

Interactive comment on “Under a new light: validation of eddy covariance flux with light response functions of assimilation and estimates of heterotrophic soil respiration” by Georgia R. Koerber et al.

Anonymous Referee #1

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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 esti-

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mating 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 nighttime 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 nighttime 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, C might be the offset due to the random error in the measurements and would be desired as a sign that the partitioning scheme shown in Figure 1 (left flow) worked.
- 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 against 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.

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

C2

throughout the ms.

- 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.

- 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 r^2 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.

- 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.

- 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,
- adding the kind of data to the figure descriptions, e.g. "monthly mean" ecosystem respiration in Fig.3,
- explanation of difference between GPP with assimilation A,
- for Section 3.1. adding a figure with the monthly NEE over the six year period.

C3

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.

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C4