

Comments to the Author:

MC1: Thank you for your important revisions. The main three issues raised by both reviewers concerned the lack of strong hypothesis to introduce the paper, the lack of evidence that dust deposition did occur and important issues regarding the statistical analyses. In addition, reviewers also made many minor comments. Following the very detailed report of both referees, the authors have carefully answered point by point to major and minor issues raised. Consequently, authors have substantially rewritten some sections, new sections have been added, new figures and tables proposed and finally the references have been updated. The paper reads very well now also because a native English speaker proofread the manuscript.

I therefore consider that your paper can be now published after some minor revisions.

MC2: I made many edits and comments directly on your text

All this edits and comments were considered. We assigned a code to each and the answers can be found in the text comment section from TC1 to TC22.

in addition, I recommend that you answer the following points:

Abstract:

MC3:- I wonder if updates could be done considering that several important points and conclusions are now supported using different statistical tools: I find it a pity that the efforts made on the statistical aspects to consolidate the interpretations of the results are not at all reflected in the abstract and the conclusion. I strongly encourage the authors to do so.

We fully agree with this comment and the abstract is now completely rewritten.

The PEACETIME cruise (May-June 2017) was a basin scale survey covering the Provencal, Algerian, Tyrrhenian and Ionian basins during the post-spring bloom period and was dedicated to track the impact of Saharan dust deposition events on the Mediterranean Sea pelagic ecosystem. Two such events occurred during this period, and the cruise strategy allowed to study the initial phase of the ecosystem response to one dust event in the Algerian basin (during 5 days at the so-called 'FAST long-duration station'), and a latter response to another dust event in the Tyrrhenian basin (by sampling from 5 to 12 days after the deposition). The present paper documents the structural and functioning patterns of the zooplankton component during this survey, including their responses

to these two dust events. The mesozooplankton was sampled at 12 stations by combining nets with 2 mesh sizes (100 and 200 μm) mounted on a Bongo frame for vertical hauls within the 0-300 meter-depth layer.

Algerian and Tyrrhenian basins were found quite similar in terms of hydrological and biological variables, which clearly differentiated them from the northern Provencal Basin and the eastern Ionian Basin. In general, total mesozooplankton showed reduced variations in abundance and biomass values over the whole area, with a noticeable contribution of the small size fraction (< 500 μm) of up to 50 % in abundance and 25 % in biomass. This small-size fraction makes a significant contribution (15 to 21 %) to the mesozooplankton fluxes (carbon demand, grazing pressure, respiration and excretion) estimated using allometric relationships to the mesozooplankton size spectrum at all stations. The taxonomic structure was dominated by copepods, mainly cyclopoids and calanoids, and completed by appendicularians, ostracods and chaetognaths. Zooplankton taxa assemblages, analyzed using multivariate analysis and rank frequency diagrams, slightly differed between basins in agreement with recently proposed Mediterranean regional patterns.

However, the strongest changes in zooplankton community were linked to the dust deposition events. A synoptic analysis of the two dust events observed in the Tyrrhenian and Algerian basins and based on the rank frequency diagrams and a derived index proposed by Mouillot and Lepretre (2000) delivered a conceptual model of a virtual time series of zooplankton community responses after a dust deposition event. The initial phase before the deposition event (state 0) was dominated by small-size cells consumed by their typical zooplankton filter feeders (small copepods and appendicularians). Then, the disturbed phase during the first five days after the deposition event (state 1) induced a strong increase of filter-feeders and grazers of larger cells and the progressive attraction of carnivorous species, leading to a sharp increase of the zooplankton distribution index. Afterward, this index progressively decreased from day 5 to day 12 highlighting a diversification of the community (state 2). A three weeks delay was estimated to get the index returned to its initial value, potentially indicating the recovery time of a Mediterranean zooplankton community after a dust event.

To our knowledge, PEACETIME is the first in situ study allowing observation of mesozooplankton responses before and soon after natural Saharan dust depositions. The change in rank-frequency diagrams of the zooplankton taxonomic structure is an interesting tool to highlight short-term responses of zooplankton to episodic dust deposition events.

MC4:- I found the section starting L18 quite confusing as it somehow contradicts the observations analyzed as a 'virtual time series' under the influence of dust deposition with different time lag. I suggest removing that sentence and to focus on a clear statement about the 'virtual time series concept' results that I think are very interesting.

See comment MC3.

Results and Table 1.

MC5: I would be more precise concerning the sediment traps data and I made suggestions directly in the text. Please report in the text the corrections that I suggest for the lithogenic cumulated fluxes. The point here is that (1) at TYR the sediment trap sampling likely missed a part of the export as it started 6 days after the event occurred and (2) at FAST, the last trap represented 24 hours collection between June 5 and 6, so the collection likely missed the main lithogenic export that likely occurred after. Lithogenic fluxes at both sites are thus likely well below the actual export following the events.

Done in table 2 and in the text paragraph 2.2

MC6: There is one remark from Referee#2 concerning the sampling 0-300m: I agree with you answer but I think your final statement "Also note that the observed impact on zooplankton is more significant because it integrates the whole water column" should be somewhere in the text, conclusion maybe (need to rephrase the sentence).

Done in paragraph 4.4

MC7: There are a number of additional figures and table that are presented in response to reviewers comments. I would definitely recommend adding this pertinent material to the Supp. Info.

Done

Text Comments (TC)

Answers to your comments on the draft

TC1: I would remove 'major' as the one at FAST was rather modest

The following change was made in the sentence: "including their responses to two dust events."

TC2: I found this section quite confusing as it contradicts the observations analysed as a 'virtual time series' under the influence of dust deposition with different time lag. I suggest to remove that sentence and to focus on a clear statment about the 'virtual time series' results.

The abstract is now rewritten and that sentence was removed

TC3: I think it is too early to give such information

The following change was made in the sentence: "A dust event occurred over a large area"

TC4: be carefull order of station was wrong St 5, TYR then ST6

The following change was made in the sentence: "samples at ST5, TYR and ST6"

TC5: parenthese

The parenthesis was added

TC6: collected at TYR between 6 and 9 days after the event (only a part of the exported lithogenic material could thus have been collected) => the deposition that occured 11-12 May was thus higher than what was collected several days after.

The following sentence was added in the draft : " Lithogenic flux values at TYR and FAST are likely underestimated considering that traps were placed with a time delay after the dust event (6 and 1 days respectively), thus the reported values could represent only a fraction of the total fluxes."

TC7: replace by "Bressac et al., in prep"

The citation was changed

TC8: Paragraph 2.2 Line 104: "considered as a 'non recently impacted site' (please add something like that, otherwise 'for comparison' alone is not clear enough)"

Answer: "station ION will be considered (for comparison) as a non-recently impacted area."

TC9-TC10: those need to be defined also in the text

All the names of the basins are now defined in the text paragraph 3.1

TC11: please, add: Central and Western (as a rev asked for additional ref in the eastern Med that you didn't add for that reason.

The following change was made in the sentence: "in different regions of the Central and Western Mediterranean Sea"

TC12: maybe good place here to indicate that biomass in that table is an average over -250 m, likely diluting any possible effect on the surface mixed layer for ex.

The following change was made in paragraph 4.4 : Thus, the PEACETIME survey dedicated to the tracking of such events was an opportunity to observe real in situ zooplankton responses in the epipelagic layer (0-300 m).

TC13: see my remark about traps at FAST: only the last sample is likely affected by the dust deposition

In the following sentence below we use the difference in swimmers in traps between the two dates with the first one as a non impacted as reference:

"The daily observation of sediment traps at 200 and 500 meters over five days between FAST1 and FAST3 (pers.comm. C. Guieu) shows a relative increase of swimmers collected at 500 m versus those collected at 200 m, also suggesting increasing numbers of migrants.

Thus, there is no reason to modify this sentence.

TC14: Nagib did all the sampling

Change done

TC15: the new citation is: Van Wambeke F., Taillandier V., Desboeufs K., Pulido-Villena E., Dinasquet J., Engel A., Maranon E., Guieu C., Influence of atmospheric deposition on biogeochemical cycles in an oligotrophic ocean system, in preparation for Biogeosciences, (this special issue).

Change done

Figure 1- TC16: these should be also defined in the text

This is defined in the section 3.1 see comments TC9-TC10

Table 2- TC17: est ce que tu as bien pris les dernières données ds le draft de France et al.?

Answer: these data were taken from a Excel file send by France. But the data is not presented in her paper, so we change the reference as personal communication.

Table 2- TC18: il y a des données de NO3 à TYR

There is data of NO₃ at TYR but not for the cast close to the zooplankton sample. Data for NO₃ was taken 2 day before the zooplanton sample. So we put this value and explain in the legend that it was taken two days before.

Table 2- TC19: Please report in the text the corrections that I made for the lithogenic cumulated fluxes. The point here is that (1) at TYR we likely missed a part of the export as we started sample 6 days after the event occurred and (2) at FAST, the last trap represented 24 hours collection between June 5 and 6, so we also likely missed the main lithogenic export.

This correction was made in the text paragraph 2.2

Table 2- TC20: FAST cumulated (5 days) lithogenic export was 50 mg.m⁻² (at 200 m) and 70 mg.m⁻² (at 1000 m) (Bressac et al., in prep.).

The sediment trap was place from June 5 to June 6 so it should be a 24 hrs collection as you said before. We understood that the 5 cumulated days you say in this point probably is a mistake. Are we right? Please answer to be changed in the text accordingly in Line 106

Table 2- TC21: Quantifying the dust deposition from sediment traps data is difficult as sediment traps were recovered on June 6 whilst the dust deposition ocured on June 5. So this cumulated flux is a minimum value for the dust deposition in the area.

This correction was made in the text paragraph 2.2

Table 2- TC22: TYR cumulated (4 days) lithogenic export was 153 mg.m⁻² (at 200 m) and 207 mg.m⁻² (at 1000 m) (Bressac et al., in prep.). Note that this is a minimum dust deposiition since the sampling started 6 days after the event

This correction was made in table 2 and in the text paragraph 2.2