Review of manuscript ***Sargassum*** **accumulation and transport by mesoscale eddies** by Rosemery Sosa-Gutierrez et al. (egusphere-2025-514.pdf)

Review by Clément Vic (LOPS, Plouzané, France) on 4th March 2025.

The authors investigate how sargassum is trapped and transported within mesoscale eddies in the tropical Atlantic. They use a combination of eddy identification and tracking based on satellite altimetry, and satellite-derived fractional cover of sargassum, in a composite approach. They find that mesoscale cyclonic eddies (CEs) contain on average 15% more sargassum than mesoscale anticyclonic eddies (AEs), which is consistent with the literature that reports such an asymmetry. Interestingly, the asymmetry seemingly grows along the eddy lifecycle. The methodology is robust and results are clearly exposed, although rapidly discussed. I recommend the manuscript for publication in Ocean Science. I only have a couple of minor comments that I hope can help to clarify some points. None of the comments fundamentally questions the methods or results.

Minor comments

1. The introduction misses some discussion and references to recent studies on the role of submesoscales in structuring floating material, near-surface boundary layer material, and ecosystems, e.g., D'Asaro et al. (2018); Lévy et al. (2018); Esposito et al. (2021). Submesoscales seem to be of paramount importance in clustering material in boundary layers.
2. L. 32, the reference to Provenzale (1999) is wrongly used. Quote from Provenzale (1999): "While in a nonrotating reference frame heavy impurities are always ejected from coherent vortices, in rotation-dominated systems, the Coriolis force may become stronger than the centrifugal term when the Rossby number is small. As a consequence, **heavy impurities can be concentrated in the cores of anticyclonic vortices** (Tanga et al 1996, Provenzale et al 1998)." See also their Figure 10.
3. L. 48-58: I find this paragraph ambiguous. What is the link between AFAI, MODIS and SAREDA? It is unclear to me if the authors performed any processing on MODIS "raw" images or if they used an on-the-shelf climatology of sargassum biomass / concentration.
4. L. 98: I am not sure I fully understand why the methodology would introduce a bias that would favour the detection of eddies with increased sargassum. It would be good to detail why and perhaps lean on references on composite approaches? I like that the authors address a potential methodological bias though!
5. Figure 3: I wonder if you could come up with a physical interpretation for the meridional shift between the peak of FC and the eddy centre for CEs in Figures 3b and 3f. Ekman pumping from a systematic wind stress difference on both sides of the eddies? …
6. Figure 5: I am confused by the colour code, contrasts are too light I think. To me, the dark red boxes are above light red boxes, but dark blue boxes are below light blue boxes. Also, I think it would be insightful to give the biomass outside of eddies, defined as the residual between total and within eddies (AEs and CEs, with an outer limit of say, between 1.5 and 3 radii?)
7. L. 134: Could you be more quantitative? What is the ratio of the surface covered by AEs vs CEs and how does it compare to the biomass within AEs vs CEs?
8. L. 142 and Figure 7: The fact that CEs increase their sargassum biomass within their lifetime is very interesting. This is different from the hypothesis made in Vic et al. (2022) that submesoscale processes prior to the mesoscale eddy formation are instrumental at gathering material. So, is there any mechanism that could help explain this result? I thought of Ekman pumping à la Gaube et al. (2015), considering that winds in the area are dominated by westward Trade winds… Also, I wonder if using a normalized time scale is physically meaningful. You would merge eddy characteristics at very different stages.

Wording, typos, etc.

- L. 10: was not … so far → has not been
- L. 50: remove "chain"
- L. 55: the tracking of high-frequency decay? → generation of near-inertial waves? Please clarify.
- L. 70: strongly → partially? I would not say that Figure 1 strongly supports this statement. It hints at a mesoscale influence, but there remain areas with high FC and no eddy and vice-versa.

- Figure 1: It would good to see the boxes for the three regions discussed in the manuscript. Also, in the caption, I would recall that only eddies with non-zero FC are shown.
- Figure 5: typo “Radio” in panels c,f,i
- Figure 6: Why is the colour range so different from previous plots? (x10^-5)
- Figure 8: Are red and blue histograms stacked or are they zero-based? Please clarify.
- L. 171: “connectors”? unclear, please rephrase.
- L. 184: Nutrient availability, and more generally, vertical motions, are driven at submesoscales more than mesoscales, e.g., Uchida et al. (2019); Picard et al. (2024).

References

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