Comment on bg-2022-99

Anonymous Referee #1

Referee comment on "Contrasting drought legacy effects on gross primary productivity in a mixed versus pure beech forest" by Xin Yu et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-99-RC1, 2022

In this manuscript, Yu et al. investigate drought legacy effects in GPP at two contrasting forest types in Germany. This manuscript represents several notable advances, including: 1) direct observation of GPP legacy effects, 2) a method to quantify sub-annual legacies, 3) incorporating uncertainty in legacy effect calculations, and 4) a neat idea to get at the mechanism behind GPP legacies. In addition, the manuscript is written very clearly and is quite compelling to read. This is a great contribution to the literature and only have a few suggestions.

Major comments:

1) The approach to calculate a "tree ring width" based on dendrometer bands is interesting. However, due to bark shrinkage and expansion, these processes aren't exactly analogous. I think there needs to be an acknowledgement of this and a discussion of how these biases might play out.

2) How well does the RF model predict GPP during drought years, if trained on non-drought data? Or, just trained on a subset of droughts and used to predict other droughts? The answer to this question has implications for the interpretation of the legacy effect calculation.

3) Along those lines, there also needs to be some information regarding model fit,

predictive ability, variable importance, etc. in the methods or results. Does model fit differ across sites, years, etc? It seems like a model with a lot of uncertainty at one site or one year may drastically alter the legacy effect calculation. What variables are most important for predicting fluxes at these sites?

4) It doesn't seem like there is any mention in the methods regarding how the length and size of legacies were calculated. It is implied that GPP recovers when it hits the uncertainty boundary, but not explicitly stated.

Minor comments:

L118: What constitutes "good" gapfilling?

L133: I might be missing something, but this doesn't seem to mention how WAI is calculated. WAI_t depends on the calculation of WAI_{t-1}, which is undefined. So, the definition seems circular.

L197-199: Detrended how?

L198: Is this annual, or a mean from the growing season? The latter would probably be more relevant.

L443: Some of your citations do exactly this, so perhaps cut this sentence.