

Interactive comment on “Global vegetation variability and its response to elevated CO₂, global warming, and climate variability – a study using the offline SSiB4/TRIFFID model and satellite data” by Ye Liu et al.

Anonymous Referee #2

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I have three main comments about the study by Liu et al. "Global vegetation variability and its response to elevated CO₂, global warming, and climate variability - A study using the offline SSiB4/TRIFFID model and satellite data".

First, I fail to see what is new here compare to previously published studies: the current study uses only one model which does not seem to perform better than the TRENDY models used in Zhu et al. (2016) according to the results p. 8 l. 24-27 and p. 9 l. 22-25. As referee #1 mentions, this paper reads like a model evaluation and new scientific insights should be brought forward. If version 5 outperforms version 4 as mentioned p.

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8 l. 25-27, the authors should consider using it instead.

Second, why is the study limited to the years 1958-2007? Considering the increasing availability of EO since 2007, extending the study period to nowadays would help address the "global vegetation variability" using satellite data as the title and the introduction (p. 3 l. 17).

Third, there is a lack of consistency between p-values reported, see for example p.9 l. 23 which points to possible cherry-picking from the authors.

Hereafter are some more minor comments:

p. 2 l. 6 Can you support this statement with a reference?

p. 2 l. 9 Leaf area "per unit of ground" area

p. 2 l. 11 Can you quantify the significantly increasing rate to give more context to this statement?

p. 2 l. 25 Consider citing Zhu et al. 2013 as an example of dataset covering the period 1980 to present

p. 2 l. 30 Please cite articles that support this 'general consensus'

p. 3 l. 9 Can you provide a bit more context and examples of these abrupt shifts?

p. 3 l. 15 See my main comment about the study period

p. 3 l. 18 'apportioned' is perhaps more correct than 'attributed'

p. 4 l. 19 Please define SPOT (Satellite Pour l'Observation de la Terre), indicate what type of sensor VEGETATION is and a what resolution these data were available.

p. 4 l. 26 To my knowledge GIMMS is also derived from AVHRR data.

p. 5 l. 3-7 As the study aims to use satellite data, why not using MODIS GPP/NPP (or GIMMS-based NPP from Kolby-Smith et al. 2016).

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p. 5 l. 20 onwards Can you summarize the experiments in a table?

p. 6 l. 8 Transient simulations are usually performed from a steady-state obtained under past conditions. Using the average conditions of the period 1948-2007 may reduce the model's sensitivity to the warming that occurred during that period. It would have been better to use the first ~10 years of driving data for this procedure.

p. 6 l. 15: Is this checked at pixel level, or only globally? Have you checked whether fluxes and initial stocks were at equilibrium? see e.g. Exbrayat et al. (2014) for the importance of initial stocks on transient simulations.

p. 6 l. 22-25 Are these sentences referring to the model or GLC?

p. 7 l. 1 This part is very specific to the model used here. Readers who are not familiar with TRIFFID need a bit of context to understand how the LSD coefficient is used, and the impact of increasing its value ten fold.

p. 7 l. 21 You can also cite Poulter et al. (2014)

p. 8 l. 19 Please clarify whether you are referring to global average LAI.

p. 8 l. 25-27 This statement raises an important question: why do you use model version 4 when you know that model version 5 outperforms it?

p. 9 l. 22-23 Please consider rewording... correlations of 0.35 cannot be described as matching the reference data closely.

p. 10 l. 19 Once again p-value...

p. 14 l. 29 I have not been able to access the data using this link, please check.

References for this review

Exbrayat J-F, Pitman AJ, Abramowitz G (2014) Response of microbial decomposition to spin-up explains CMIP5 soil carbon range until 2100. *Geosci Model Dev* 7:2683–2692. doi: 10.5194/gmd-7-2683-2014

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Kolby Smith W, Reed SC, Cleveland CC, et al (2016) Large divergence of satellite and Earth system model estimates of global terrestrial CO₂ fertilization. *Nat Clim Chang* 6:306–310. doi: 10.1038/nclimate2879

Poulter B, Frank D, Ciais P, et al (2014) Contribution of semi-arid ecosystems to inter-annual variability of the global carbon cycle. *Nature* 509:600–603. doi: 10.1038/nature13376

Zhu Z, Piao S, Myneni RB, et al (2016) Greening of the Earth and its drivers. *Nat Clim Chang* 6:791–795. doi: 10.1038/nclimate3004

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