

Interactive comment on “ESD Reviews: Evidence of multiple inconsistencies between representations of terrestrial and marine ecosystems in Earth System Models” by Félix Pellerin et al.

Anonymous Referee #2

Received and published: 22 October 2020

General comments:

The manuscript starts from the premise that representations of terrestrial and marine ecosystems differ in present ESMs and that this raises the question whether inconsistencies between terrestrial and marine ecosystem models exist, with consequences on the simulated effects on climate.

I find it difficult to follow this premise. Terrestrial and marine ecosystems ARE different. Competition for space and water is much different, the amount of structural plant

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biomass is different, the role of physico-chemical effects like gravity or fires is different, and trophic interactions are different. Why should descriptions of such different systems be similar in models?

The authors assume that ‘Inconsistencies in ecosystem representation can lead to wrong predictions about the role of the biosphere in the climate system’ (l.270). This appears to be a main motivation for their study, but there is no evidence provided that this statement may be correct. Also, there is no justification for their conclusion that a unified framework of terrestrial and marine ecosystem models is urgently needed (l.288) or that combined databases of terrestrial and marine organisms (l.289) would be useful.

I am not at all convinced that there would be any improvement in trying to model the different terrestrial and marine systems via a unified model framework. By introducing processes of secondary importance, noise level, parameter indeterminacy and thus model uncertainty may grow. Models are simplifications of the real world and should not be made more complex than necessary. The authors provide no evidence that their suggestions (which they call conclusions) can be useful. I don’t think that this is a useful scientific approach.

specific points:

l.78: The statement that the biological (carbon) pump is responsible for 90% of the marine carbon uptake is wrong (and never said by Friedlingstein et al., 2019). Current marine carbon uptake is essentially exclusively due to the solubility pump. I am not aware of any solid evidence that the biological carbon pump is playing a significant role in the oceanic uptake carbon in the anthropocene.

l.169: photosynthesis and respiration are not ignored in marine ecosystem models.

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They are rather treated as a constant proportion of NPP. This difference wrt the representation of terrestrial plants may well be justified by the tighter stoichiometry in marine plant biomass due to the absence of major investment into cellulose.

Fig.1: The term 'Redfield ratio' is used incorrectly. Presumably 'C:N:P ratio' is meant here (which can vary - the Redfield ratio is a fixed C:N:P ratio that does not vary).

Interactive comment on Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2020-55>, 2020.