

Interactive comment on “Drivers and impact of the seasonal variability of the organic carbon offshore transport in the Canary Upwelling System” by Giulia Bonino, Elisa Lovecchio, et al.

Anonymous Referee #1

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GENERAL STATEMENT

This paper presents a comprehensive modeling study to test the seasonal variability of the offshore transport of particulate organic carbon (POC) in the Canary Current EBUE from 17° to 32°N. It is based on a coupled hydrodynamic + biogeochemical model that has been developed and previously used by the same research group to respond other pertinent scientific questions about this EBUE (Lovecchio et al. 2017; 2018). The results of the modeling exercise confirm that seasonal differences are significant and dependent on latitude. The authors also explore the physical and biological drivers of this variability. Overall, it is a well-written, suitable contribution to the understanding of

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part of the Canary Current EBUE and it is very appropriate for Biogeosciences.

I would not say that the paper is filling the gap of knowledge about the seasonality of the offshore transport of POC (line 5 of the manuscript). It would be more reasonable to say that this modeling exercise have identified that seasonality appears to be significant. This wording would make much happier the many observational oceanographers that would be interested in this work.

It is the author's choice to focus their study on part of the Canary Current EBUE, but it is important to define appropriately this EBUE, which extends from 43°N to 10°N and, therefore, includes also the Atlantic coast of the Iberian Peninsula. Although the model domain does include neither the Iberian coast nor the Strait of Gibraltar, when defining the Canary Current EBUE they should be included (line 37).

Although the authors refer to offshore transport of organic carbon (Corg), they clearly state that only particulate organic carbon (POC) is simulated. It is well-known from previous observational works in the area that the dissolved organic carbon excess in surface coastal waters compared to deep upwelled waters (ΔDOC) represents from 65 to 95% of the total organic carbon export ($\text{Corg} = \Delta\text{DOC} + \text{POC}$) by upwelling filaments (Muñoz-García et al. 2004; 2005; Álvarez-Salgado et al., *Limnology & Oceanography*, 2007; Santana-Falcón et al., 2016). Note that it is not DOC but ΔDOC , i.e. after subtracting the refractory fraction of DOC. Therefore ΔDOC would represent the labile DOC pool. According to those papers, if the model run here considers only the POC pool, it would underestimate the lateral transport of Corg from 3 to 20 times. But, if the POC export fluxes obtained here are multiplied by 3 to 20, then the Corg export would surpass the NCP, which would be inconsistent. At the end of the manuscript, in the section devoted to model limitations the authors state that the small (slow-sinking) POC pool can potentially compensate the lack of a DOC pool (lines 439-441) and refer to their previous papers (Lovecchio et al., 2017; 2018) for a discussion about the quantification of lateral fluxes of Corg in the absence of the DOC pool. However, I think that this point is sufficiently important to be discussed in this manuscript.

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Furthermore, the issue about how good is the small POC pool mimicking the labile DOC pool should be introduced earlier instead of just stating that “no DOC pool is included in the model” (line 100-101). In this regard, the recent work by Santana-Falcon et al. (*Progress in Oceanography*, 2020) is relevant for this discussion as they used a coupled physical+biogeochemical model that includes a DOC pool.

SPECIFIC COMMENTS

Line 10. I would say “the interaction of the Cape Blanc filament with the Cape Vert front”.

Line 30. Longer time scales associated to global warming should also be considered.

Line 34 (and also in Line 458). Frischknecht et al. 20??.

Line 98. Please, indicate integration depth here.

Line 101. See general comments above.

Lines 196. Add “eddy” after “mesoscale”.

Line 400. Comparison with the recent modeling study by Santana-Falcón et al. (2020) should be included here.

Lines 433-442. As indicated above, the issue of the contribution of deltaDOC to lateral Corg export is very relevant for the manuscript, should be introduced earlier and discussed in more detail. Note also that although deltaDOC is a small fraction of the total DOC it represents from 3 to 20 times the concentration of POC. Furthermore, it is also likely that the deltaDOC transported offshore accumulates in the adjacent oligotrophic gyre because of nutrient limitation to heterotrophic activity rather than the refractory nature of these materials (e.g. Hansell et al., 2009).

Figures 2 and 3 are somewhat redundant. I would erase Figure 2.

Figure 4. Please, add the non-mesoscale flux contribution too.

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Figure 10. Change “NCO” by “NCP” in caption.

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