Anonymous Reviewer #2

We would like to thank Anonymous Referee #2 for her/his comments and suggestions on our manuscript. We agree with most comments and modified/updated the manuscript accordingly. Below is a point-by-point reply, our answers appear in blue.

The project aimed at extensively studying and parameterizing the chain of processes occurring in the Mediterranean Sea after atmospheric deposition, especially of Saharan dust, and to put them in perspective of on-going environmental changes (Guieu et al., 2020).

What else was deposited?

This was removed since the objective of the cruise was to study the impact of all types of atmospheric particles.

both under present environmental conditions and following a realistic climate change scenario for 2100 (ca. +3 °C and -0.3 pH units; IPCC, 2013)

This is probably a conservative scenario; see: Flecha, S., F. F. Pérez, J. García-Lafuente, S. Sammartino, A. F. Ríos, and I. E. Huertas (2015), Trends of pH decrease in the Mediterranean Sea through high frequency observational data: indication of ocean acidification in the basin, Scientific reports, 5, 16770-16770.

This manuscript does not provide projections for the end of the century. Kapsenberg et al. (2017) provided a lower estimate of current pH decrease in the Mediterranean Sea on a longer time series. Anyway, we preferred considering a IPCC global scenario for the 2100 projection, which is actually close to the most pessimistic one as IPCC reports a -0.06 to -0.32 pH unit decrease depending on the socio-economic scenario considered (RCP2.6 to RCP 8.5).

The tanks are made of high-density polyethylene (HDPE) and are trace-metal free in order to avoid contaminations.

How did you establish this?

Because all the material used is made of HDPE, and was cleaned following the same protocols used for trace-metal free studies.

The tanks were filled by means of a large peristaltic pump (Verder© VF40 with EPDM hose, flow of 1200 L h-1) collecting seawater below the base of the boat (depth of ~ 5 m), used to supply continuously surface seawater to a series of instruments during the entire campaign.

Were you always sailing? I could imagine that contamination would occur easily if you were not?

The boat was "at station" while filling the tanks. This is a very normal way to work at sea. For example, all CTDs used during the cruise, including the Trace Metal Free Titanium Rosette equipped with GoFlo bottles, was deployed at station. The sampling at 5 m with this device does not indicate any type of contamination (Bressac et al., in prep.).

The particle size distribution showed that 99% of particles had a size smaller than 0.1 µm, and that particles were mostly made of quartz (40%), calcite (30%) and clay (25%; Desboeufs et al., 2014)

This seems VERY fine grained to me; did you grind it? Before, you mentioned <20µm?Material this small will never settle (at least as individual particles....).

Absolutely, thanks for pointing that up. We made a mistake that has been corrected: “particles had a size smaller than 1 µm.”

The experiment at stations TYR and ION lasted 72 h (3 days) whereas the last experiment at station FAST was extended to four days.

Why 3 days and why 4 days?

This was added: This relatively short duration of the experiments was constrained by the time available between stations and the time needed to properly clean the tanks between the experiments, following the protocol described by Bressac and Guieu (2013). As a larger time window was possible at the end of the cruise, the experiment at FAST was extended to four days.

The identification of species was performed by automatic comparison with the library data set EcoTaxa (https://ecotaxa.obs-vlfr.fr/, last access: 17/04/2020) and then all validated and corrected by a human operator.

i.e. you or one of your co-authors?

Modified to: “The identification of species was performed by automatic classification with a reference dataset in EcoTaxa (https://ecotaxa.obs-vlfr.fr/, last access: 17/04/2020) and then all validated and corrected manually.”.

Overall, the differences between the warmed treatment (G) and the other tanks were +3, +3.2 and +3.6 °C at TYR, ION and FAST, respectively

Within 0.6 of each other; that is amazing!

Thank you!

However, at all three stations, initial concentrations of NOx (14, 18 and 59 nmol L-1 at TYR, ION and FAST, respectively; Table 2) were lower that the ones reported by Manca et al. (2004).

Replace that by than.

Sentence has been removed following suggestions from Reviewer #1.

Furthermore, as already mentioned, based on pigment analyses (HPLC), the sum of Fucoxanthin and Peridinin (representative of diatoms and dinoflagellates, respectively) represented only ~10% of the total chlorophyll a biomass at all stations. As biomass of both heterotrophic nanoflagellates and prokaryotes followed a west to east gradient (FAST > TYR > ION), ratio of autotrophic vs heterotrophic biomass appeared clearly in favor of the heterotrophic compartment at stations TYR and FAST (ratio of 0.6) while a value above the metabolic balance was estimated at ION (ratio of 1.3).

before you mentioned a lower number: <5%

Indeed, we clarified in the Results section: “At all three stations, the proportion of pigments representative of larger species (i.e. Fucoxanthin and Peridinin; diatoms and dinoflagellates respectively; Ras et al., 2008) were very small (< 5% for each pigment)”.

Corrected to “the ratio”

NOx levels moderately decreased over the course of our experiments due to biological uptake

Reverse order

Modified

The opposite feature was observed for the DIP released by dust that rapidly decreased during our experiments

Reverse order

The sentence has been modified following Reviewer #1 suggestion: “While NOx levels decreased moderately over the course of our experiments due to biological uptake, more abrupt decreases were observed for DIP released by dust, reaching values close to the ones observed in the controls, except at station FAST where concentrations were still above ambient levels at the end of the experiment.”.

Regarding the intensity of simulated wet deposition event, the 10 g m-2 deposition event considered here represents a high but realistic scenario, as several studies reported even higher short wet deposition events in this area of the Mediterranean Sea (Bonnet and Guieu, 2006; Loÿe-Pilot and Martin, 1996; Ternon et al., 2010).

Modified as suggested to: “The intensity of this simulated wet deposition event (i.e. 10 g m-2) represents a high but realistic scenario, as several studies reported even higher short wet deposition events in this area of the Mediterranean Sea (Bonnet and Guieu, 2006; Loÿe-Pilot and Martin, 1996; Ternon et al., 2010)”.

This was especially true at station ION where no clear response to nutrient enrichment was observed for nano-eukaryotes throughout the experiment. However, it must be stressed that our experiments were performed over a relatively short period (3 to 4 days).

so why did you choose so (relatively) short experiment durations?

This is now explained in the Material and Methods section.

Feliu et al. (2020, this issue) have shown that the mesozooplankton assemblage at TYR was clearly impacted by a dust event that took place nine days before sampling at that station (François Dulac, Pers. Com. 2019) and evidenced by dust export in in situ deployed sediment traps (Bressac et al., in preparation, this issue).

it would be very interesting to study the particle-size distributions of the dust in this event sampled in the water column!

The sentence was modified as we actually have evidence directly from dustborn elements in the water column. Modified to: “Regarding the first hypothesis, Feliú et al. (2020) have shown that the mesozooplankton assemblage at TYR was clearly impacted by a dust event that took place nine days

before sampling at that station as evidenced as evidence from particulate inventory of lithogenic proxies (Al, Fe) in the water column (Bressac et al., in preparation).".

DIP levels decreased to reach similar levels than in control tanks at the end of this experiment (Fig. 6)

Add as

This section has been significantly modified. See revised version.

This results appears surprising as large impacts of warming and acidification have been observed,

Results to Result

Modified.

This is further evidenced by the absence of differences detected over the relatively short time duration of our experiment on meso-zooplankton abundance and carbon export efficiency (Gazeau et al., in preparation, this issue).

Reverse order

Modified.

At FAST, similar to what was observed at station ION, all phytoplanktonic groups were positively impacted by warming and acidification

Reverse order

Modified.

Also, in contrast to station ION, the abundance of heterotrophic prokaryotes in the warmer and acidified treatment reached a maximum after two days of incubations and then strongly decreased to reach levels observed in the control treatment.

Reverse order

Modified.

We fully acknowledge that the duration of our experiments was certainly too short to carefully assess the proportion of newly formed organic matter

See addition in material and Methods.