

Biogeosciences Discuss., referee comment RC2  
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## Comment on bg-2021-100

Anonymous Referee #2

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Referee comment on "Estimation of the natural background of phosphate in a lowland river using tidal marsh sediment cores" by Florian Laurysen et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-100-RC2>, 2021

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The paper does address relevant and appropriate scientific questions which are very important to environmental P cycling and the journal. The authors propose to use sediment cores as a chemical archive to estimate historical surface concentrations of orthophosphate (orthoP) using a Langmuir-type sorption model in order to test statements regarding orthoP pre-industrial levels in freshwater rivers.

The manuscript is relevant and valuable work, but the manuscript as submitted needs significant work with regard to the Introduction and language throughout. There are many areas where the language struggles and the meaning of the sentence is lost. I would recommend authors seek editing advice for English language, as many of the difficulties maybe due to language barriers.

Because the paper uses a model to predict pre-industrial orthoP concentrations the authors should be careful to use language to that effect throughout the document. Language such as estimates, predictions, suggestions rather than words like identification (title). The name of the model should be mentioned in the abstract - after reading the abstract I had no idea a model was being used as the main methodology.

The introduction needs to be re-written with current literature on global P problems in the worlds waterways and why estuaries/lowland rivers need to be studied to determine P capacity and/or leakage. I would recommend that the Introduction be re-written to include some of the literature referenced in the methods section. I had a much better idea about what the authors were investigating after reading the methods section – and that should be reflected in the Introduction. For example, the Introduction should introduce why P is a problem globally, and why estuaries/lowland rivers are particularly a problem for both P storage and leakage – although not enough is known about either problem in these areas. There also needs to be a thorough discussion of why P in sediments would reflect overlying orthoP concentrations – leading the reader as to why you chose to use the methods described. And finally, a thorough discussion of the specific P problems related to this area of Belgium. After reading the Abstract and Introduction compared to the Methods section I had very different ideas about what was going to be discussed in the paper.

I will try and identify specific examples regarding my overall comments above as well as highlight the great parts of the manuscript.

Recommend defining P forms early in the manuscript (Introduction) and sticking to that nomenclature throughout the document. For example, orthophosphate for dissolved P or reactive P (Line 38), Total P as organic, and inorganic – all forms of P. I would also recommend using the nomenclature  $L^{-1}$  rather than /L (Line 41) - unless that is mandated by the journal.

The use of historical orthoP data from collections using DPS sediment data from adjacent marshes is a novel concept of how to predict pre-industrial level orthoP concentrations – and will help with predictions on P loading for the future in these types of environments.

Recommend a sentence in the abstract from Discussion 4.2 Limitations of the model such as careful consideration for P-migrations, checks or correlations on DPS and orthoP peaks when recreating orthoP levels or history in areas prone to excess orthoP or eutrophication.

Specific examples of rough or misguided or language barriers includes Line 181, Line 215, Line 324-325, Line 357.

The methods section is well written. The language in the methods with regard to calculations of P-saturation and P sorption capacity is great – it would be great to see some of this language put into the Introduction as to why measuring P this way is important in gauging effects of long-term P loading – correlations between P sorption and pore water concentrations. The authors also used a published Langmuir-type sorption model to predict orthoP concentrations that had been used before for sediments and water in this area – which makes it very relevant in this study.

Expected a discussion of why previously reported/estimated values for background orthoP in this lowland river is larger than estimates for background P in other lakes/streams (15-35  $\mu g P/L$ ) what might be causing excess surface orthoP concentrations in these lowland areas pre-industrial era.

The results from sediment core selection – the discussion on P-migration for the two samples (Old2 and Young2) and why they should be eliminated from the analysis of DPS and  $PO_4$  relationship is appropriate, understandable, and very relevant.