

Biogeosciences Discuss., author comment AC3
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Reply on AC1

Jennifer A. Holm et al.

Author comment on "Exploring the impacts of unprecedented climate extremes on forest ecosystems: hypotheses to guide modeling and experimental studies" by Jennifer A. Holm et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-65-AC3>, 2023

Dear Reviewer,

We realized that some reviewer comments were not fully addressed from the last review period, and we would like to address these outstanding comments here. Thanks, and sorry for this oversight. The last manuscript version has been updated to include these new changes based on the reviewer comments.

RC: While this study has enough to investigate under the existing framework, one possible extension that comes to mind is to include the increase in frequency. Authors consider magnitude and duration but not the frequency of back-to-back UCEs. Please consider coming back to it in the discussion, potentially in an explicit "limitations of the current study and future steps" sub-section.

Author Answer: We agree it is important to include that back-to-back UCEs were not explored in this manuscript, and should be considered in future studies. In the summary section we included the following sentence:

"For example, we begin to investigate duration of droughts but we did not consider frequency of back-to-back UCEs."

RC: While there is some observational support for linear response as cited by the authors, I wonder if expecting a linear response from these highly non-linear VDMs forms a plausible null-hypothesis as it sounds rather easy to refute.

Author Answer: We agree that complex biological life systems are not linear, and that VDMs are also highly nonlinear. The correct hypotheses that we were trying to test was comparing different degrees, or amplitudes, of nonlinearities, with carbon loss becoming more strongly nonlinear with increasing UCEs. Therefore, we removed text that described the null hypothesis as a linear relationship between carbon stock and drought, and instead are describing the null hypothesis and near-linear, and alternative hypothesis as different degrees of non-linearities.

RC: Could the authors expand on the definition of 'moderate' quantitatively here?

Author Answer: In the revised manuscript we have updated the text to say: "However, the majority of such experiments apply moderate treatments based on a historical sense, which are mostly weaker in intensity and/or shorter in duration than potential future UCEs"

"...take into account only low to moderate drought intensities (such as 50% rain excluded) or single events, or combine drought with moderate effects of temperature change. Where there has been 100% rain exclusion, it was on very small plots of 1.5 m² (Meir et al., 2015)."

RC: Looking at Fig 2 LPJ-GUESS seems to show some differences to drought duration, maybe consider saying "very little" instead of "no sensitivity".

Author Answer: We have updated the text to say LPJ-GUESS very little sensitivity to drought duration, instead of no sensitivity.

RC: The reasoning behind how the model simulations lead to the suggestion of better representing morphological and physiological characteristics relevant to plant-water relations (e.g. leaf age) is not very obvious. Could the authors add some connecting and specific thoughts to the text?

Author Answer: In the discussion section of the revised manuscript we included a sentence that describes that leaf age classifications could be used in models to provide distinctions in the variations of leaf productivity and turnover time, which help to determine the balance between carbon gains and losses.