We want to thank the reviewer 2 for its detailed reading of our ms and useful suggestions.

Our replies to comments are in blue. *« Blue quoted text »* ***is the updated text in the ms.***

Note that an error was spotted in table 2. Some values for layer 5-300 m have changed, and some sentences in results and discussion have also been changed accordingly.

R2

General Comments:

This paper focus on the oceanographic and biological data collected during the PEACETIME cruise in the Ionian Sea in May 2017. The results focus on the heterogeneity of the water masses salinity, fluorescence and particle content observed along the ION-tr transect, suggesting their different origins and connecting them with the surface dynamics of the Ionian Basin. The ION-tr transect results in an interesting crossroads between three different water masses; their presence and characteristics are linked to the basin-scale circulation of the Ionian Sea.

I find this work very interesting and certainly suggest its publication, but I also believe that the authors can still work on improving the description of the context and results. The introduction should be used to explain the importance of this kind of studies and to introduce the dynamics and the surface circulation of the Ionian Sea, in order to give the reader the right elements to better understand and interpret the results. In this form, it becomes very difficult to follow the descriptions without a deep knowledge of the study area. The results of Lagrangian numerical simulation are an important point of this work, and the criteria chosen for the simulations should be explained in more detail.

We have developed the context in the introduction to provide background information on the Ionian Sea circulation and why studying particle distribution is important:

"*The study of particle abundance, size structure and dynamics is a key to understand the marine ecosystem, from primary and secondary production, export and remineralization all the way through food-web dynamics (McDonnell et al 2015, Giering et al 2020). In the semi-enclosed Mediterranean Sea, the main particles sources are the biological production in the open ocean and over continental shelves, rivers discharge, atmospheric deposition as well as sediment resuspension. From West to East and North to South, the Mediterranean Sea harbours areas of very distinct productivity, going from eutrophic (e.g. in the Alboran Sea) to ultra oligotrophic (e.g. in the Levantine basin, Moutin et al 2017). This heterogeneity is further developed by the complex general and mesoscale circulation that favor exchanges between these contrasted areas, leading to a fine scale spatial distribution of biogeochemical properties and particles (Karageorgis et al 2008, Durrieu de Madron et al, 1992, Rousselet et al 2019).*

Located in the center of the Mediterranean Sea, the Ionian Sea is a cross road where three different surface water masses meet: i) recent Atlantic water (AW) flowing from the Sicily channel ii) older AW flowing from the East after its cyclonic circulation in the Levantine basin and iii) fresher (Po influenced) water coming from the Adriatic Sea (Malanotte-Rizzoli et al 1997). Circulation in the North Ionian is strongly variable, as is the path of AW spreading. The most stable branch of the Atlantic Ionian Stream entering the Ionian Sea follows a rather direct pathway to the SouthEast, connecting the Sicily Channel with the Cretan Passage (Mid Ionian Jet, MIJ, Menna et al 2019). South of the MIJ, circulation pattern is more stable and anticylonic, known also as the Syrte Gyre (Pinardi et al, 2015). North of the MIJ, two alternate circulation states have been proposed, the

anticyclonic and cyclonic mode of the so called North Ionian Gyre (NIG, Gačić et al 2010). In addition, semi-permanent mesoscale gyres are observed in the western part (Maltese Channel Crest, Medina Gyre, Messina Rise Vortex) as well as in the eastern part (Pelops Gyre), some of them triggered by wind. Although the AW circulation has been documented according to seasons and NIG modes (Malanotte-Rizzoli et al 1997, Gačić et al 2011, Menna et al 2019), the fine-scale pathways of AW crossing the Ionian Sea have only seldom been sampled. The mode of the NIG has a strong influence on the dispersal of water masses and properties in the Ionian basin, also impacting its productivity (Lavigne et al 2018).

The Ionian Sea is generally considered oligotrophic (Boldrin et al 2002), with a north-south gradient of Chl-a (d'Ortenzio et Ribera d'Alcala 2009). However, it is not homogeneous, as distinct phytoplankton communities associated to the main water masses have been described (Casotti et al 2003). Three main phytoplankton communities were associated with water coming from Adriatic in the north west, water from the Eastern Mediterranean in the north east and AW from the Sicily channel to the south. Zooplankton community was also contrasted between northwestern and eastern Ionian (Mazzocchi et al 2003).

Particle distribution in the Ionian Sea is less described. The particle concentration in the water column can be measured with several instruments. Discrete sampling is carried out using bottles or pumps followed by filtration, allowing bulk mass measurements (McDonnell et al 2015). Continuous sampling can be carried out using optical measurements that give either bulk measurements (transmissometer, backscatter (Briggs et al 2013)) or size-resolved measurements: Laser In Situ Scattering and Transmissometry- LISST, (Karageorgis et al 2012), Underwater Vision Profiler – UVP (Picheral et al 2010), Laser Optical Particle Counter – LOPC, (Herman, 2004) for the most common instruments, see Giering et al (2020) for a comprehensive review. In the Ionian Sea, few data are available on the horizontal distribution of particles. These data have a coarse horizontal resolution and are mostly from transmissometry, water filtration (Rabitti et al 1994, Boldrin et al 2002, Karageorgis et al 2008, 2012) while few data are from optical devices (Karageorgis et al 2012, Ramondenc et al 2016). Here we used the LOPC, providing size resolved abundances over the size range [100-2500] µm. This instrument was mounted on a free-fall MVP fish, allowing high resolution horizontal and vertical sampling of particles and water mass properties along the ship track, to investigate their joint distribution in the Central Ionian Sea.

The objective of this paper is to document particle distribution in the central Ionian Sea, based on a high-resolution multi-parametric transect. In particular we analyse particle distribution with regard to water mass properties and transport, to propose scenarios of histories of these waters masses and discuss implications for the functioning of the Ionian Sea ecosystem. ***"***

Regarding the criteria chosen for the simulations, we have detailed our choices in the new version of the Material and Methods section.

"The simulated particle positions were initialized in a polygon around the ship's track on May 29th (Longitude from 18° to 20.1°, Latitude from 35.4° to 35.9° with a 0.2° widening in Latitude). This polygon surrounds the actual track, to consider the uncertainty associated to the spatio-temporal resolution of the satellite-derived current velocity field. 10000 particles (sufficient for a comprehensive sampling of the polygon area and for saving computing time) randomly seeded inside the launch area were advected backward for one month. This duration was chosen as a trade-off between particle source identification, error accumulation along the trajectories and

residence time in the Ionian Sea (39 days according to Celentano et al 2020). The particle trajectories and final positions were analyzed to determine the main source areas. "

Specific comments:

Introduction:

I like short, concise introductions, but I find this one too essential. It would be interesting to have a brief discussion of the main results in the literature and some considerations on the importance to study particle distribution.

See above.

Lines 47-48: these two sentences seem a repetition.

Right. We changed this paragraph, including more background.

Lines 51:53: I suggest a broader explanation of the background (PEACETIME cruise) and of the objectives of this study. This sentence rather than explaining the objectives seems to anticipate the results in a cryptic way.

We added details for the PEACETIME cruise in the methods. The objectives are better explained (See above).

Materials and Methods:

Figure 1: I suggest reproducing the figure in a more accurate way. The transect ST8-tr is not labelled in the figure; the label of the ION-tr transect is positioned away from the transect itself; use different colours for circulation patterns and transects.

We updated the figure adding ST8-Tr and arrows to be more explicit.

Results:

Lines 135-138: Figure 2 is introduced at the beginning of the results without context (it is unclear where the time series was derived from and why). I suggest inserting a paragraph at the beginning of the section that introduces and contextualizes the results explained below. For example, the authors could start by describing the Ionian surface circulation during PEACETIME cruise and explaining why that area was chosen the averages of SST and Chl-a. In the caption of Figure 2, the authors talk about an average on the "northern Ionian Sea", but actually the selected area involves almost all the Ionian Sea.

Following the reviewer's suggestions, we added the following sentence to introduce the figure and the choice of the region. We prefer not to discuss here the surface circulation as it is shown on figure 4. The caption of the figure was also modified accordingly.

"Considering the surface circulation over the northern Ionian Sea (figure 1), averages of satellite Chl-a and surface temperature for the region 16° to 22°E, 34° to 40°N were computed for the period before our sampling."

We restricted the region of average (34-40°N) to fit the region of influence of our transect.

Lines 143-144: it should be better explained to the reader how to recognize these cyclonic and anticyclonic structures in Fig. 3a and 3b.

We now included the positions of the main eddies in the text: (anticyclones located at 34.7°N 17.5°E, 35.7°N 19°E, and cyclones located at 37.5°N 16E, 38°N 17.5°E and 34.5°N 21.3E)

Line 153: this sentence is not clear for me! "Sufficient abundance" of what?

We rephrased the sentence :

«showing contrasted distribution and abundant enough for the counts to be accurate.»

See table 2 in Leroux et al (2017) http://dx.doi.org/10.1016/j.pocean.2017.10.010

Line 155: add "…of Sicily, where lower salinities are associated to large abundance."

We changed the sentence as suggested.

Line 163: add also a comment about the difference in speeds between AVISO and ADCP currents.

We added : *«current magnitude estimated from AVISO was about half the value of ADCP derived current magnitude»*

Section 3.3: It would be easier for the reader to follow this description by adding in the text an indication of the sub-plots referred to.

We now refer to the subplots in the text.

Section 3.4: The results of this figure are essential to understanding the discussions and conclusions sections of this work. For this reason I believe that the authors should explain more accurately what we see in the different panels of Figure 8 and then focus on the results of panels E and F. The rectangle enclosing the location of the ION-tr transect in Figure 8E is really hard to see.

Thank you for this remark. We now explain further the panels in the results.

"*Figure 8 show the full trajectories of particles originating along the ION transect, splitted in four panels according to the main path followed by particles and therefore origin. Each color identifies a distinct path. Panel E show the particle positions one month before our sampling, colored according to the origin.* ***"***

We also updated figure 8 to make it clearer and larger. The legend was changed as follows:
*« Black dots are the particle positions at the end of the backward advection, ie one month before our sampling.****"***

Technical Comments:

Line 85: the acronym TSG is not defined

ThermoSalinoGraph (now in full in text).

Line 111: check the spatial resolution of the SST.

Thank you for this remark. The SST data was at 1km resolution indeed. It is now corrected in the methods.