

Interactive comment on “Coastal mesoscale processes and their effect in phytoplankton distribution and community composition in the SE Bay of Biscay” by Xabier Davila et al.

Anonymous Referee #1

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The manuscript describes the occurrence of different (sub)mesoscale processes during a summer in the SE Bay of Biscay and their effect on phytoplankton distribution. This work is based on a comprehensive data set collected at different spatiotemporal scales and the research topic is interesting. However, there are many issues that have to be addressed in order to be published.

General comments:

1. The structure, organization and narrative of the paper are difficult to follow, especially during the introduction and discussion (see comments below). I think this has to be deeply revised. In addition, sometimes the paper seems to be written in haste,

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with several grammar, spelling and punctuation problems (see a few examples in the technical comments). Also, check things such as “(?)” in L402 and 427.

2. Throughout the entire paper, there are several assertions without references (see comments below). For instance, L18-19 or L22-23 in the introduction.

3. In the introduction, the motivation of the study, the relevance of the topic and knowledge gap(s) have to be better introduced and established. For instance, I find interesting studying the effect of (sub)mesoscale processes in coastal areas due to its complexity, and maybe there are few studies about it in the BoB. However, L58: “Few studies provide the link between phytoplankton occurrence and physical processes in the BoB” is definitely not true. In relation to this, maybe it could be highlighted and argued the importance of using data collected at different spatiotemporal scale (something this paper does well). Also, I do not feel that the introduction goes from general to more particular aspects of the research topic. In some paragraphs, there are too many ideas (although there should be 1 or 2), which is especially clear in paragraph 1 (L18-29). Why not using a whole paragraph (or even 2 paragraphs) to develop the importance of (sub)mesoscale processes and phytoplankton and their link? Why focusing so fast on eddies when this is just one case? Why introducing already the BoB? Other paragraphs just feel like a collection of examples with no clear message (for instance L58-67: paragraph 4). Additionally, the ideas and concepts have to be connected better, within and among paragraphs.

4. The statistical analyses should be better conducted. This also affects section 3.3 in results. Although I like the use of GAMs, I really miss a model comparison based for example on AIC (or other criteria). Why are predictors inspected only one by one? What about interaction effects among predictors? In GAMs, those could be included as tensor products or varying coefficient models. Have the authors checked if the predictor variables are correlated? I think using a model with interaction is a better approach than the analyses described in L160-162 and L339-348. Also, in material and methods, the description and specifications of the model(s) and statistical methodology

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is too scarce. What are the formulas and specifications for the model(s) used? What are the characteristics of the residuals? In results, what about deviance or variance explained by the models?

5. Sometimes, the study mixes different biological concepts. For instance, fluorescence can be translated to Chl a concentration. However, Chl a concentration is not the same as phytoplankton biomass, as this depends on variations of C:Chl a cell ratios. In addition, larger biomass accumulation does not necessarily imply larger phytoplankton growth. See for instance L263 and L361.

6. In my opinion, the authors should translate better the relationships found into a mechanistic understanding. How could salinity affect distribution? Is it directly affecting phytoplankton physiology and growth? Is it because differences in salinity reflect the occurrence of processes such as fronts or other modifications of the physical structure of the water column? The same goes for vorticity.

7. In my opinion, the discussion is the weakest part of the article. It has to be better structured and the implications more clearly defined at the end (including the conclusions). Please, be more concrete, thinking about how specifically does this study contribute to the field (the statements at the end of the conclusion sounds too generic).

Specific comments:

Abstract

L2-4: Why just focusing on the effect on nutrients (which are not directly analyzed in the study)? What about the modification of the water column structure? They only define niches or also affect phytoplankton through advection? I like the motivation for the study in L4-5.

L11: This is again the goal of the study. Merge it with L6-7.

L15-16: Do studies analyze hydrographic aspects and not consider the dynamics of the system? Think about more particular and specific implications of this work.

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Introduction

L18: Please define spatiotemporal scale ranges for mesoscale processes (km and days). For instance, Mahadevan (2016) in L22 actually talks about submesoscale processes. Maybe mesoscale should be replaced by submesoscale in the entire article (or at least in some parts)?

L20: Not only nutrients can be limiting. Light is the other main factor (e.g. in temperate and polar areas in winter or at depth). Elaborate.

L20: Are not all processes confined in time and space? What does this mean?

L21: After "evolve and transport seawater properties" there is a "-i.e. nutrients". However, this is just one of the non-conservative properties.

L31-40: Give a purpose to the paragraph by highlighting that the study area is complex in terms of coastal hydrographic processes.

L44: Include a mention to a figure in the introduction is unusual as far as I know.

L76-78 should be integrated with L71-72. Both parts are about what was done in the study.

Material and Methods

L90-102: Include references for all the instrument and methodology used. Also, is there any calibration? Chlorophyll is mentioned here, but fluorescence is used for the analyses instead. Four algal pigmentary groups can be detected by the fluorometer, but only 2 are inspected in this study. Why? If there were an instrumental bias and different measuring sensitivity for the 2nd multi-spectral fluorometer, can the data be trusted at all?

L113: Why a 3h running mean average was applied? Please explain and justify.

L135: Define small Rossby number range. Is it realistic to assume totally con-

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stant mesoscale features during the sampling? If not, elaborate this. Also, replace time/space by spatiotemporal. In relation to this point, is it not always important the spatiotemporal distribution of observations?

L139: Which are those key dynamical variables? Please elaborate.

L148: "the correct representation" is a strong statement. Better "good" or "appropriate".

L153: Include the statistical analyses as a different section with a title (2.4).

L159: Please indicate the version of R and mgcv package used. Also, cite the R program.

Results

L166-168: Part of it belongs to Material and Methods or even to the introduction.

L171: "relaxed" is in my opinion vague.

L186: Do these results belong to the 1st or 2nd period? Clarify this.

L219-220, L222-224, L246-256 and L266-271 and L288-293: Belongs to the discussion.

L238: It is hard for me to observe how green algae fluorescence follow the salinity contours at waters saltier than 35.49. Please clarify this.

L239: "logarithmically transformed" sounds better to me.

L265-266: "isohaline" instead of "halocline"?

L266-271 and L288-293: Check the writing and description of the relationships (for instance, I do not observe a positive relationship at the edges of the range of temperature).

Discussion

L260-307: I think the first paragraph should be a brief summary of the main results.

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L301-305 belong part to Material and Methods and part to Results.

L318: What do non-linear terms mean here? Join this paragraph with the previous one?

L327-328: Is this statement from other studies? Then, please include references. If not, from the results provided in this work, this can only be speculated (nutrients were not analyzed here). Riverine plumes have also other effects such as advect phytoplankton or generate fronts where plankton can accumulate.

L336-337: Again, this should be more speculative.

L339: See general comment 6. Include references.

L340-348: This belongs to Material and methods (and part to Results).

L350-365: This belongs to Results.

L372: What does mean "areas of vertical velocities"? of maximum velocities? Why should we expect higher concentrations in these areas? Elaborate.

L382-383: I do not get this sentence.

L409: Include references. Also, diatoms have different mechanisms to regulate their vertical position. This can be discussed too.

L418-430: I miss some references here.

Figures

-Include in the caption all the information necessary to understand each figure. For instance, in Fig. 1 indicate that the dot corresponds to the buoy, stars correspond to radar antennas and names to rivers (do the same for the other figures). Also, before the acronyms such as MVP, include the complete name.

-Figs. 1 and 2 can be joined in a single figure.

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-Fig. 1: Are the eddies shown a permanent part of the general hydrography? Clarify.

-Fig. 2: Replace "T-" by: (T-1, T-3 and T-5).

-Fig. 3: Include axis with units.

-Fig. 4: Change labels of facets by A, B; C, D; E, F. Please, do not use scientific notation for the colour scales in this case. Also, note if the scales are logarithmic for turbidity and Chl a.

-Fig. 5: indicate in the caption that scale ranges are different for each depth. Salinity has no units, so delete PSU (apply this to other figures and text too). To what date(s) correspond(s) the maps? Indicate what positive and negative vertical velocities mean. The 43.77°N dashed lines are hard to see.

-Fig. 6: Are isolines actually isopycnals?

-Fig. 8: To which dates correspond the plots?

-Figs. 9 and 10: Caption should start with "Relationship between XXX and YYY". Please, do not use the default R output and replace variable names in the x-axis by the name of the variable and the units. Why the y-axis (fluorescence) in the 1st 3 rows can be negative?

-Fig. A2: Why is the cross-section here 43.70°N and not 43.77? Is it because C17W moved?

Technical corrections:

L33: Insert "of" before "the water runoff".

L116: Delete "of the".

L149: After "Gomis et al. (2001)" something is missing (in? by? As in?).

L180: Replace "generate" with "generated".

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L182: Replace "; as well as" by a comma.

L196: Erase the 1st "wind".

L201: Include "at" after "(A17)". Also, replace "however" by "although".

L238: Replace "is" by "are".

L368: Replace the comma after "at first" by "as" or similar.

L486: Which number is "XXX"?

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