Author's reply to Reviewer 1:

Authors response to comments by to the manuscript " Sargassum accumulation and transport by mesoscale eddies " by Sosa-Gutierrez et al. (rsosa@mercator-ocean.fr, julien.jouanno@ird.fr). We would like to thank Maria Josefina Olascoaga for the detailed and helpful comments to improve the manuscript. Below, we use black text for comments and green text for our response.

1. My primary concern pertains to the methodology employed for detecting eddies. It is widely recognized that the method outlined in the paper is observer-dependent. The authors should incorporate a discussion addressing the potential issues associated with this methodology. For a detailed analysis on this subject, refer to Andrade-Canto, F., & Beron-Vera, F. J. (2022). \Do eddies connect the tropical Atlantic Ocean and the Gulf of Mexico?" Geophysical Research Letters 49, e2022GL099637.

Thank you very much for raising this issue, we have now added the following sentence in the discussion section:

"*The eddy detection method used in this study (Chaigneau et al., 2009) has been widely applied in the literature (e.g., Pegliasco et al., 2021; Ernst et al., 2023). Like any method, however, it has certain limitations. Its performance can be influenced by the resolution of the satellite data and the specific detection criteria employed. It is also important to exercise caution when interpreting Eulerian mesoscale eddy detections, as these rely on streamline-based approaches that are inherently observer-dependent (Andrade and Beron-Vera, 2022). In contrast, Lagrangian methods—such as geodesic eddy detection—identify eddies as coherent material structures that resist stretching and deformation over time, and are therefore better suited to capturing flow-invariant transport pathways. In this work, we opted for an Eulerian detection method due to its relative ease of implementation. While it would be possible to reproduce this analysis using the methodology of Andrade and Beron-Vera (2022), we do not expect fundamentally different results, particularly because our detection method does not identify eddies that cross the Antilles Arc or the Yucatan Channel (see Figure 2), as was the case in Huang et al. (2021). That said, Lagrangian approaches would be particularly valuable for investigating transport and accumulation mechanisms, especially in scenarios where eddies re-form in the wake of island chains."*

2. In line 30, the citation Beron-Vera et al. (2021) should be corrected to Beron-Vera (2021). Additionally, the paragraph lacks clarity and should be rewritten.

Thank you for your observation, the citation is now corrected and elsewhere. We rewrote the paragraph as follows, and we hope it has improved its clarity:

"Sargassum remains afloat in the upper ocean due to its gas-filled bladders, making it highly responsive to both surface currents and wind. The dynamics of the upper ocean play a critical role in the formation of Sargassum accumulations, which can occur across a wide range of spatial scales (see Ody et al., 2019). At smaller scales, on the order of tens of meters, accumulations are typically driven by Langmuir circulation (Langmuir, 1938). At larger scales, reaching hundreds of kilometers, mesoscale and submesoscale frontal dynamics become dominant (Gower et al., 2013; Zhong et al., 2012). In particular, convergence zones associated with submesoscale dynamics have been shown to concentrate buoyant material and to structure the ecosystem (D'Asaro et al., 2018; Esposito et al., 2021, Lévy et al. 2018). However, the role of mesoscale eddies in the accumulation and transport of Sargassum remains uncertain. Early theoretical and experimental work by Provenzale (1999) suggested that only cyclonic eddies can retain floating particles. More recent advances, incorporating

wind drag and elastic forces into the Maxey–Riley equations, have shown that these additional factors can have opposing influences—sometimes favoring accumulation in anticyclones rather than cyclones (Beron-Vera, 2021). Observational studies also present a mixed picture. For instance, limited in situ measurements have shown microplastic accumulation within anticyclonic eddies (Brach et al., 2018), while a more systematic study by Vic et al. (2022) demonstrated a tendency for drifters to accumulate in cyclonic structures in the North Atlantic. These contrasting findings highlight the complexity and context-dependence of floating object dynamics in mesoscale eddies. The accumulation and transport behavior likely depend on the specific properties of the objects in question—especially their buoyancy and windage."

3. Around line 40, it is inaccurately stated that Andrade et al. (2022) investigated only a single instance. In reality, an 8-year-long record was analyzed in the Caribbean Sea, where the study discovered Sargassum in both cyclonic and anticyclonic formations in similar quantities.

We apologize for the misquote, it is now corrected:
"Andrade-Canto et al. (2022), using 8 years of satellite altimetry in the eastern Caribbean Sea, showed that mesoscale eddies (both cyclonic and anticyclonic) can carry out Sargassum transport."

4. Vic et al. (2022) do not signicantly contribute to the issue explored in this paper. Based on my understanding, Vic et al. used drogued drifters in their study. Employing undrogued drifters instead could potentially provide more valuable insights.

We agree that the undrogued drifter would probably better reflect the Sargassum dynamics, nevertheless their results show preferential accumulation in cyclonic eddies from their simulation using surface velocity, in line with our study. We now added in the text "drogued drifters".

5. Examining Figure 3e raises questions about the methodology used for eddy detection, as there is no evident pattern in the tracer distribution to corroborate the presence of an eddy.

Our interpretation is different and given in the discussion:
"The central Atlantic region only had 1739 AE detected, against >4000 eddies for all other diagnostics (see Fig 5). In this region where mesoscale is weak, this sample size is probably too small for the average to converge.
Results also suggest that the trapping is much more effective in the Caribbean than in the Central Atlantic, as revealed by sharpest contrast of Sargassum cover between the interior and exterior in the Caribbean. One hypothesis is that there is a much less energetic mesoscale activity in the Central Atlantic compared to the Caribbean: weak eddy circulation and the drift associated with the trade winds may reduce the capacity of the eddies to accumulate Sargassum in the Central Atlantic region."

6. The authors observe a greater accumulation in cyclones. However, what is the ratio of cyclones to anticyclones in the region, regardless of Sargassum presence?

Thank you for your proposition, we added a new table (Table 1) with ratio between the areas and biomass associated with the AEs and CEs, and discuss them:
"*To quantify these differences in Table 1 we show the ratio of total area and biomass ratio of CEs vs AEs. In the Caribbean, while the area ratio CEs/AEs is of 0.54, the accumulation of Sargassum in CEslead to a biomass ratio CEs/AEs of 0.80."*