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

by Yotam Fadida et al (2026)

The Eastern Mediterranean Sea is an ultra-oligotrophic marginal sea, with scarse nutrient inputs. Coastal exchanges play a critical role in supplying nutrients for the biological production. The cyclonic basin-scale along-shore current can destabilize in mesoscale eddies. These intermittent features can locally disrupt the offshore waters isolation, potentially enhancing primary production by providing nutrients. These coastal eddies are relatively small-scale (~20km in radius), which is why it is hard to detect them using conventional altimetry, while they sign in chlorophyll. Satellite chlorophyll is then a useful data to monitor these locally important coastal processes.

Overall, the topic is relevant and results could be promising, but the current manuscript is not well written enough to highlight the results, calling for major revisions. I suggest in particular a more elaborated introduction, a more detailed and illustrated methodology, and an improved discussion to previous mesoscale eddy detection methods. Mesoscale eddies have been studied for about 2 decades using sea surface height, it is also necessary to discuss the differences between both methods.

Major comments :

- 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.
- 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.
- The methodlogy should be asserted with statistics over several years.
- A clear and substantiated conclusion should summarize your results in a quantitative way

Other comments :

- l.18 : which nutrients ?
- 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.
- l.28 : Similar comment, you should define properly what you call ‘connectivity’
- l.36 : Similar comment for ‘fine-scale’
- 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)
- l.53 : ‘surface expressions of coastal eddies’ is very imprecise. SSH ? SST ? Chlorophyll ?
- 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.
- l.75 : Why using 1993-2012 average for mean dynamic topography if you are studying 2018-2020 ?

- l.86 : Discuss how does 1.5 km compare to the coastal area extent, or to the Rossby radius
- 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.
- 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.
- l.158 : why do you need to do manual selection ?
- l.161 : what is the frontal polygon ?
- l.170 : earlier references for the Rhodes Gyre would be more appropriate (Robinson & Golnaraghi, 1991 or 1994?)
- l.175 : outputs of your eddy detection method (eddy centers, boundaries, track) should appear on Figures 1-2
- l.190 : what do you call ‘dynamically coherent’ ? This is asserted on l.200 but should be introduced earlier.
- 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
- Figure 5 : why is only 2018 shown and not 2022 ?
- l.270 : Precise that your focus is on chlorophyll
- 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.
- 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.