

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2022-99

Anonymous Referee #2

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-RC2>, 2022

The authors present a sophisticated collaborative work and the development of a new method to separate GPP legacy effects. The analysis clearly demonstrates the value and importance of long term flux measurements with eddy covariance in combination with biometric data for the evaluation of concurrent and legacy effects of ecosystem GPP on different temporal scales. The potential applicability to other ecosystems is attractive as well. Only very few remarks needed for clarification.

Regarding the importance of changes in the energy balance caused by drought and legacy effects, a bit more evaluation of evapotranspiration would improve the paper even more. Even though transpiration seems not to be influenced by drought / drought legacy here, it is unclear whether the term 'transpiration' in the manuscript is standing for 'evapotranspiration' from eddy covariance data.

Mortality of trees is mentioned to be already caused by droughts. Can the effect of mortality / less trees over time be separated already? Have these trees been in the flux footprint? It should also be mentioned whether the biomass data from dendrometers and the litter harvest were from within the footprint.

Specific remarks:

L 212ff: could you clarify a bit more the description of the model setting with EVI anomalies? It seems not to be totally clear how structural effects are removed

L 223: "...other factors in addition to..."

L 331/332: "...using eddy-covariance data at two forests in central Germany in the same climate but with different management and species composition." I suggest to repeat here briefly what these forests have in common and where they differ.

L 338: "...if they appear only in critical periods of the growing season,..." –check formulation

L 349: "Finally, our approach allows determining the uncertainties in estimated legacy effects..." replace one 'estimate'

L 365: "...negative legacies on GPP (reduced uptake) in the..." -just for the reader's convenience

L 399: "...of stand age the heat and drought impact on carbon...."

L 431 + 432: this should probably be evaporation instead of evapotranspiration

Fig. 2:

As a) represents DE-Hai for 2003 and following years and b) represents DE-Hai for 2018, I suggest to write such:

Figure 2: "Daily GPP in the selected drought and legacy years at a), DE-Hai 2003, b) DE-Hai 2018 and c) DE-Lnf showing the 2003 droughts and following legacy years, respectively."

Similar for Fig. S2

Fig 5: seasonal GPP anomalies: lines ResEVI (structural effect) in figures hard to distinguish from Res. Could you e.g. zoom in to the periods discussed?