

Reply to RC3

The reviewer attests that “the work presented in this manuscript represents a valuable contribution to the field that should be published.”

General comments:

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Specific comments:

Lines 108-109: Give a short definition of “pseudo-observations” in the context of this work.

Reply: Agreed.

Action: Text was updated:

*Pseudo-observations are ‘virtual’ samples that are placed in undersampled areas and for which the value of the response variable can be assumed with high certainty.*

Lines 111-112: Define how many are meant by “Some of the sedimentation rate values: : :”, does this refer to the four values that are amended later in the same sentence or are these four a subset of the “some”? If it’s a subset, the selection process should be explained.

Reply: Agreed.

Action: Sentence now reads:

Four of the sedimentation rate values from non-depositional areas reported by de Haas et al. (1997) and van Weering et al. (1993) were set to 0 cm yr<sup>-1</sup> *due to low <sup>210</sup>Pb activities and indistinct decreases with depth.*

Line 131 (Figure 2): There seem to be no OC measurements in the Elbe Paleo valley region (Region 2), if this is the case it should be explicitly mentioned.

Reply: de Haas et al. (1997) cite an average deposition rate of 1 mm yr<sup>-1</sup> (Eisma, 1981). However, no precise location is given, hence the rate is not included in the dataset on sediment rates.

Action: None.

Line 145: “critically reviewed and removed if they were not deemed accumulative” an explanation on the selection/removal criteria should be added here.

Reply: The sentence was rewritten to provide more clarity.

Action: The sentence now reads:

*These potential accumulation areas were critically reviewed in the light of measured sedimentation rates and geological interpretation of sediment cores (de Haas et al., 1997 and references therein).*

Lines 263-264: "It is therefore safe to assume that the sediment slice between 5 and 10 cm will contain between 0 % and 100 % of the OC stock of the upper 5 cm." It is generally safe to assume that anything contains between 0% and 100% of anything, so this sentence is either unnecessary, or should be reworded in a way that makes more sense.

Reply: The sentence has been removed as the beginning of the section was restructured.

Action: No further action.

Lines 339-341: "Lack of advective oxidation [...] and relatively high sedimentation rates." The wording of this sentence is unclear and should be revised.

Reply: Agreed, we provide additional detail.

Action: The sentences were changed:

*This lack of advective oxidation (Huettel et al., 2014; Huettel and Rusch, 2000) translates into slower OC degradation. Fine-grained sediments provide mineral protection (Hedges and Keil, 1995; Hemingway et al., 2019; Keil and Hedges, 1993; Mayer, 1994), which also promotes OC preservation. Short oxygen exposure times (Hartnett et al., 1998) due to shallow oxygen penetration depths and relatively high sedimentation rates limit the time for aerobic mineralisation. Collectively, this leads to high OC densities and accumulation rates.*

## References

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