

Interactive comment on “¹⁴C-age tracers in global ocean circulation models” by W. Koeve et al.

Anonymous Referee #2

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Using different ¹⁴C and “age” tracers, the study highlights limitations in using natural ¹⁴C to determine the age of a water parcel. The results suggest that ¹⁴C age of a water parcel is dependent on the preformed ¹⁴C and the aging of the water. They conclude that using bulk ¹⁴C age of water masses to test/tune the circulation of a global ocean model might lead to errors. Instead preformed ¹⁴C ages should also be included. Please find below a list of comments regarding the manuscript.

This paper tries to understand the bulk ¹⁴C age distribution in the ocean and its relationship with “ideal age”. I think some interesting conclusions could be obtained but in its present form, the “interesting” conclusions are difficult to grasp. The main conclusion is that using bulk ¹⁴C age of water masses to test/tune the circulation of a global ocean model might lead to errors. However as far as I know, the evaluation/tuning of the oceanic circulation in most global ocean models is first based on physical parameters (e.g. T,S). Indeed many global ocean models do not include biogeochemistry and thus

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¹⁴C. The authors point to the importance of the air-sea gas exchange parameter in determining the preformed ¹⁴C and thus the bulk ¹⁴C age. However, as stated above not all biogeochemistry models include ¹⁴C and thus the tuning is oftentimes not based on ¹⁴C. Finally, even if ¹⁴C distribution is used to tune the models, other tracers are also used. While the authors are most likely right in their analysis, they should clearly state that it is relevant only for the models that use ¹⁴C as a validation/tuning of the model.

Δ¹⁴C is also measured in benthic and planktic foraminifera, and the difference between the two is used to estimate the ventilation age at a certain location, mainly in relation to changes in ocean circulation. The authors briefly state the paleoclimate use in the conclusion but I think this is an important point that the authors can make. Is this method robust given their results? Would that work in any part of the ocean? Could we compare these measurements with modeling studies? Additional figures might be needed to really answer these questions.

I would suggest to remove section 4 and the associated figures. I don’t see the point of the first example (oxygen minimum zone of the Pacific Ocean) and I don’t think a good point is made out of the second example: changing *K_v* alters the oceanic circulation, which thus changes all the age tracers. For the second example to be relevant much more information should be added.

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