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Title: "Pelagic primary production in the coastal Mediterranean Sea: variability, trends and contribution to basin scale budgets" by Paula Maria Salgado-Hernanz et al. 2021.

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Response to Interactive Discussion Referee #2. 1strevision (16-02-2021):

Dear referee, we would like to thank you the interest you have shown in our study and we appreciate the point you made about the importance of studying coastal areas. We thank you for consider our manuscript as suitable for publication in Biogeosciences with minor changes. We then proceed to reply to your comments:

Response to supplement minor comments from Referee #2:

#2.1: PG 2 Line 41 missing full stop: 2007). The productivity.

Corrected.

#2.2: PG 5 line 125 I would rephrase "*Note that neither Chl , a^* and ϕ are made variable with time.*" With "*Note that Chl , a^* and ϕ are considered time independent parameters.*"

It has been changed accordingly. We appreciate the reviewer's suggestion.

#2.3: PG 5 In Equation 4, in order to compute light attenuation is it necessary to consider the normalization on cosines to account for Solar Declination?

The χ factor and the exponent "e" were derived from a large dataset of in situ measurements taken over a range of solar zenith angle. As such, the sun zenith angle is not explicitly considered in this formalism, yet it is taken into account on average.

#2.4: PG 5 lines 148,149 the empirical formula, Morel (1991) and Morel et al. (1996), are valid also for coastal waters, the modelled primary production corresponds to Gross Primary Production or Net Primary Production?

This is Net Primary Production (NPP).

#2.5: PG 6 lines 156,159 The studies by Laws 2000,2011 to derive *ef*-ratio are calibrated on open ocean conditions, could Authors comments on the applicability of such empirical relations in the coastal areas?

The temperature dependent *ef*-ratio is certainly an empirical approximation and a global algorithm that may present local biases. According to Laws et al, It provides a good approximation to experiments of N-15 labeled uptake, explaining 87% of the variance in the observed ratios. As shown in the original paper (Laws et al., 2000), values from highly different systems were

considered in this relationship. As pointed out by the reviewer, most of these regions were oceanic, but also included coastal upwelling areas such as Peru. Even though the algorithm is a coarse generalization of the relationship between total production, export production, and environmental variables (T) that may not be particular systems like river discharge regions we believe it yields reasonable results in the Mediterranean and provides a good approximation of export production.

#2. 6: PG 6 lines 169,170 “We report annual PP estimates (Gt C) for the entire Mediterranean coastal areas (ΣPP_{coast}) and separately for the Western, Eastern and Adriatic basins (ΣPP_{basin}).” Here Authors mean Western and Eastern coastal basins or open ocean Basins?

We refer to the coastal basins. It has been now specified in the manuscript.

#2. 7: PG 7 Table 1: The total values of PP for the Mediterranean Sea are obtained combining literature data for the open ocean water summed to the coastal estimates derived in this manuscript? Please explain.

Our coastal values are added to open ocean estimations to estimate total basin PP.

#2. 8: PG11: Does Figure 3 show surface PP values or vertically averaged values or they coincide because chlorophyll vertical distribution is constant?

Figure 3 shows the vertically average PP values registered in the water column. PP_{VOL} is simply the integrated PP divided by whichever is shallower of the bottom depth or the productive layer.

#2. 9: PG12 Figure 4 In the caption I would specify “whole Mediterranean coast, b) western coast basin, c) eastern coast basin” otherwise it can be confusing.

Thank you for the suggestion. We decided to specify “whole Mediterranean Sea” in the figure caption. Now it reads ‘Figure 4: PP variability and trends for coastal waters in a) the whole Mediterranean Sea, b) western basin, c) eastern basin and d) the Adriatic coast.’

#2. 10: PG 13 lines 315,316 “A significant negative correlation was observed between coastal ΣPP and SST ($r=-0.63$, $p< 0.001$; Fig. 6a) showing that the important decrease of Chl over the years was able to compensate the effect of temperature increase.” Could authors elaborate a bit more the expected correlation between ΣPP , SST and Chl and the corresponding compensation?

We agree this was confusing. The sentence has been rephrased to “A significant negative correlation was observed between coastal ΣPP and SST ($r=-0.63$, $p< 0.001$; Fig. 6a) revealing a decrease in phytoplankton biomass as the sea warms up”.

#2. 11: PG 14 Figure 6: It would be nice to see also the chlorophyll trend and how it correlates with SST, NAO and MOI.

The figure with Chl provides similar results to the one provided with PP. This relationship has now been included in Supp. Figure 3.

#2.12: Pg 18 lines 391-392 *“Indeed, Case-1 waters are largely predominant in the coastal Mediterranean regions whereas Case-2 waters are reduced to less than 5% of the whole basin.”* The 5% is related to the coastal basin or to the total Basin? It would be important to report the Case-2 water fraction of the coastal basin to evaluate the relative importance.

It refers to the whole basin. In order to clarify this point, the text now reads *‘This constitutes some 23% of the coastal waters with prevalence in the north Adriatic Sea, Gulf of Gabes and around Nile delta’*.

#2.13: Pg 20 Lines 439,441 *“While negative tendencies seem to fit with the assumed model of PP limitation associated with increasing temperatures, the origin of the positive trend in the Adriatic basin is more uncertain”*. Also chlorophyll exhibits a reduction starting from 2012 and being an independent variable it could be the responsible, or a concurring responsible, for such trend.

We appreciate your contribution. We add now it in the manuscript as a plausible explanation.

#2.14: Pg 22 line 511. *“Our data does not display a general relationship between shelf width (Q) and PPannual”* from this sentence it seems that Q is the symbol to indicate shelf width instead in figure 9 Q refers to river discharge.

We agree. This error has been corrected. Figure caption now reads *“Our data does not display a general relationship between shelf width (Q) and PPannual (Table 4 and Fig. 9)”*.

#2.15: Pg 22 Figure 9. The bubble are a bit superimposed and it is not easy to understand what’s going on especially near the origin axis. Would it be possible to use a color bar with fixed size bubbles to reduce overlapping, use a log scale for x and y axis, or to arrange the plot to increase readability.

Figure 9 has been changes following reviewer’s suggestion.