This is a sound piece of work showcasing the use of eddy covariance measures of ecosystem fluxes as an experimental tool, with measures examining impacts of N and P additions to semi-arid savanna ecosystem. Tree-grass savannas occupy ~30% of the global land surface and quantifying fluxes from these systems is critical as they appear to be a source at present to the atmosphere and they drive global variability of global atmospheric CO2. This is a unique experiment, and the EC work described here is a great add on, highlighting the power of long-term studies - another 7 or 8 years we will start to pick up impacts of CO2 fertilisation, heatwaves, increasing variability of precip, as well as the +N and P effects reported. Given the novel statistical analytics described in this study, untangling all of these interacting drivers of C, water and nutrient dynamics may well be possible. I hope funding can be made available to continue this important work.

Methods used were well described for both the EC measures, the experiment and a statistical analysis linking Singular Spectrum Analysis, Pearsons coefficient and information theory to identify key drivers of fluxes, plus lags between biophysical drivers of NEE all as a function of time and across the + N, +P and additive N and P treatments effects, impressive.

Given the quality of site and data set, the performance of the CT site is interest as it was a significant source to the atmosphere of ~80-100 g m2- y-1 or almost 1 t C per year lost from the system. Mean and interannual variability is similar to other semi-arid savanna as reported by Archibald et al (2009) for the semi-arid savanna at Kruger NP and Ma (2007) over oak savanna in California - more needs to made of this in the Discussion. Where is this carbon coming from – grazing and net loss from the soil? Can't be fire here. The word 'fire' is never mentioned in the paper, an oversight given this is a major feature of savanna ecosystems.

Revisions are required, overly long ms, somewhat verbose and repetitive, the writing needs to be tightened considerably! With revisions post-reviews will make for an excellent paper.

Technical comments

Introduction

Background provided in the Introduction was good

L52-55 "Light absorption … Oritz (2024)" – consider delete these lines, your audience will be aware of this theory, basic plant physiology. There is a lot of these sort of statements in the Discussion as well.

L57 re-word – "Typical ecosystems in semi-arid regions are savannas where coexisting vegetation layers (e.g., tree and grass) interact in complex ways (Higgins *et al.,* 2000, House *et al.* 2003).

Cite some classic savanna ecology papers here to support this important claim, e.g.;

Higgins, S. I., Bond, W. J., & Trollope, W. S. W. (2000). Fire, resprouting and variability: A recipe for grass-tree coexistence in savanna. Journal of Ecology, 88(2), 213–229. doi.org/10.1046/j.1365-2745.2000.00435.x

House, J. I., Archer, S., Breshears, D. D., Scholes, R. J., & Participants, N. T. I. (2003). Conundrums in mixed woody–herbaceous plant systems. Journal of Biogeography, 30(11), 1763–1777. *https://doi.org/10.1046/j.1365-2699.2003.00873.x*

L60 delete "Especially the …"

L61 should read "On the Iberian Peninsula…"

L66 "…), limited by water in the dry season and by nutrients and energy in the wet season (Moreno, *et al.* 2008… }. Add Whitley et al 2011 here, relevant paper on light limitation on GPP in savannas

Whitley, R., Macinnis-Ng, C., Hutley, L. B., Beringer, J., Zeppel, M., Williams, M., Taylor, D., & Eamus, D. (2011). Modelling productivity and water use across five years in a mixed C3 and C4 savanna using a soil-plant-atmosphere model: GPP is light limited not water limited. Global Change Biology, 17, 3130–3149. https://doi.org/doi.org/10.1111/j.1365-2486.2011.02425.x

L84 delete "set up", replace with "established"

L110 "… 20-25 trees" a bit loose, do you have estimates of mean tree basal area in m2 ha-1 or similar tree size metric? Mean height also useful.

L112 spatially variability of grass - here and comment on significant seasonal temporal variability of grass growth that you describe L309 add text "described in detail below".

Giving an LAI range a single value not useful in this context

move Figure 1 here which is in the methods as more site information here would be useful.

You could also Fig 1 more comprehensive by adding 2 panels - Fig 1a) add a site map, this is lacking, showing location within country and the treatment locations, plus a second panel b) mean monthly precip and mean monthly Tair, and c) the current Fig of GCC of the grass layer over the growing season.

This will highlight the seasonality of this savanna climate system and the dynamic phenology, largely driven by the grass phenology, with presumably tree cover relatively constant.

L167 define the standard NDVI acronym "… and satellite data (normalized difference vegetation index, NDVI)".

L192 consider using Sentinal-2 EVI as well, or both indices. I have found with flux data that EVI covaries more closely than NDVI.

L311 "spring, dry down, summer, autumn and winter, as described above in Chapter 2.1.). Delete "as described above in Chapter 2.1), clearly a left over from your PhD thesis?!

L348 delete ".and".

L351 should read "For all plots, …"

L401 "NT (12 days) compared to 15 and 16 days at NPT and CT,…" Would this be a significant difference? How would you test this?

In fact all the these rather modest differences in lags i.e. 2-4 days in this paragraph, are they significant or simply error / variability in the data?

L406-408 delete this text, focus on VPD as a driver.

L431 re-word "… phenological seasons based on the grass layer GCC derived from PhenoCam "

L435 re-word " as well as radiation parameters PAR and SWDR …"

L443 re-word "Additionally SWDR, PAR were important in ...". There are numerous examples like this, a bit repetitive, inefficient writing.

L454 No need for this sub-heading, delete "3.5 Changes in NEE Sensitivity over Time" seemed to me like this text is continuing description of Table 2.

L476 "Fig. 6", add a space

L485 delete "amount"

L515 see also Moore et al 2016 Biogeosciences 13: 5085-5102, doi:10.5194/bg-13-5085-2016.

L544 re-word "do not appear to play a crucial role at the seasonal scale."

L560 "growing season, spring, NEE is dominated by GPP." Careful making statements like this as these two variables are not independent of each other ie GPP is derived from NEE observations. You would have to be very confident of your Reco model used in this system to estimate GPP.

L592 delete "made"