Answer to Anonymous Referee nr.2

We thank Anonymous Referee nr.2 for their specific comments, and apologize for having forgotten to address them in our initial answer. We include our answers below, highlighting the Referee's comments in blue and our changes to the manuscript in red.

SC 1) Key paper not cited: Reinhard CT., Planavsky NJ et al. "Evolution of the global phosphorus cycle." Nature 541, no. 7637 (2017): 386.

Thank you for your suggestion, we have added the reference in the manuscript's discussion.

SC 2) Equations 14 & 17: AirSea should appear the same in both

Thank you, we have corrected it.

SC3) Equation 17: why does anaerobic remineralisation remove oxygen?

In our model, the reducing agent produced by anaerobic remineralisation is methane gas and it is only produced when the sediments and the deep shelf water column have gone anoxic. As we do not track other oxidising agents such as SO_4 there is nothing for the methane to be oxidised by until it reaches the surface ocean, and as the surface ocean is equilibrated with the atmosphere, the fact that we assume oxidation in the atmosphere is a reasonable approximation.

We have added this discussion to our manuscript in subparagraph 2.2.5 in order to clarify our equations.

SC 4) Line 5 of page 7: anaerobic remineralisation of organic matter also releases phosphorus (in fact oxygen-depleted sediments are stronger sources of phosphorus to the overlying water column).

We agree with Referee nr.2 and we have modified our model accordingly, following the suggestions of one of the major comments of Referee nr.1. We refer to our answer to the comment R1C1 (Referee nr.1, comment nr.1) for a detailed description of the changes to the model.

SC 5) Table 1: moles of air or moles of oxygen in the atmospheric box?

Oxygen in the atmospheric box is expressed in terms of its mixing ratio [mol mol^{-1}]. We have added a table (Table 1) with the list of the variables and of their units.

SC 6) Table 2: the Redfield ratio of oxygen to phosphorus (-O2:P) is ∼150:1 not 106:1 (see for instance: Anderson, L.A. and Sarmiento, J.L., 1994. Redfield ratios of remineralization determined by nutrient data analysis. Global biogeochemical cycles, 8(1), pp.65-80; Thomas, H., 2002. Remineralization ratios of carbon, nutrients, and oxygen in the North Atlantic Ocean: A field databased assessment. Global biogeochemical cycles, 16(3)).

We thank Referee nr.2 for their comment. Our latest version of the model adopts the suggested value O2:P=150:1, and we have updated this value in Table 3.

SC 7) W0 is a baseline flux (line 3 of page 4), hence cannot have units of mmol if equation 3 is to be dimensionally plausible.

Thank you, we have corrected it. The correct unit is: mmol yr^{-1} (see Table 3).