

Interactive comment on “Preformed and regenerated phosphate in ocean general circulation models: can right total concentrations be wrong?” by O. Duteil et al.

Anonymous Referee #1

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The study compares the nutrient partitioning between preformed and regenerated phosphate in the observations with a range of global biogeochemical models. The mismatch between the model distributions and observations is greater for either the preformed or regenerated phosphate, rather than the total phosphate concentrations. This mismatch suggests that the general circulation models have different relative strengths in the physical and biological pathways of nutrients. These differences are important as they affect the biological drawdown of carbon from the atmosphere.

The study is carefully conducted and the error misfit clearly set out with appropriate figures.

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The discussion paper interprets the mismatch between the model distributions and the climatology mainly as reflecting model error. While this spread in model and data agreement almost certainly is dominated by the model performance, there are also valid concerns about the reliability and representativeness of the observational data. There are inherent errors, measurement and sampling errors, in the composite of the climatological data. In particular, the lack of seasonality in the climatological data and the bias of any observations to the summer period at high latitudes, especially in the Southern Ocean, needs to be mentioned. While this aspect is touched on in the Conclusions, it is preferable to more fully address this aspect earlier in the manuscript. In addition, how large might the natural variability in the observed phosphate distributions and their partitioning likely to be?

In some parts of the text, the arguments could be set out slightly clearer and some terminology or statements tightened up and made more precise. These detailed points are set out below.

Detailed points P12425 L24: Do not refer to “so-called preformed phosphate”, as a clumsy phrase. Instead define preformed at the outset. P12426 L3–L9: These two sentences could be made much clearer to read, they cut to the heart of the interpretation, but are over long. P12427, L4: Ito and Follows (2005) should also be cited for this point, as they first set out the link to atmospheric CO₂. P12427, L8: Cut “Without the intention to perform a complete model intercomparison”, as a model intercomparison is performed here. P12428, L6–7: As you have raised the issue of the different oxidants, it would be useful to quantify how important they are. How minor are they? At present, you raise an issue, then dismiss it, but without providing any quantification. P12428, L20: Fixed stoichiometric ratio, R_P:O₂. There are really two issues here, one is the value assigned, which is discussed in the following text. The other issue is whether the value varies at all. Certainly this choice of a fixed ratio is plausible, but useful if any further discussion is provided as to its validity. P12429 L4–5. The assumptions about the rapidity of air-sea gas exchange are rather vague. Instead please provide

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likely exchange or equilibration timescales for dissolved oxygen. What is rapid or not is subjective. P12429 L10-15. I do not really see why the models could not be used to provide some insight as the skill of the AOU approach. This surely is the benefit of using a model, rather than just the data. As this information is not provided here, please add a quantification of the errors taken from Ito et al. (2004). P12435, L10. In the Southern Ocean, there is also an issue of how representative the data is.

In summary, the paper sets out the view that the skill of ocean biogeochemical models can be critically assessed in terms of the preformed and regenerated partitioning of nutrients. I recommend acceptance subject to the above minor comments being addressed.

Interactive comment on Biogeosciences Discuss., 8, 12423, 2011.