Seasonal and interannual variability of the pelagic ecosystem and of the organic carbon budget in the Rhodes Gyre (Eastern Mediterranean): influence of winter mixing

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Responses to the Reviewers' comments

Answers to reviewers' comments are reported point by point. The questions and comments of the reviewers are in blue, the answers in black and the modifications that we made in the revised manuscript in red.

Responses to the comments of the anonymous Reviewer 1

First we would like to warmly thank Reviewer 1 for her/his comments and corrections which helped to improve the manuscript.

The manuscript has been thoroughly revised addressing all points and i recommend its publication. A few suggested technical corrections are given below (Line numbers based on the track changes ms).

L230 "and the intermediate layer, from 150 to 400 m, includes the LIW…"

..,which includes the LIW..

Reply: This was corrected in the revised manuscript.

L301 "Figure 2 shows the temporal variation of the satellite and modeled surface chlorophyll averaged over all the Levantine Sea (panel (a)), as well as the BGC-Argo float data, and the modeled surface chlorophyll along the trajectory of floats located in the Levantine Sea (panel (cb), data located specifically in the Rhodes Gyre are indicated in lighter colors in panels (b,d), over the study period."

I would repharse to "averaged over the entire Levantine Sea"
also better to replace "panel (a)" etc with Fig. 2A, Fig.2c,b etc

Reply: This was corrected in the revised manuscript.

L342 "a gradual, low decrease below"
you mean slow decrease?

Reply: This was corrected in the revised manuscript.

L379 "The model represents the seasonal cycle.."

The model reproduces the observed seasonal cycle?

Reply: This was corrected in the revised manuscript.

L435 "transfer of both plankton and DOC under 150 m "

below 150m

Reply: This was corrected in the revised manuscript.

L458 "for the mild winter 2023-14"

winter 2013-14

Reply: This was corrected in the revised manuscript.

L471 "concentrations in the border of the gyre (panels (a) and (c))."

gyre (Fig.S9 a, c)

Reply: This was corrected in the revised manuscript.

L473 "as soon as the water column restratified (panels (b) and (d))."
the water column is restratified (Fig.S9 b, d)

Reply: This was corrected in the revised manuscript.

L476 " For example, it was found mid February during.."

For example, the chlorophyll maximum was found in the mid February both…

Reply: This was corrected in the revised manuscript.

L536 " indicating a divergence of organic carbon from the Rhodes Gyre to the surrounding regions…"

indicating an export of organic carbon?

Reply: This was corrected in the revised manuscript.

L618 " which could be partly explained by the locations of the observations, mostly outside the Rhodes Gyre where the concentrations are slightly lower compared to the surrounding Levantine Sea in the model outputs"

a bit confusing, I would suggest to rephrase
Perhaps you mean that observations are mostly outside the Rhodes Gyre, including coastal river influenced areas, characterized by relatively higher DOC, which is not captured by the model?

Reply: In the revised manuscript, we modified this sentence:

"These results are in agreement with what was reported in previous observational studies in the Levantine Sea (Krom et al., 2005; Santinelli et al., 2010; Pujo-Pay et al., 2011; Martinez Perez et al., 2017). The surface values fall in the lower range of observations (41-100 mmol C m-3), which could be partly explained by the locations of the observations, mostly outside the Rhodes Gyre ; indeed in the model results the concentrations are slightly lower in the Rhodes Gyre compared to the surrounding Levantine basin."

L624 "in other regions of the Mediterranean, the the Ligurian and southern Adriatic seas,.."

in other areas of the Mediterranean, characterized by strong winter mixing, such as the Ligurian and southern Adriatic Seas (Avril et al., 2002; Santinelli et al., 2013)

Reply: This was corrected in the revised manuscript.

Responses to the comments of the anonymous Reviewer 2

First we would like to warmly thank the anonymous Reviewer 2 for her/his corrections and comments which helped to improve the manuscript.

I thank the authors for theirs corrections and answers. I can now recommend publication after a few minor corrections:

Figure 3 : it would be easier to refer to the figure if panels were identified (a, b, c…).

Reply: We added the panel letters on the figure and in the text, and moved the description of the comparison of modeled and observed nutrient profiles to start the sub-section with the description of Figure 3a.
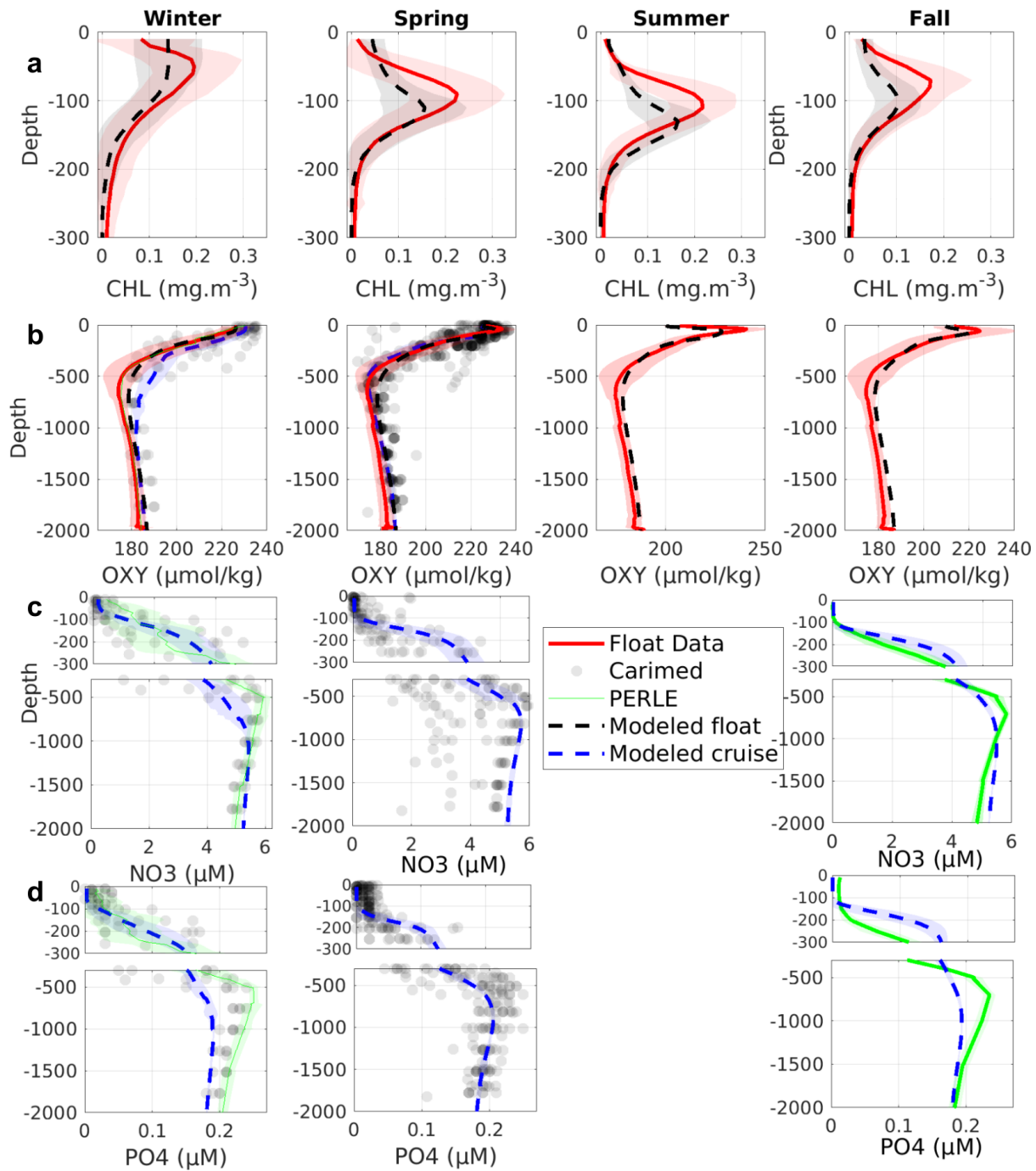
Figure 1 (Figure 3 in the article): Comparison over the Levantine Sea between observed (gray points for CARIMED, green lines for PERLE1 and PERLE2, red line for BGC-Argo float data) and modeled (blue and black lines) profiles of chlorophyll (mg Chl m⁻³), dissolved oxygen (µmol kg⁻¹), nitrate (µM) and phosphate (µM) concentrations, averaged by season (winter: 21 December to 20 March, spring: 21 March to 20 June, summer: 21 June to 20 September, fall: 21 September to 20 December). Shaded areas represent standard deviation.

Figure 4: the legends next to the colorbars are a bit small, maybe put then on top of panels a and b.

Reply: We have modified the position of the colorbar legends, and the panel letters in Figure 4a and c.
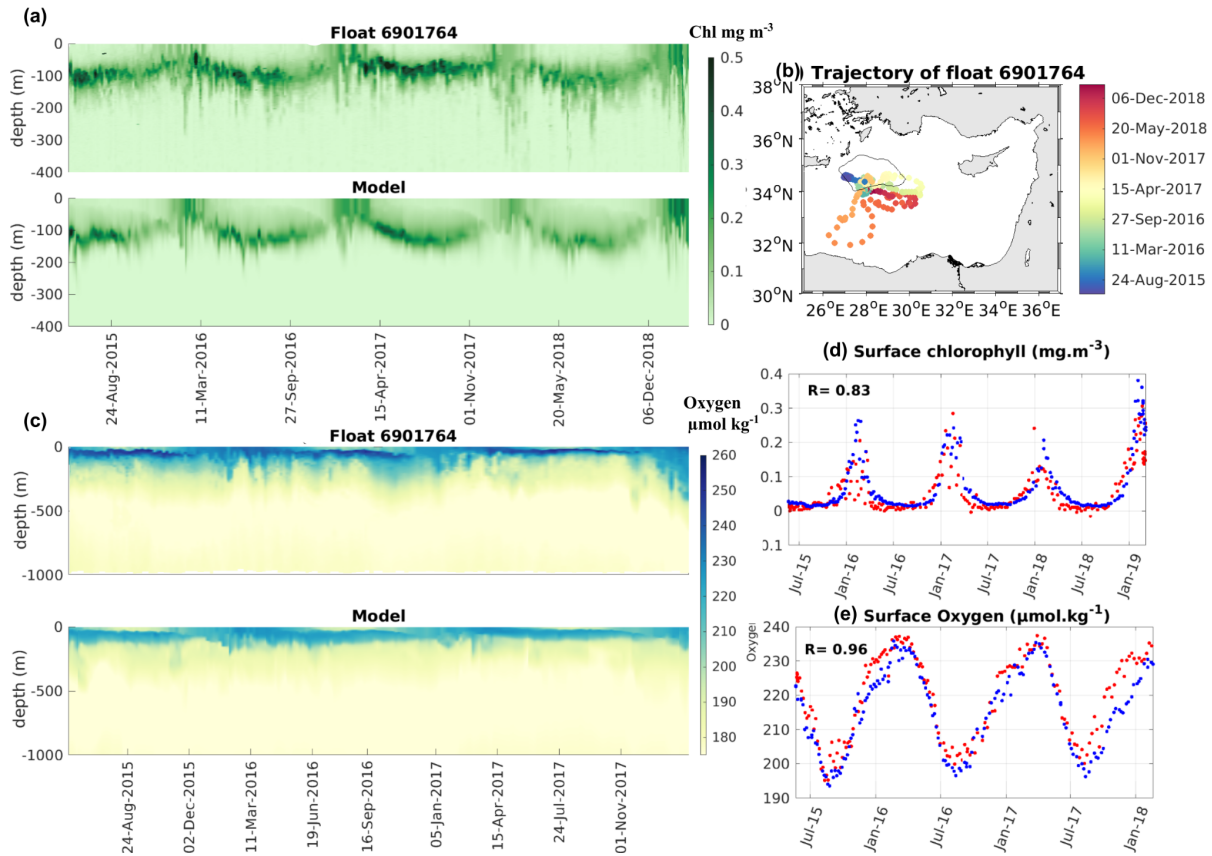
Figure 2 (Figure 4 in the article): Time evolution of BGC-Argo float 6901764 observed and modeled data: (a) Hovmöller diagrams of chlorophyll concentration (mg m⁻³), (b) trajectory of the BGC-Argo float (the black line indicates the limit of the defined Rhodes Gyre area), (c) Hovmöller diagrams of dissolved oxygen concentration (μmol kg⁻¹), (d) surface chlorophyll (mg m⁻³) in the first 10 m, (e) surface dissolved oxygen (μmol kg⁻¹) observed in the first 10 m. Red dots represent the float data and the blue dots the model outputs in (d) and (e).

Figure S7: it is unclear whether this is modeled or observation results.

Reply: We specified this is modeled results in the caption of the figure in the revised manuscript.

Line 423 : 2013-14

Reply: This was corrected in the revised manuscript.

Discussion, line 565: Please provide the values found by Moutin and Raimbault.

Reply: The value of the POC export found by Moutin and Raimbault (2002) was added in the revised manuscript.

"Only Moutin and Raimbault (2002) reported an estimate of POC export for the Rhodes Gyre, but limited to the period May-June 1996. The value of 7.5 ± 0.9 g C m^{-2} year^{-1} is twice our mean value for the same months."