Answer to Referee #1

We thank Referee #1 for the time spent on reviewing our manuscript and for his/her thoughtful comments on the pattern of the carbon fluxes and on the eddy influence on the organic carbon anomalies and fluxes, which have helped us to improve our manuscript. In order to address these comments, we have carried out further analysis with the aim to clarify some questions. We include below our detailed answers to the three major concerns raised by the Referee and to all the specific comments and describe the proposed changes to the manuscript.

Answers to Major comments

MC1) Pattern of the meridional and vertical organic carbon fluxes

"One of these issues is that the mean vertical carbon flux presented in Figure 6c and 8c. There seems to be clear contrast between northern and southern regions separated at C. Blanc in plan view of the vertical carbon flux, which looks somewhat similar to the distribution of the mean meridional flux in Figure 6b. Also, in the vertical section, there is an upward flux at 60-70 m depths, right under and above the downward carbon fluxes. I'm puzzled by these mean vertical and meridional carbon flux distributions, and consider that this needs to be clarified."

Answer to MC1

As stated by Referee #1 the pattern of the mean meridional and vertical organic carbon fluxes (Figure 6 of the manuscript) differs strongly between the regions north and south of the Cape Verde front, according to the subregional differences in the circulation of the Canary Upwelling System, which include a large-scale anticyclonic circulation north of the front and a cyclonic circulation to the south (Arístegui et al. 2009; Pelegrí and Benazzouz, 2015; Pelegrí and Peña-Izquierdo 2015). The mean signature of the wind stress curl (negative north of the front, positive south of the front) also induces a change of sign in the mean vertical fluxes at the front, as in Figure 6c (see also Lovecchio et al. 2017, Figure 11, and the in-depth discussion of the subregional differences in the C_{org} fluxes). In the present paper, we quickly refer to these differences in our introduction (page 3, lines 9-13). In order to clarify the drivers of the mean flux pattern, we will modify the first sentence of section 4.2 as follows:

"The Reynolds decomposition of the advective fluxes of C_{org} in the top 100 m shows that the time-mean fluxes (Figure 6a-c) clearly agree with the known pattern of regional circulation and wind stress curl characterizing the CanUS (Arístegui et al. 2009, Pelegrí and Peña-Izquierdo 2015, Lovecchio et al. 2017). While these mean fluxes dominate the total fluxes (see also: Lovecchio et al. (2017), Figure 11, Total organic carbon fluxes), the turbulent fluxes contribute substantially to the total fluxes and to the lateral and vertical contributions to the flux divergence (Figure 6d-f)."

Also the alongshore average section of the vertical advective flux (Figure 8c of the manuscript) reflects the subregional differences described above, showing a composition of positive (southern CanUS) and negative (northern CanUS) mean vertical advective fluxes of organic carbon. We refer to this in page 16, line 5-6 of the manuscript, as: "The different signature of the wind stress curl and consequent Ekman pumping offshore in the northern and southern CanUS results, on average in the CanUS, in a mixed signature of the vertical transport in the open waters.". In order to better illustrate these differences we include in the present document the profile of the vertical advective flux calculated separately for the northern, central and southern CanUS (Figure 1). Furthermore we propose to modify the sentence mentioned above to:

"Offshore, the different sign of the wind stress curl (negative and positive, respectively) that characterizes the latitudes located north and south of the Cape Verde front results in an opposite sign of the time-mean vertical flux of organic carbon in the two zonal bands. These opposite fluxes, once averaged along the entire CanUS, give rise to an alternate pattern of positive and negative signatures in the profile of the mean vertical transport in the open waters."

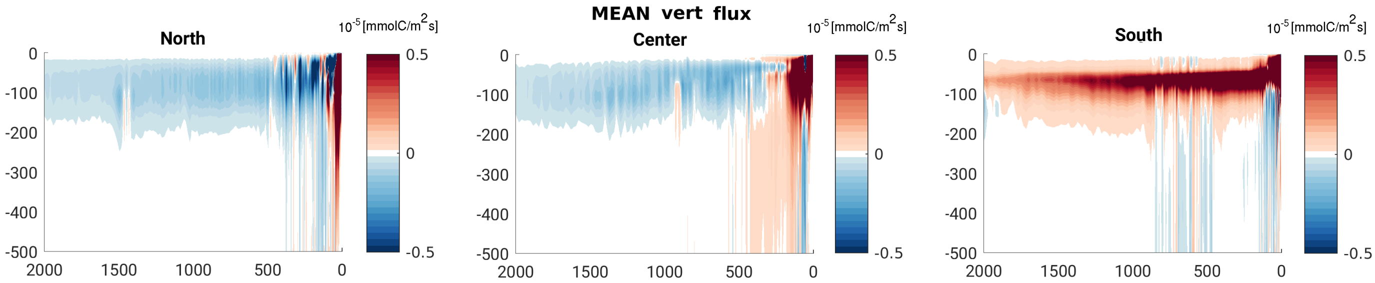

Figure 1: *Alongshore average sections of the vertical advective fluxes of organic carbon for the three CanUS subregions, as defined in the manuscript. The change of signature in the vertical flux offshore is in agreement with the change of sign of the wind stress curl in correspondence of the Cape Verde front.*

MC2) Analysis and discussion of the results of Reynolds decomposition and covariance

"In some part, although the authors tried to explain the resultant interesting patterns obtained by the Reynolds decomposition and structure based extraction of eddy and filament contributions, they are often stated without sufficient evidence and would make readers feel that they are rather speculative. For example, the high covariance between anticyclonic eddies and carbon anomaly in northern offshore, is explained by the upwelling induced by the anticyclonic eddy spin down, without any analysis."

Answer to MC2

In order to address this comment we decided to make some changes in the Results section, keeping in mind also the suggestion of Referee #2 to shorten the manuscript where possible. We therefore propose the following changes to the manuscript:

- We agree with Referee #1 that there isn't enough evidence supporting the upwelling in ACE in the final stages of their life in the proximity of the Canary Archipelago (discussion of Figure 9). Animations of the model output suggest that this positive C_{org} anomaly in ACE is rather associated with the extremely sharp offshore gradient in the average C_{org} concentrations at these latitudes. This gradient, resulting in very low C_{org} concentrations in the open waters, makes it possible for ACE formed near the coast to still contain on average more carbon than the open waters. Moreover, some of the ACE that cross these latitudes interact with filaments generated south of the Archipelago, which are particularly rich in C_{org} due to the north-south positive gradient in the tracer concentrations. We therefore plan to revise the discussion of Figure 9 according to this analysis. We propose to change the paragraph on page 17, lines 1-9 as follows:

"Local deviations from the widespread negative correlation of SSH' and C_{org}' may also be explained in terms of eddy anomalies. The positive C_{org}' for ACE seen in the nearshore southern CanUS is likely a consequence of the northward flowing Mauritanian Current, which favors the trapping of carbon-rich coastal waters in ACE at the time of their formation. However, this signature is not far reaching. The signature of C_{org}' within eddies at the northern CanUS boundary is connected to the presence of incoming large eddies formed in the Azores current (Gaube et al., 2014, Figure 1), leading to ACE with positive C_{org}' and CE with negative C_{org}'. Also in the offshore waters of the northern CanUS, ACE have a positive C_{org}' signature. Animations of the model output suggest that this is possibly due to the sharp offshore gradient in C_{org} at these latitudes, where coastally generated ACE still have a positive impact on the organic carbon budget of the carbon depleted open waters."

- To further reduce the speculative elements in the discussion of our results, we propose also to shorten section 4.4, limiting it to the discussion to the contribution of mesoscale activity to the organic carbon stock, while moving Figure 12 to the Appendix. This change to the manuscript is also listed in the answer to the general comment of Referee #2. The discussion of the nutrients

concentrations and production in the eddies (page 20, lines 1-14) will be limited to the following sentence:
"Moreover, the two types of eddies are characterized by a strong asymmetry in the nutrient concentrations and in the production rates (see also Appendix: and Figure B7), which likely are exacerbating the differences in C_{org} between long living CE and ACE. The combination of relevant differences in both organic carbon availability and typical velocities of the three types of mesoscale structures determine the magnitude of their relative contribution to the total C_{org} fluxes. "

MC3) Manuscript structure: merging Summary and Synthesis with Conclusions
"To be concise, section 6 and 7 could be combined into one section."

Answer to MC3
We plan to merge the two sections "Summary and synthesis" and "Conclusions" into a single "Conclusions" section (complying with the Biogeosciences "Manuscript preparation" guidelines). We will shorten the portion of text belonging to the current "Summary and synthesis" as follows, while leaving the final conclusions part largely unchanged:
"Our Reynolds flux decomposition shows that the turbulent component of the zonal flux of C_{org} out of the coastal CanUS contributes, on average, from 5 % to above 30 % to the total zonal transport and 30 % to the total zonal flux divergence, extending out to 2000 km from the coast. The turbulent zonal transport is mostly confined to the first 100 m of depth, but it shows a subsurface intensification, owing to a strong turbulent vertical downwelling. The contribution of the turbulent zonal flux to the total flux and to its divergence is particularly important in the northern and southern CanUS, while in the central CanUS its contribution pales in comparison to the already intense mean offshore transport. With the use of eddy and filaments masks we separate the contribution of mesoscale eddies and filaments to the availability and transport of C_{org}. Filaments are characterized by inner flow velocities that reach up to 0.5 m s^{-1} and contain most of the total C_{org} up to 200 km from the coast, but their C_{org} share declines quickly offshore. Eddies, on the contrary, drift with speed of a few cm s^{-1} but see a sharp increase of their C_{org} content in the first 200 km from the coast and contain beyond this distance about 30 % of the total available C_{org}, two thirds of which is found in CE. Thanks to their high advective speeds, large C_{org} concentration and semi-permanent character, filaments dominate the nearshore zonal transport accounting for nearly 80 % of the total flux at 100 km offshore. The filament transport captures a large part of the mean Reynolds offshore transport near the coast, while vertically it is responsible for a strong turbulent vertical downwelling. The divergence of the filament offshore transport adds the majority of the extra C_{org} to the first few hundreds km offshore, but the divergence drops off quickly, reaching zero at 1000 km. The eddy lateral transport, on the contrary, resembles in pattern and intensity the turbulent Reynolds offshore flux and accounts for about 20 % of the total zonal flux and total flux divergence. Eddies, which move slowly but contain about 30% of the C_{org} available offshore, add C_{org} to the offshore waters up to 2000 km from the coast; in particular CE are responsible for most of the offshore transport largely because of their elevated C_{org} concentration and longer lifetimes."

Answers to specific comments

P2L13 *"Coastal filaments are narrow (<50 km wide) structures that extend from the coast to several hundred kilometers into the open sea with rather large velocities (between 0.25 and 0.5 m s^{-1}) " Is this velocity in "with rather large velocities (between 0.25 and 0.5 m s^{-1})", propagation speed or current velocity?*
Answer: This velocity refers to the current velocity found inside of the developed filaments. We clarified this modifying the sentence as follows: "Coastal filaments are narrow (<50 km wide)

structures that extend from the coast to several hundred kilometers into the open sea and are characterized, in their interior, by rather large flow velocities (between 0.25 and 0.5 m s^{-1})."

P2L15 *"Offshore transport by filaments is typically accompanied by intense subduction, due to the high density of the cold upwelled waters" The subduction is intense in the cold filaments because frontogenesis at a cold filament generate two cell ageostrophic cross-frontal circulations, which work together to restratify the two fronts at the edge of the filament, and to narrow the width of the filament, producing the strong downwelling in the filament. This sentence seems not accurate, and I suggest that it should be modified with a reference of McWilliams et al. 2009, Cold filamentary intensification and oceanic surface convergence lines".*
Answer: We agree that this sentence is not clear. We will modify it to read as follows:
"Transport by filaments is typically accompanied by a deepening of the tracer fluxes in the offshore direction, due to the higher density of the upwelled water (Cravo et al., 2010). It is also associated with intense downwelling by the generation of ageostrophic cross-frontal circulation at the edges of the filament (McWilliams et al. 2009, Nagai et al. 2015)."

P2L26 *"These non-linear structures propagate with velocities of a few centimeters per hour, about one order of magnitude slower than the filaments . . ." "a few centimeters per hour" is 10 µms-1, and should be too slow for the mesoscale eddy propagation speed.*
Answer: Thank you. We corrected this typo with "a few centimeters per second"

P4L17 *"CanUS also showed that eddies tend to reduce coastal production through the lateral export of the upwelled nutrients " I think that the reduction is caused by both lateral and vertical nutrient transport.*
Answer: Thank you, we will modify the sentence as follows:
"...CanUS also showed that eddies tend to reduce coastal production through the lateral export and subduction of the upwelled nutrients"

P5L8 *"$F = \overline{F} + F'$, were " Typo. "were" should be "where".*
Answer: Thank you, we will correct this typo.

P6L4 *"The last term $r = \langle u' \overline{C}_{org} \rangle + \langle \overline{u}\, C_{org}' \rangle$ term represents the sum of the residuals which we verified to be small, at least one order of magnitude or more smaller than the other terms" The original rule of the Reynolds decomposition is that the mean of the fluctuation is zero, and the mean of the mean is the same mean, but the authors'choice allows non-zero values for the former, as we as difference between the mean and the mean of the mean.*
Is there any difference between the results using the original method, in which monthly average has just one value at each grid point for each month, and that with the authors' method? If the difference is about 10%, which is the order of magnitude of r, then which method is better?
Answer: As Referee #1 states, our choice of the reference mean (climatological monthly means interpolated to 2-day steps) results in non-zero residuals in the long-term average fluxes obtained from the Reynolds decomposition. The Referee asks what would happen with the use of simple non-interpolated monthly averages, therefore an average that has a constant value for each month. As far as there is a time varying component in the reference mean (interpolated in time or not), the residuals of the decomposition will not be zero, as the long-term averaging of the components and the reference mean are calculated differently. The suggested non-interpolated monthly mean would give zero residuals only if we calculated the flux components separately for each month, obtaining 12 couples of plots for mean and turbulent fluxes, each with zero residuals. However, this level of detail goes beyond the purpose of the present study. Instead, the use of non-interpolated monthly means would result in large jumps in our time evolution of the turbulent deviations, with unrealistic discontinuities in the moment of transition between one month and the following one. Furthermore,

the anomalies would have, on average, minimum values in the middle of the month and large values at the beginning and at the end of each month. We therefore consider our choice of reference mean a better choice than the use of non-interpolated monthly means. As stated in the manuscript (page 6, lines 5-6) the residuals of the Reynolds decomposition obtained with our choice of reference mean are at least one order of magnitude smaller (<10%) than the smaller component between mean and turbulent fluxes in each direction of flow. In order to better document our results, we include the plots of the residual fluxes below (Figure 2).
To clarify this point, we modify the above-mentioned sentence as follows:
"The last term $r = \langle u' \overline{C}_{org} \rangle + \langle \overline{u}\, C_{org}' \rangle$ term represents the sum of the residuals which arises from the use of a time-varying reference mean and which we verified to be small, at least one order of magnitude or more smaller than the other terms"

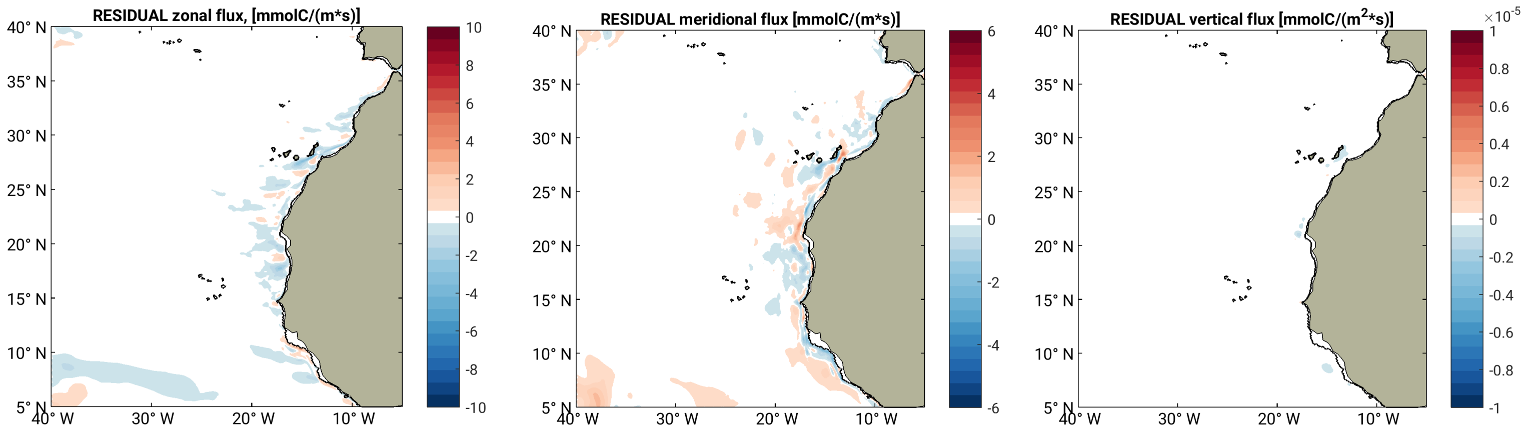

Figure 2: *Residual fluxes of the Reynolds decomposition obtained using the time variable reference mean adopted in the manuscript, plotted on the same scales as the turbulent fluxes in each direction of the flow.*

P6L20 *"First, the above reference mean SST field. . ." This definition of the filament, does not include any shape criteria, and allows the region between straight upwelling front and the coast to be detected as a filament. Is it okay?*
Answer: With the present question Referee #1 expresses two concerns regarding the filament mask: (a) the fact that the mask covers the nearshore upwelling band at most time steps, and (b) the lack of an explicit shape criteria for the filament identification. We address them separately.
(a) As stated, the filament mask often covers the nearshore upwelling band roughly corresponding to the first 50 km offshore. However, this does not affect our main results and conclusions significantly. In fact, the filament flux divergence in the nearshore is calculated taking differences between the flux at 100 km offshore (well defined filaments) and the flux at the coast (zero). In the discussion of the filament contribution to the tracer concentrations we avoid to show the filament tracer stock in the first 50 km (inserts of Figures 11, 12). We also do not refer to the nearshore fluxes (0-100 km offshore range) in our summary figure (Figure 15). For the remaining figures, we state that this potential limitation must be kept in mind (see also the discussion at p 21 lines 5-9 of the present manuscript). Operatively, it is actually difficult (if not impossible) to unequivocally identify the base of a filament, distinguishing it from the nearshore flow that feeds into the structure. Possible alternatives would be either to remove the first 50 km of the filament mask and attribute the flux to the NF-NE transport (resulting in discontinuous pattern in the fluxes), or somehow split this portion of the flux between filaments and NF-NE transport. We consider these two methods more arbitrary than attributing the nearshore flux to the filament mask, while acknowledging the limitation in the manuscript.
(b) As regard to constraining the shape of the filaments, in the course of the analysis the filament mask was evaluated on the basis of both SST and surface Chlorophyll images (see Figure B1 for an

example) with very satisfactory results and an extremely limited number of cases of overestimation of the filaments either in time or in space. Of the few cases identified, they were all confined to the southern CanUS latitudes. The coarsening of the reference-mean field before calculating the temperature anomalies and the choice of an appropriate threshold in temperature anomaly (see Methods, page 6, lines 18-25) assure in fact the identification of narrow cold structures.
In order to provide a comprehensive description of the algorithm and of its sensitivity to the parameters, we propose to add a **supplement to the manuscript**, which includes a technical description of the algorithm and of its properties, and an evaluation of the algorithm performance.

P7L21 *"representation of turbulence" should need "geostrophic" after "of". The term "turbulence" throughout the manuscript sounds not adequate as it includes the meaning of three-dimensional microscale turbulence. The scale of the "turbulence" should be specified, or replace "turbulence" by "eddy"*
Answer: We will add "geostrophic" before "turbulence".

P8L1 *"The AVISO datasets. . .". The 1/4 degree is the resolution of the grid for mapping, the actual AVISO sea surface data's resolution should be even coarser.*
Answer: Thank you for this comment, we will rephrase as follows:
"The AVISO dataset grid, in fact, has a resolution of 1/4^{o} ..."

P11L2 *"small eddies are abundant found in the. . ." This should be "small eddies are abundantly found in the. . ." or "small eddies are abundant, and found in the. . ."*
Answer: Thank you, we will correct this typo.

Figure 6c ***mean vertical flux*** *Why is the mean vertical flux directed upward in a fairly wide region in the southern part, and vice versa for the northern part? Is it vertical flux of omega flux, in which horizontal flux can contribute through the sloping grid bottom faces?*
Answer: The mean vertical flux is directed according to the regional signature of the wind stress curl, which is negative north of the Cape Verde front and positive south of the front (see also answer to MC1 for a further description of the flux pattern in the region). This results in a mean downward and upward flux respectively north and south of the front. In the nearshore the effect of the mean upwelling becomes evident, resulting in an intense upward flux in the nearshore northern and central CanUS. In the southern CanUS, where the upwelling intensity is on average weaker and the slope is especially wide (Arístegui et al. 2009), downwelling cells are also visible in the nearshore. The flux is not calculated with the omega velocity, but with the purely vertical component of the velocity. In order to further clarify this point, we propose to add in the Methods section, following the description of the Reynolds decomposition:
"The vertical flux components were calculated using the purely vertical velocity from the model output"

Figure 7e *What is the green color?*
Answer
We propose to add the following to the figure caption:
"The green area shading results from the overlapping of opposing mean and turbulent flux contributions."

P16L4 *"Switching to the vertical fluxes, the differences between the mean and turbulent flux components are even more pronounced" and Figure 8c. I'm puzzled by the mean vertical carbon flux. The bands of down-up-downwelling flux indicates the increase of carbon at 20 m and the decrease at 80 m depth on average, unless there is compensating lateral flux divergence. I don't understand how the Ekman pumping results in*

this structure.
Answer: Figure 8c shows the mean vertical component of the flux, averaged in the entire CanUS. As shown in Figure 6, the sign of the vertical component changes between northern and southern subregion. Therefore the mean plot shows a combination of downward organic carbon flux in the north and upward flux in the south. We refer to our answer to MC1 for a further explanation of the flux pattern, and for our proposed changes to the manuscript regarding this point.

P16L30 *"This signature is typical of that expected from an eddy-induced vertical displacement of the nutricline (McGillicuddy, 2016). " If this is the case, the eddy is linear Rossby waves, and not trapping to carry carbon when it propagates. I think eddy propagation speed c is a few centimeter per second, and velocity u > 0.2 m/s, so u/c>1, suggesting that eddy is nonlinear, which can hold a large volume of water inside to travel together westward, which is the dominant signal discussed in this manuscript, rather than wave induced isopycnal displacement.*
Answer: We clarify this by modifying the sentence to read: "This signature is typical of that expected from an eddy-induced vertical displacement of the nutricline which occurs in the initial stage of eddy formation and intensification, possibly followed by the trapping of the tracer anomalies (McGillicuddy, 2016)."

P17L7 *"In the offshore waters, ACE can also. . ." Is this mechanism same as the warm core eddy spin down, accompanied by weak upwelling at the center (e.g. Frictionally induced circulations and spin down of a warm core ring by Glenn R. Flierl and Richard P. Mied)? Do you have any evidence to support that this is the cause of positive C'org within ACE?*
Answer: We thank Referee #1 for highlighting this passage and we refer to the answer to MC2 for our proposed changes to the text.

P22L3 *"Between 100 km and 500 km from . . ." and Figure 15d The structure based estimate mean flux divergence between 100-500km is negative. Does it mean that the mean flux is removing the carbon from the shore? If so this makes sense, because Ekman transport from the coast should act to remove carbon from the shore. But the distance is somewhat too far from the coast. Why does it start from 100 km not 0 km? Also, in Figure 15, why does the Reynolds decomposition based mean flux divergence in 100-500 km show different results from the structure based results?*
Answer: In Figure 15d the blue area does not represent the mean flux but the non-filament-non-eddy (NF-NE) flux, which is different from a mean transport (Reynolds decomposition, Figure 15b). The two fluxes must not be confused, as they are defined differently and represent different processes. The mean Reynolds component of the flux refers to a mathematical definition of mean flux, as defined in the Methods section, which can include the contribution of recurrent structures. The NF-NE component is defined as everything which is not identified by our mesoscale structure identification masks and therefore does not include (for example) recurrent filaments. But it may include some turbulent transport which is not identified as an eddy or a filament (e.g., variable small-scale fronts offshore). For this reason, the Reynolds-decomposition-based divergence of the mean flux and the structure-identification-based NF-NE flux divergence should not be the same, but the divergence of the components must nevertheless sum to 100% of the total divergence.
The plots in Figure 15 only refer to the offshore ranges of distances from 100km to 2000 km offshore, in which the divergence of the total offshore flux is positive and therefore receive organic carbon from the nearshore (see inserts of Figure 7a and Figure 14a, and the total offshore flux results previously presented in Lovecchio et al. 2017). Therefore, these plots have the aim of attributing the enhancement of the organic carbon availability offshore to the physical drivers. In the range of 0-100km offshore, instead, the divergence of the total offshore flux is negative,

removing organic carbon from the productive nearshore. We will clarify this point modifying the caption of Figure 15 as follows:

"Comparison between the results of the turbulence-based and structure-based methods for the entire EBUS in the range of 100km to 2000 km from the coast, where the divergence of the total offshore flux is positive, therefore resulting in an increase of the organic carbon availability (see also Lovecchio et al. 2017, Figure 10 for the divergence of the total offshore flux)."

The negative divergence of the NF-NE transport is determined by the fact that the non-mesoscale flux is weak at 100 km offshore, where most of the offshore transport is carried on by the filaments, while it intensifies moving towards 500 km from the coast.

We will clarify this point adding the following passage at the end of the first paragraph of section 4.5:

"The NF-NE flux continues to intensify also in the 100 km – 500 km range, therefore resulting in a negative contribution to the offshore flux divergence."

P22L12 *". . .offshore reach due to the their. . ." remove "the".*
Answer: Thank you for pointing out this typo, we will correct it.

P22L19 *". . .mean deflection of their trajectories (Chelton et al., 2011)" The earlier study should be included "McWilliams and Flierl 1979: On the evolution of isolated, nonlinear vortices. Phys. Oceanogr., 1155–1182."*
Answer: Thank you for this suggestion, we will include this reference.

P22L28 *"In particular, ACE are responsible for the northward . . . due to their relatively fast decay that results in a slowing down of the clockwise rotation while they move offshore, these eddies induce a net northward transport of Corg" I don't understand this explanation for the net northward carbon transport by ACE. Considering the positive carbon gradient in zonal direction with clockwise stirring, the southward transport should be stronger. How is this result related to Reynolds decomposed eddy meridional flux in Figure 6e?*
Answer: The regional gradient in the organic carbon concentration is not only negative in the offshore direction (zonal gradient) but also positive southward, with a reduced zonal gradient at lower latitudes (Aristeguí 2009, Demarq and Somoue 2015). ACE rotate clockwise and stir this gradient while moving offshore. In the nearshore, where the zonal gradient dominates, it is indeed possible to see a negative signature in the meridional ACE flux (Figure B9c). Away from the nearshore, where the meridional gradient and the ACE decay become relevant, the southern edge of the eddy stirs the organic carbon northward. The relatively fast decay of ACE also determines that in each point of the domain, on average, the western edge of a nearshore (therefore on average younger and more intense) ACE stirs the gradient northward, while the eastern edge of an offshore (older) ACE stirs it southward more slowly, resulting in a net northward meridional flux. In order to clarify this point, we will modify the sentence to read:

"In particular, ACE are responsible for the northward recirculation of the C_{org} through the asymmetric stirring of the background regional gradient, which results from the combination of an offshore negative gradient (strongest in the nearshore) and a southward positive gradient in the C_{org} concentration(Aristeguí 2009, Demarq and Somoue 2015). Due to their relatively fast decay and slowing down of the clockwise rotation while they move offshore, these eddies induce a net northward transport of the tracer. In fact, on average at any location, a younger and more energetic ACE stirs the C_{org} northward, while an older and weaker ACE stirs it southward."

P22L31 *"In the vertical direction. . ." I don't understand why NE-NF vertical flux is the stronger than eddy components. Also do these vertical carbon fluxes reflect the lateral structure of the vertical flow itself or carbon distribution? For confirmation, the total mean vertical flow at 100 m depth should be presented in appendix. The mean vertical*

flow should be largest at ∼O(10-5 ms-1) along the coast with the internal Rossby radius as the lateral width, which is very narrow compared to the model domain.
Answer: We thank Referee #1 for raising this interesting question, which points in the direction of our most recent analysis of the physical fluxes inside of the eddies, currently in development for a further dedicated publication. In order to address this question we therefore refer to our current understanding of the mesoscale eddy vertical fluxes according to our model results. Animations of the velocities inside of the eddies at each time step show dipolar or quadrupolar patterns in the vertical fluxes of well-formed stable eddies. These patterns average to a dipole in positive and negative vertical velocities in both composite cyclones and anticyclones at 100 m, in nice agreement with high-resolution observations of the mesoscale velocities in eddies (e.g., Barcelo-Llull et al., 2017, JPO). The pattern of positive and negative vertical velocities averages nearly to zero throughout the eddy surface, therefore constituting a minor net contribution to the advective fluxes in well-developed eddies. As a consequence, the net eddy contribution to the vertical advective flux is mostly driven by the large scale forcing, and in particular by the pattern of the wind stress curl (see answer to MC1 for a detailed explanation of the vertical flux pattern in the region). Submesoscale fluxes are not explicitly resolved by our model due to the limited resolution of our grid in the offshore waters. The total vertical advective flux at 100 m is published in our previous publication on Biogeosciences "On the long range offshore transport of organic carbon from the Canary Upwelling System to the open North Atlantic", and is visible in Figure 11c.
In order to clarify this point, we decided to modify lines page according to read:
"In the vertical direction, eddies have a minor role in the C_{org} advection compared to the filaments, and their signature cannot be clearly distinguished from that of the NE-NF component. Inspection of the model output (not shown) reveals that mesoscale vertical velocities in well-developed eddies present a dipolar or quadrupolar pattern of upwelling and downwelling similar to that observed in in situ measurements (Barcelo-Llull et al., 2017), which results in a minor net contribution of these structures to the vertical flux."

P23L4 *The convergence at filament is revisited with the theory of frontogenesis by "McWilliams et al. 2009, Cold filamentary intensification and oceanic surface convergence lines"*
Answer: Thank you very much for this suggestion, we will add this reference in the manuscript.

P25L15 *"Nagai et al. (2015) showed that this subduction happens primarily at the filament tip. . ." Remove "tip" and insert "periphery of" before filament*
Answer: We will correct this sentence accordingly.