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Interactive comment on "Re-evaluating ^{14}C dating accuracy in deep-sea sediment archives" *by* Bryan C. Lougheed et al.

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Dear Dr. Hajdas,

Thank you for your interest in our manuscript and for sending it out for review and discussion. Thanks also to the referees for taking their time to provide their insight into our work, which will help to improve the manuscript.

We have responded to both referees directly in separate replies and sum up our replies in a final author comment here.

Both Referee #1 and Referee #2 found that our model approach correctly incorporated the processes of sedimentation, bioturbation, Δ14C, AMS measurement and the calibration process. Referee #2 considers the manuscript unsuitable for Geochronology,

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Discussion paper

due to our best-case scenario simulations not being a exact imitation of field conditions, where such best-case scenarios do not exist. As we detailed in the manuscript and further elaborated in the response to Referee #2, our best-case scenario approach intentionally does not mimic reality, thus allowing us to construct a classic experimental design whereby many input variables are kept constant, thereby testing the accuracy of the current 14C dating state-of-the-art applied to deep-sea sediments at the most fundamental level, in a way that is not possible in the field. We think that such a study is inherently interesting for the readership of Geochronology. We will strive to improve the clarity of our reasoning in an updated version of the manuscript.

Following the referee comments and our replies, we propose the following two main action points for an updated manuscript:

(1) The main request of Referee #1 is that we include dynamic scenarios for other variables in Figure 5. As mentioned in the reply to Referee # 1, we will include this in Figure 5 in the form independent simulations with independent stepwise changes for other variables (such as abundance, reservoir age, etc). This will allow the reader to separately judge the influence of different drivers upon the 14C dating process.

(2) Both Referees #1 and #2 suggested that the simulated measurement uncertainty of $\pm$200 14C yr for very old 14C samples close to the blank level was overly optimistic. We note that our study attempts to simulate best-case scenarios, including for measurement. However, I have since been in contact with multiple laboratories regarding the theoretical best-case measurement uncertainty in the case of minimal contamination, high-quality blanks, et cetera. We can conclude that while a best-case scenario measurement error of $\pm$200 14C yr for very old samples is in theory possible, it might not be applicable to foraminifera samples, which are more susceptible to contamination than, e.g., bone or wood samples. We will re-run the simulations with a more suitable theoretical best-case value (e.g. $\pm$500 14C yr) for completeness. The outcome of our study will not be affected.

The other helpful points of the referees pertaining to better communication of certain concepts and clarification of methods will also of course be implemented, as detailed in the responses to the referees.

We thank you again for your interest in our manuscript and await your decision on how to proceed, including any suggestions you may have for the improvement of the manuscript.

On behalf of the authors,

Kind regards,

Bryan Lougheed

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