Review 2nd round : Coastal Eddies as Vectors for Connectivity During the Summer in the Levantine Sea

by Yotam Fadida et al (2026)

Following the first round of reviews, the authors clarified the scope of their study. The introduction is clearer, better highlighting the scientific issues and the link with existing literature. The strong seasonality in the Levantine Basin and the implied changing physical processes driving biological response is an important topic. Submesoscale features such as filaments developing lateral stirring are more active in winter, while strong stratification sustains more balanced flows in summer.

Beyond the introduction and discussion, the manuscript has not been substantially revised, and remains difficult to follow. The methodology section in particular is difficult to understand, because equations are not labelled, and references to figures are missing. Major comments remain regarding reliability of the eddy detection method (see below). In the results section, the 3 different events are not extensively compared, letting the reader with an accumulation of study cases.

The authors chose to adopt a event-based approach, combining multiple remote-sensing and in situ data on specific case studies, and this choice can be justified. However as the authors already mentioned, these coastal eddies were already described in the literature, briefly from drifters buoys by Gertman et al (2010), then characterized with both in situ and remote-sensing chlorophyll by Efrati et al (2013). If the authors do not aim to develop a chlorophyll-based eddy detection method, nor to compare their results with existing mesoscale SSH detection methods, the main added value of the manuscript is that the DCM is shoaled to about 50m inside anticyclones, and has a bimodal distribution, based on a 3 single events

I then recommend major revisions, and defer to the editor on whether this study is better suited to *EGU Biogeosciences* given the balance of its contribution. In any case, the manuscript needs in-depth rewriting to clarify its results. I suggest to enphasize the biogeochemical vertical footprint, which is the most interesting result.

Major comments :

1. The authors claim an enhanced ‘connectivity’ in summer, connectivity being understood as the transport of material from coastal areas to offshore, expressed in chorophyll kilograms. The reader may expect a quantification of this contribution. Simply : how much compared to winter ?
2. L3 chlorophyll are used, but L4 is used in figures. This should be clarified by using only level 3 data in figures, in order for the reader to see the associated uncertainty. A sensibility check to L3 versus L4 chlorophyll is expected for the reader, maybe in supplementary materials
3. Methods should be compared with existing eddy dectection methods. Numerous studies use SSH to detect eddies. In coastal areas SSH can be sometimes unreliable, and this is why comparison with chlorophyll-based methods can be interesting. The distinction between large offshore anticyclones (well-studied) and coastal eddies (understudied) is the main novelty which should drive the analysis.
4. A confusion remain throughout the study, whether the authors study eddies (closed circulation contours at mesoscale) or filaments.
5. In situ data are not in accessible to reviewers in data availability section. This is now a requirement in Ocean Sciences (https://www.ocean-science.net/policies/data_policy.html)

6. To clarify the points raised above, the added value compared to existing studies on these Levantine coast mesoscale eddies is vague. The most interesting results are not physical oceanography contributions, and they are not clearly highlighted in the abstract.

Other comments

- l.12, abstract : their is a confusion for the reader with ‘anticyclonic circulation’, between the anticyclones detached from the coast and the basin-scale cyclonic circulation.
- l.57 For observations about mesoscale descriptions, Zodiatis et al (2023) can also be commented in this paragraph, or Poulain et al (2013) for drifters observations. More details from numerical studies (Verna et al, 2024 for instance) will be interesting.
- l.67 : The present work focuses on mesoscale eddies, not filaments.
- l.71-76 : a bit messy, this seems to anticipate the discussion part.
- Section 2.1 : Grouping in situ versus remote-sensing (or alternatively Satellite/HF radar/in situ) would ease the reading. The present manuscript introduces alternatively remote-sensing and in situ.
- l.96-98 : two lonely sentences which may need to be rephrased.
- l.106, 120 and 129 : Precise the exact time range of your event, or the period when data is available
- l.127 and 131 : ‘N800’ and ‘RV Mediterranean Explorer’ are proper nouns, you should put them in italic.
- l.129 : Time coverage is unclear. *N800* is a repeated monthly station from when to when ? The information actually lies only in l.280.
- l.130 : ‘filaments’ is unclear, as the study aims to study eddies.
- Section 2.1.3 : HF radar : what is its horizontal resolution and uncertainty ?
- Section 2.2, Methods : Methodology remains with missing references to figures, and some methodological details are found in the results section. Equations are not labelled.
- l.201 : see previous comment, ‘anticyclonic circulation’ is misleading.
- l.203 : Earlier reference to complement Belkin et al 2022 might be Krom et al (1992)
- l.204, again : ‘cyclonic features’ is vague, ‘cyclonic eddies’ would be more precise.
- Figure 1 : a summary map of station and glider transects would ease identification for the reader. For instance the reader needs to wait until Figure 7 to see location of N800 station.
- l.218-220 : Your analysis is based on Sea Level Anomaly currents. However in the Mediterranean Sea, for mesoscale eddies, ADT should be preferred to SLA to compute geostrophic currents. See Pegliasco et al (2021).
- l.240-275 : Again, these 3-lines paragraphs are difficult to read. The mixed description of the 2018 and 2022 events is also misleading.
- Section 3.4 : this section is likely the most interesting of the manuscript, I suggest to deepen its relevance.
- l.246 and Fig.5-6 : Be more precise in the number of profiles. How many profiles are within eddies, in each event ? How many constitute the reference ? The reference period is quite small, 2 days in both events. Their positions could be highlighted on figures 3A-C and 4A-C.
- l.281 : month selection is somehow vague. Each month is only constituted by a single profile, and you only have 2 profiles in background conditions.

- Fig.5-6-7 : Comparison between events is misleading, because axes do not share the same limits. Furthermore chlorophyll in *N800* stations are in ***microg/L*** while gliders are in ***mg/m3***. Also it would help the reader to remind that Fig.5-6 are from glider transects.
- l.326 : Numerous studies on eddy propagation - dedicated to the Mediterrean Sea - can be added and discussed here.
- l.349 : The 3 references cited all investigated eddies using SSH, calling for comment on this. Only Espinosa-Carreon et al (2012) focus on coastal eddies in Southern California. More generally, what are the main differences between these coastal eddies in the ultra-oligotrophic Levantine Basin compared to other coastal systems ?
- l.359 : Does this depth of about 50m match the average depth of the shelf ?
- Section 4.3 : Could you estimate an evolution timescale of these coastal structures ? Another explanation to their difficult detection in SSH is their fast evolution.
- Conclusion and opening : Considering that you propose an estimated chlorophyll export of about 1500 to 3500 kg per eddies, could you estimate the average formation rates of these eddies ? How many are formed per year, and what is the total export / year ?

Additional references :

- Krom, M. D., Brenner, S., Kress, N., Neori, A., & Gordon, L. I. (1992). Nutrient dynamics and new production in a warm-core eddy from the Eastern Mediterranean Sea. *Deep Sea Research Part A. Oceanographic Research Papers*, *39*(3-4), 467-480.
- Pegliasco, C., Chaigneau, A., Morrow, R., & Dumas, F. (2021). Detection and tracking of mesoscale eddies in the Mediterranean Sea: A comparison between the Sea Level Anomaly and the Absolute Dynamic Topography fields. *Advances in Space Research*, *68*(2), 401-419.
- Poulain, P. M., Bussani, A., Gerin, R., Jungwirth, R., Mauri, E., Menna, M., & Notarstefano, G. (2013). Mediterranean surface currents measured with drifters: From basin to subinertial scales. *Oceanography*, *26*(1), 38-47.
- Solodoch, A., Barkan, R., Verma, V., Gildor, H., Toledo, Y., Khain, P., & Levi, Y. (2023). Basin-scale to submesoscale variability of the east mediterranean sea upper circulation. *Journal of Physical Oceanography*, *53*(9), 2137-2158.