

Repply to reviewer #1

We really appreciate the comments made by the reviewer. He/she focuses in the context where these data were gathered and encourage us to include an additional analysis in the manuscript where our results are compared with the outputs from numerical modelling.

Hence, we have included at the end of the discussion some paragraphs where outputs from the GLORYS-BIO are used to estimate nutrient fluxes in the domain. Nutrient fluxes from in situ observations sampled in this manuscript are then compared with those numerical outputs. Both the abstract and the conclusion sections have also been modified to include this new aspect of the manuscript.

Main comments:

This manuscript studies the difference in circulation and nutrient transports off the Northwest African Continent between autumn 2002 and spring 2003. The results indicate that due to circulation changes between the two seasons, the studied area works as a nutrient sink (source) in autumn (spring). I think this is an interesting work and the revised manuscript shows improvement, but it still fails to address a key issue that is also raised by both referees in the first round of review. That is the usage of the GLORYS model outputs. It is absolutely true that observational data are very valuable and scarce, but that does not justify the authors' argument that the observational nature of the data is the only important aspect of this work. First of all, SiO₂, NO₃, PO₄ were so sparsely sampled during both cruises that the authors used the GLORYS outputs to perform the nutrient transport calculation. This highlights the importance of the assimilation model. Secondly, it is a perfect opportunity to show how well the model compares to the observations in terms of circulation and nutrient transports, which provides reference for other studies using the model. This would also potentially be a key strength for this work. Finally, I totally agree with one of the referees in the first round, who wrote: "*...the maximum mass, nutrients and DOC lateral transports occur mainly during upwelling seasons summer and winter respectively north and south of Cap blanc where the system is highly dynamic! ... having hydrographic data covering the whole seasonal cycle is very difficult, but fortunately we have the outputs of the bio-geochemical models...*".

Other comments:

1. The authors should consider to provide a sensitivity experiment on how robust the inverse solutions are with respect to the initial conditions, e.g., reference level, reference velocity, and Ekman transport.

The reviewer is right with respect to the addition of this kind of experiments when working with a priori uncertainties. We have added a reference to a comprehensive analysis performed in a similar domain just north of the one considered in this manuscript.

2. Line 18, please indicate what the CINECA program is.

It was been included in the manuscript the full name of the CINECA program.

3. Line 85, please indicate what temperature it is, in situ or potential temperature.

It has now been indicated that it is in situ temperature.

4. Line 140, my understanding on this paragraph is that it is about the horizontal difference in salinity among the profiles instead of temporal variability.

We disagree with the reviewer. During the fall cruise the upwelling is well developed, a process that doesn't occur during the spring cruise. Hence, the main differences highlighted are related to temporal variability.

5. Line 169-170, here we have a very good example to explain my main point: High values of nutrients are discovered in GLORYS-BIO, and it is attributed to long-lived eddies. Despite the fact that this can be easily verified by showing the GLORYS circulation field and compare with the observations, it is not done.

Actually, we are not attributing those high values to long-lived eddies. We humbly suggest that it might be related to long-lived eddies or to variability related to the Cape Verde Frontal Zone.

In any case, GLORYS doesn't provide a velocity field that could explain the variability indicated in the nutrients field.

6. Line 253-255, 10^8 ms^{-1} is a extremely large number, please check the preciseness.

The reviewer is right. We missed a minus sign in the exponent of those numbers. It has been corrected.

7. Line 285, what do you mean by vertically shortened? I understand that the water occupied less density range, but in depth space the water is not necessarily thinner in spring than in fall.

The reviewer is right. We have deleted that sentence to avoid any misunderstanding about the depth range affected by the eddies, which is an issue that cannot be concluded from figure 10.

8. Line 299, the total mass is not necessarily balanced, because the water column below 2000 m is neglected.

The reviewer is right. Since the box is opened by the bottom, we cannot expect a full imbalance. However, the mass transfer across that bottom layer is expected to be low (10^{-2} Sv), according to the vertical velocities and to the area covered by the cruise. Hence, the mass imbalance must be really close to the values provided in those lines.