**We appreciate the suggestions and comments provided by the reviewer. We have tried to Include them in the revised version of the manuscript.**

General comments

The long time taken to complete the sampling introduces unavoidable aliases in the distribution of the variables and geostrophic velocities and this is reflected in the large errors associated with both biochemical and mass transports. The approach has been to use the annual mean estimate of the velocity variance at the reference level from GLORYS. Would it be better to use global model outputs instead that would have a higher resolution (more comparable to the resolution of the observations?).

**In the revised version of the manuscript, we have used the climatological variability obtained for the summer months obtained from 25 years of GLORYS, which is a global model reanalysis. We have not used a global prediction model because the outputs are worse than those of the reanalysis. On the other hand, global models with higher resolution are not available for our area.**

As for the validation, it would be very useful to compare the geostrophic transport estimates with the ship's ADCP data, at least for the SW and CW layers.

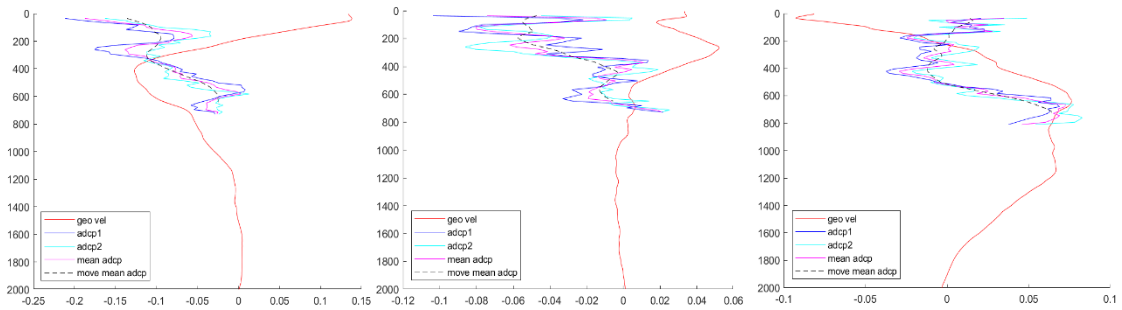


*Figure 1: Three examples of two subsequent across-section? velocity profiles from sADCP (dark and light blue lines) together with the mean between them (pink line) and the moving mean of this last mean (dashed black line). The geostrophic profiles obtained with the density field in the middle position between two sADCP profiles are shown for comparison.*

**An attempt was made to perform this validation. The velocity profiles obtained from the in situ density field and those measured by the sADCP had uneven shapes in many stations (Figure 1 of this document), so it was not feasible to reference the reference level geostrophic velocity to the sADCP samplings, as suggested by the reviewer. In addition, we believe that the sADCP was not correctly calibrated prior to sampling, so they have not been used in this work.**

I would consider moving figures A8 and A13 earlier in the results section to provide a seasonal context to the observations. I would also welcome a brief description of the conditions in 2017 with respect to the other years to put the values into a wider context (maybe this can be done in the discussion instead).

**We appreciate the suggestion; we have modified the discussion section according to this comment.**

I am curious to see the impact of using DIVA vs a standard krigging interpolation scheme. Would it be possible to include an example in the supplementary materials section? Do you think this would have an impact on the transport estimates?

**Performing the comparison suggested by the reviewer is likely beyond the goal of this manuscript. We have now added references to specific works where those comparisons are performed (Barth et al., 2010; Troupin et al., 2012; Beckers et al., 2014). The interpolations are made with DIVA because it is an objective mapping which computes and gives us the error made in all the interpolations. In this way the precision of the method is checked. In the updated text, it is pointed out that the interpolations with an error greater than 10% are not considered in the subsequent analysis.**


*__Barth, A., Alvera-Azcárate, A., Troupin, C., Ouberdous, M., & Beckers, J. M. (2010). A web interface for griding arbitrarily distributed in situ data based on Data-Interpolating Variational Analysis (DIVA). Advances in Geosciences, 28, 29-37.__

***Troupin, C., Barth, A., Sirjacobs, D., Ouberdous, M., Brankart, J. M., Brasseur, P., ... & Beckers, J. M. (2012). Generation of analysis and consistent error fields using the Data Interpolating Variational Analysis (DIVA). Ocean Modelling, 52, 90-101.**

***Beckers, J. M., Barth, A., Troupin, C., & Alvera-Azcárate, A. (2014). Approximate and efficient methods to assess error fields in spatial gridding with data interpolating variational analysis (DIVA). Journal of Atmospheric and Oceanic Technology, 31(2), 515-530.**


**The interpolation results have been verified with the mass transports. Figure 2 of this document shows the differences between estimating the accumulated mass transport using only the CTD stations (along the transects N, W and S) or also including the reconstructed stations with interpolated salinity data and in-situ temperature from XBTs.**

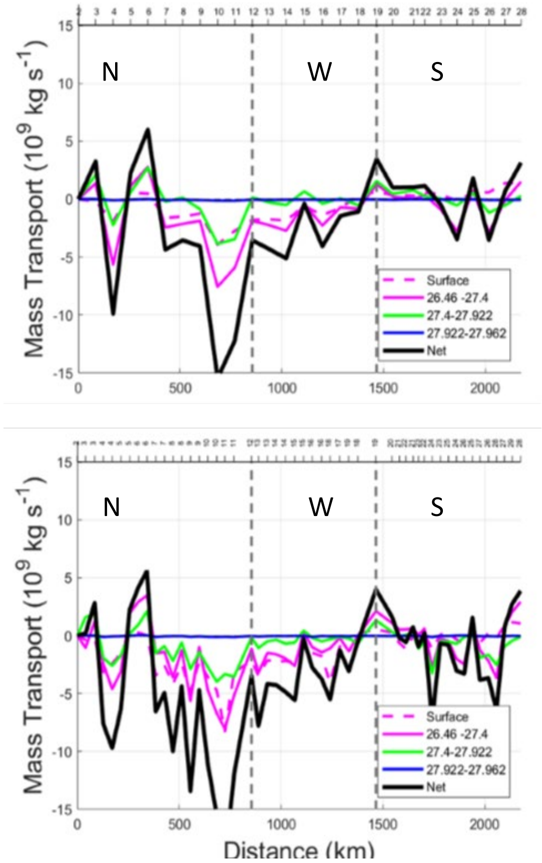


*Figure 2: Accumulated mass transports per water types layers along transects N, W and S employing only CTD stations (up) and CTD plus interpolated stations (down).*

**The accumulated mass transports which include the interpolated stations are noisier (down in Fig. 2), with a similar shape to those estimated only with CTD.**

Is there any reason why the water mass content was not quantified through the Optimal Multiparameter Method? (OMP) (i.e. Zhou, P., Song, X., Yuan, Y., Cao, X.,Wang, W., Chi, L., & Yu, Z. (2018). Water mass analysis of the East China Sea and interannual variation of Kuroshio Subsurface Water intrusion through an Optimum Multiparameter method. Journal of Geophysical Research: Oceans, 123, 3723â ˘A ˘R 3738. https://doi.org/10.1029/2018JC013882)

**We have included an OMP analysis in the updated version mainly to quantify the central waters NACW and SACW. In this way, we could assess the vertical and horizontal location of the front between both water masses. The front location estimated with the OMP analysis compares well with that obtained with a new methodology provided in the updated version of this manuscript, where WOA climatological data are used to extend vertically the classical definition of the Cape Verde Front (Figure 3 of this document).**

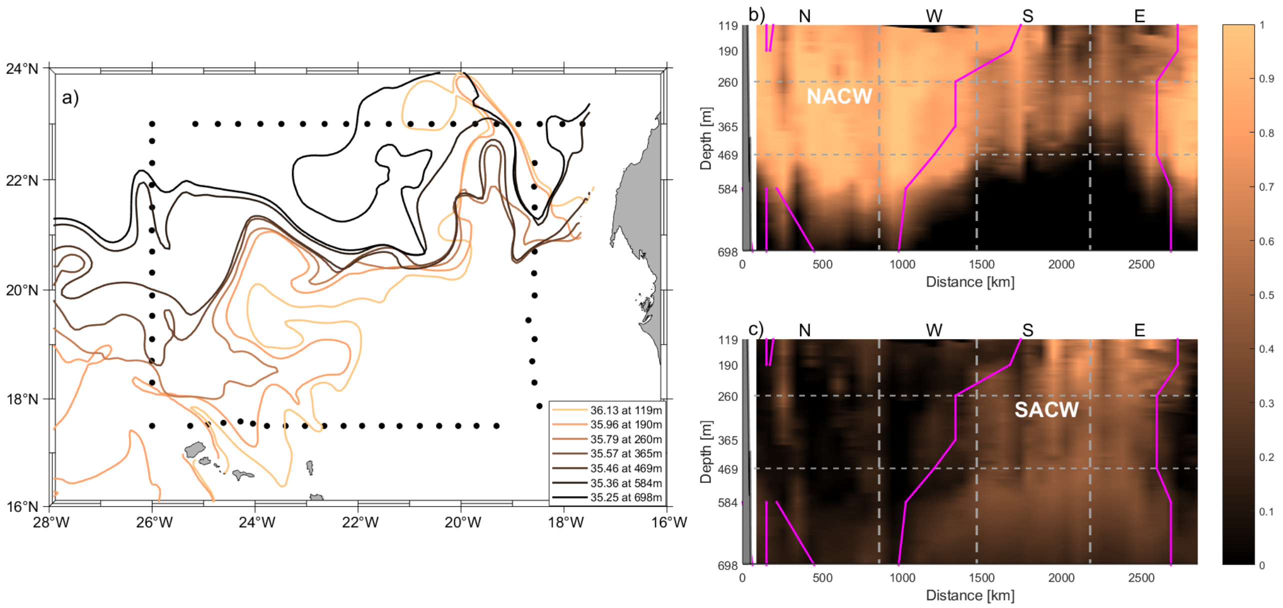


*Figure 3: a) Location of the front at the isohalines 36.07, 35.88, 35.67, 35.43, 35.31, 35.2 and 35.08, corresponding to average depths of 119, 190, 260, 365, 469, 584 and 698 m equivalent to 26.46, 26.63, 26.85, 26.98, 27.162, 27.28 and 27.40 kgm$^{-3}$. Vertical sections of the three layers of CW with the percentages of NACW (b) and SACW (c) and the front location indicated by pink lines. The 4 transects are separated by three vertical gray dashed lines located at stations number 12, 19 and 28. Three layers are also separated by two horizontal gray dashed lines.*

Grammar/English There are some instances in which the text is difficult to follow due to complex descriptions and syntax that could benefit from the input of an english speaker. I know how difficult it is to summarise such a large dataset but adding every detail dilutes the main messages that one would like to convey. It is important that the descriptions be kept short with simple sentences to help the reader. This can be aid by anotating the figures (i.e. N, W , S and E in the title sections of the transect figures, depth labels in A1, special features/water masses in figs A5-6, major current names in A7, features described in the text in A8 such as CVFZ etc.. )

**We have revised the English grammar and style of the manuscript. In addition, the updated manuscript includes relevant information in the figures to facilitate its understanding and to easily follow the text.**

The discussion and conclusions section would need to be revise in detail to make it easier to follow.

**We have thoroughly reviewed the discussion and conclusions to improve its understanding.**

Detailed comments

P1L15 hinder (instead of hinders)

**We changed it.**

P2L1 Being a permanent upwelling area the CUF is always present (intensity and location might change). Revise

**CUF exists where upwelling is permanent year-round (Benazzouz et al., 2014). In our case this happens only north of Cape Blanc. The trade winds are intense all year round between Cape Blanc and the Canary Islands, reaching Cape Vert during winter (Pelegri et Bennazouz, 2015).**

***Benazzouz, A., Pelegrí, J. L., Demarcq, H., Machín, F., Mason, E., Orbi, A., ... & Soumia, M. (2014). On the temporal memory of coastal upwelling off NW Africa. Journal of Geophysical Research: Oceans, 119(9), 6356-6380.**

***Pelegrı, J. L., & Benazzouz, A. (2015). Coastal Upwelling off North-West Africa, Oceanographic and Biological Features in the Canary Current Large Marine Ecosystem. IOC-UNESCO, Paris, 93-103.**

P2L6 try and mimic SACW description (i.e. add location of where it forms)?

**We have rephrased the sentence to: "The northern side of the CVFZ is mainly occupied by waters of different subtropical origin grouped as Eastern North Atlantic Central Water (NACW) which flows southward transported by the Canary Current (CC)".**

**In the new section where we show the contributions of NACW and SACW estimated by the OMP (Figure 3), it is pointed out that NACW is indeed composed of Madeira Mode Water (MMW) and Eastern NACW of 15 and 12 ºC.**

P2L15 IS modifiED

**We changed it.**

P2L14-21 Revise paragraph

**This paragraph deals with the detailed path followed by SACW from the southern hemisphere to the domain of interest. The reviewer suggests revising it without giving any additional details, so we have focused our action in adding references to support the content presented in the paragraph. The text is now presented as follows:**

**"South Atlantic Central Water (SACW) is the main water mass at the southern side of the CVFZ. This water mass is formed at the subtropical South Atlantic and it is modified after crossing the tropical regions (Peña-Izquierdo et al., 2015). SACW penetrates into the Cape Verde Basin via the northern branch of the North Equatorial Countercurrent reaching the African Slope as the Cabo Verde Current (CVC) (Peña-Izquierdo et al., 2015; Pelegrí et al., 2017). CVC move**

**anticlockwise around the Guinea Dome (GD) reaching to the southern part of the CVFZ (Peña-Izquierdo et al., 2015; Pelegrí et al., 2017) with a seasonal variability mainly driven by latitudinal changes in the Inter-Tropical Converge Zone (ITCZ) (Siedler et al., 1992). In summer, GD intensifies as a result of the northward penetration of ITCZ (Castellanos et al., 2015). In addition, the northward flow along the African coast intensifies due to the relaxation of trade winds at latitudes south of Cape Blanc, so Mauritanian Current and PUC can reach just south of Cape Blanc in this season (Siedler et al., 1992; Lázaro et al., 2005)."**

*** Peña-Izquierdo, J., van Sebille, E., Pelegrí, J. L., Sprintall, J., Mason, E., Llanillo, P. J., and Machín, F.: Water mass pathways to the North Atlantic oxygen minimum zone, Journal of Geophysical Research: Oceans, 120, 3350–3372, 2015.**

*** Pelegrí, J. L., Peña-Izquierdo, J., Machín, F., Meiners, C., and Presas-Navarro, C.: Deep-Sea Ecosystems Off Mauritania, Chapter 3, Oceanography of the Cape Verde Basin and Mauritanian Slope Waters, Springer, https://doi.org/10.1007/978-94-024-1023-5_3, http://api.elsevier.com/content/abstract/scopus_id/85035361292, 2017.**

P3L13-19 Include what sets the present manuscript apart from the papers cited.

**This manuscript aims to address the circulation patterns and the physical processes behind the distribution of $O_2$ and inorganic nutrients at the dynamically complex CVFZ, a domain where *in situ* data availability has historically been very limited. Secondly, we have extended the classical definition of the CVF to assess its location with depth, a result that has never been produced before. The CVF acts as a barrier and a source of meso- and sub-mesoscale variability, so now the transports of mass, $O_2$ and nutrients can be estimated independently on the subtropical and tropical domains, evaluating how the front affects all transports and producing an interpretation of the imbalances in $O_2$ and inorganic nutrients.**

P4L22 - Add who provided the wind data (i.e. url or data provider)

**We have updated the url direction to:**

ftp://ftp.ifremer.fr/ifremer/cersat/products/gridded/MWF/L3/ASCAT/Daily/

P5L25. I am afraid I couldn't understand this paragraph and what it meant. Could you point in A1 what stations were in fact climatological nodes?

**We include these stations with green dots in this figure (Figure 4 of this document).**

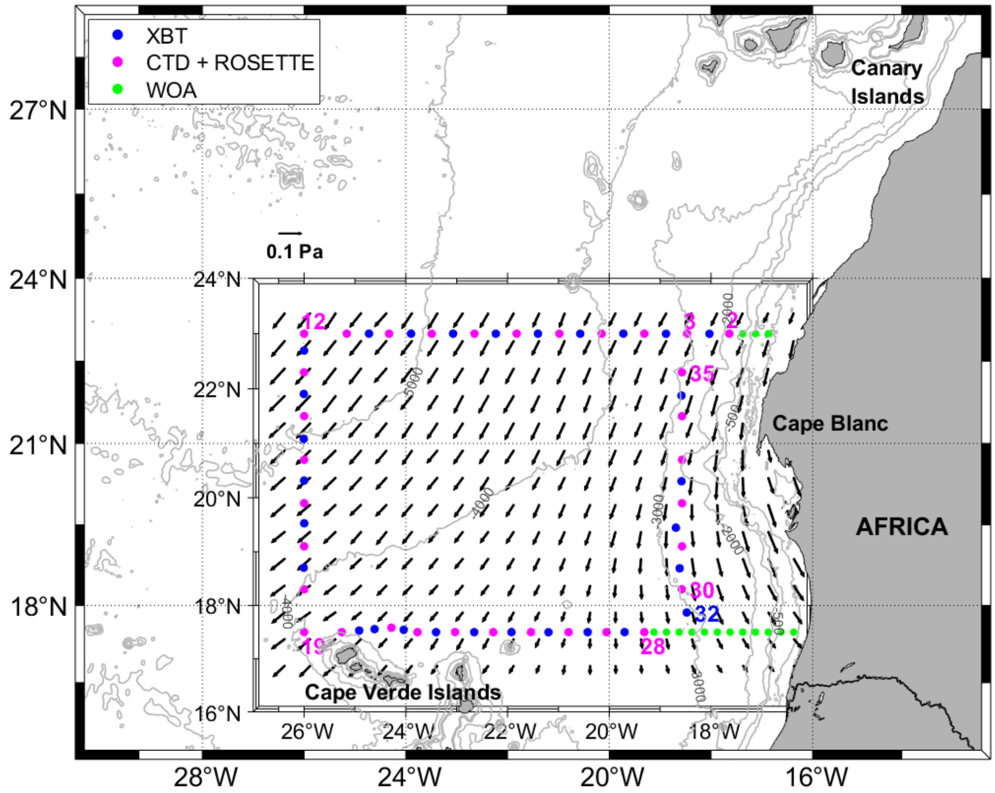


*Figure 4: CTD-rosette sampling stations (pink dots) and XBT (blue dots) during FLUXES-I cruise. There are also represented WOA stations (green dots). Time-averaged wind stress during the cruise is also represented with the inset arrow denoting the scale (shown with half of the original spatial resolution).*

P7L5. This is an area where diapycnal mixing is significant, specially in the CW layers and in the confluence of NACW and SACW as here. Dismissing them from the inverse model might be another reason for the large errors in the estimates and the lack of mass conservation in the results. (Peña-Izquierdo, J., . On the circulation of the North Atlantic shadow zone 150., Peñaâ ˇA ˇRIzquierdo, J., Sebille, E. van, Pelegrí, J.L., Sprintall, J., Mason, E., Llanillo, P.J., Machín, F., 2015. Water mass pathways to the North Atlantic oxygen minimum zone. Journal of Geophysical Research: Oceans 120,3350–3372. https://doi.org/10.1002/2014JC010557)

**The diapycnal turbulent diffusivity value, $K_s = 10^{-5}$ m$^2$ s$^{-1}$, estimated from in-situ data for the column between 150-600 m in our area by Martinez-Marrero et al. (2008), allows us to estimate the diapycnal mixing in the central waters domain:**

**$K_s=10^{-5}$ m$^2$ s$^{-1}$;**

**Z=600-150 m= 450 m;**

**Area of the rectangle described by stations (A) = height * base =540 km*770 km ≈ 4x10$^{11}$ m$^2$**

**Mean density (ρ) = 1027 kg m$^{-3}$**

**Diapycnal transport= Ks * ρ * A / z = 9x10$^6$ kg s$^{-1}$ ≈ 0.01 Sv**

**This diapycnal transport of 0.01 Sv is small as compared to the estimated isopycnal transports. Therefore, this transport is negligible and it will not introduce major errors in the method followed.**

*Martínez-Marrero, A., Rodríguez-Santana, A., Hernández-Guerra, A., Fraile-Nuez, E., López-Laatzen, F., Vélez-Belchí, P., & Parrilla, G. (2008). Distribution of water masses and diapycnal mixing in the Cape Verde Frontal Zone. *Geophysical Research Letters*, *35*(7).

P7L17 definitions for instead of "relationship between"

**We changed it.**

P7L29 included instead of "grouped"

**We modified it.**

P8L12-27 Revise text to make it clearer.

**We have re-written it as follows:**

**The distributions of $O_2$, $NO_3$ and $PO_4$ and $SiO_4H_4$ (Figs. A6 and A7) were highly variable mainly in the CW and IW layers with a notable minimum concentration of $O_2$ (60-90 µmol $kg^{-1}$ between 100 and 800 m), two large maximum values of $NO_3$ and $PO_4$ (30-32 and 2 µmol $kg^{-1}$ respectively between 350 and 1000 m) and a deeper and less abrupt maximum value of $SiO_4H_4$ (21 µmol $kg^{-1}$ below 700 m) centred in transect S. These marked distributions were closely related to the distribution of the different water masses.**

**In transects N and W, where NACW was found, the concentrations of $O_2$ were higher than in transects S and E, where SACW was found. For instance, concentrations of $O_2$ lower than 60 µmol $kg^{-1}$ are observed at 300 m in transects S and E (Fig. A6). In contrast, the concentrations of the three inorganic nutrients in these last two transects were higher than in transects N and W at CW levels. For example, concentrations around 27-30 µmol $kg^{-1}$ of $NO_3$, 1.5-1.7 µmol $kg^{-1}$ of $PO_4$, and 7.5-9.9 µmol $kg^{-1}$ of $SiO_4H_4$ are observed at 300 m depth in transects S and E (Figs. 6 and 7).**

**Below the first layer of IW, the distribution of $O_2$ was quite uniform. With respect to inorganic nutrient distributions at IW levels, transect N had lower concentrations than the rest of transects which had a higher content of AAIW. Figures A6 and A7 show concentrations higher than 33, 2.05 and 21.4 µmol $kg^{-1}$ of $NO_3$, $PO_4$ and $SiO_4H_4$, respectively, associated to AAIW around 1000 m in transects S and E.**

**In the deepest layer, high concentrations of $O_2$ and inorganic nutrients were found. Specifically, the concentrations of $SiO_4H_4$ were the highest of the water column while the concentrations of $NO_3$ and $PO_4$ were lower than their maximum values observed between 350 and 1000 m.**

P8 I think this is where having the OMP results might help the description. This can complement the information in A11 and A12 too.

**The reviewer is right. We have discussed it in the last version of the manuscript.**

Clarify terminology when refering to eddy, meanders and filaments. Sometimes, their use in the text is confusing.

**We have changed the filament term by "intrusion". We also include some station numbers in Figure A8 to follow the text more easily.**

P9L18-19 revise sentence.

**We have revised and changed it:**

**"The velocities in transect E were the smallest ones making difficult to identify the main structures and to link them with altimetry. In addition, the high variability in this transect due to the proximity of the coast and upwelling system makes also difficult to deeply describe the estimated velocities."**

P24-25 Label of A11 and A12. Second NO3 should be PO4

**The reviewer is right. It has already been changed.**