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Interactive comment on “A comparison of the variability of biological nutrients against depth and potential density” by J. While and K. Haines

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Of our two reviews this is the more critical and cites several papers suggesting that this work is not new, although they do not criticize the analysis methods themselves. The reviewer has identified several papers that are relevant and so we would certainly include these in a revision (all except the Goes reference which we have not traced, although its 2000 publication date implies that it cannot say much about Argo data) The Kamykowski paper in particular takes a global view like ourselves, although this paper is 25 years old and a much larger database of observations is now available. However, a key difference between these papers and ours is that they concern themselves with explicitly calculating nutrient-temperature relationships, or, for the Kamykowski paper, nutrient-density relationships.

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In our work we have emphasized the temporal variability about those relationships and also compare our results against variability of nutrient-depth relations. However we have clearly not made this clear enough for the reviewer in the main text and we will certainly do so in the revisions. We do discuss the origin of much of the additional temporal variability about a nutrient-depth relationship as resulting from dynamical variations and cross reference to similar ideas used in comparing physical water mass properties (T and S). This is not mentioned by the reviewer, perhaps because of his/her biochemist viewpoint. The reviewer gives a good discussion of the remineralization issues associated with determining the local nutrient-depth/density relationships, although as we point out above it is not the actual relationship we focus on but the variability about it. Once we remove the local nutrient-depth or nutrient-density relationship, the variability observed can only come from three sources: variability over the averaging area, instrument error, and temporal variability. We have tried to keep the averaging area small so as to leave temporal averaging as the dominant term, thus justifying our claim that it is temporal variability that is being investigated.

It is important to deal with this from a data assimilation perspective because temporal variability, particularly between nutrients and depth, can easily become aliased onto the mean field. As a result if these issues are not dealt with during data assimilation mean variations of nutrients can become distorted.

Both this review and the second review, point out some minor deficiencies in our paper. These would be corrected in a future submission. We agree that Figure 2 does warrant improvement in order to see detail and we would look to improve it; eg, a future version will probably be in color.

Interactive comment on Biogeosciences Discuss., 6, 10177, 2009.

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