#Reviewer 1

Suggestions for revision or reasons for rejection

The manuscript has greatly improved in this new version in terms of readability and structure and the authors have in general correctly addressed most comments and suggestions. However, I think there are still many minor and technical issues that should be corrected.
Specific comments and technical corrections:

AR: Dear reviewer, thank you for your thorough and critic review of our manuscript. Your comments have help us to improve the manuscript. We hope that thanks to your suggestions we have managed to improve the manuscript, and that it suits now the standards of Ocean Science. The specific responses to your comments and the related changes are detailed in the following.

Best regards,

Xabier Davila

AR = Author's response
AC = Author's changes in the manuscript

Abstract:

L2: Avoid repetition and improve a bit the narrative by better connecting both sentences.

AR: The authors agree that the two sentences are a bit repetitive.
AC: These sentences were merged in the new version of the manuscript: "Submesoscale processes play a determinant role in several ocean processes by transporting momentum, heat, mass and particles. Furthermore, they can define niches where different phytoplankton..."

L4-5: "this effect is" should be "these effects are".

AC: Done

L5: Submesoscale processes coexist with different spatiotemporal scale oceanic processes always. Instead, I think the authors should somehow highlight that in coastal areas, oceanic processes act together with coastal ones, which makes it even a more complex scenario.

AR: The authors agree. Thank you for your comment.
AC: The sentence has been modified to: "However, to evaluate the effect of this variability is not straightforward in coastal areas, where sub mesoscale oceanic processes act together with coastal ones, resulting in a more complex scenario."

L6: What type of dynamic variables? Please specify. Also, delete "the" before "dynamic".

AR: The authors agree that it should be specified.
AC: "dynamic" was changed to "hydrodynamic, such as vorticity". The sentence is now: "The present study brings into consideration the relevance of hydrodynamic variables, such as vorticity, in the study of phytoplankton distribution, from the analysis of in-situ and remote multidisciplinary data."

L9: The link is always there but I think the goal is rather to understand/describe the link between.

AR: The reviewer is right about this observation.
AC: This sentence was changed to: "The main objective of this cruise was to describe the link between the occurrence and distribution of phytoplankton spectral groups and mesoscale to submesoscale ocean processes."

L14: Replace by the whole name Deep Chlorophyll Maximum (DCM).
AC: Done

L15: Include the acronym and replace General with Generalized (do this replacement in other parts of the paper, for example in L80).
AC: Done

L16: Now DCM can be used instead.
AC: Done

L18: Use a more generic term than deviance: "variability of total…". Also, include at the end of the abstract a sentence or 2 of main conclusions and/or implications of the study.

AR: The authors agree that the main conclusions of the study should have been added.
AC: The term "deviance" was substituted by "variability of total". In addition, the main conclusions of the study were added and the last part of the abstract is now: "However, at the DCM, among the measured variables, vorticity is the main modulating environmental factor for phytoplankton distribution and explains 19.30 \% of the variance. Since its distribution within the DCM cannot be statistically explained without the vorticity, this research brings into consideration the relevance of the dynamic variables and multi-spectral chl-a at high spatial resolution. Only by combining both we were able to determine the relative importance of the environmental variables for different spectral phytoplankton groups at the DCM. "

Introduction:

L21: replace "timescales" with just scales.
AC: Done

L22: I don't know what the O before the parentheses mean. If this is a typo, please correct it. If not, maybe use a more general notation such as the symbol ~. Please, fix this for other cases.

AR: This is a nomenclature used in papers dealing with physical processes to provide an order of magnitude of the spatial scales. See for instance: https://www.nature.com/articles/s41467-019-10149-5. However, since this comment was raised by both reviewers and we expect this paper to have a mixed audience, we decided to use a more extended nomenclature.
AC: In order to reach a wider audience and avoid confusion we changed it by "spatio-temporal scales of 0.1 - 10 km and days".

L23: I think Interact (or interaction) is not the best word, in this and next cases throughout the introduction. Interact is a two-way direction, but these processes rather affect or influence the ecosystem (or in next cases the phytoplankton). Please fix this.

AR: The authors agree with this observation.
AC: The word Interact (or interaction) was replaced in the manuscript for a more precise word, for example : "The IPC is, due to the effect of bathymetry, responsible for…" instead of "The IPC is, by the interaction with the bathymetry, responsible for…". Or the subsection in Results section is now called "Exploring bio-physical impacts" rather than " Exploring bio-physical interactions".

L24: Remove "the" before "photosynthetic".
AC: Done

L25-26: Not sure what is the intention of the sentence. What does it mean that "extends beyond primary production?

AR: The authors agree that this sentence is unclear, it was supposed to be a transition between two sentences, as we consider this unnecessary, it was removed.
AC:The sentence was removed and "In addition" was added to the beginning of the next sentence.

L27-28: PP does not absorb CO2, but rather the absorption of CO2 occurs during PP.

AR: The authors agree.
AC: The sentence was changed to: primary production drives the absorption atmospheric CO2".

L40: I don't think "Contrarily" is the best connector here.

AR: We agree that the choice of the connector is not completely accurate.
AC: "contrarily" was substituted by "Regarding phytoplankton distribution,"

L43: Move "Latasa et al, 2017" after "drivers involved". Also, (L56) "Caballero et al., 2016" after "plumes".

AC: Done

L55: Add main or largest before "nearby rivers".

AC: Done, "main" was added.

L62: No need to define again what is the DCM; you can put just DCM.

AR: The authors agree.
AC: Done

L66: I think the authors should refer directly to the "submesoscale dynamics" (not just especially) and also that the other studies do not analyze hydrographic and hydrocynamic (erase the "s") mechanisms at the same time.

AR: The authors agree with this observation.
AC: The whole sentence was substituted by: "Nevertheless, to our knowledge, none of these studies have focused on the relative importance of submesoscale dynamics, analyzing hydrographic and hydrodynamic forcing mechanisms at the same time."

L69: Replace "its" with "their".

AC: Done

L75: Replace "the consolidation of" with "consolidate".

AC: Done

L78: To avoid redundancy, replace by "…from remote sensing to in-situ measurements".

AC: Done

L80: This last sentence is redundant. Just include in the previous one the new information that is missing (i.e. "on phytoplankton distribution above and below the pycnocline, and at the DCM"), and erase this one.

AR: The authors agree that the sentence is repeating information already mentioned.
AC: The sentence was erased and the previous one was changed to: “Secondly, we investigate the link between the observed submesoscale structures and the distribution of the two dominant spectral groups of phytoplankton above and below the pycnocline, and at the DCM, by performing a set of General Additive Models.”

Material and Methods:

L88: “Undercover” should be uncover, unveil, unravel…

AC: “Undercover” was changed to “unravel”.

L96: Replace by light-emitting diodes (LEDs).

AC: Done.

L98: What do you mean with mixed red group? Cyanobacteria are already in the Blue algae group, which I think is correct. Do some cyanobacteria belong to this group? Please specify this. Also, if the “it” in “it estimates” refers to the FluoroProbe, please replace with this.

AR: The sentence was not clear indeed.
AC: We added “phycocyanin-containing Cyanobacteria” to the “Blue algae” spectral group, and “ phycoerythrin-containing Cyanobacteria” to the “mixed-red group spectral group. In addition “it” was replaced by “The FluoroProbe”.

Replacements: (L109) by long-range high-frequency (HF) radar. (L130) by Muller et al. (2009). (L133) by Sea Surface Temperature (SST). (L146) by Gomis et al. (2001).

AC: Done.

L168: Replace by "sections of the water column" or by "layers of the water column".

AC: Done.

L169-171: Suggestion to improve and simplify the sentence: Therefore, the dataset was divided in three different dynamic sections/layers “Above the pycnocline”, “Below the pycnocline” and “at the DCM”.

AR: The authors agree with the suggestion.
AC: The sentence was changed according to the suggestion.

L173: Erase this sentence as this was already said in the last sentence of the previous section.

AC: Done.

L180: An error term should be added at the end of the formula (+ epsilon).

AC: The error term was added in the formula and the following sentences were modified to: "Where *a* is an intercept, *z* is the location in the water column (above or below the pycnocline or at the DCM), the *g*s are nonparametric smooth functions describing the effect of environment on chl-a concentrations and *epsilon* is an error term."

L189: Replace "approached" by "approach"

AC: Done.

L190: Is this Wood 2006? Wood 2000? You have this reference incomplete in the bibliography.

AR: This was Wood 2000. There was a bug on the latex code for the bibliography.
AC: The reference is now complete.

L192: Replace by (Llope et al. 2009).

AC: Done.

L196: Please keep the same precision for the values (choose 3 or 4 decimal digits).

AR: 4 digits were selected.
AC: The precision now is as such: "from 0.0130 to 0.0125".

Results:

L206: Please replace "Then" by Thus or Therefore if this is a conclusion from the previous lines. Also, the Etoile cruise occurred 2-4 August 2017, and according to Fig. 2, the direction of the wind was more or less constant during these dates.

AR: The authors agree with this observation. Even if there is a small change in the wind to a Northern component on August 3rd, this is punctual and it can be said that the wind direction was almost constant.
AC: The sentence was changed to: "Therefore, the wind conditions during the whole cruise remained almost constant in direction and low in intensity."

L207: Replace by "fields; the latter allowed us" or similar.

AC: Done.

Replacements: (L209) "give" by gave. (L210) "provide" by provided or provides.

AC: Done.

L216: insert a comma after 2nd. "sharp change" can be replaced by "sharp decrease" to reinforce the message. In L222, insert the 2nd parenthesis after Figure 4.

AC: Done.

L224: "35.5" is the minimum value so replace < by ~. Or choose a different threshold (<35.56 or <35.57). Apply this idea to the next threshold mentioned (>35.6).

AR: The authors agree with this observation.
AC: "<35.5" was replaced by "~35.5".

L228: This was already mentioned and can be deleted.
AC: Done.

L255: Why salinity provides a synoptic distribution of phytoplankton? Move this information at the end of next sentence and link it with the existence of a plume. Also, delete the "the" before "the phytoplankton".

AC: We agree that "salinity" is misplaced and was moved to the suggested position.
AR: These two sentences were changed to: "Chl-a data collected at surface by the continuous recording system provides a synoptic distribution of phytoplankton during the sampling period (August 2nd - 4th 2017). Figure 6 illustrates how chl-a distribution is spatially dependent on salinity at 3.5 m depth, related to the position of the river plume."

Section 3.3 is a bit difficult to follow as there is too much information and details. I think it should be simplified, highlighting mainly the relationships and details that are most relevant to the story and main messages of the paper (see for instance the last part of the first paragraph in the discussion and section 4.2).
Another issue in this Section 3.3 that was already mentioned in the previous review is that the description of the shape of the relationships is in general confusing and should be better written and explained. Some examples (but check all of them): (L278) lower salinity values can be associated with higher chl a, i.e. they show a negative correlation/relationship; (L284-285): Chl a of brown shows a dome-shape relationship with salinity, with a maximum at around 35.1, so below the effect of increasing salinity is positive and below is negative; (L285) If the relationship is in general negative, the effect of temperature is negative; (L302) Again a case of dome-shape relationship. (L304) Check this one too.

AR: The authors agree that there was too much detailed information in section 3.3.
AC: We have removed those details that are not so important for the main story and we also improved the narrative and description of the relationships. We have reviewed thoughtfully the whole section 3 and improved the writing when necessary. We also added a uniform terminology to

refer to the three subsections used for the analysis and defined relative to the DCM and pycnocline depths.

L280: Something is missing in "to the explain the".

AR: "to the" was a typo and has been now removed. The sentence was partially rewritten to avoid repetition of words.
AC: The new sentence is now: Salinity and temperature contribute to most of the deviance of the model and explain the 13.10 % and 9.8 % of it, respectively (Table 2)."

L287: Percentage symbol should be after the value in %23.3. Fix this for the other cases.

AR: This was a typo.
AC: It is corrected in the new version of the manuscript.

L300: Include reference to table 1 and maybe figure 9 after "the deviance". Also, in L319, after "the deviance" but in this case Table 1 and maybe figure 10.

AC: Done.

Discussion:

L390-394 belong to results (and even the part of the statistical analysis to M&M). Also, L421-428.

AR: We agree that some of those sentences belong to others section and we thank the reviewer for the observation.
AC: Lines 390-394 were removed since this information is already included in the Results and M&M. Lines 421-424 have now become the beginning of paragraph 3 in section 3.3. Lines 424-428 were removed since the information is already in the Results section.

L391: Delete the "And" before "in addition". Also delete "the" in L401 after "explained by" and in L402 after "deviance is".

AC: Done.

L415: I think this could be better written, something similar to "The negative effect of salinity for values higher than 35.1 (figure 8e) is still present below the pycnocline".

AR: The authors agree that the sentence could be improved.
AC: Following the suggestions of the reviewer, the sentence is now: "The negative effect of salinity for values higher than 35.1 (figure 8e) persists below the pycnocline, but the effect is positive at values equal and higher than 35.6, probably due to higher nutrient levels in deeper waters."

L441: Modify as (D'Ovidio et al., 2010).

AC: Done.

L460: Replace "Will help" by something like "would have helped".

AC: Done.

L471: Should it be "direction and speed"?

AR: Yes, thank you for your comment.
AC: The sentence now reads: "The location of the plume depends on the surface currents, which are ultimately conditioned by the speed and direction of the wind."

Figures:

General comment also mentioned in the previous review: include in the caption all the information necessary to understand each figure, including explanation for acronyms (the same goes for tables).

Fig1: Delete "these are" in "these are located every". Also replace "dots represents" by "dots represent" and delete the "to" in "to the HF radar". Replace "data, while big white dots to the" by something similar to "data, and big/large with dots mark the". Additionally, replace "square" by "rectangle" and "zoom in area" by "area zoomed in A".

AR: The authors thank the reviewer for this corrections.
AC: The changes were implemented as suggested and, in addition, the sentence " data, while big white dots to the" is now "data, and large white dots mark the".

Fig3: Include in the caption a mention of the Cyclonic eddies drawn in the left column (also in Fig. 4). Replace "to periods" by "two periods".

AR: The authors modified the caption in the figure as suggested.
AC: "to" was substituted by "two" and sentence about the eddies was added: "The circles drawn in the left column represent the approximate location of the observed cyclonic eddies (C17W and C17E)."

Fig4: Also mentioned in the previous review: Include a note at the end of the caption that the scale range for each variable is different for each depth. This is important as the reader might try to compare the three depths.

AR: The authors agree with these observations and thank the reviewer for pointing it out.

AC: The following sentence was added at the end of the caption: “The scale range for each of the variables is different for each depth”.

Fig5: As this cross section goes through A17 and C17E, I think it would nice to draw them as horizontal lines above each column, with its corresponding color and include reference in the caption (also this could be done in Fig. 7). Include also the period (2nd-4th August 2017). Please do also this in Figs. 6 and 7. At the end of the 1s line in the caption, replace by "salinity (A) and temperature (B) with isopycnals (black and white contours, respectively)". Indicate after velocities that solid or dashed black contours correspond to positive or negative velocities.

AR: We thank the reviewer for the suggestion of including the horizontal extension of A17 and C17E , which helps interpreting the figure. The rest of the suggestions were also implemented.
AC: Horizontal lines marking the extension of the eddies were added in Fig 5 and 7. The measurement period was included in Fig 5, 6 and 7. The 1s line in the caption in Fig 5 was replace by "salinity (A) and temperature (B) with isopycnals (black and white contours, respectively)" and also it has been indicated that solid (dashed) black contours correspond to positive (negative) velocities.

Fig6: If possible, draw also the eddies. Replace “the black” by “and black ones”.

AC: Done

Fig7: after 43.11ºN, include reference to Figs 1,4 and 5 (as in Fig. 5).

AC: Done

Tables:

Table1: Is Standard Deviation or Standard Error? you wrote SE. Replace “GAMs for” by “GAMs for the water column sections/layers”. Replace “the Deep Chlorophyll” by “at the Deep Chlorophyll”. Also indicate that dependent variables are the estimated Chl a concentrations for different algae groups and also define what is B:G (also in Table 2). The p-value is missing for DCM, total Chl a. Also, the precision has to be always the same. For instance, if in a case the deviance explained is 57.10, then it has to be in other case 43.00 and not 43 (always 2 decimal digits). Check also this in Table 2. Additionally, deviance explained and R2 report similar information so pick one of them. Why Intercept, SE and deviance explained is separated from the covariate results and R2? If there is no clear reason, merge both groups of rows as this could be confusing.

AR: Thank you for your comment which have help to make the table more comprehensive. SE refer to Standard Error. There was no strong reason to separate the GCV and R2 from the intercept, SE and explained deviance and therefore everything has been merged.
AC: We have applied all the suggestions and the precision wass checked in both tables.

Table2: Maybe better replace “Deviance contribution” by “Variance contribution” as in Llope et al. 2009. The R2 is the percentage of variance explained, in this case by the model. However, you also report a percentage of variance accounted by the model. In the table, both seem

to correspond to different things, in particular R2 correspond to the whole model and the % is related to each environmental variable. Please clarify this in the caption for Stepwise Deletion and Delete-one-covariance. Also, indicate in the caption the meaning of the values in bold. Include all the information in the caption, about the water column sections and dependent variables. Finally, replace "vorticity and salinity" by "vorticity or salinity" as the models include only 1 variable.

AR: Deviance was replaced by Variance, also throughout the rest of the text. We also clarified in the caption what is % referring to in each of the cases Stepwise Deletion and Delete-one-covariance.
AC: The caption is now: “Variance contribution of the environmental variables to the estimated chl-a concentrations for the different algae groups and Brown:Green (B:G) ratio and the subsets "Above the pycnocline" (APY), "Below the pycnocline" (BPY) and at the Deep Chlorophyll Maximum (DCM). The left columns in each of the sections show these values for the models after stepwise deletion of the variables listed to the left (first vertical velocities and then temperature). The coefficient of determination (R2) and general cross validation score (GCV) and the percentage of variance (%) correspond to the different models. The last two models included only the variable listed (vorticity or salinity). For the right columns in each section, one variable (those listed on the left) was removed at a time while keeping the rest. While R2 and GCV still refer to the whole model, % is individual and corresponds only to the removed variable. Bold numbers point out the main modulating variable -i.e. The one that, individually, explains most of the variance in the model.”

Reviewer 2

Suggestions for revision or reasons for rejection

The authors have done a fantastic job reviewing this manuscript. It is now easy to follow; the aims and limitations are clearly defined and it describes much better the results obtained and their implications.
Congratulations for the introduction, it is clear and concise. The discussion repeats a bit results for my taste, but overall is a good discussion, it focuses on the insight that can be obtained from the results and raise interesting questions to be further explored. Great conclusions.
I just mention below some details, mostly formal, that I think could tidy up a bit more the manuscript.

Dear reviewer,

First, thank you for your careful review of our manuscript and your remarks. Thanks to your comments we have improved the discussion section avoiding repetition with the results. We hope that thanks to your suggestions we have managed to improve the manuscript, and that it suits now the standards of Ocean Science.

Best regards,

Xabier Davila

22 I don't know if it is intentional or not I don't understand this notation for space and time scales "O(0.1 - 10) km and O(1) day". It appears again in lines 39 and 365.

AR: This is a nomenclature used in papers dealing with physical processes to provide an order of magnitude of the spatial scales. See for instance: https://www.nature.com/articles/s41467-019-10149-5. However, since this comment was raised by both reviewers and we expect this paper to have a mixed audience, we decided to use a more extended nomenclature.
AC: In order to reach a wider audience and avoid confusion we changed it by "spatio-temporal scales of 0.1 - 10 km and days".

38 "requires more demanding surveying methods that can cover a high range of spatio-temporal scales." I would say that requires methods that can provide high spatio-temporal resolution more than a range of scales.

AR: The authors agree with this observation.
AC: The sentence was changed to: "In coastal regions, where oceanic currents meet the bathymetry, the connection between the submesoscale processes and phytoplankton becomes even more challenging, and therefore requires more demanding surveying methods that can provide a high spatio-temporal resolution".

70 "spectral groups" have not been defined yet, so maybe just "phytoplankton groups distribution".

AR: Done

From line 98 onwards it is clear that fluorescence is now chlorophyll, but in the rest of the methods (101,165,172) and results (257) the authors keep using fluorescence and chlorophyll alternatively. To stick to just chlorophyll would be clearer, I think.

AR: Thank you for your comment, we think you are right.
AC: The text has been modify accordingly.

134 The comma between "turbidity" and "from" looks out of place.

AR: Thank you for your remark.
AC: The comma has been deleted.

287 Check the placement of some "%" signs.

AC: The typos were corrected.

401 In this sentence, "on the other hand" is not opposing any other previous concept. Also, it is used twice in the same sentence. I imagine "on the other hand" would fit in line 409 at the beginning of the "Below the pycnocline" part as opposed to the "Above the pycnocline" one.

AR: Thank you for your remark.
AC: The sentences have been rewritten: "At APY, most of the variance of Total and Brown algae chl-a is explained by salinity, while the environmental variable that explains most of the Green algae chl-a variance is temperature."