

Interactive comment on “On the zero-level offset in the GOSAT TANSO-FTS O₂ A-band and the quality of solar-induced chlorophyll fluorescence (SIF): Comparison of SIF between GOSAT and OCO-2” by Haruki Oshio et al.

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The study by Oshio et al. analyzes the impact of the so-called zero-level offset (ZLO) on SIF retrievals from GOSAT TANSO-FTS near-infrared spectra. The ZLO is an additive signal with a similar in-filling effect of near-infrared absorption lines as SIF has, which causes the ZLO can bias SIF retrievals. The first part of the manuscript deals with the characterization of the ZLO from data acquired over different non-fluorescent targets (either the cloudy ocean or bare soils), whereas the second part compares SIF retrievals from GOSAT under different ZLO corrections with OCO-2 SIF data at different

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spatial scales.

I can't identify any methodological flaw in this study, the text is well written and the results are clearly presented and discussed. My only major concern is on its very narrow scope and lack of highly significant findings: it deals with a GOSAT-specific instrumental issue (the ZLO) for which several characterization and correction methods have already been published, SIF data from GOSAT are no longer so widely used after the advent of GOME-2, OCO-2 and TROPOMI, and in any case the results of the analysis seem to show that the accuracy of the GOSAT SIF data is relatively robust against which ZLO characterisation/correction method is used in the processing. The most interesting result in my opinion is the very good correspondence between GOSAT and OCO-2 SIF data, which suggests the user community could easily combine both data sets to produce longer time series of "high spatial resolution" SIF data (as opposed to the "low resolution" of GOME/GOME-2/SCIAMACHY).

Here there are some comments that the authors might like to consider in their revision of the manuscript (at their discretion):

- Format: The manuscript could be reformatted as a shorter technical note simply presenting the most meaningful ZLO characterization approach among those tested (the one over bare soils for different latitudinal belts, I think) and the subsequent good comparison between the GOSAT and OCO-2 SIF products when that ZLO characterization is used. I believe that several sub-sections and figures could be moved to the Supporting Information without harming the rigor and readability of the manuscript. For example, whether cloudy skies or barren areas are better to characterize ZLOs for latter SIF retrievals is a very specific research question, and the paragraph "To date ... OCO-2 SIF (Köhler et al, 2018a)" could be removed from the Introduction.

- Introduction: In p.2 L14 it is mentioned that ZLOs in GOSAT are actually not only important for SIF retrieval, but also for XCO₂ and XCH₄ retrievals (core GOSAT products). Why is then this study solely focused on SIF? Extending it to XCO₂ and XCH₄ would

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actually solve my “narrow scope” concern mentioned earlier, although I am aware that it would then require to fully rewrite the manuscript. It might also be good to mention GOSAT-2 in the introduction, and adding some preliminary assessment of ZLOs in GOSAT-2 would also help enhance the impact of the manuscript.

- Comparison of TOA radiances from GOSAT and OCO-2: it would be interesting to see how near-infrared TOA radiances from TANSO-FTS and OCO-2 compare. A radiometric offset in TOA radiance should translate into the same offset in SIF. Do the near-infrared radiances from GOSAT and OCO-2 compare within 0.1 mW/m²/sr/nm as the SIF products do? Is there a bias between the radiances from the two instruments? If so, how is that translating into biases in SIF? A comparison of TOA radiances could also help assess the effect of varying illumination and observation geometries between the two systems.

- p.5, L14: How exactly were the different view zenith angles in GOSAT (up to ~30°?) taken into account in the comparisons with nadir OCO-2 data? It is mentioned that “It is difficult to investigate the influence of observation geometry on SIF...” in p.11 L8.

- p.8, L15: Guanter et al. (2012) reported on an apparently clear decrease of ZLOs with time for both S and P polarizations at 755 nm (not at 770 nm), which seemed to compare well with the temporal evolution of the spectral slope of the radiance spectrum at the same wavelengths. Could the authors confront those findings with their own results, perhaps expanding their analysis to also include a test on spectral slopes (could be included in the Supporting Information)?

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