

## ***Interactive comment on “A mechanistic particle flux model applied to the oceanic phosphorus cycle” by T. DeVries et al.***

**E. Ingall (Referee)**

ingall@eas.gatech.edu

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Overall, this is a very well written and interesting paper. The description of the model and the justifications of the assumptions are clear. The modeling experiments are done in a logical progression. This leads to the key finding that observed phosphate, particle flux profiles and sediment trap data are best fit when organic matter burial and ballast effects are added to the model. The ballast mechanism essentially offers a mechanism to slow the remineralization of P from organic matter during transit to the sea floor. The authors nicely point out that this could also be achieved by allowing for less degradable P forms to be included in organic particles. No matter the mechanism, one wonders if this less degradable fraction could explain the Redfield-like organic C:P ratios seen in low sedimentation rate pelagic sediments described by Ingall and Van Cappellen

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A smaller point of this modeling effort is the suggestion that the oceanic residence time for phosphorus that is on the same order as that for nitrogen. This is in line with a progression of papers over the last 30 years revealing data resulting in a calculated reduction of the oceanic P residence time by almost an order of magnitude. Such a shorter residence time is certainly consistent with many observations in sediment data of a rapid and dynamic response of the marine P cycle to glacial-interglacial cycles.

For the non-modeler, the conclusions of this paper can certainly form the basis of future research hypotheses regarding the forms and reactivity of P in marine particulates.

The manuscript is in great shape. However, the text size on many of the figures is so small that it is nearly illegible. This should be an easy fix upon revision.

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