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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.

Anonymous Referee #1

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This article presents data on a range of tree species that demonstrates the apparent respiratory quotient measured on stems (ARQ, the ratio of CO2 emission and O2 uptake) is often well below a value of $\sim$1 expected for aerobic metabolism of carbohydrates. The authors do an excellent job outlining possible explanations for this discrepancy in the introduction and discussion. They pull together an analysis of multiple experiments, including field measurements and lab incubations of samples from 12 species across half a dozen sites. While the methods are a bit confusing due to integration across so many disparate experiments, overall they are clear. Of particular interest in the lab incubations of excised stem and leaf material in the discussion of transport of DIC.

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Discussion paper

The biggest potential issue with this manuscript is the choice of ANOVA as an analytical approach, particularly in the use of ARQ as a response variable. Since ARQ is not measured directly, but is the ratio of the two measurements, it does not necessarily have the correct statistical properties for ANOVA. In particular, if measurement error scales with the component fluxes of ARQ, then the relative error of ARQ increases as the component fluxes decrease. This is of particular concern in light of the admission that in multiple cases, samples were excluded for having very low flux measurements, presumably approaching detection limits. I would recommend the authors consider another approach that preserves the original scaling of the measurements, such as ANCOVA or multiple regression. I would not object to summarizing some of the findings in terms of ARQ, however, as it is a useful tool for explanation.

Another potential issue is the combination of analyses across so many species and sites. While, on one hand, this a strength of the paper, there is an implicit assumption that the mechanisms are consistent across species and sites. This is not necessarily the case, especially in regard to the transport of DIC in sap, which could be effected greatly by species or wood anatomy. One may expect that this process and the contribution of transport to observed ARQ values would depend greatly on the depth of active sapwood, vessel size and other anatomical characteristics, such as medullary rays.

Overall, the basic observation of ARQ being less than unity across many studies is a useful contribution to the literature and the discussion of the topic is well written and clear. One possible spot for improvement is connecting the putative mechanism of PEPC fixation of CO2 with transport and canopy-level measurements of CO2 and O2 exchange. In particular how this could result in similar decoupling of the component fluxes in time rather than or in addition to spatial decoupling from processes such as the transport of DIC in sap.

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