

Interactive comment on “Towards a more complete quantification of the global carbon cycle” by Miko U. F. Kirschbaum et al.

Anonymous Referee #2

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The manuscript by Kirschbaum and others is a well-written summary of existing estimates of small C fluxes that should not be excluded from global C syntheses, as the authors demonstrate. I feel that it is publishable after the authors consider a number of minor points for clarity and a few more major revisions regarding deposition pathways. Namely, some dry and wet deposition terms are attributed to a flux to the ocean but in reality go to both land and ocean. In a few instances the authors appeared to be overly critical of existing budgets without justification in my opinion. The paper would also very strongly benefit from a table of abbreviations (especially equation 1!). Figure 1 is nice but doesn't link pools and fluxes with the abbreviations used in the text.

In section 2, 'The shallow ocean is too small for significant carbon storage, but the deep ocean has a huge carbon-storage capacity' seems inconsistent with the goal of

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the paper to quantify small C fluxes

'As these organisms are eaten by larger organisms' is true, but small organisms also die. Regarding 'However, we believe that a more explicit representation of this pool would be desirable for greater transparency.' Yes, everyone does, but writing it as such doesn't make it clear if this will be addressed in the paper.

'However, under anaerobic conditions, breakdown effectively ceases completely' and 'never breaks down' are slight elaborations. Over meaningful time scales to the contemporary climate system perhaps. (See also Table 1 'permanently'. Readers with a long view of time may disagree.)

Wording can be simplified in many places. For example, 'Forbes et al. (2006) estimated this flux to be only small at less than 10 MtC yr⁻¹. Could lose 'only small at'.

'any transfers to the ocean' in section 9 could also be transfers to land to the extent that NMVOCs create aerosols and cloud condensation nuclei that are subsequently deposited to the surface at some point. Later in the section dry deposition (can also be wet deposition) is mentioned. This needs to be integrated more strongly with the material above. Figure 7 also needs to be modified; dust, NMVOCs, charcoal and the like also land on land.

Section 12.1 for some reason dismisses a large body of literature demonstrating that 'older' forests can take up substantial amounts of carbon, e.g. <https://www.nature.com/articles/nature07276>.

This sentence is an overly-harsh critique of the hard work that goes into global carbon budgeting: However, the global carbon budget in its currently used simplified form is incomplete and, therefore, does not provide appropriate guidance on the way anthropogenic and natural processes interact to lead to the observed increases in atmospheric concentrations.

Table 2: waterway is one word.

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Simultaneous red and green should be avoided in Figure 5.

Figure 6 is somewhat underwhelming.

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