

18 July 2016

Dear Dr. Hecht,

Please find attached our revised manuscript. In this new version we have included a clarification about the 30% result in the abstract, results and conclusions.

The text highlighted in blue color in the revised manuscript shows our new additions and modifications in the light of the comment.

Yours faithfully,

Bàrbara Barceló-Llull on behalf of all co-authors

## EDITOR COMMENT AND ANSWER:

We acknowledge Dr. Matthew Hecht for his comment.

In the next paragraphs we present the editor's comment (in blue) followed by our reply (in black).

There is one point that remains a concern, regarding the way in which the 30% increase is discussed. Reviewer Xavier Capet's comment was:

“2) A more useful diagnostic when trying to estimate the importance of vertical velocity is the additional experiment where drifters are released on isopycnals and followed for a year. This new experiment is overall well designed (despite some missing pieces of information, see below) but my impression is that its conclusions are orthogonal to those of the first experiment set. Indeed Fig. 9 and 10 suggest that the effect of vertical velocities is relatively limited. In particular, lateral advection is responsible for the overwhelming fraction of nutrient uptake. 30% increase mentioned in the text take place where nutrient uptake is small, e.g. just west of the high uptake taking place at the eastern domain boundary. I understand that a “positive” conclusion is preferable but the analyses do not support the conclusions which should be reformulated and nuanced.”

Your reply, in the exchange with the Reviewer, is very reasonable, acknowledging that these big increases of order 30% are occurring in places where the level of uptake is low:

“mesoscale activity is an important support for nitrate uptake (hence productivity) in this region where uptake is rather low”

But while this discussion puts the enhanced uptake into an accurate context, the manuscript still fails to do so.

I must insist that both abstract and main text be changed to qualify this salient result, acknowledging that the increase of up to 30% is generally found in areas of low uptake.

REPLY: We have added this clarification in the abstract, results and conclusions:

Abstract: “From identical initial distributions of nitrate-tagged particles, the Lagrangian results show that vertical motions induce local increases in nitrate uptake reaching up to 30%. Such increases occur in low uptake regions with high mesoscale activity. Despite being weaker than horizontal currents by a factor of up to  $10^{-4}$ , vertical velocity associated with mesoscale activity is demonstrated to make an important contribution to nitrate uptake, hence productivity, in low uptake regions.”

Results (Section 4.2): “While the restricted resolved vertical velocities leave the overall pattern of nitrate uptake unchanged, local nitrate uptake increases reach up to 30% in the region characterized by low uptake rates and high mesoscale activity (fig. 6c).”

Conclusions: “This analysis reveals that, in regions with low rates of nitrate uptake, vertical motions associated with high mesoscale activity may be responsible for local increases in these uptake rates of up to 30%. [...] Nevertheless, these results are indicative of the importance that mesoscale vertical motions have on sustaining primary productivity in the oligotrophic regions of ocean interiors.”