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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 #1

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Comments on "Evidence of multiple inconsistencies between representations of terrestrial and marine ecosystems in Earth System Models" by F. Pellerin et al.

This manuscript reviewed how biogeochemical, biogeophysical, and particle exchange processes of marine and terrestrial ecosystems are implemented in the contemporary Earth System Models. The authors focused on climatic feedbacks of these biospheric processes and clarified which processes have inconsistencies between the marine and terrestrial ecosystems.

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Discussion paper

General points As revealed by model-intercomparison studies, the contemporary Earth System Models have serious uncertainties in the representation of climatic feedback mechanisms and thus future climate projections. The present manuscript addressed, in this regard, an important issue to reduce the uncertainties, making contributions for our climate management. However, this is a narrative review and lacks quantitative analysis. Therefore, in my view, this is not for expert researchers of the study area but for students or researchers of other expertise.

The authors tried to contrast between marine and terrestrial ecosystems and to specify inconsistencies between the ecosystems. It is not obvious for me that the two systems should be represented in a consistent manner, because they have clear differences in physical and chemical properties. For example, lateral and vertical convective transportations are important for marine ecosystems, while these transportations exert relatively small roles in terrestrial ecosystems. The authors should, at first, clarify the similarity and difference between the marine and terrestrial ecosystems. Apparently, these issues have been addressed by ecological and meteorological studies, and then a brief summary is sufficient. Another caveat on this manuscript is the lack of consideration on the interaction between marine and terrestrial ecosystems, such as riverine transportation and coastal system, which become increasingly important in the present Earth System Model studies.

Finally, I conclude that the manuscript needs major revision before being accepted for publication. Introduction should provide more research background, and Discussion should provide more insightful discussion.

Specific points

Line 91: “THOM” should be “Thom”.

Line 102: The gas and particle section has some overlap with the biogeochemical section; this section should, for example, focus on short-lived species such as BVOCs and organic aerosols. Similarly, in Figure 2, “respiration” appears in categories 1 and

3.

Line 230: Recently, a synthesis on the global CH4 budget (Saunois et al., 2020) was published.

Line 261: This Discussion and Conclusions section should provide more in-depth discussions such as priority for improvement of Earth System Models.

Line 292: A new paper on TRY (Kattge et al., 2020) was published.

References

Kattge, J., et al.: TRY plant trait database - enhanced coverage and open access, Global Change Biol., 26, 119–188, 10.1111/gcb.14904, 2020.

Saunois, M., et al.: The global methane budget 2000–2017, Earth System Science Data, 12, 1561–1623, 10.5194/essd-12-1561-2020, 2020.

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