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Biogeosciences Discussions

Interactive comment on "Comparison of CO_2 and O_2 fluxes demonstrate retention of respired CO_2 in tree stems from a range of tree species" *by* Boaz Hilman et al.

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Thank you for your comments. We addressed the major concerns below.

Concerns were raised regarding the organization of the paper. The paper presents a synthesis of results from different sites with different experimental designs and methods, and we made big efforts to report this synthesis in fluent and coherence manner. Yet, from the reviewer comments there is more room for improvement. In the revised paper we will follow editing suggestions provided by the reviewer: re-organizing methods section and table 1, broadening the introduction for PEPC as a potential mechanism. We will also edit the discussion to mirror the introduction, improving overall

cohesiveness. We also will take care to keep sites names consistent. Obviously, we will clarify/correct minor issues the reviewer pointed out.

Steady state vs instantaneous ARQ determination. The reviewer is concerned about the equivalency of the steady-state and the instantaneous measurements as determined from the linear regression (Fig 2) and from the results of Angert et al. (2012). Specifically, the reviewer criticizes the decision to force the regression line in figure 2 through the origin. Figure 2 presents a linear regression with a slope of $\sim$1 (but with considerable scattering) where the variables are the steady-state and the instantaneous ARQ measurements of the same incubations. We aimed to demonstrate by that the overall validity of our box-model that predicts same ARQ values shortly after the beginning of chamber incubation (instantaneous) and after steady-state is reached (>day). As we discussed in the paper and previously (Hilman & Angert, 2016), the considerable scattering around perfect agreement can reflect several things: (1) real differences in the ability of the measurement method or (2) real temporal differences in ARQ that occur between the time the instantaneous and steady-state measurements are realized (the model we use assumes constant ARQ with time). Examples for temporal changes in ARQ are shown in Fig. 5-6. The reviewers' comment has led us to re-think whether linear regression is the best way to demonstrate the adequacy of the steady-state and the instantaneous measurements, because there are not necessarily dependent-independent variables. Instead, we think a better way to illustrate the agreement is to plot the data points, the 1:1 slope, and to report the mean difference (0.02) and RMSD between determinations which is 0.15.

Why does ARQ plateau at 0.7 in the model presented in Figure 1? Shouldn't it plateau closer to 1 if that's what the theory suggests? The theory dictates the ratio DCO2/DO2 in the beginning of stem incubation should equal 0.76*DCO2/DO2 at the plateau stage. In this model run ARQ=0.5, hence the DCO2/DO2 plateaus at $\sim$0.65. Post-hoc comparisons. We performed post-hoc comparison only in the experiment presented in Figure 9, where the letters indicate significant differences are shown. Line by line

comments: Line 275 – what is the duplicates error? Single ARQ measurement is the average of duplicate flasks taken from the stem chamber, and the error is the standard deviation. We will clarify this in the text. I was surprised that pre-dawn water potentials were not referred to as a measure of water stress in lines 190-192, especially since stress is stated as a potential explanation for lower ARQ values in the discussion (line 307-308). Drought treatment was mentioned in these lines as one potential explanation for lipid respiration that could cause a decrease in ARQ. As natural trees in Israel are acclimated to the long dry Mediterranean summer, we are not sure the term “stress” describes exactly the water status of these trees. For eliminate misunderstanding we will remove the reference to “stress” in the text.

Angert, A., Muhr, J., Negron-Juarez, R., Alegria-Muñoz, W., Kraemer, G., Ramirez-Santillan, J., . . . Trumbore, S. E. (2012). Internal respiration of Amazon tree stems greatly exceeds external CO2 efflux. Biogeosciences, 9, 4979-4991. Hilman, B., & Angert, A. (2016). Measuring the ratio of CO2 efflux to O2 influx in tree stem respiration. Tree Physiology, 36(11), 1422-1431. doi:10.1093/treephys/tpw057

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