Reviewer 2

The paper describes a global dataset of Sun-Induced chlorophyll Fluorescence (SIF) obtained by the Sentinel 5P-TROPOMI mission. I believe this dataset is of great value to the community, and I want to express my gratitude to the authors for their diligent work.

Thanks to you for this positive feedback.

L28: In addition to the GPP related studies, I suggest mentioning also the value of SIF for hydrological studies, e.g., on ecosystem transpiration and water limitation (see, e.g., Maes et al. Remote Sensing of Env. 2020; the review of Jonard et al. Agric. Forest Meteo. 2020; Gonsamo et al., Remote Sensing of Env. 2019).

Done. We have added references as "and also ecosystem transpiration and water limitation (Pagán et al., 2019; Maes et al., 2020; Shan et al., 2021)." (**L29**)

L50-55: It might be interesting to mention the Fluorescence Correction Vegetation Index by Yang et al. Remote Sensing of Env. 2020 here. This is, similar to NIRv, an index to assess the effect of canopy structure. I'm not entirely sure whether their framework is applicable to TROPOMI data, but it's certainly worth mentioning.

Thanks, a reference to Yang et al. (2020) has been added. (**L51**)

L54-56: I have a few annotations to make on the sentence about SIF yield, used for monitoring vegetation stress. First, it is important to highlight the difference between SIF yield and fluorescence yield. SIF yield is a canopy-scale variable, affected by both canopy structural and leaf biochemical aspects. SIF yield is relatively easy to retrieve from satellites. The variable that is however directly impacted by a plant's stress status is the photosystem scale fluorescence quantum yield. This variable is fundamentally different from SIF yield as it does not depend on variables such as chlorophyll content, leaf area index, or leaf orientation. Measuring the latter variable from satellite imagery is not self-evident. Celesti et al. Remote Sensing of Env. 2018 provides a framework for retrieving the fluorescence quantum yield at the canopy scale. Please clarify how you define the SIF yield and how it can be compared to photosynthetic efficiency?

L56: I understand the point that you want to make here, but I suggest being more careful in the wording. While Dechant et al. indeed showed that NIRv is a better predictor for GPP compared to SIF, I am not sure to which extent this idea holds in case of a stress situation. SIF can be decomposed into the following factors: SIF = PAR · fPAR · Phi_f · f_esc

NIRvP only takes into account PAR·fPAR·f_esc. This does not consider variations in Phi_f despite the latter's sensitivity to short-term stresses. This is why Dechant et al. raises the point that NIRvP might show significant disagreements with SIF in case of short-term stresses, such as droughts or heatwaves. We believe that NIRvP bears the potential to serve as a 'potential SIF emission' or 'reference SIF emission' (similar to reference evapotranspiration using the Penman-Monteith method). The ratio between NIRvP and SIF could then serve as a stress factor, as it more or less isolates Phi_f. It is however worth noting that there is not yet any experimental evidence supporting this claim, despite the seemingly simple logic behind it.

Thanks for these two clarifications related to the interpretation of NIRv/NIRvP and their potential for the calculation of SIF yield (L54-56). We agree with the distinction between SIF and fluorescence yield. This part has been rewritten as “NIRv and NIRvP could then provide useful information for the calculation of the SIF yield, which is a top-of-canopy variable providing information on both fluorescence yield (leaf-level variable) and any remaining canopy structure effects not accounted for by NIRv and NIRvP.” (**L56-58**)

L80: It would be good if the authors could provide a brief explanation of the meaning of a and α.

Information added.

L279: Section 3.3 provides an interesting comparison between SIF products. It describes a difference in the SIF signal depending on which bands have been used for the retrieval. It describes that OCO-2 and Sentinel 5P-TROPOMI data are comparable. I wonder to which extent the SIF data from the dataset here will be comparable to FLEX-derived SIF data, as it will not be based on the exact same bands. Do you have an idea on that?

Thanks for the thoughts on the upcoming FLEX mission. As far as we know, the FLEX retrieval will rely on oxygen absorption bands centered at 687 and 760 nm. The second one is relatively close to the far-red window used in our retrieval, with a 740 nm reference wavelength, so the comparison should be feasible.

However, we do not consider this discussion to be central to our manuscript and have opted for not performing any action on the manuscript in response to this comment.

E.g. Figure 9 and text below: Information on the interpretation of the negative SIF values is missing. Could you please explain the reason why there are negative SIF values and what their physical meaning is? It would be good to know for future users whether these negative SIF data should be considered or not?

This clarification has been added: “On the other hand, negative SIF values are found for the two fitting windows. These are caused by noise in the data being propagated to random errors in the retrieved SIF. Removing negative SIF retrievals from the processing should be avoided, as it would lead in positively-biased averages.” (**L278-280**)