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Interactive comment on "Impacts of droughts and extreme temperature events on gross primary production and ecosystem respiration: a systematic assessment across ecosystems and climate zones" *by* Jannis von Buttlar et al.

Anonymous Referee #1

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The authors investigated how climate extreme events altered GPP, Reco and NEE across global FLUXNET data sites. The key findings include that heatwave, drought, and heatwave*drought control GPP, Reco, and NEE differently, and the duration of the extreme events also control CO2 flux behaviors. Those findings have great relevance in global carbon cycle community, and will be useful for developing LSMs to better reflect climate extremes and C cycles. I have a few comments.

1. I am curious why the authors used LaThuile dataset which includes short term dataset than FLUXNET2015. This is particularly important as this manuscript deals

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Discussion paper

with climate extreme and C fluxes.

2. I am curious why Tmax related events are much more frequent than the others (Tmin, WAI..) in Fig 3a. The extremes were defined as 5

3. I recommend choosing a few (not all) long-term (>15 years) flux tower data from FLUXNET2015, and testing how your delta GPP, Reco, and NEE are robust with different time spans (e.g. 5, 10, 15 years) or random samples (say, 10 years) many times and check delta GPP, Reco and NEE. Although the authors started with Fig 1 stressing available long-term data, I feel many sites have <5 years data records, which might be not enough to test delta GPP, Reco, and NEE although they include climate extreme years. I think the authors already have all results for individual sites, so it would not require substantial efforts.

Specific comments: P8 L13: Curious why APAR was used in computing potential evaporation. Net radiation is a better proxy and is available from reanalysis datasets.

P9 L1: I think some ecosystems (e.g. savanna) reveal seasonally varying sensitivity to water availability (e.g. wet vs dry season).

P10 L27: remove ")"

P12 L7: add "("

P12 L17: Reco is computed using soil/air temperature from NEE. I am curious if such high sensitivity of Reco to temp extremes is entirely independent from the way to compute Reco.

P15 L8: The argument, "a stronger increase in Reco led more C gain" looks contradictory. Probably stronger increase in GPP?

P18 L27: add ")"

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