Reviewer 2

In this work, Barrillon et al. characterize the response of phytoplankton to a storm event in the NW Mediterranean Sea. In my opinion, this work is truly relevant. There are few studies out there that compare the before and after of phytoplankton response to short-term anomalous events that disrupt the ecosystem. Since there is a real possibility that such extreme events may become more frequent in the future, there is a dire need for more studies on this topic. Unfortunately, most of these works occur as a reaction to a given extreme event and, thus, lack a comprehensive methodology that may evaluate the impact it had, which is understandable. This is not the case of this manuscript, as Barrillon et al. clearly tried to use as much as they could to characterize this event: in-situ ship-based sampling before and after the storm, a glider sampling during the storm, as well as remote sensing and modelled data to complement the in-situ data. Therefore, this is an important work and a good example on how various sources of data should be integrated to study a short-term event.

While methodology is sound, the writing is overall good and its conclusions are relevant and supported by the results, I do have a few gripes with the manuscript that I believe should be resolved before being accepted. Therefore, for my part, I recommend major revisions.

We are very grateful to the reviewer for the careful reading and relevant comments about the manuscript. All the remarks have been addressed below and the associated modifications will be performed in the revised version of the manuscript.
(Color legend : comments and questions in green, answers in blue, new text proposal in orange)

I will now list my main questions or areas where I think the manuscript could be improved.

- In the introduction, the goals of the work are not explicitly stated. There is a large paragraph detailing the FUMSECK cruise, some overall methodology and its aims, but these are the cruise's aims, not this work's aims. Clearly stating the objectives and linking them with the methodology and results would help the reader navigating through the substantial number of results described in this work.

Yes, the new introduction will be as follows, also taking into account the other comments about introduction (changes in orange).

"Marine environments are subject to short-term events whose effects on biogeochemical processes can be substantial. This is the case of desert dust deposit on oligotrophic areas (Guieu et al., 2014), volcanic ash deposit (Hammes et al., 2010), submarines sources of iron (Guieu et al., 2018), and sudden mixing of the water column from typhoons (Wang et al., 2020). Even the classical phytoplankton spring bloom can vary in intensity and spatial extent depending on the amount of previous short term storms (Ferreira et al., 2021). Effects on micro-organisms activity and diversity encompass sudden changes compared to the previous conditions. Indeed, depending on the redistribution of nutrients, the intensity of any turbulences, the light conditions and the mixing of different water masses, the phytoplankton community can either collapse or grow, affecting carbon export by generating decoupling phenomenon between production and remineralization (Henson et al., 2019).

Meteorological impulse wind events such as storms, and their effects on oceanic physics and even more on biogeochemistry, are poorly explored with in situ data. Such events generate mixing and stirring of the surface layer and can trigger transitional peaks in primary production, mainly explained by nitracline shoaling and grazers dilution (Lomas et al., 2009; Menkes et al., 2016). In oligotrophic ocean conditions, Babin et al. (2004) and Han et al. (2012) observed from satellite ocean colour the sudden and large increase in chlorophyll-a, lasting several weeks, after summer hurricane-storms. The resulting increase in surface chlorophyll-a (chla) reached values close to those from the spring bloom (Babin et al., 2004) with potential primary production comparable to the one induced by some mesoscale (~ 10 – 100 km horizontal range) eddies, but could not reach further processes understanding due to the lack of in situ observations. Only a few studies have combined high-resolution physical descriptions of wind events with a phytoplankton resolution at the functional group level. Some coastal studies, such as Fuchs et al. (2022), have evidenced pico-nanophytoplankton abundance and biomass rises for most phytoplankton groups, within two to four days following wind-induced events at a coastal station located in the north-western (NW) Mediterranean Sea in stratified conditions. Again, the authors showed that extreme events can generate daily biomass increases of the same order of magnitude as those observed during the spring bloom. Similarly, Anglès et al. (2015) studied the response of nano-microphytoplankton to tropical cyclones generating wind-physical forcing and substantial rains in the Western Gulf of Mexico. They highlighted strong increases in plankton abundance following the storms with delays consistent with Fuchs et al. (2022). These storms observed on either coastal Mediterranean systems or tropical open ocean may potentially exert a strong control on both primary production and community structure also in the Mediterranean open ocean, thus playing a potentially important biogeochemical role on the whole basin. However, in our knowledge no such event in the Mediterranean open sea has been reported in the past.

The classical spring bloom as observed in temperate oceans is triggered by the shoaling of the mixed layer when passing from the winter convection to the spring stratification (Behrenfeld, 2010), which ends when no more nutrients are available in the euphotic layer or when grazers overpass the phytoplankton growth capacity. This is particularly the case in the NW Mediterranean Sea characterised by winter deep convection (Houpert et al., 2016; Testor et al., 2018) and by spring blooms of different intensities that can be detected from satellite images (d'Ortenzio and Ribera d'Alcalà, 2009; Mayot et al., 2016). This area is affected by strong northerly winds, and their intensity in winter defines the bloom intensity (Conan et al., 2018). In summer stratified conditions, impulse wind events could induce submesoscale (~ 1 – 10 km horizontal range) vertical mixing and trigger patches of high phytoplankton production. Yet, observing the effect of these events on phytoplankton dynamics and distribution is challenging, especially during stratified oligotrophic conditions, and requires the deployment of dedicated automated and high-frequency sampling tools. Indeed, the mixing of the water column may bring microorganisms from deep to surface layers, affects their physiological properties due to photoacclimation processes, and has an impact on carbon-to-chlorophyll ratios used to run primary production models at large scales (Sathyendranath et al., 2020). In addition, some scarce observations at the functional group level evidence daily adaptation processes rather than community changes after water column mixing (Thompson et al., 2018) or a taxonomical dependency in physiological strategies (Graff and Behrenfeld, 2018). Being able to monitor phytoplankton distribution at a functional level, by integrating small and rapid scale dynamics into larger space and time scales would precise the role of phytoplankton in biogeochemical processes.

The objective of this paper is to study in situ physical and biological effects of a particularly intense episode of wind in spring 2019 in the Ligurian Sea (NW Mediterranean Sea). The methodology is to combine data taken during the FUMSECK cruise (Facilities for Updating the Mediterranean Submesoscale - Ecosystem Coupling Knowledge, https://doi.org/10.17600/18001155, PI S. Barrillon (Barrillon et al., 2020)) when this episode happened. High-resolution physical properties, chla and phytoplankton were measured and combined to show abrupt changes in water characteristics, and phytoplankton abundances and physiological properties in surface waters."

- For a work in which its conclusions revolve around the "role of storms on the biogeochemistry and ecology of the Mediterranean open sea (…)", I saw very few references in the introduction to works focusing on other than phytoplankton abundance or biomass changes. For instance, the authors could have discussed other studies that have approached the potential impact of such short-term events on carbon export (e.g., Hamme et al., 2010; Henson et al., 2012, 2013; Ferreira et al., 2022). Regarding this matter, I would be curious to see some remote sensing POC images/data before and after the storm. These may even tie in nicely with the conclusions of the article, if they reveal something interesting.

We thank you for the suggested references. After reading the suggested papers, we propose to add in the introduction several examples to illustrate the impact of short events on biogeochemical processes (first paragraph of the new introduction):

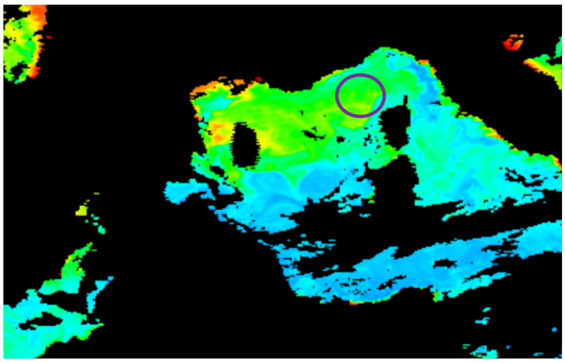
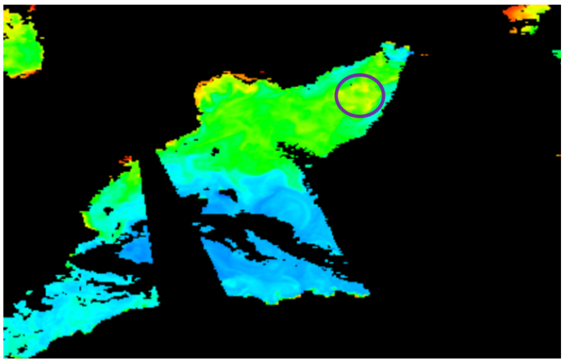
"Marine environments are subject to short-term events whose effects on biogeochemical processes can be substantial. This is the case of desert dust deposit on oligotrophic areas (Guieu et al., 2014), volcanic ash deposit (Hammes et al., 2010), submarines sources of iron (Guieu et al., 2018), and sudden mixing of the water column from typhoons (Wang et al., 2020). Even the classical phytoplankton spring bloom can vary in intensity and spatial extent depending on the amount of previous short term storms (Ferreira et al., 2021). Effects on micro-organisms activity and diversity encompass sudden changes compared to the previous conditions. Indeed, depending on the redistribution of nutrients, the intensity of any turbulences, the light conditions and the mixing of different water masses, the phytoplankton community can either collapse or grow, affecting carbon export by generating decoupling phenomenon between production and remineralization (Henson et al., 2019)."

We also propose to include a sentence in the discussion:

"This could in turn foster the integrated primary production by enhancing phytoplankton division rate and biomass (Behrenfeld, 2010) which, when grazers are diluted, is related to higher organic carbon export efficiency (Henson, 2019). This phenomenon was also observed after winter storms in the Sargasso Sea, where diatoms increase was maximal within two days after shoaling of the mixed layer depth (Krause, 2009). These pulsed production events could be responsible for up to 20% of the global primary production in the Sargasso Sea (Lomas et al., 2011)."

Regarding the POC analysis, we found this NASA product :
https://oceancolor.gsfc.nasa.gov/atbd/poc/#sec_6

A quick look seems to show some cloud issues during the storm (04, 05 of May). Nevertheless, looking at the region (images extracted from the web site, purple circle) on the 30th of April (before the storm) and the 06th of May (just after the storm), an increase of POC could be possible. This study would require some more time to deepen, we propose to perform this analysis when the revised manuscript will be submitted.

	
2019/04/30, extracted from https://oceancolor.gsfc.nasa.gov/showimages/MODISA/IMAGES/POC/L3/2019/0430/AQUA_MODIS.20190430.L3m.DAY.POC.poc.4km.nc.png	2019/05/06, extracted from https://oceancolor.gsfc.nasa.gov/showimages/MODISA/IMAGES/POC/L3/2019/0506/AQUA_MODIS.20190506.L3m.DAY.POC.poc.4km.nc.png

- Some paragraphs or portions of the manuscript are a bit verbose and could be shortened or even removed. For instance, in lines 53-64, there is an exhaustive description of the FUMSECK cruise. This description could be shortened and most of it could be integrated into the Material and Methods section to avoid redundancy.

Yes, we will remove the paragraph L53-64 from the introduction, shorten and embed it in the material and methods introduction as follows :

"The FUMSECK cruise aimed at combining physical and biological oceanography for the study of mesoscale and submesoscale dynamics, which imply structures such as eddies, filaments, or fronts over a horizontal spatial range of 1 to 100 km, a vertical one of 0.1 to 1 km, and a temporal range of days to a few weeks (Giordani et al., 2006; Ferrari and Wunsch, 2009; McWilliams, 2019). It took place from 30 April 2019 to 7 May 2019, in the Ligurian Sea (NW Mediterranean Sea), onboard the RV Téthys II. During this cruise, we deployed towed instruments and an underwater glider (Testor et al., 2019) to measure physical properties at high resolution. These measurements have been paired with shipboard measurements of phytoplankton functional groups from an automated pulse-shape recording flow cytometer, based on cell sizes and pigment contents (Dugenne et al., 2014; Thyssen et al., 2014; Bonato et al., 2015; Louchart et al., 2020). Figure 1 shows the cruise and the glider trajectories. Right after the storm for which we had to take shelter, the ship came back to the wind-exposed zone to collect data. Meanwhile, the glider stayed in the storm-exposed zone all along and collected data. In addition to in situ data, we exploited satellite data to guide the cruise and obtain a synoptic view of the region and a meteorological model to study the storm."

We will also remove the mention to the stations, and the following paragraph :

"Several in situ instruments for measuring physics and biogeochemistry were deployed and are described in this section within the first two parts: transect measurements, and glider. The satellite data exploited to guide the cruise and obtain a synoptic view of the region are described in the third part, followed by the meteorological model. The last part deals with the comparison of the fluorescence and chla concentrations from the different measurements."

Also, passages such as 66-69 and 73-76 are redundant. There is no need to state what the results section will show after the material and methods because that will become clear for the readers as they continue to read the manuscript. I recommend looking at such situations across the manuscript to keep the text as straightforward as possible for the reader.

Yes, such passages will be removed from the introduction, and the material and methods introduction.

- I think the sampling scheme could be clearer. For instance, there are underway surface water measurements of ADCP, SSS, SST and chl-a via fluorometer throughout the entire cruise (30/04/2019-07/05/2019). Then there is also an MVP which was deployed along seven different transects (only two are shown, as far as I noticed) and again sampled temperature, salinity, chl-a via fluorometer. It also included a plankton counter. Yet we only know the timing and duration of transect 1 (30/April) and 7 (5-6/May). Figure 6 is exhibiting the transects and its measured variables, but this should be clearly stated. Furthermore, while I was reading the manuscript, I was frequently unsure if what is being shown is the temperature/salinity data from the MVP or from the underway system. Inorganic nutrients were also sampled at 26 locations (or, at least, 26 samples were collected) and chl-a again (now via laboratory fluorometer) was sampled at 20 locations, all at surface. Judging from Figure 7, I think most of these chl-a and nutrients samples match, but, again, it should not be necessary for the reader to carefully compare figures and count stations to understanding the overall picture of what was done and how. What are the seven stations presented in Figure 1? Did multiple-variable sampling occur in these stations or are they just the location where the ship turned and began a new transect? For instance, in Figure 7, does the discrete in-situ sampling stations match the seven stations in Figure 1? Overall, I suggest revisiting the methodology section. One idea that may help could be including a table that lists all variables sampled, abbreviation and the source (ship underway, MVP, glider, discrete).

To answer your comment we propose several actions for the revised manuscript:

- The stations correspond to vertical velocity measurements, which are not exploited in this paper → we propose to remove them from the figures and the text.
- Add two zoomed plots as Fig1b and Fig1c, one showing the MVP transects and the other one showing the in situ samplings locations (one color for the common Chl/nutrients stations, another color for the stations not in commun)
- Remove from the material and methods the measurements not used in the paper
- Add the table below in the text, following your suggestions.

Observables	Abbreviation/ name	Vertical Range	Sampling	Source
Horizontal currents	ADCP currents	18 - 562 m	all cruise, 0.4 km resolution	VM-ADCP
	geostrophic currents	first meters	daily, 2 April to 3 July 2019	Satellite
Connservative Temperature	ϴ_tsg	2m	all cruise, 0.2 km resolution	TSG
	ϴ_mvp	0-308 m	7 transects, 1.3 km resolution	MVP
	ϴ_glider	0-600 m	2 transects, 1 km resolution	Glider
Absolute Salinity	S_A_tsg	2 m	all cruise, 0.2 km resolution	TSG
	S_A_mvp	0-308 m	7 transects, 1.3 km resolution	MVP
	S_A_glider	0-600 m	2 transects, 1km resolution	Glider
Fluorescence	RFluo_tsg	2 m	all cruise, 0.2 km resolution	TSG
	RFluo_cyto	2 m	400 samples, 3.9 km resolution	AFCM
	FL_npq	0-600 m	2 transects, 1 km resolution	Glider
Chlorophyll-a	Chl_tsg (converted)	2 m	all cruise, 0.2 km resolution	TSG
	Chl_insitu	2 m	20 samples	in situ
	Chl_cyto (converted)	2 m	400 samples, 3.9 km resolution	AFCM
	Chl_ACRI Chl_MEDOCL3 Chl_MEDOCL4	first meters	daily, 2 April to 3 July 2019	Satellite
Nutrients	Phosphate (PO_4^{3-}) Nitrate (NO_3^-) Nitrite (NO_2^-) Silicate ($Si(OH)_4$)	2 m	26 samples	in situ
Phytoplankton	Abondance, size,	2 m	400 samples, 3.9 km	AFCM

observables	biovolume, biomass		resolution	

- Finally, I think the discussion can be improved since it seems slightly superficial. For a large body of results (pages 9-21, including figures), a ~1 page discussion is quite short, particularly when the results are good. I feel the discussion lacks a comparison to other works on storm events, both in the Mediterranean and other areas. The authors do briefly compare some results with the OSCAHR cruise, yet this cruise occurred in November and did not sample a storm event (as far as its mentioned in the manuscript). Therefore, why would the results be directly comparable? This is not to say that this comparison is not valuable, but a better contextualization should be included.

We agree that we have to deepen the discussion. We will add a comparison with the datasets collected by Boudgriga et al., 2022, crossing the area during a similar period of the year (see the modified discussion at the end of the major comments below), and Latasa et al., 2022, showing similar trends in the Western Mediterranean Sea.

- Also, some conclusions within the discussion feel rushed and could do with better contextualization and arguments. For instance, in lines 317-318, the authors state that 'This suggests that cells did not have time to photo-acclimate or that different species were involved" after comparing the ratio of chl-a between chl-a in "cold" and "warm" waters. First, this information is not enough to make these statements. Secondly, this is the only mention of photoacclimation in the manuscript, except for line 46 in the introduction. Finally, this conclusion is quickly forgotten since the paragraph moves on and compares the increase in chl-a with a previous work from 2000.

We agree this part is missing information. A change is proposed in the new discussion.

- Again, in lines 333-334, the authors now suggest the drop in carbon/chl-a ratio is a "clear signature of a sudden change in phytoplankton cell physiology and translated the unadapted configuration of the cells to high light condition". Why is it a clear signature? Why is one thing related to another? It is up to the authors to make the 'bridge' between the results and the conclusions, not the reader. Moreover, the paragraph ends with this sentence, without any comparison to other studies or without a discussion of its implications.

In accordance with the previous comment, changes are suggested in the text in order to make the reading more friendly.

New discussion:

In the NW Mediterranean Sea, in May, the water column is generally well stratified with nearly undetectable surface nutrient availability (Pasqueron De Fommervault et al., 2015). This was indeed the oceanographic setting before an intense storm dominated by north-westerly winds impacted the water column. The analysis of 30 years of coastal data in the South of France (Toulon) by Meteo France shows that winds of intensity > 100 km h^{-1} occur on average 8 times per year, but only once every 4 years in May. Concerning winds of intensity > 130 km h^{-1} (i.e. 36 m s^{-1}), they occur on average once every 2 years, and once every 30 years in May (http://tempetes.meteo.fr/spip.php?article221). The wind intensity of the studied storm was rare in the Mediterranean Sea, and similar to the average wind intensity of the typhoons studied by Wang et al., 2020.

The physical and biogeochemical data, collected thanks to the deployment of high-resolution sensors, showed a clear shift in the local ocean physical-biological conditions after the storm. These changes included a steep change in temperature and salinity, and increases in surface chla concentrations and surface phytoplankton biomass and abundances.

Overall, the abundances of Redpicoeuk and Rednano were more than twice higher in April during the MERITE-HIPOCAMPE cruise (Boudgriga et al., 2022) than during the FUMSECK cruise, suggesting that the FUMSECK cruise occurred after the spring bloom events when nutrients in the euphotic layer are consumed. Only Orgpicopro, related to *Synechococcus* cells, were similar for both samplings. Abundances were also very close for Orgnano, Redpicoeuk and Rednano to the ones in the Eastern Mediterranean Sea in May (Latasa et al., 2022). A contrario, the abundances of phytoplankton groups during FUMSECK were on average twice higher than the ones observed at the same location during the OSCAHR cruise in November 2015 (Marrec et al., 2018) for the Rednano and the Orgpicopro but similar for the Redpicoeuk. The size of Rednano and Redpicoeuk were smaller on average (-20% and -16% respectively) than the ones observed during the OSCAHR cruise but larger for the Orgpicopro (+8 %).

The conversion into chla from the total red fluorescence evidenced Rednano as the main contributor during the entire study. The same observation is held in terms of biomass. All groups exhibited higher Chla_cyto in the newly-mixed waters with respect to the surrounding waters, reaching up to +68% for Rednano in the newly-mixed waters compared to the NC surroundings, despite the cells being smaller. Similarly, fluorescence per group was higher in the cold core of the OSCAHR eddy than in the surrounding warm waters, but did not exceed 20% difference. During OSCAHR, the ratio in chla reached 1.5 between the cold and the warm waters while in our study, Chl_cyto for Rednano and for Redpicoeuk was nearly 3 times higher in the cold newly-mixed waters.

This suggests that the cells did not have time to photo-acclimate, or that different species were involved. The newly mixed water was sampled less than one day after deeper layers reached surface layers. The phytoplankton abundances and size classes distribution inform on the capacity of the area to sustain the marine food web while the carbon/chla ratio is an indicator of photoacclimation status, especially interesting to collect when primary production is calculated from chla only (Behrenfield et al., 2002). It also gives insight about the rapid changes in light conditions of the cells, as it takes some time to photo-acclimate and adjust the pigment content of a cell to the new light conditions (Lewis et al., 1984). Most of the carbon over chlorophyll estimates are bulk, only few studies attempted to convert values per size classes. This paper aims at contributing to the estimated ratio from field studies with much higher precision thanks to the clear separation between phytoplankton and bulk particulate organic carbon given by AFCM, but also because of the resolution at the single cell level. The estimation of the cell carbon biomasses could be biased by the errors made during the prior estimation of the cell biovolumes, but also by the use of biovolume-to-biomass conversion factors from the literature. Nevertheless, the high variability of the carbon/chla values between phytoplankton groups evidenced different metabolisms between groups, Redpicoeuk having a much higher ratio (268.4) than Rednano (127.4). Compared to the study of f Calvo-Díaz et al. (2008) where values for picoeukaryotes varied from 0.07 to 282, the ratios found here for this group were in a similar range amplitude. Generally, the carbon/chla ratios presented in our study were high compared to the traditional value of 50, and were much higher than values found in high nutrient environments with lower light conditions (Jakobsen and Markager, 2016). The carbon/chla ratio integrating all groups varies from approx. 90 to 250 in surface conditions but dropped down to 50 in the newly-mixed waters (Fig.14). The high ratios observed before the storm could reflect the high light and low nutrient conditions of the post-bloom oligotrophic period sampled in the Ligurian Sea. The remarkable drop in the ratio observed in the cold water patch was a signature of a sudden change in phytoplankton cells and may have translated the not-yet photoacclimated configuration of the cells to high light conditions (Jakobsen and Markager, 2016).

While surface observations alone suggested a rise in chla concentrations (Fig.6 and 7), the integrated chla values from the glider fluorometer rather suggested that this surface increase is due to a dilution of the deep chlorophyll maximum in the mixed layer during the storm (Fig.13). The deepening of the mixed layer depth can lead to the dilution - by vertical mixing - of phytoplankton cells previously concentrated in the deep chlorophyll maximum. This sporadic event has potential consequences on the carbon fluxes estimates in this oligotrophic area.

Typhoons can be compared to the type of storm observed in our study only by the intensity and duration of the winds triggering a fast decrease of surface temperature and an increase in surface chla. Most of the typhoons enhance chlorophyll surface concentration (Wang et al., 2020). Nevertheless, in open water tropical and sub-tropical areas, dilution phenomenon of the deep chlorophyll maximum after typhoons was warned to be source of overestimation of potential phytoplankton production when using only satellites observation, because the nitracline is not always affected (Chai et al., 2021).

In our case, although the increase in chla after the deepening of the mixed layer depth during post-bloom periods and linked to wind events is not obvious as demonstrated by Andersen and Prieur (2000), the deepening of the mixing due to the storm was accompanied by an increase in surface nutrients that could only be linked to the uplift of the nitracline, as we were far enough from coastal run-off influences. This mixing was related to the spreading and the increasing of the phytoplankton in the upper layer, leading to a possible dilution of the grazers favouring the pico-nanophytoplankton accumulation in the shallowing mixed lays a few days after (Morison et al., 2019). This could in turn foster the integrated primary production by enhancing phytoplankton division rate and biomass (Behrenfeld, 2010) which, when grazers are diluted, is related to higher organic carbon export efficiency (Henson, 2019). This phenomenon was also observed after winter storms in the Sargasso Sea, where diatoms increase was maximal within two days after shoaling of the mixed layer depth (Krause, 2009). These pulsed production events could be responsible for up to 20% of the global primary production in the Sargasso Sea (Lomass et al., 2011).

Our observations captured the short-term physical and phytoplankton response to a storm, with rapid and strong changes observed but without the possibility to follow in situ post-conditions. Although not representative of what happens in the entire mixed water column, satellite data showed an effect on surface temperature and chla within the ship-glider storm geographical zone (longitudes between 8° E and 8° 30' E and latitudes between 43° 30' N and 43° 42' N). In this zone the mean value of SST was lower during four days after the storm (6-10 May, 14.8°C) than between the 20 April-20 May period (15.1° C), while the mean value of Chl_ACRI was higher (0.44 ng mL^{-1} with respect to 0.32 ng mL^{-1}), suggesting the pico-nanophytoplankton size classes could have had the time to grow and accumulate, as their growth rate is close to one to two divisions a day when nutrient and light are available (Morison et al., 2019).

For future work, the objective will be to study the medium to long-term response, after the so-called reaction period, and for each observed phytoplankton group. Indeed, such events are critical, as they may affect the primary production annual budgets.

Minor comments (lines on the left):

3: Please remove or change ‘violent’ for a more adequate term (e.g., intense).

Yes, intense.

4: NW is written as ‘north-western’, yet the title includes ‘northwestern’. Uniformize.

Yes, we will uniformize all over the text.

8: missing of: factor of two

Yes.

9: missing of: and of seven

Yes.

24: missing have: have combined

Yes (see new introduction).

26: what does ‘have evidenced pico-nanophytoplankton abundance and biomass responses’ mean? Did it increase, lower?

Yes, an increase for most of the groups (see new introduction).

29: remove have: ‘have studied’

Yes.

34: Are you suggesting that no previous cases of storms shaping primary production and phytoplankton community structure have been reported? It is not clear if this only refers to the NW Mediterranean, the entire Mediterranean or if it also includes other systems.

It refers to the Mediterranean open sea, changed in the new introduction.

38: missing the: overpass the phytoplankton growth capacity

Yes.

38: you already have north-western written in line 27, you can already use NW

Yes.

41: This area

Yes.

45: Add 'may': 'the mixing of the water column may bring microorganisms from deep to surface layers and affect their photophysiological properties (…)'

Yes.

62-64: methods?

Yes, this paragraph will be moved to Material and Methods.

91: were performed

Yes.

95 and 102: please specify that these are surface-only samples

Yes.

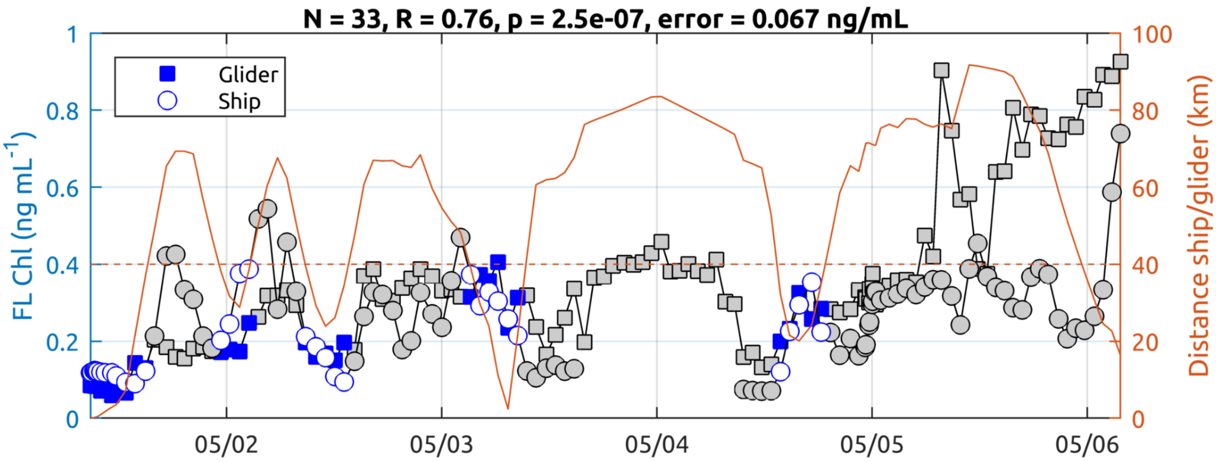
Figure 2 caption: Orgnano and Unidentified particles groups have the same colour (green dots). Use light and dark green, for instance, to differentiate them in the caption.

The Orgnano and Unidentified particles already had dark and light green colors, respectively, but as the Orgnano are rare and in the top-right part of the cytogram (Fig.2a), they are not visible enough. We propose to change the color of Orgnano to fushia.

149-150: It should have been calibrated prior to the cruise. Nevertheless, how good is the agreement with ship-based chl-a? Since the glider is the only source of data during the storm, this should be presented as supplementary material or, at least, the R, p-val, error and N should be indicated in the text.

No pre-cruise calibration of the Ecopuck was carried out. Nevertheless, we observe a good statistical agreement between the measurements of the glider with those taken from the ship (see Figure). Over a sample of N = 33 glider profiles where the glider-ship distance is lower than 40km, surface chla fluorescence from the ship and 0-10m average from the glider have a correlation coefficient of R = 0.76 (with a significant p-value of 2.5e-7) and a mean standard error of 0.067 ng mL^{-1}, well below of the amplitude of the observed signal during the storm (approx. 0.5 ng mL^{-1}). Values from the onset of the storm have been excluded (grey values after 05 May) since the glider was experiencing different conditions than the ship sheltering from the bad weather. At the end of the time series, when the glider was recovered, the values between the two platforms agree well again, which gives us a good confidence in the chla fluorescence signals described by the glider's sensor during its mission.

We could put this paragraph and the associated figure in supplementary material.



156: swap SSH and sea surface height

Yes.

157: swap SST and sea surface temperature

Yes.

157: there is no such thing as sea surface chl-a. Satellite chl-a does not capture only surface chl-a.

Right, we will replace sea surface chla by chla integrated over the first few meters, when satellite chla is concerned.

159-160: please provide a bit more detail on the satellite products instead of just referring to another paper. You may leave the citation, but please add a brief description, just mentioning the name of the products or sensors and their resolution.

Yes, you will find below the information on all the products. We propose to put in the text only the ones used for the results (in orange).

. SSH and associated geostrophic currents

- "MEDITERRANEAN OCEAN GRIDDED L4 SEA SURFACE HEIGHTS AND DERIVED VARIABLES" (SEALEVEL_MED_PHY_L4_NRT_OBSERVATIONS_008_050, now SEALEVEL_EUR_PHY_L4_NRT_OBSERVATIONS_008_060, https://resources.marine.copernicus.eu/product-detail/SEALEVEL_EUR_PHY_L4_NRT_OBSERVATIONS_008_060/INFORMATION) : 0.125° x 0.125°, multi-satellite

. SST

- "MEDITERRANEAN SEA - HIGH RESOLUTION AND ULTRA HIGH RESOLUTION L3S SEA SURFACE TEMPERATURE (SST_MED_SST_L3S_NRT_OBSERVATIONS_010_012, https://resources.marine.copernicus.eu/product-detail/SST_MED_SST_L3S_NRT_OBSERVATIONS_010_012/INFORMATION) : 0.01° × 0.01°, strict temporal window (local nightime), to avoid diurnal cycle and cloud contamination. provides supercollated (merged multisensor, L3S) SST data remapped over the Mediterranean Sea

- "MEDITERRANEAN SEA HIGH RESOLUTION AND ULTRA HIGH RESOLUTION SEA SUR- FACE TEMPERATURE ANALYSIS (SST_MED_SST_L4_NRT_ _OBSERVATIONS_010_004,https://resources.marine.copernicus.eu/product-detail/SST_MED_SST_L4_NRT_OBSERVATIONS_010_004/INFORMATION): 0.01° × 0.01°, nighttime images, multi-satellite

. Chl

- "GLOBAL OCEAN CHLOROPHYLL FROM SATELLITE OBSERVATIONS" (OCEANCOLOUR_GLO_CHL_L3_NRT_OBSERVATIONS_009_032, now OCEANCOLOUR_GLO_BGC_L3_NRT_009_101, https://resources.marine.copernicus.eu/product-detail/OCEANCOLOUR_GLO_BGC_L3_NRT_009_101/INFORMATION) : 4km x 4km, ACRI-ST company, multi-satellite, hereafter called Chl_ACRI

- "MEDITERRANEAN SEA SURFACE CHLOROPHYLL CONCENTRATION FROM MULTI SATELLITE OBSERVATIONS" (OCEANCOLOUR_MED_CHL_L3_NRT_OBSERVATIONS_009_040, now OCEANCOLOUR_MED_BGC_L3_NRT_009_141, https://resources.marine.copernicus.eu/product-detail/OCEANCOLOUR_MED_BGC_L3_NRT_009_141/INFORMATION): 1km x 1km, multi-satellite, hereafter called Chl_MEDOCL3

- "MEDITERRANEAN SEA DAILY INTERPOLATED SURFACE CHLOROPHYLL CONCENTRATION FROM MULTI SATELLITE OBSERVATIONS" (OCEANCOLOUR_MED_CHL_L4_NRT_OBSERVATIONS_009_041, now OCEANCOLOUR_MED_BGC_L4_NRT_009_142,

https://resources.marine.copernicus.eu/product-detail/OCEANCOLOUR_MED_BGC_L4_NRT_009_142/INFORMATION):
1km x 1km, multi-satellite, hereafter called Chl_MEDOCL4

167: reference for the ECMWF model?

We will add these two references :

- Bechtold, P., R. Forbes, I. Sandu, S. Lang, and M. Ahlgrimm, 2020: A major moist physics upgrade for the IFS. ECMWF Newsletter, No. 164, ECMWF, Reading, United Kingdom, 24–32, https://www.ecmwf.int/node/19720.

- Ben Bouallègue, Z., 2020: Accounting for representativeness in the verification of ensemble forecasts. ECMWF Tech. Memo. 865, ECMWF, 28 pp., https://www.ecmwf.int/node/19544.

174: techniques instead of sources

Yes.

179: in this context, this R2 could be higher.

We think we had misqualified the names in the equation. We have changed the Chl_tsg and Chl_cyto by the Chl_insitu.

→ "Fluorescence from the TSG (RFluo_tsg) was converted into units of chla concentration (Chl_tsg, ng mL^{-1}) using the significant correlation with Chl_insitu, Chl_insitu = 0.85 x RFuo_tsg - 0,19, r2 = 0.79, n = 20.

AFCM chla concentration (Chl_cyto) was estimated from the Rfluo_cyto. Values were normalised with 2 µm Polyscience beads, and multiplied by the abundance of each group to get the total normalised Rfluo_cyto per unit of volume (nRFluo_cyto (a.u mL^{-1})). nRFluo_cyto was then compared to the Chl_insitu (Fig. 3a and b). A set of samples from a minicosm experiment (PIANO, unpublished data), acquired with the same chla extraction protocol and the same Cytosense instrument was added to the observations. These samples presented higher chla concentration values, strengthening the relationship. The linear relation between nRfluo_cyto and Chl_insitu was used to estimate chla concentration for each AFCM phytoplankton group (Chl_cyto, ng mL^{-1}) following the linear regression Chl_insitu = 0.11 x nRFluo_Cyto, r2 = 0.97, n = 41 (Fig. 3b). The origin of the linear regression was not significantly different from zero."

In the case this was not the reviewer's request, we found the correlation between chla from samples analysed in the lab and fluorescence from a fluorimeter not so bad in our case. Indeed, as a comparison:

Marrec et al., 2016 : r^2=0.50, n=41, chla varying from 0.08 to 0.41 µg L^{-1}

Thyssen et al., 2015 : r^2=0.86, n=12, chla varying from 0.21 to 7.80 µg L^{-1}

Our study : r^2 = 0.79, n=20, chla varying from 0.07 and 0.82 µg L^{-1}

189: again, remove sea surface.

Yes.

191-192: the comparison period should actually be much shorter since the main ocean colour sensors overpass occurs between 10h-13:30h, depending on the sensor (see section 3.1 in Sathyendranath et al., 2019; Remote Sensing, 19(19), 4285). I would try rerunning the comparisons with a shorter period, it is possible the results may improve.

We agree that the 10h-13h30 period is indeed more appropriate to perform the comparison: most of the correlations found with this time period increase with respect to the 6am-6pm time period. Yet, using this time period, the correlation between Chl_insitu and Chl_ACRI is performed on 4 points only, between Chl_insitu and MEDOC_L3 on 2 points and between Chl_insitu and Chl_MEDOCL4 on 5 points, which is far too low for this time period to be used in practice.

Figure 3:

- how does the R between MEDOCL3 and MEDOCL4 is equal to 1, but the R between MEDOCL3 and Chl_insitu is 0.84 and MEDOCL4 and Chl_insitu is 0.65?

MEDOCL3 has gaps due to cloud coverage, and MEDOCL4 fills the gap with some climatology. Thus, L4 points are composed of the L3 points plus some additional climatology-based interpolated points. The correlation between L3 and L4 is therefore performed only on the "L3 points": by construction the correlation is 1. Similarly, the Chl_insitu/MEDOC_L3 correlation is performed on 10 points whereas the Chl_insitu/MEDOC_L4 correlation is performed on 17 points (10 "L3 points" and 7 interpolated points). The worst correlation for Chl_insitu/MEDOC_L4 shows that the climatology interpolation does not match our in situ observations here.

- Where does the N=4555 come from when comparing satellite and in-situ data? Satellite data should be, at most, daily data unless the authors are working with geostationary sensors

We agree that this number can be misleading. Satellite data are indeed daily provided, on a lat/lon grid. We performed the association between each Chl_tsg data and the Chl satellite data on the same day and for the closest lat/lon pixel, then selected the ones where the Chl_tsg data is between 6:00-18:00 UTC day time. As a matter of fact, checking this, we found that the number 4555 in the text was not correct: Chl_ACRI n = 3522, Chl_MEDOCL3 n = 2094, Chl_MEDOCL4 n = 4498. We will correct these numbers.

- The colour palette for the correlation plot should be changed to a more uniform one (e.g., R=0 white, R=1 dark red)

Yes, we will change to shades of blue.

197-199: these are not results

Yes, we will move these lines to the Material and Methods.

201: why did you opt for MEDOCL4 when the relationship between satellite and in-situ was much better for MEDOCL3?

For this figure, the purpose was to define the mean dynamic zones during the cruise. We decided to use MEDOCL4 even if the correlation with in situ Chl is worse than the MEDOCL3 one, to avoid the clouds that can create artificial features when averaging on several days.

204: I recommend changing the Chl-a units from ng/mL to either ug/L or mg/m3 since these options are more commonly used.

We understand your remark, as chlorophyll-a concentration is often written in µg/L. Our manuscript uses volumes a lot, and we are presenting all the data in units/mL to homogenise with the flow cytometry datasets. Indeed, if we would use L, we would be required to add a 10^3 for each abundances presented in the tables and in the figures.

212: I recommend using m/s for wind speed. Also, the same units should always be used throughout the text (see line 222).

Yes, we will use m/s and homogenise through the text.

212: are these average or maximum intensities? Not clear.

They are the ranges of the intensities.

215-218: Again, these are not results from this work, unless you include them as supplementary material. Thus, this comparison would be more suitable in the discussion.

Yes (see new discussion).

224: The final sentence of the paragraph can be removed.

Yes.

237: rose instead of rised up

Yes.

299-300: this should also be in the discussion.

Yes.

302: the water column was

We mean general characteristics, we propose a rephrasing :

"At the time of the FUMSECK cruise, in May, the water column is generally well stratified with nearly undetectable surface nutrient availability (Pasqueron De Fommervault et al., 2015"

→ "In the NW Mediterranean Sea, in May, the water column is generally well stratified with nearly undetectable surface nutrient availability (Pasqueron De Fommervault et al., 2015, This was indeed the oceanographic setting for the FUMSECK cruise, before an intense storm dominated by north-westerly winds impacted the water column."

311-312: add percentages or values when comparing

Yes (see new discussion).