if I quite follow this interpretation here. For me, it looks more like GOME-2A for the NH starts with a baseline close to 0 for the first 3 years, then has a jump up in 2010 before it slowly drifts down again to a 0 baseline in 2016. GOME2-A for the SH starts negative, drifts up until in it is in the positive in 2010/2011, but then jumps straight down again in 2011/12 and stays in the negative.

Page 6, line 127: comma after 'From Table 2'

Page 7, Figure 4 & Fig 4 caption: I like Figure 4, it's a nice visualisation of the different wavelength intervals used. To figure out which interval is used by which group, this can be identified via Table 2. Just to make it a bit easier, would it be possible to add the group names into Fig 4 straight behind the wavelength interval? Or alternatively, the group names could also be added in the caption e.g. in the order of appearance from top to bottom.

Page 7, Fig 4 caption: add 'analysis' after 'DOAS', just to clarify that this is not the wavelength interval each instrument covers but the interval each group uses for their data analysis.

Page 7, line 138: 'Also, ...'

Page 8, line 139: Add comma after 'needed'

Page 8, line 141: Just to be clear, water vapour should have been included but it was not, correct? Could clarify that in the text.

Page 8, line 146: 'In this section, ...'

Page 9, line 160-161: Is there any particular reason why Ny- Ålesund was chosen to be the test site?

Page 9, lines 168: How were the median OCIO SCD values determined, e.g. were any selection criteria applied?

Page 10, line 192: '... lead to a systematic ...'

Page 10, line 205: '... used as input for...'

Page 11, line 218: '... measurements at Arrival Heights. At this site, the ...'

Page 12, Figure 7 caption: '... the offset ...' and delete 'of' before 'Neumayer'

Page 13, line 238: delete the 2<sup>nd</sup> 'et al.'

Page 13, line 242 – 244: The authors state: 'On average, over the 85o to 92 o SZA range, the AMF difference is close to zero.' However, looking at Figure 8, this is still between 5% and -8% ... is that accounted for?

Page 14, line 247: '... OCIO SCD measurements...'

Page 14, line 252: '... mid-May...'

Page 14, line 254: '... is larger in ...'

Page 14, line 255: '...OCIO SCDs...'

Page 14, line 260: 'At Arrival Heights, ...'

Page 14, line 262: '... mid-April...'

Page 14, line 264: '...overpasses are ...'

Page 14, line 266: 'Each year, ...'

Page 15, Fig 9 & page 16, Fig 10 captions: '...there are no ...' Same also for Figures 13 & 14

Page 18, line 288: '... can only be made during April/May ...'

Page 18, line 291: '... SCDs ...'

Page 18, line 299: '... prevent detection of the other ...'

Page 19, line 300: 'The large OCIO peak at Ny- Ålesund and Kiruna in early 2008 ...' (just to be clear)

Page 20, line 304: Should it be 'over Ny- Ålesund and Kiruna' rather ?

Page 20, line 309: Shouldn't that be 'GOME2-A SZA'?

Page 20, line 315: Add 'respectively' in the bracket

Page 20, Figure 15: Would be interesting to have the same plot for one more station, in particular e.g. for Ny- Ålesund (NH station).

Page 22, Fig 16 caption: '... defined as follows:...'

Page 23, Fig 17 caption: '... during the active months.'

Page 24, line 359: 'For the ground-based ...'

Page 25, line 377: Replace 'points' with something like 'measurements' or 'data'

Page 25, line 380: 'OCIO GOME2 products ...'

Page 25, line 379-381: On what study or analysis is the conclusion based that the GOME2 OCIO data product discussed within this manuscript meets the AC SAF mission requirements? Either this needs to be explained in more detail in the text or the relevant reference together with a short summary needs to be provided.

Page 25, line 390: comma after 'retrievals'

Page 24, line 401: 'At the end of 2012, a new instrument was installed ...'

Page 24, line 405: '... since 1999 ....' (delete 'the')

Page 26, line 406: 'Generally, ...'

Page 26, lines 412 & 418: '... a Vis zenith-sky DOAS at ...' (more consistent with the rest of the text)

Page 26, line 414: '... during the winter/spring season ...'

Page 26, lines 415 & 419: '... UV/Vis MAX-DOAS was...'

Page 26, lines 415 – 417: The last 2 sentences in this paragraph should be switched around.

Page 26, lines 415 & 421: 'OCIO SCDs'

Page 26, line 416: 'Ground-based SCD measurements...' (delete s in SCDs)

Page 27, line 424: '... OCIO SCD analyses ...' and looks like a bracket is missing after 'window'

Page 27, line 429: '... what is used for ...'

Page 27, line 433: '... each group's OCIO cross-section ...'

Page 27, line 440: '... each group's choice ...'

Page 27, line 443: '... the Ny-Ålesund ...'

Page 27, line 452: '... each group's analysis ...'

Page 28, Figure A1, caption: '... Ny-Ålesund ... result on the cross-sections ... DOAS analyses .... what is described in ...'

Page 29, Figure A2 & Figure A3, caption: '... OCIO SCDs ...' and '... Ny-Ålesund ...'

Page 29, Figure A3, caption: '... DOAS analyses used ....'