

Earth Syst. Sci. Data Discuss., referee comment RC1
<https://doi.org/10.5194/essd-2021-452-RC1>, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on **essd-2021-452**

Anonymous Referee #1

Referee comment on "Vegetation photosynthetic phenology metrics in northern terrestrial ecosystems: a dataset derived from a gross primary productivity product based on solar-induced chlorophyll fluorescence" by Jing Fang et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-452-RC1>, 2022

Fang et al. generated a 0.05 degree, annual dataset of vegetation photosynthetic phenology metrics (i.e., SOS, EOS, LOS) in North Hemisphere (NH) terrestrial ecosystems during 2001-2020. There are two major innovations in this study. First, a solar-induced chlorophyll fluorescence (SIF) derived GPP (GOSIF-GPP) product was utilized to derive phenology metrics, because SIF has been demonstrated to be a better proxy for photosynthesis than other vegetation indices (VIs). Second, a method that combined smoothing splines with multiple change-point detection was employed, so that phenology metrics, especially with multiple growing seasons, could be derived accurately. Fang et al. found SIF derived GPP could provide a better phenology estimation than other VIs, when validating with the metrics inferred from flux tower GPP. Further, the new dataset showed a trend of advanced SOS, delayed EOS, and extended LOS over 60-70% of the land area in NH. I believe this dataset will be useful for future studies to examine vegetation phenology under climate change and benchmark Earth System Models. The data is well archived and the analysis is generally solid. However, this manuscript still requires some revision work, especially to clarify some ambiguous expressions so that readers will not be confused about. Please see my comments below.

Major comments:

1. In Section 4.1, the authors utilized R and RMSE to evaluate the phenology metrics estimated from different datasets. I suggest the authors checking the mean bias as well. In addition, I suggest the authors making a comparison separately for each land cover to evaluate the performance of each biophysical variable.
2. For figures, the North Pole with no vegetation was in the center, while the vegetated continents were kind of clumped and hard to recognize. Especially, it is not straightforward to find California and North China Plain mentioned in the text. I suggest the authors using a different projection to present the results.

Some minor suggestions:

Line 13 Specify which vegetation indices were used for comparison in this study.

Line 54 Clarify "better" compared to what, or just use "well".

Line 56 "instantaneous" refers to changes happening in a short time (e.g., diurnal), therefore may be not accurate to be used here. The point should be: these traditional VIs can mainly detect structural changes but are less sensitive to physiological changes.

Line 64 Clarify "more accurately" compared to what.

Line 72 Explain a bit more about "predetermined thresholds or inflection points".

Line 74 Explain what kind of "reconstruct" is referred to here, smoothing?

Line 78 "of" -> "which combined"

Line 80 "The strength of this method is not limited by... and can also be applied..." -> "This method has great strength in two aspects: (1) it is not limited by...; (2) it can also be applied..."

Line 83 "needs to be extended" -> "can be further extended"

Line 89 "constructed" -> "adopted"/"developed"

Line 94 "SIF-GPP" -> "GOSIF-GPP"

Line 110 Clarify which classification type was used, IGBP?

Line 117 Clarify at which time scales the maximum GPP was calculated, e.g., 8-day maximum over 2001-2020?

Line 122 Clarify which type of partitioning approach was used for FLUXNET 2015 GPP?

Line 125 Clarify how the sites were determined as "relatively homogeneous"?

Line 136 Briefly describe how the MODIS GPP dataset was derived.

Line 136 Clarify why the time period "from 2001 to 2014" was selected for comparison?

Line 152-153 I suggest separately describing why (1) smoothing splines and (2) change points were used in this study. It seems the smoothing splines is to minimize the influence of outliers (as mentioned later in the paragraph) and not specifically aim to resolve multiple cycles.

Line 163 Clarify what "change characteristics" refers to, seasonal cycle?

Line 166 How about the case when ratio is larger than one standard deviation ABOVE the mean ratio?

Line 169 "by reconstructing the data time series by estimating parameters in the double logistic model" -> "if reconstructing the data time series with a double logistic model"

Line 176 Briefly explain what the "penalty factor" was used for.

Line 182 Explain what the "baselines" were used for.

Line 185-186 Explain what "amplitude thresholds" mean.

Line 188 I am not sure what "the most tightly-constrained transition dates" means.

Eq1, 2. Does this assume Bottom1 and Bottom2 are roughly zero? Fig 1 showed above-zero values. How would this affect your threshold calculation?

Line 195 "smoothing splines" -> "smoothed splines"?

Line 210-211 The current expression about uncertainty quantification is ambiguous. I am not sure if I fully understand. Could you elaborate more on this?

Line 229 Was the correlation coefficient calculated across all the site-years?

Line 255 "that" -> "which showed that". And "uncertainty occurred" is not accurate, as phenology estimation from GOSIF-GPP also present uncertainties (Section 4.4).

Line 262 "the method" -> "the proposed method"

Line 264-265 "part of the cropland" -> "some croplands"

Line 284-286 I am not sure what information the authors would like to convey here.

Line 296 "10% SOS" -> "SOS10%" to be consistent with Line 223

Line 299 "two different mixed grids" -> "two different kinds of mixed grids"

Line 300 "another" -> "the other"

Line 338 The analysis seems still long-term trend, not "interannual variation".

Line 359 How did you define "re-modeling of the GPP time series"? Is the smoothing procedure employed in this study not a kind of "re-modeling"?

Line 362 "most appropriate for their specific application" is ambiguous and confusing.

Line 368-369 Describe the "spatially explicit pattern".

Fig 2 Figure labels are confusing. X and y variables should be evaluated at the same threshold. Only adding the threshold to y axis label is misleading. "GOSIF-GPP", "NDVI", etc., in the top of the figure are also confusing, shouldn't they be added to the y axis

labels?

Two suggestions for archiving the data:

1. The authors can set the data type as integer to reduce the file size.
2. Set NA values for the ocean.