

Atmos. Meas. Tech. Discuss., referee comment RC4
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Comment on amt-2022-43

Anonymous Referee #4

Referee comment on "Retrieval of greenhouse gases from GOSAT and GOSAT-2 using the FOCAL algorithm" by Stefan Noël et al., Atmos. Meas. Tech. Discuss.,
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This paper describes the new v3.0 FOCAL retrievals for GOSAT and GOSAT-2, used to retrieve XCO₂, XCH₄, XCO, XNO₂, XH₂O, and the relative ratio of semi-heavy water to water vapour. The paper describes the methods used in the retrievals and validates the new dataset against the TCCON network. Overall, the paper clearly describes the retrieval methods and demonstrates the value of the new data products. Therefore, I recommend publication, with several minor revisions based on the comments below.

Specific comments

- Title: Should the title list the species being retrieved?
- Abstract: Are the new FOCAL v3.0 datasets publicly available?
- Line 10: I found this paragraph a bit difficult to follow. For lines 10-11, do you mean something like this? "For XCO₂, the new FOCAL retrieval (v3.0) significantly increases the number of valid XCO₂ data compared with the previous FOCAL retrieval version (v1) by 50% for GOSAT and about a factor of two for GOSAT-2." Are "All FOCAL data products" in line 11 referring to all v3.0 data products?
- Line 165: For the filtering procedure - how do you ensure that real variability isn't accidentally filtered out from the dataset?
- Line 216: Could you add a brief definition of the full physics vs proxy datasets for CH₄ and explain why there are more data for the proxy products? Are the full physics and proxy comparable or do they have different applications/uncertainties?
- Line 252: Add a brief description of the CO₂ timeseries to the text since this is also shown in the figure? Is the timeseries qualitatively in line with other versions of the CO₂ retrieval? Other monitoring?
- Line 263: Is there also no temporal trend in delta_D? Is it expected that year-to-year variations for delta_D be larger?

- Line 287: Please add a bit more detail about the comparison quantities being calculated. Perhaps including formulae would be helpful. For example, how is the seasonal variation of the difference at each station being calculated?
- Figure 1: This figure takes a bit of effort to read. Is there a reason that the full timeseries is shown instead of, e.g., a summary of the count during the measurement period with all available datasets? If so, describe the timeseries more in the text. Perhaps it would be easier to read if colours were used consistently across figure panels and if the FOCAL data product was somehow distinguished from the other products (e.g., with a distinct colour choice, cross-hatching or something else?). In panel (d), could the FOCAL v1.0 and focal v3.0 XCO₂ be put next to each other so that they can be more easily compared?
- Figures 6-10 are barely described in the text. Can these be moved into an appendix or the supplementary material? Also, please make font sizes bigger.
- Tables: There are a lot of tables included in the paper. Some of these are not referenced from anywhere in the text (Table 2, 4, 5). Are all tables needed in the main body of the text - if so add descriptive text. (Otherwise, could move to appendix or supplement)

Technical comments

- Line 266: Rephrase so that it is clear what XCO is similar to. E.g., "Across different latitudes, GOSAT-2 XCO shows similar values and seasonal variations, except in the southern hemisphere..."