

Comment and Reply

Some points have been clarified by the authors in the revised manuscript, but some points still remain unclear. These points still need to be revised:

General points:

- The intro is still confusing: What is the main difference and new part of the IAPCAS/SIF algorithm compared to the mentioned existing algorithms? Why is it compared to OCO-2 in this study and to what extent? This was already summarized and addressed in the authors' reply. I think it would be good to add these explanations to the manuscript too. The authors should also clearly highlight that the new algorithm has already been used and tested in Yao et al 2021 and should also explain why the algorithm is now presented in this manuscript and/or what is different to Yao et al 2021.

Reply: The information was added and clarified in the revision.

- L141-198: What exactly is the new part of the IAPCAS/SIF algorithm and how is this incorporated and tested? Are there any sensitivity studies? As this is a technical journal, I think it is important to have more insight on the used algorithm.

Reply: The IAPCAS/SIF algorithm introduced in the paper is based on the simplified physical model. The main optimization is the usage of a scale factor to correct the influence of O₂ column absorption induced by the uncertainty of surface pressure in the inversion state vector to reduce the interference of the O₂ absorption line on the SIF signal. Sensitivity studies were not performed, but our first version of SIF product retrieved without scale factor in state vector shows a worse global distribution and magnitude. The content was modified in the revision: "In other physical-based retrievals, the surface pressure data of the European Centre for Medium-Range Weather Forecasts (ECMWF) is usually used as the true surface pressure to simulate the molecular absorption cross-section. However, there is still a difference between the true surface pressure and the model surface pressure, so we introduced a factor here to reduce the influent of the inaccurate surface pressure. "

- L400-402: There is little discussion of the SIF-GPP results. What are potential explanations for these differences and findings? What do we learn from this? The SIF-GPP results are also not mentioned in the conclusions at all.

Reply: For the same vegetation type, the SIF-GPP correlations of the two satellites are relatively similar, indicating that the two satellite SIF products have similar GPP characterization capabilities. It shows that the comprehensive application of different satellite products has strong feasibility. For different vegetation types, the SIF-GPP correlations for both satellites were significantly different, indicating that there were differences in the ability of SIF to characterize different vegetation GPP. A detailed explanation for SIF-GPP correlations was added in the revision.

Minor points:

L18: ,signal-to-noise ratio‘ instead of ,SNR‘ in the abstract

Reply: it was modified in the revision.

L21: What does ,at sounding scale‘ mean?

Reply: the SIF signal was retrieved for each sounding and it was modified in the revision.

L22-24: It is still not entirely clear for the reader which SIF algorithm (,the SIF retrieval algorithm‘) is used here. Could you give your new SIF algorithm a name (IAPCAS/SIF?)?

Reply: “the physical-based algorithm” here was replaced by “the IAPCAS/SIF algorithm” in the revision.

L28: annually

Reply: it was modified in the revision.

L375: Is the GPP resolution $1^{\circ}\times 1^{\circ}$ or $0.5^{\circ}\times 0.5^{\circ}$ as stated in the author reply?

Reply: the spatial resolution of GPP product is $0.5^{\circ}\times 0.5^{\circ}$ and it was resampled to $1^{\circ}\times 1^{\circ}$ grid-cell for comparison with SIF in the study. It was clarified in the revision.