Anonymous Referee #1 (AR#1)

The manuscript presents a promising idea for partitioning ecosystem respiration into autotrophic and heterotrophic respiration: Since leaf area index (LAI) is directly related to the autotrophic respiration, the y-intercept from the regression of ecosystem respiration against LAI would be the heterotrophic respiration. Due to a severe bush fire, the ecosystem around the eddy covariance (EC) flux tower was severely damaged and therefore LAI showed a wide variation over the six reported years to test this hypothesis.
However, there seems to be error in reasoning in the light response approach for estimating the ecosystem respiration:
- The net ecosystem exchange (NEE) is first partitioned into average adjusted night EC flux and assimilation A. Hence A is purely the assimilation WITHOUT night time respiration. However, in the light response approach, A is fitted against light with an offset C and for zero light, C is described and discussed as night time respiration R night (which has already been subtracted beforehand). That does not seem to make any sense or needs to be clarified.
- Furthermore, the offset C is quite small for all calculated months (Table 2) with values below the random error typical for EC measurements (cf. Richardson, A.D. et al., 2008. AgForMet, 148(1): 38-50.).

"Hence, offset C might be due to the random error in the measurements and would be desired to be small (close to zero) as a sign that the partitioning scheme shown in Figure 1 (left flow) worked."

This review process has been very challenging for me to grapple with the terminology, a view I am assured is felt by everyone in the eddy covariance community. I have found great solace and affinity in the opinion piece by Wohlfahrt and Gu (2015) in Plant, Cell and Environment, 38, 2500-2507. I can see now that my method calculates 'true photosynthesis', V_c.

I feel very grateful to AR#1 for advancing my knowledge and allowing for my understanding to meet his/her.

What I aimed for my manuscript was to calculate an accurate ecosystem respiration (R_{eco}) requiring an accurate gross primary productivity where photorespiration accompanies carboxylation. Unfortunately my method eliminates photorespiration preventing me from calculating an accurate R_{eco}. My ultimate aim with an accurate R_{eco}, was to partition into autotrophic and heterotrophic, the later to compare with ground measurements to ground truth the eddy covariance data from the tower.

I agree with AR#1 and am able to clarify my light response approach does not deliver night time respiration.

- Some of the monthly regressions in Table 2 yielded ecophysiological implausible values (such as negative light compensation points) and other so low r^2 that it is questionable if the light response can be fitted for these months at all (since light does not seem to be the primary driver of the ecosystem response).
- Since the main result of the LAI regression again ecosystem respiration in Figure 4 is derived from monthly ER as the difference between monthly NEE and monthly A (hence no light response function used, right flow in Figure 1), it might be recommendable to totally exclude the light response approach from this manuscript.

As it stands, the AR#1 is correct. My calculations give V_c. I admire Wohlfahrt and Gu (2015) for remaining with Brooks and Farquhar (1985) in Planta 165, 397-406 as I endeavour to partition the

eddy covariance flux from a processes point of view and agree wholeheartedly it is imperative to determine GPP or the apparent photosynthesis where it integrates photorespiration (V_o). To go over my calculations in order to explain how I plan to improve them; my calculations had the advantage of removing soil respiration ($R_{non\text{-}leaf}$) as:

$NEP_d - NEP_n$ when equilibrated for the soil temperature and water content gives;

$V_c - 0.5V_o - (R_{day} + R_{non\text{-}leaf}) + - (R_{dark} + R_{non\text{-}leaf})$

Delivers: $V_c - 0.5V_o + R_{gap}$

R_{gap} is the amount suppressed by light of the non-photo-respiratory respiration. It immediately reduces apparent photosynthesis to true photosynthesis along with cancelling out of the $R_{non\text{-}leaf}$.

In my revised manuscript, I will instead use diurnal traces of soil respiration and instead add the night onto the day such that;

$NEP_d + NEP_n$ when equilibrated for the soil temperature and water content gives;

$V_c - 0.5V_o - (R_{day} + R_{non\text{-}leaf}) + - (R_{dark} + R_{non\text{-}leaf})$

Delivers: $V_c - 0.5V_o - R_{gap} - 2R_{non\text{-}leaf}$

Subtracting double the soil respiration will deliver $V_c - 0.5V_o - R_{gap}$, an estimate of GPP, that will be somewhere between apparent photosynthesis ($V_c - 0.5V_o$) and net photosynthesis ($V_c - 0.5V_o - R_{day}$).

I will feel satisfied using this estimate of GPP to calculate ER for regression against LAI, leading into the next points below.

The other major concern is the robustness of the main results in Figure 3 and in Figure 4 of "monthly NEE minus monthly A" against LAI:
- To my understanding, the used partitioning scheme is the right flow of Figure 1 and does not use the light response equation but directly calculates monthly ER from monthly NEE minus monthly A. However, it is often referred to “light response function of calculated assimilation” e.g. in Figure 3. This would need to be clarified or revised throughout the ms.

The revised manuscript will follow the right flow of Figure 1 with an estimate of GPP as described above.

- It is interesting that the ecosystem respiration estimates from partitioning with OzFlux are so much lower, only 16%, than the estimates found with the new partitioning scheme after Figure 1, right flow. This would definitely require further investigation and discussion.

We can understand now why so different as it is just a carboxylation rate when subtracted from NEE give a much larger R_{eco} than from OzFlux. I can’t wait to see the next R_{eco} from a better GPP.

- The main result in Figure 4 show monthly data points for prefire and postfire. The two clouds of data points have very different properties in terms of scatter as well the slope/intercept. As a quick test (by reading the values from the figure), a linear regression of only the postfire data yielded a y-intercept of 0.23 and a very low r2 value of 0.26. The y-intercept is thus only half of the regression of the postfire data points. The disturbed ecosystem after the fire might have a

different heterotrophic respiration e.g. due to decomposition, regrowth, carbon re-allocation. These two datasets should maybe be analysed separately as well as together to give a measure of robustness.

I agree to carry out regressions pre and post fire separately and together.

- Generally, the manuscript is missing any uncertainty estimates of the flux calculated from the EC measurements e.g. due to random error, ustar filtering, gap filling, partitioning. These are necessary to be able to assess the significance of the results.

I have now familiarised myself with uncertainty analysis, accounting for random and systematic errors (Moncrieff et al., 1996) and will follow Hollinger and Richardson (2005) with guidance from Peter Isaac (OzFlux). The 95% confidence intervals will be derived from the Bootstrap method, and I would like to incorporate a table of descriptive statistics for the heat, water vapor and CO_2 fluxes (H, LE and F_c.

- For the regressions, bootstrapping would be useful to give more realistic estimate of the uncertainty than just the standard deviation from the regression.

The following few minor point would favourable for easier reading of the ms
- a table with abbreviations,

A table of abbreviations will be added.

- adding the kind of data to the figure descriptions, e.g. "monthly mean" ecosystem respiration in Fig.3,

Figure descriptions will be added.

- explanation of difference between GPP with assimilation A,

The revised manuscript will use an estimate of GPP.

- for Section 3.1. adding a figure with the monthly NEE over the six year period.

The revised manuscript will add a figure of monthly NEE over the six year period.

Hopefully, these comments will help to advance the progress of this ms and I would like to encourage resubmission. By focussing only on the right flow of the partitioning scheme in Figure 1, it would be a short and sweet analysis.