Referee nr.2 Takeyoshi Nagai

We thank Dr Takeyoshi Nagai (Referee nr.2) for the time spent on reviewing our manuscript and for their useful input and corrections. Following the Referee's comments, we have better clarified our conclusions, stating the processes that drive the latitudinal variations in the seasonality of the offshore flux in the Canary Upwelling System. We have also added a short explanation of the negative contribution of filaments in the text. Further, we have gone through the suggested list of typing errors and corrected them, and have scanned the entire manuscript again in order to spot and amend any additional typo.

We include our detailed answers to their main and specific comments below. We copied in blue the Referee's comments, and included our answers in black. Changes to the manuscript text are highlighted in italics

Answers to the main comments

MC1) Although the authors mentioned several reasons of the less seasonality in the central sub region, such as the convergence of CC and CUC, and the Cape Blanc filament, the dominant mechanism of this is not clearly written in the conclusion and abstract in the manuscript. I think that the novel finding of this paper is the seasonality variation along the latitude. Therefore, it is important to convey the concise and clear statement for the mechanism, which drives the seasonality variations both in the abstract and the conclusion.

We appreciate this comment which allowed us to revise and improve our Conclusions. In order to clarify the drivers of the latitudinal and seasonal variations of the Corg offshore flux, our new conclusions read as follows:

The CanUS is characterized by the most intense seasonal fluctuations in physical and biogeochemical fluxes among all EBUS (Chavez and Messié, 2009) and by an offshore transport of Corg that determines Corg availability in the adjacent open waters. Upwelling processes, driven by the surface alongshore winds, play a crucial role in determining the seasonal variations and latitudinal changes of the nearshore Corg fluxes.

Our results show that, in the CanUS, small scale upwelling filaments dominate the total flux at 100 km from the coast in each season and at all latitudes, and are therefore responsible for the seasonal fluctuations of the Corg offshore flux in the nearshore. A combination of eddy and non-mesoscale lateral fluxes extends the Corg transport farther away from the coast. The eddy flux, driven by cyclones, has a maximum offshore extension in spring and summer and maximum relative contribution in winter during moderate upwelling. In the northern subregion, eddies contribute up to 40 % to the total flux offshore of 500km. Anticyclones contribute significantly to the Corg transport only in the nearshore 100 km of the central CanUS in spring, i.e. when the upwelling is maximum south of Cape Blanc. Additional seasonal variability in the alongshore displacement of Corg depicts a dynamic and fully 3D biological pump.

Our results also highlight that temporal variations in nearshore processes such as upwelling, production and coastal circulation determine analogous temporal variations in the magnitude and spatial extension of the Corg offshore flux, which is an essential component of the coastal-open ocean biological coupling. In the northern CanUS, the total upwelling shows strong seasonal variability, peaking in summer due to the coastal upwelling. In the central CanUS, the total upwelling shows moderate seasonal variability, peaking in summer and spring due to a combination of coastal upwelling and Ekman pumping. This is reflected in the seasonality of the Corg offshore flux, which in turn contributes to modulate the seasonal changes in the trophic state of the open waters at several hundreds of kilometers off the north-western African coast, albeit with some temporal delay. This delay is shorter than a season only in the nearshore range covered by the intense filament transport. As the dominant scales of temporal variability differ for different EBUS (Chavez and Messié, 2009; Frischknecht et al., 2018), further studies are needed to investigate the repercussions for the open ocean biological activity in regions others than the CanUS.

Answers to specific comments

SC1) L12 "every season season" Remove one of "season"s.

Thank you very much, we have corrected this typo.

SC2) L34 "Frischknecht et al." Publication year is missing.

We have included the publication year.

SC3) L55 "N)," Remove a parenthesis. L107 "17âU ˛eN to 24.5â ˚ U ˛eN]" Remove "]". ˚

Thank you, we have removed it.

SC4) L108 "This correspond to" should be "This corresponds to"

We have corrected it.

SC5) L199 "In every season the filament flux is dominated by a negative (and therefore offshore-directed) Corg flux, with only a minor contribution to the onshore Corg recirculation." Why is the filament flux dominated only by offshore flux, despite that the filament has offshoreward and onshoreward currents on its northern and southern parts, respectively?

We thank the referee for this very interesting comment.
The filament flux is strongly dominated by a net offshore flux due to the asymmetry in the offshore/onshore velocities associated to, respectively, the northern/southern edges of these structures. The northern side of filaments, in fact, is typically characterized by a faster flow. This asymmetry has been previously observed and documented in several studies, such as, for example:

Álvarez-Salgado et al. 2001: https://doi.org/10.1016/S0079-6611(01)00073-8

Sánchez et al. 2008: https://doi.org/10.1029/2007JC004430

Furthermore, part of the coastal organic matter transported offshore by the filaments may sink and/or be downwelled below the euphotic layer before being recirculated onshore by the southern edge of the structure, therefore resulting in a weaker onshore flux in the first 100m of depth, which is the focus of our study.

As a consequence, at latitudes characterized by an abundant number of filaments that form along the coast, as well as in regions in which the north-south oscillation of the filament structure is remarkable, the intense offshore flux associated with the northern edge of filaments exceeds and cancels the weaker onshore recirculation.

In fact, Figure 3 of the present manuscript (subplots a,c,e,g) does show a weak onshore recirculation associated to the filaments in those regions where these structures are found at a sufficient distance from each other. One clear example is the onshore recirculation in the filament flux located about 100 km south of the Canary Archipelago. This onshore recirculation is likely generated by the southern edge of the intense Cape Juby filament, which is well spaced and separated from the following filament forming along the coast moving south. Analogously, at the northernmost edge of the analysis domain, just north of the Canary Archipelago, the southern edge of the Cape Ghir filament is also characterized by onshore recirculation of Corg.
At southern latitudes, instead, where filaments form densely along the coast, this weak positive signature in the offshore flux gets averaged out.

In order to clarify this point, we have added the following sentence to subsection 4.2:

"This is due to the faster offshore flow that characterizes the northern edge of a filament compared to the southern onshore filament transport (Álvarez-Salgado et al., 2001; Sánchez et al., 2008), combined with the fact that a portion of the Corg transported offshore may be exported below the euphotic layer before being recirculated onshore."

SC6) L247 "In Winter and spring. . ." Uncapitalize "W".

Thank you, we have corrected it.

SC7) L306 "offhore" should be "offshore".

Idem.

SC8) L339 "and Total upwelling" "T" should be lowercase.

Idem.

SC9) L340 "the ratio between offshore transport at 100 km offshore and NCP in the first 100 km from the coast is higher in the CSR in all seasons" Is it the ratio of offshore transport at 100 km offshore to NCP in the first 100 km from the coast, or the other way around?

We have rephrased the above sentence in: *"the ratio of offshore transport at 100 km offshore to NCP in the first 100 km from the coast is higher in the CSR in all seasons"*

SC10) L342 ". . .results more pronounced along. . ." Pronounced effects?

We have rephrased this sentence as:
"However, the seasonal variation of the upwelling processes is more pronounced in the NRS"

SC11) L342 "NRS" Is it "NSR"?

We have checked. Yes, it is NSR.

SC12) L345 A comma is needed after "In the NSR".

Thank you, we have added it.

SC13) Fig. 11 caption "m3s-1" Numbers should be uppercase.

We have corrected the caption.

SC14) L355 "Even thought" should be "Even though". "NCP flux". Is it flux or production rate?

We have corrected it.

SC15) L359 "still strong in winter (0.22 Sv)" It's better to refer Fig. 10.

Thank you, we referred the statement to Figure 10b.

SC16) L380 "model is agrees" should be "model agrees".

We have corrected it.

SC17) L386 "HAGEN, 2001" is all capital. Is it okay?

We have corrected it.

SC18) L406 "CanCS" This appears here at the first time in the paper without any definition.

Thank you, we have changed it to CanUS coherently with the rest of the manuscript.

SC19) L414 "in the annual mean the CanUS" Remove "the" in front of CanUS.

We have corrected it.

SC20) L416 "This excess heterotrophy is fueled by the lateral redistribution of Corg in the offshore and alongshore directions combined with the shoaling of the mixed layer depth in the warm seasons, . . ." Before this sentence, the authors mentioned the effects of deepening of the mixed layer, not shoaling. Do you mean that the shoaling of the mixed layer prevents the Corg from being diffused up?

What we meant here is that the excess heterotrophy observed in the warm seasons offshore is likely driven by a combination of two factors: 1. the Corg redistribution from the coast to the euphotic layer of the open waters that provides extra Corg for remineralization; 2. a lower nutrient input into the open ocean euphotic layer due to a stratified water column, the latter resulting in low primary production.
As a consequence of the low nutrient availability (stratification) and high Corg availability (lateral input) the warm seasons are the most likely to develop a net heterotrophy in the near-surface open waters.

We have rephrased the mentioned sentence as follows:
"This excess heterotrophy is fueled by the lateral redistribution of Corg in the offshore and alongshore directions combined with lower offshore productivity driven by the shoaling of the mixed layer depth in the warm seasons..."

SC21) L441 "We refer the reader to (Lovecchio et al., 2017, 2018) for a discussion. . ." should be "We refer the reader to Lovecchio et al., (2017, 2018) for a discussion".

We have corrected this typo.

SC22) L457 "This delay is smaller than a season only in the nearshore range covered by the intense filament transport." Do you mean that "This delay is typically shorter than one season only in the nearshore range covered by the intense filament transport."?
Thank you, we have substituted "smaller" with "shorter".