Response Letter for - Coastal Eddies as Vectors for Connectivity During the Summer in the Levantine Sea

We would like to thank the Editor and both reviewers for their careful evaluation of our manuscript and for their constructive and insightful comments. We believe that the revisions prompted by these comments have substantially improved the clarity, readability, and overall quality of the manuscript.

In particular, the reviewers' suggestions led to a clearer presentation of the study objectives and methodology, including a more explicit distinction between the different analytical approaches used throughout the manuscript and additional figure annotations illustrating the outputs of these methods. The discussion was also expanded to better place our findings within the broader context of physical–biogeochemical interactions in oligotrophic marine systems and to further clarify the significance of the observed transport events.

Below is a point-by-point response to the reviewers' comments. Reviewer 1 comments are shown in **red** and Reviewer 2 comments in **blue**, our responses provided in **black**. Corresponding revisions in the tracked-changes manuscript follow the same convention, with modifications associated with Reviewer 1 shown in **red** and those associated with Reviewer 2 shown in **blue**.

Response to Reviewer 1

General Comment

My only general suggestion is to expand the discussion to better contextualize the role of fine-scale physical features in oligotrophic systems.

We thank the reviewer for this helpful suggestion. To better contextualize the significance of the observed transport events, we expanded the Discussion to place our findings within the broader framework of oligotrophic marine ecosystems. We now emphasize that biological productivity in nutrient-limited environments can be particularly sensitive to physical transport processes and that fine-scale circulation features may exert a disproportionate influence on ecosystem structure and productivity through the redistribution of nutrients and biomass (Lines 413–417). We further discuss the role of fronts and mesoscale features as organizers of biological heterogeneity in oligotrophic oceans and their potential influence on ecosystem structure beyond simple biomass redistribution, incorporating the suggested literature where appropriate (Lines 430–436). While maintaining the event-scale interpretation of our results, these additions place our findings within the broader context of recurrent fine-scale transport processes in oligotrophic marine systems.

Comment 1

Line 36, "small-scale dynamic": In recent literature, the term fine-scale is more commonly used...

We agree and revised the text to use terminology consistent with recent literature. The relevant section now explicitly distinguishes between submesoscale (~1–10 km) and mesoscale (~10–100 km) processes, replacing the more ambiguous term "small-scale" with the specific scales relevant to the processes discussed in this study (Lines 39–44).

Comment 2

Section 2.1.1: I do not clearly understand the temporal coverage of the satellite data...

We thank the reviewer for pointing out that the temporal coverage of the satellite products was not sufficiently clear. We revised Section 2.1.1 to explicitly state the temporal range of the satellite observations used in this study and clarified the meaning of the 1993–2012 reference period used in the altimetry product.

The chlorophyll, SST, and altimetry observations analyzed correspond to the periods of the glider, HF-radar, and cruise observations discussed in the manuscript (2018–2023 for glider analyses and 2020 for HF-radar and N800 analyses). The "1993–2012" period refers only to the mean dynamic topography reference used in the Copernicus DUACS altimetry product for the computation of sea level anomalies and geostrophic currents, rather than to the observational period analyzed in this study.

The manuscript text was revised to clarify this distinction (Lines 98–106).

Comment 3

Is the factor two for the threshold arbitrary or empirical? How much this value could change the results?

We thank the reviewer for this important comment. The threshold was not selected arbitrarily but through iterative testing of a range of plausible threshold values. Lower thresholds tended to incorporate substantial offshore background variability, whereas higher thresholds excluded portions of the coherent offshore feature visible in the chlorophyll imagery. A threshold of twice the offshore background concentration was ultimately selected because the resulting contour most closely matched the observed morphology of the coastal-origin mesoscale eddy while minimizing inclusion of surrounding background waters. The purpose of the threshold was therefore to identify the spatial extent of the transported feature rather than to establish a universal eddy-detection criterion. We have clarified this rationale in the Methods section (Lines 158–164).

Comment 4

Is Ceddy time-dependent? Why 'eddy-period profiles' rather than 'eddy profiles'?

We thank the reviewer for this clarification request. We agree that the terminology was unnecessarily complicated. Ceddy is not time-dependent, its purely spatial. The text was revised and now simply refers to eddy profiles and reference profiles (Lines 177–179).

Comment 5

Section 2.2.2: Potential offset between chlorophyll front and physical front?

We thank the reviewer for this interesting point. We acknowledge that biological tracers may exhibit small spatial offsets relative to the underlying dynamical structures due to biological response times and nutrient utilization. To clarify this point, we have added a brief discussion in the manuscript noting that chlorophyll distributions have previously been shown to provide reliable indicators of mesoscale circulation features when combined with HF-radar observations, despite the possibility of small tracer–dynamics offsets (Lines 343-348). We further note that the close agreement observed here between the chlorophyll-defined frontal boundary and the regions of strongest azimuthal velocity suggests that any such offset was small relative to the scale of the eddy and does not affect the interpretation of its kinematics. This close correspondence supports the interpretation that the chlorophyll-defined frontal structure captured the dynamically coherent eddy boundary at the scales relevant to this study.

Because the eddy was only partially captured by the HF-radar domain during most of its evolution, the eddy geometry and center had to be estimated from the satellite chlorophyll structure. Only during the final stage of the event was the entire eddy contained within the HF-radar domain. We also note that only days with sufficiently clear L3 satellite observations were used in this analysis, minimizing potential artifacts associated with interpolation in gap-filled products.

We do not expect any such offset to substantially alter the qualitative conclusions regarding eddy coherence and rotation.

Comment 6

Fig. 1C: What is the date of ADT and geostrophic currents?

The figure caption has been clarified to explicitly state that the ADT and geostrophic current fields correspond to the same date as the chlorophyll and SST observations (30 July 2020) (Figure 1 caption).

Comment 7

Section 3.3: I do not understand to which figures you refer when you talk about the integrated anomaly profiles.

We thank the reviewer for pointing out this lack of clarity. The text was revised to clarify that the anomaly profiles and associated chlorophyll-stock calculations are presented separately for the 2018 and 2022 case studies in Figs. 5 and 6, respectively (Lines 274–280).

Comment 8

Why use depth instead of density for vertical profiles?

We thank the reviewer for this suggestion. Density coordinates can indeed provide useful dynamical information, particularly for examining water-mass structure and isopycnal displacement. However, we retained depth coordinates because the main objective of this analysis is to quantify the shoaling, broadening, and vertical redistribution of the deep chlorophyll maximum (DCM) relative to its typical summer depth in the Levantine Basin.

This approach is consistent with previous studies examining mesoscale impacts on phytoplankton chlorophyll structure, where vertical chlorophyll responses are commonly presented and interpreted in depth coordinates together with hydrographic context, such as Espinosa-Carreón et al. (2012) for mesoscale processes off Baja California.

In addition, the present study combines glider profiles with ship-based nutrient, particulate, and fluorescence measurements from station N800, all sampled and interpreted in depth space. Retaining depth coordinates therefore facilitates direct comparison among the different observational platforms. Potential density information is included where available (Fig. 3) to provide dynamical context.

Comment 9

Could you clarify how changes in vertical nutrient profiles are attributed to eddies passage rather than local background variability?

We thank the reviewer for this valuable suggestion and have expanded the analysis. Background variability was calculated relative to the non-eddy months within the stratified period (April–November) shown in Fig. 7, excluding the eddy-influenced periods (July and September) (Lines 297–300). We now report mean background values, standard deviations, and anomaly magnitudes for dissolved silica, inorganic particulate matter, and particulate Fe (Lines 302–317).

Additionally, the precision and limits of detection (LOD) table for the nutrient analysis has been added to the appendix (Table A1).

Comment 10

Local biological response may be qualitative rather than quantitative.

We agree and expanded the Discussion and Conclusions to acknowledge that mesoscale transport processes may influence ecosystem structure through changes in community composition and trophic interactions, in addition to changes in chlorophyll concentration. We now discuss the role of fronts and mesoscale circulation features as organizers of biological heterogeneity in oligotrophic environments and incorporated the suggested literature, including studies demonstrating ecological responses to fine-scale physical forcing and changes in plankton community structure (Lines 430–436).

Technical Corrections

Section 2.2.1 - lines 123–124 The sentence “A threshold of ...” could be ended by ”to detect those eddies” or something similar

We thank the reviewer for this suggestion. The sentence was revised and expanded to clarify that the threshold was applied to identify offshore chlorophyll anomalies associated with coastal mesoscale features. (Lines 158–164).

Section 2.2.2 - lines 145 and 149 You could add the variable names (Gthr) and (Camp) in the following sentences:

“A robust gradient threshold (Gthr) was ...”

“an adaptive amplitude (Camp) threshold was ...”

We thank the reviewer for this suggestion. The variable names were added to the text to improve readability and facilitate comparison with the corresponding equations.

Variables Gthr and Camp added (Lines 192–199).

Fig. 1 :

Adding names of features (cyprus eddy, rhodes gyre, levantine coast, nile river ...) on maps could help (especially if readers are not familiar with the med sea)

We thank the reviewer for this suggestion. Major regional features were added to Figure 1.

Section 3.1 - line 177 A space is missing after “(Fig 1A),”

We thank the reviewer for identifying this typographical error. The missing space was corrected.

Figure 5: a space is missing after “[...] black).”

We thank the reviewer for identifying this formatting issue. The missing space in the figure caption was corrected.

Section 3.4 - line 244 “[...] when station N800 was located [...]” could be rephrased to clarify that the station is fixed. For example something like “when coastal mesoscale eddies propagating offshore crossed or were adjacents to the N800 station”

We thank the reviewer for this suggestion. The sentence was revised to clarify that N800 is a fixed offshore station and that the observed changes correspond to periods when coastal mesoscale eddies propagated over or adjacent to the station (Lines 295–299).

Section 4.2 - lines 293 to 294 “Elevated surface and subsurface temperatures observed within the eddy further support this interpretation. Independent ship-based observations at the time-series station N800 further support these findings.” These two sentences could be combined to avoid the repetition of “further support”

We thank the reviewer for this suggestion. The sentences were revised to remove the repeated wording and improve readability (Lines 368–370).

Reviewer 2 Response Letter

Major Comment 1

The scope of the article should be better introduced and linked to previous literature. For instance, the time frame is not clearly stated: you aim to develop a methodology which can be applied at any time with remote-sensing chlorophyll, or colocate analysis with only 2 glider cruises? It is also not straightforward why you focus only on summer instead of winter.

We thank the reviewer for this important comment. We agree that the scope and objectives of the manuscript were not sufficiently explicit and have revised the Introduction and Methods accordingly (Lines 54-57, 79-83, 450-452).

The purpose of this study is not to develop or validate a generalized chlorophyll-based eddy detection methodology intended for long-term climatological applications. Instead, the detection framework is used as a practical tool to identify offshore transport events and collocate them with independent observations in order to investigate the role of coastal mesoscale eddies in summer coastal–offshore exchange.

The study is built around three independent case studies corresponding to summertime coastal mesoscale events: two glider missions (2018 and 2022) and one HF-radar / cruise observational case (2020). These events are used to characterize the physical and biogeochemical structure of the transported water masses.

The main contribution of this work is therefore the three-dimensional characterization of coastal mesoscale eddies and their associated offshore transport signatures using complementary observational platforms. In particular, we characterize their vertical chlorophyll structure, DCM reorganization, hydrographic properties, nutrient and particulate signatures, and event-scale offshore redistribution.

The focus on summer conditions is intentional because the connectivity regime in the Levantine Basin differs strongly between seasons (as was quantified in our previous study, Fadida et al. 2026). Winter conditions are characterized by deep mixing and enhanced lateral stirring, promoting broader basin connectivity, whereas summer stratification suppresses vertical exchange and largely isolates offshore waters. Under these conditions, episodic coastal mesoscale transport becomes particularly important and can be investigated more clearly.

Major Comment 2

The eddy detection methodology is unclear and without illustrations of the successive steps. The link between steps 2.2.1 and 2.2.2 is not obvious, more supplementary material is advised.

We thank the reviewer for this comment. We agree that the relationship between Sections 2.2.1 and 2.2.2 was not sufficiently clear and have revised the manuscript accordingly (Lines150-190).

The two sections represent detection of two different aspects of the eddies. Section 2.2.1 describes the identification of offshore chlorophyll anomalies associated with coastal mesoscale transport and their use for estimating offshore area and chlorophyll redistribution. Section 2.2.2 serves a different purpose and was developed specifically for the HF-radar analysis. Here, a gradient–amplitude approach is applied to identify the dynamically active frontal boundary of the already identified feature in order to collocate current measurements and estimate rotational kinematics.

To improve clarity, we expanded the methodological description and added outlines of the detected regions in each method. Figure 2 shows the output from the method described in 2.2.2, Figures 3B,4B show the output from the method described in 2.2.1.

Major Comment 3

The methodology should be asserted with statistics over several years.

We thank the reviewer for this suggestion. We agree that a multi-year statistical analysis of coastal mesoscale transport events would be valuable and could help quantify their recurrence, spatial distribution, and cumulative contribution to offshore exchange.

However, the objective of the present study is to characterize the physical and biogeochemical structure of individual transport events using coincident satellite, glider, HF-radar, and ship-based observations. The manuscript therefore adopts an event-scale approach based on three independent case studies rather than a climatological analysis.

To clarify this distinction, we expanded the Introduction and Methods sections and added additional discussion on the role of transient transport events. A broader statistical characterization of these features represents an important direction for future work (Lines 79-83, 443-445).

Major Comment 4

A clear and substantiated conclusion should summarize your results in a quantitative way.

We thank the reviewer for this suggestion. The conclusion was expanded to include a more quantitative summary of the principal findings, including the offshore extent of the sampled eddies, chlorophyll redistribution estimates, DCM shoaling, and the observed biogeochemical signatures associated with transported coastal waters (Line 459-463).

Other Comments

l.18 which nutrients ?

We thank the reviewer for this comment. The text was revised to clarify that the oligotrophic character of the Levantine Basin is associated with extremely low concentrations of macronutrients, particularly phosphate, nitrate, and silicate, which contribute to the low primary productivity of offshore waters (Lines 18-20).

l.24 'many other boundary systems' > which boundary systems ? In many occasions throughout the manuscript there are some loose assertions, calling for more precise sentences.

We thank the reviewer for this observation. We agree that several statements in the original manuscript could be made more precise. In response, we reviewed the manuscript and revised a number of broadly phrased assertions to provide clearer definitions, more specific comparisons, and more explicit descriptions of the processes being discussed. For example, the reference to "many other boundary systems" was replaced with a comparison to more productive Mediterranean regions and coastal systems influenced by stronger terrestrial inputs (Lines 25-30). We also clarified the meaning of connectivity in the context of this study, replaced general references to "small-scale dynamics" with explicit definitions of sub-mesoscale and mesoscale processes, and revised several statements throughout the Introduction and Discussion to more accurately reflect the scope of the observations and the limitations of the study. These revisions improve the precision of the manuscript and reduce the use of overly broad or potentially ambiguous statements.

l.28 Similar comment, you should define properly what you call 'connectivity'

We thank the reviewer for this comment. Rather than introducing a formal definition, the text was revised to clarify that connectivity refers to the degree of exchange and transport between the coastal and offshore domains. The description of enhanced and reduced connectivity was expanded accordingly (Lines 32-36).

l.36 Similar comment for ‘fine-scale’

We thank the reviewer for this suggestion. The Introduction was revised to clarify the terminology and characteristic scales used in this study. The relevant section now explicitly distinguishes between sub-mesoscale (~1–10 km) and mesoscale (~10–100 km) processes, replacing the more ambiguous term “small-scale” with the specific scales relevant to the processes discussed in this study (Lines 42–44).

l.43 ‘Mesoscale features such as coastal eddies and filaments are frequently observed’ > you need to introduce more clearly what are mesoscale eddies (cyclone & anticyclones) and how mesoscale sign in sea surface height. The Rossby scale should also be introduced (Chelton et al 1998 or Kurkin 2020 for Med Sea)

We thank the reviewer for this suggestion. The Introduction was expanded to provide a clearer description of mesoscale eddies, their characteristic scales relative to the regional Rossby radius, and their dynamical expression in sea surface height fields. Additional references describing mesoscale variability in the Mediterranean Sea were also included (Lines 52-58).

l.53 ‘surface expressions of coastal eddies’ is very imprecise. SSH ? SST ? Chlorophyll ?

We thank the reviewer for this comment. The wording was revised to clarify that the previously documented surface signatures refer specifically to chlorophyll anomalies associated with coastal mesoscale features rather than to a broader set of surface indicators (Lines 69-71).

l.69 Why gridded L4 products ? The Levantine basin is rather free of clouds in summer, using L3 products will avoid interpolating data. The question is raised for both SST and Chlorophyll.

We thank the reviewer for this comment. Event identification and selection were initially performed using L3 satellite products. Only periods during which the coastal eddies and transport features were clearly visible were retained for analysis. Although occasional cloud cover was present in some scenes, it did not obscure the investigated features and therefore did not influence event selection .

L4 products were used in the manuscript figures primarily for visualization purposes, providing continuous maps without small cloud-related gaps and improving readability. No interpolation was used within the regions containing the investigated features, and all analyzed eddies and transport structures were directly visible in the original L3 observations.

The underlying identification of the investigated events was therefore based on direct inspection of the L3 satellite imagery, it has been added to the Methods (Lines 90-93).

l.75 Why using 1993-2012 average for mean dynamic topography if you are studying 2018-2020 ?

We thank the reviewer for this comment. The temporal coverage of the altimetry product was clarified in the manuscript. The period 1993–2012 refers only to the mean dynamic topography reference used in the Copernicus DUACS product for the computation of sea level anomalies and geostrophic currents, rather than to the observational period analyzed in this study.

The satellite observations used in the manuscript correspond to the investigated events and the periods of the glider, HF-radar, and ship-based observations (Lines98-105).

l.86 Discuss how does 1.5 km compare to the coastal area extent, or to the Rossby radius

We thank the reviewer for this comment. The 1.5 km spacing refers to the approximate horizontal separation between adjacent ascending and descending glider profiles, which were treated as quasi-vertical profiles. This spacing was not used to resolve the full horizontal circulation of the eddy or to define its dynamical scale. Instead, the eddy extent was identified from satellite imagery, while the glider observations were used to characterize the vertical chlorophyll and hydrographic structure along transects crossing the feature.

Because the coastal eddies considered here have horizontal scales of several tens of kilometers, the glider transects provided multiple profiles within and outside the eddy, enabling comparison of eddy-interior and reference vertical structure. No changes were made to the manuscript.

Sections 2.2.1 & 2.2.2 : I don't understand why you detect eddies twice. From l.154-155 I understand that you combine both but do not see how. Illustrations of the successive steps are necessary.

We thank the reviewer for highlighting this point. We agree that the original presentation could give the impression that two independent eddy-detection methods were being applied. The manuscript has been revised to clarify that the two analyses serve different purposes. Section 2.2.1 identifies offshore chlorophyll anomalies associated with coastal mesoscale transport and is used to estimate the spatial extent of transported coastal waters and the associated chlorophyll redistribution. Section 2.2.2 does not represent a second eddy-detection method; rather, it identifies the dynamically active frontal boundary of the previously detected feature in order to collocate HF-radar observations and characterize the eddy kinematics. To make this workflow clearer, we revised the Methods section and added visual representations of the detected features and frontal boundaries to Figures 2–4 (Lines 150-154, 155-158, 189-190, Figures 2, 3B, 4B).

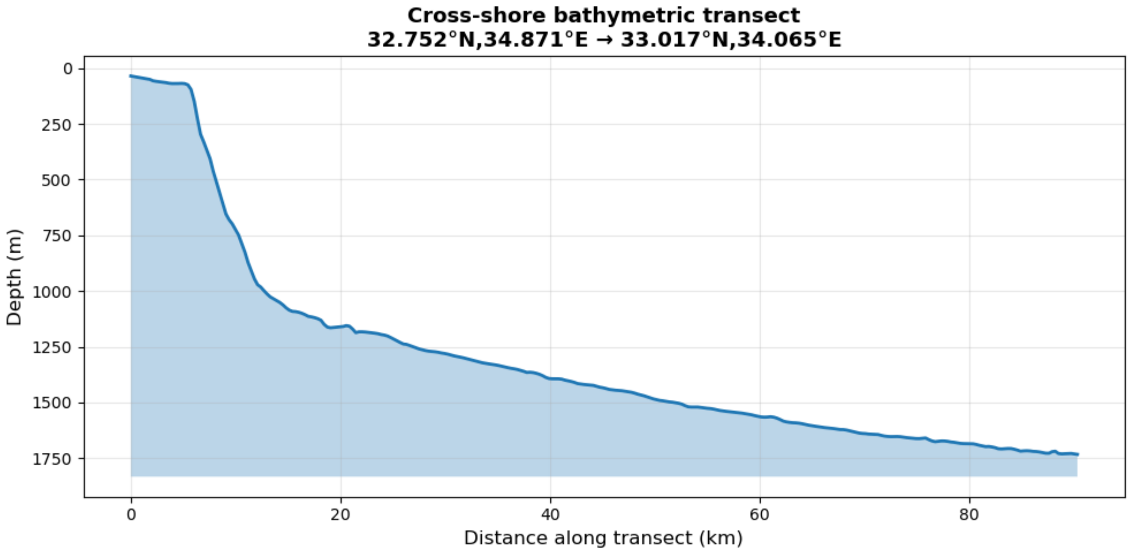
l. 123-124 : Your background definition is hard to understand. Rephrase and explain better your choices. Background computed per day ? With a rolling average ? Why is the 700m selected instead of 500 or 1000m ? As this is a fixed parameter, a sensitivity check of your results to this 700m choice is expected.

We thank the reviewer for pointing out that the background definition was not sufficiently clear. We revised the Methods section to clarify that the offshore background concentration was calculated independently for each daily chlorophyll map and was not based on a rolling average (158-172). The offshore background was computed from waters deeper than 700 m, using the mean chlorophyll concentration between the 20th and 80th percentiles in order to reduce the influence of very low values and localized high-chlorophyll features. This daily offshore background was then used to define the detection threshold.

The 700 m depth criterion was selected as an operational offshore boundary because the objective of the study is to identify coastal waters transported beyond the shelf/slope region into the open Levantine Basin. Along the southeastern Levantine margin, the transition from the shelf to the deep basin occurs over a relatively narrow and steep slope, approximately spanning the 200--1000 m depth range. The 700 m contour therefore represents a suitable mid-slope boundary for identifying offshore transport.

Because the bathymetric gradient is steep, moderate shifts of the depth criterion (e.g. toward 500 or 1000 m) would produce only very limited changes to the offshore mask and would not alter the identification or interpretation of the major transport features examined here.

To further illustrate this point, we provide a representative cross-shore bathymetric transect in the response showing the rapid shelf-to-basin transition characteristic of the study region.



l.158 why do you need to do manual selection ?

We thank the reviewer for this comment. Manual specification of the eddy center was required because estimation of rotational kinematics from HF-radar velocities must be performed relative to the eddy core position. The center was therefore used only for the HF-radar analysis and not for identification of the transport features themselves.

Automatic identification of the center from chlorophyll was not possible because maximum chlorophyll concentrations were not consistently located at the eddy core and were often associated with frontal regions or the eddy periphery. Likewise, conventional SSH products were considered too coarse to reliably identify the centers of these relatively small coastal eddies (radius of approximately 20-30 km).

In addition, during the first days of the event the eddy was only partially contained within the HF-radar domain and became fully resolved only later in the sequence. Manual center specification therefore provided a consistent reference frame for calculating rotational velocities throughout the event.

This procedure affected only the estimation of rotational kinematics and did not influence the identification of offshore transport features or chlorophyll redistribution calculations.

Estimation of rotational kinematics was initiated only when the frontal polygon entered the HF-radar domain.

l.161 what is the frontal polygon?

We thank the reviewer for this comment. The frontal polygon refers to the closed boundary reconstructed around the northeastern frontal limb of the coastal mesoscale eddy, corresponding to the leading edge of the feature during its eastward propagation. It was obtained using isocontour reconstruction of the detected chlorophyll front and was used to define the dynamically active boundary region for HF-radar collocation and estimation of rotational kinematics (Lines 200-204).

To improve clarity, we added a contour around the identified frontal region in Figure 2.

l.170 Earlier references for the Rhodes Gyre would be more appropriate (Robinson & Golnaraghi, 1991 or 1994?)

We thank the reviewer for this suggestion. Earlier references describing the Rhodes Gyre have been incorporated, including Robinson and Golnaraghi (1991, 1994), to provide more appropriate historical context for the regional circulation features discussed in this section (Lines 215–218).

l.175 outputs of your eddy detection method (eddy centers, boundaries, track) should appear on Figures 1-2

We thank the reviewer for this suggestion. Figure 1 is intended primarily as a general overview of the study region and an illustration of the typical summertime coastal mesoscale features observed in satellite chlorophyll, SSH, and SST imagery. No quantitative eddy detection or tracking analysis was performed from this figure, and we therefore retained it as a contextual overview without additional overlays.

For Figure 2, we added the frontal boundary identification output used to collocate the HF-radar velocity measurements with the chlorophyll-defined mesoscale feature. The downstream propagation estimate was based on the displacement of the easternmost frontal boundary, which is already visible in the sequential satellite imagery.

We also added a contour to represent the output of the eddy detection method used for surface area estimation described in section 2.2.1 in Figures 3B,4B.

l.190 what do you call 'dynamically coherent' ? This is asserted on l.200 but should be introduced earlier.

We thank the reviewer for this comment. We agree that the criterion for dynamic coherence should be introduced before it is applied. The text was revised to clarify earlier in Section 3.2 that we consider the feature dynamically coherent when HF-radar velocities show organized anticyclonic rotation around the eddy and when rotational velocities exceed the downstream propagation speed, indicating that the structure is dominated by internal circulation rather than passive advection (Lines 239-241).

Section 3.3 : those 3-lines paragraphs are hard to read in a smooth way. You mention first the 2022 event, then the 2018 event, then both. The temporal frame should be better defined

We thank the reviewer for this comment. Section 3.3 is organized to first present the three-dimensional structure of the two eddies independently (2018 followed by 2022), allowing comparison of their hydrographic and chlorophyll signatures. The section then moves to a second stage in which offshore chlorophyll redistribution is quantified for the same events through vertically integrated anomaly profiles and export estimates.

We retained this organization because it separates the structural characterization from the transport quantification and allows the common vertical response to be established before introducing the redistribution estimates. To improve readability, the temporal sequence of the two case studies was clarified at the beginning of the section (Lines 255-258).

Figure 5 : why is only 2018 shown and not 2022 ?

We thank the reviewer for this comment. The two case studies were intentionally presented in separate figures (Fig.~5 for the 2018 event and Fig.~6 for the 2022 event) to improve clarity. Although both eddies exhibit a similar overall redistribution pattern, they differ in vertical structure, anomaly magnitude, and sampling geometry. Presenting them separately therefore allows the characteristics of each event to be shown more clearly while facilitating comparison between the two case studies.

l.270 Precise that your focus is on chlorophyll

We thank the reviewer for this comment. We agree that the statement could be interpreted too broadly. The text was revised to clarify that the disruption refers specifically to the transport and redistribution of chlorophyll and associated biogeochemical signatures rather than complete breakdown of physical isolation across the basin (Lines 338-339).

l.268 : a review of regionalization of the Med Sea can also be found in Ayata et al (Progress in Oceanography, 2018), were the Levantine Basin clearly stands out as a distinctive area.

We thank the reviewer for this suggestion. The recommended reference has been added to support the description of the Levantine Basin as a distinct biogeochemical and ecological region within the Mediterranean Sea (Line 334-336).

Section 4 : You should also compare your results with more standard SSH-derived eddy detections. Barboni et al (Ocean Sciences, 2021) provides a study of mesoscale evolution in the Levantine basin using SSH-based products, also comparing with glider data. Moutin et al (Biogeosciences, 2012) also provides a benchmark for comparison with the larger scale Cyprus/Shikmonah/Eratosthenes anticyclone.

We thank the reviewer for this important comment. The Discussion was expanded to compare the present results with previous Mediterranean studies based on SSH tracking and hydrographic observations, particularly Moutin and Prieur (2012) and Barboni et al. (2021) (Lines 437-446).

Previous studies primarily characterized large anticyclonic eddies, their circulation, occurrence, trajectories, and subsurface physical anomalies using SSH, CTD, Argo, and cruise observations. In contrast, the present work focuses on smaller coastal mesoscale features and emphasizes the offshore transport of coastal-origin water masses and their three-dimensional biogeochemical structure. Traditional altimetry measurements are currently too coarse to resolve these feature, and are also generally less reliable close to the coast. By combining satellite chlorophyll, HF-radar currents, glider observations, and ship-based nutrient and particulate measurements, the study extends earlier physical descriptions by resolving the associated biogeochemical redistribution.