Biogeosciences

Open Access

Discussions

EGU

BGD

Interactive
comment

Interactive comment on "Summarizing the state of the terrestrial biosphere in few dimensions" *by* Guido Kraemer et al.

Anonymous Referee #3

Received and published: 20 September 2019

Review for Manuscript bg-2019-307

This manuscript entitled "Summarizing the state of the terrestrial biosphere in few dimensions" is well-thought and well-written, and fits the scope of Biogeosciences, so overall, I am favourable to get it published there. I do have some concerns which I would like to see addressed by the authors, and I also have several recommendations to improve the manuscript before getting it published. Please find these points below.

My first point regards the interpretation of the first to PCA components. Having the first related to productivity and the second to water availability is indeed interesting and useful to summarize that state of vegetation. However, I believe some more effort is needed to more clearly separate these 2 in their interpretation. Productivity is inevitably dependent on water availability, so in principle, one wonders why these would be the

[Printer-friendly version](#)

[Discussion paper](#)

first 2 components, which by definition should be orthogonal and 'unrelated'. I suppose this is perhaps because these refer to signals at different scales, PC1 describing an overall general state of potential productivity of the system at that location, while PC2 describes more events of water shortages and or excesses that are not directly related to the stationary potential productivity. Am I correct? Could you please clarify/elaborate on this to help readers better understand how these two axes should be 'read'.

Much related to the previous point, isn't it surprising that the 2 first principal components have such similar spatio-temporal patterns in Figure 3? These seem very highly correlated, which is something I would not have expected from the first two components which explain the maximum of variance in two orthogonal direction. Can you help me grasp this apparent paradox? In a way having such similar patterns make me wonder how useful having 2 PC is instead of only 1? Of course you do show the value of the 2D space in figure 2, but even there, much of the variation goes along the PC1 axis. Your selected cases in the anomalies in Figure 5 also generally go in the same direction of lower productivity coinciding with dryer conditions (Russian heatwave, droughts in Amazon), or vice versa (Floods in horn of Africa). Perhaps a stronger focus in general throughout the paper should be made on highlighting the much more specific cases where the two PCs give different but complementary information rather that going in the same direction.

I think you should also explore the third component. It does represent 9% of the variance, which is not so little, but above all it seems to be quite different from the first 2 in that it reacts much more to the albedo, which you hardly mention in the entirety of the manuscript. Could this be related to biophysical effects that vegetation could have on the climate? E.g. to understand where radiative vs non-radiative mechanisms dominate their effect on local temperature, for instance.

The behavior of the biosphere is much related to the elevation. While I know the effect of elevation should be reflected in the other variables, this is still dependent of modelling assumptions that may end up diluting the effect of elevation. Yet elevation is a

variable that is very well measured, and which could contribute to summarizing the ter-restrial biosphere. So why not including such a variable in the PCA? I know changes in elevation are minimal (and probably very difficult to detect) and having a static variable with respect to all the other dynamic ones you propose is a bit odd, but still, what are your arguments for not doing so? I think some discussion on this is warranted.

The paper generally could be improved by curating more the structure. Several points on this: - Section 3.2 could benefit from some introduction naming what you intend to calculate first (get trends, test significativity, get breakpoints, hysteresis) before go-ing in the details. This part could also be more pedagogic, providing more rational on why you do these things. - Parts of the 'discussion' should be much further after the 'results', such as lines 155-162 which should come in some kind of 'caveats and perspective about the method' section - Section 3.2 is very unbalanced with respect to 3.1. Probably best to reorganize to avoid 'sub-sub-sections' and have subsections from 3.1 to 3.5 - Parts describing concepts, such as Hysteresis (lines 235-246) should not appear in the results but before, either in methods or introduction.

Lines 74, 75: how do you manage intermittent gaps in the data? Does this affect your averages and your normalization? Also, please clarify if the normalization is based on the entire data cube for each variable, or is the normalization done per time frame?

Line 182: don't you mean sensible heat instead of latent heat?

Figure 1: caption could be more instructive, perhaps somehow say there what the reader should understand/read from the "rotation matrix".

Figure 7: surprised to see the strong pattern in Eastern Australia. Is this corroborated in other studies?

Regarding all trend analyses, make sure you more clearly mention in the captions the extend of the period you are considering, as these are not long-term trends and could thus be mis-interpreted.

For clarity and readability, figures with maps could benefit from either a dark background on the oceans or a line vector showing the coasts, as many of the colour scales use very light colours which are confounded with the white background.

I wonder if the breakpoint detection is really useful if it is not more mentioned and elaborated in the main text and just left in appendix. I would recommend to bring it in as a main figure if something strong can be extracted from there, and otherwise remove it entirely from the methods. Eventually you could include it in supplementary, but then include the description of the breakpoint methodology only there.

On the other hand, I would strongly recommend to integrate the Figure C1 in the main text as you do talk in detail about the Bowen ratio and how the 2 PCs do characterize it well.

Figure 1D I have a bit of a hard time to make good use of it as it is. Are the values in normalized units or absolute values? Would it not be prefereable to have the same scale for MSC min and MSC max? Do you refer to this figure in the main text.

There are some typos in several places. Make sure to address them.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2019-307, 2019.