



EGUsphere, referee comment RC1
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Comment on egusphere-2022-34

Yingping Wang (Referee)

Referee comment on "Ideas and perspectives: Allocation of carbon from net primary production in models is inconsistent with observations of the age of respired carbon" by Carlos A. Sierra et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-34-RC1>, 2022

Review report "Ideas and perspectives: Allocation of carbon from Net Primary Production in models is inconsistent with observations of the age of respired carbon"

This is a well written piece. The authored argued why carbon allocation should be based on GPP rather than NPP, as often done in most land surface or ecosystem models. These models assume zero residence time of respired carbon through autotrophic respiration, which contradicts the field measurements of the age of respired C from plants. However, there are several significant limitations with the proposed approach: (1) ecosystem GPP cannot be measured directly; where NPP can be easily measured in the field and with a large number of observations available globally; (2) autotrophic respiration of individual biomass components are rarely measured, therefore allocation fractions of GPP to individual biomass components often are not available at ecosystem scale; (3) to model the age of respired C in an ecosystem or land surface model using the proposed approach by the authors here, we will need to represent the total carbon in each biomass component using multiple pools with different availability for respiration and their responses to stresses, which will introduce quite a few additional, poorly constrained model parameters, and additional uncertainties in the model. On the other hand, most of the respired carbon is less than one-year old in leaf, and much younger than the mean age of woody carbon in stem. In my view, the authors should provide a more balanced view of the pros and cons of GPP-based and NPP-based approaches for carbon allocations, and their potential limitations.

Some detailed comments

Figure 1. I disagree with the statement that majority of the models assume "a constant

proportion of GPP". I know that ACCESS-ESM, GFDL, NorESM2, BCC are not. Not sure about other models. Because of the pool-size based approach, there is a negative feedback between respiration and pools, therefore the ratio of autotrophic respiration of GPP is rather constant when averaged over a year globally.

L121. CABLE does not assume a fixed fraction of GPP being respired by plants. See Wang et al. (2012), GEOPHYSICAL RESEARCH LETTERS, VOL. 39, L19405, doi:10.1029/2012GL053461.

P9, the last two lines below Figure 3. "the median transit time is 0 yr, because the autotrophic respiration flux, which corresponds to 50% of GPP..". That statement may be specific to the model of Emanuel et al. (1981) and that model is more than 40-year old! In most land surface models, Ra/GPP is not constant, particularly at daily or seasonal time scale. The median transit time would have to be weighted by the carbon flux, then the median transit time will not be zero!

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