Dear Becky and Krista,

It’s great to see how this manuscript is coming along – congrats! Here are my major comments at this point (October 7, 2019).

Right now the motivation for the analyses is “five broad hypotheses and corresponding specific predictions”. I suggest that this would work better as five questions and corresponding hypotheses. See my notes on table 1. (I really like the idea of this table, btw!)

The clustering into geographic areas is currently explained only in the caption to table 2, and that explanation is inadequate, and left me with many questions about how this worked in practice.

The fluxes are standardized to mean 0 and SD 1 for some analyses but not others. I think it is worth carefully considering whether the standardization is really helpful. I really liked figure 4 for the analyses with temperature, which is based on nonstandardized variables and includes each flux as a separate panel. After all, the nonstandardized values are ones I can easily interpret. The separate panels meant I could clearly see the distribution of data relative to the fitted values for each flux. And it was easy to compare how the shapes of the fitted functions were similar or different by comparing across panels. I strongly recommend using the same approach for the figure 2 analysis vs. latitude. I would rather have separate panels and original nonscaled response variables for this analysis than the current overlayed rescaled analyses. Not only are the scaled values impossible to interpret directly, but overlaying all the lines and points means I can’t really tell how the data are distributed for any particular analysis. I would also like to see a non-rescaled version of figure 6 with separate panels for each flux. I realize this would require a lot of panels (24 in total, probably best done as 2 figures of 12 panels each), but I think it would be a lot more informative than the rescaled version. I would recommend splitting into one 12-panel figure that includes independent variables related to temperature: MAT, length of growing season, and temperature seasonality. And one with the precip related variables of MAP, PET, and VPD. I would especially like to be able to see clearly how the data for each variable combination are distributed when the fitted functions are nonlinear. And separate panels would make it easy to always include r2 values on each panel (and/or other measures of fit).

I would like to see figures for every question/hypothesis/prediction in Table 1, whether the associated figures are in the main text or in SI. That is, sure, not every figure needs to be in the main text, but the figure should be somewhere. For example, right now prediction 4.2 of table 1 is listed as not supported, but there is no figure showing this. Similarly the last paragraph of the results on relationships with productivity per growing season length should be supported by a set of SI figures.

The allocation questions seem to me to be particularly interesting, but they are treated fairly cursorily here at present. They are a subset of one question, and there are no supporting figures. I suspect that in practice we don’t necessarily really have much power to address these questions, so maybe that is why this is downgraded, but I’d like to see what we do have in figures. If there is too little power, then the analyses should be dropped entirely. If there is the power to address them, then at the least there should be SI figures, and possibly main text figures.

It was frequently unclear to me whether the influences of other climate variables were being considered in multivariate or univariate analyses. This needs to be clear. I can see reasons to do it either way, but they need to be differently motivated and clearly presented. Also, for the purposes of interpreting analyses with other climate variables, it is useful to provide information on the correlations among the climate variables for these datasets in the SI. That is, how are MAT, MAP, VPD, PET, latitude, etc. correlated for these datasets? I suggest a matrix of scatterplots in SI. This matters because of course for example if productivity is driven by MAT, and MAT happens to be correlated with seasonality of temperature in this dataset, then productivity will be correlated with temperature seasonality even if there is no causal relationship.

In addition, I made some little comments on the pdf, marking it up with my tablet stylus; you can find those on the pdf BeckyMs\_2019-10-07HM. I repeat a few of these here:

I was puzzled by some of the criteria for excluding NPP measures. In particular, the text said that measures of NPP that included reproductive structures, NPP lost to herbivory, understory, VOCs, and/or exudates were excluded. Why, and for that matter how? Reproductive structures are usually part of litterfall, so wouldn’t pretty much every measure of NPP include these either implicitly or explicitly, and is this a case of only excluding them when they are mentioned explicitly? And all of these are generally quite small, so does it really make sense to exclude sites that include them? Or does this mean in practice that the analyses still included these sites but without these fractions?

In terms of climate values, I’m not sure it is such a good idea to use local climate data where available and WorldClim elsewhere. I would think that using the same climate data source (WorldClim) everywhere would protect against potential biases related to climate data source. I guess one issue would also be whether to make any attempt to use climate data for the same time period that the productivity data are collected…. My inclination would be to think that would not be worth it (so just use the same time period for all). In any case, the methods should be clear about the time period is included for the climate data (e.g., mean temperature varies depending on which years it is calculated over).

I just did a quick look at the discussion; I’ll take a closer look in the next round when the methods and results (including SI) will be more final.

Overall, super interesting, and I look forward to the next version!

Best regards,

Helene