Authors' response to Anonymous Reviewer #1 on the manuscript "Seasonal and Interannual Drivers of Sargassum Inundations in the Northern Gulf of Guinea"

We thank the reviewer for the careful and constructive assessment. Reviewer comments are reproduced in black, and our point-by-point responses and verbatim excerpts from the revised manuscript are shown in blue.

Reviewer #1 evaluation

This work is very interesting and has value, contributing to the ongoing discussion and theories of where the sources of sargassum are in the region. It contributes to the knowledge gap of Sargassum in the Eastern Tropical Atlantic, where there are few studies compared to the Western side. It is clear that a lot of effort and thought has gone into applying this model, assessing the sensitivity, and gathering validation data. However, the authors need to consider their narrative more clearly and reconsider the structure of the paper. There needs to be inclusion of significantly more detail in their methods section, as well as reviewing the results and discussion to ensure the results are only the results. The authors should also add a conclusion section.

We thank the reviewer for recognizing the value of the study. We substantially expanded the Methods, reorganized the Results and Discussion, transferred supporting figures to the Appendices, and added a dedicated Conclusions section. Detailed responses are provided below.

Abstract

The abstract is quite long and detailed, the highlight results get a bit lost, the authors should consider removing details, so the results found in the paper stand out strongly. The authors should also clearly state the impact or potential value of their work and what or who their results are useful for.

We shortened and refocused the Abstract around the semiannual cycle, upstream source regions, transport pathways, wind and stranding effects, and the AMM relationship. We also added an explicit statement of practical relevance. The revised Abstract reads: [lines 5–22.]

"Abstract: Sargassum strandings have become recurrent along the northern Gulf of Guinea (n-GoG) and are reported in the literature as having significant societal impacts, particularly on fisheries. However, persistent cloud cover limits satellite monitoring, complicating efforts to study the phenomenon. We combine satellite-derived observations, NEMO-Sarg simulations of transport, growth and stranding, and Lagrangian trajectories to identify the seasonal pathways and interannual controls of coastal arrivals during 2010–2024. Both observations and the model reveal a semiannual cycle, with coastal maxima in March–May and September–November. In both seasons, biomass is supplied mainly from the eastern tropical Atlantic (e-TA) rather than by local growth. Spring events are linked to biomass retained off Guinea and Sierra Leone during winter, together with an additional lower-latitude pool, whereas autumn events result from a larger upstream accumulation near the Intertropical Convergence Zone. Transport occurs through the North Equatorial Countercurrent and Guinea Current, with an advection time of two to three months between the e-TA and the n-GoG. After passing south of Cape Palmas, southerly winds drive Sargassum shoreward and help maintain it north of the Equator. Without windage and Stokes drift, Sargassum remains embedded in the Guinea Current, spreads farther across the Gulf and partly recirculates through the South Equatorial Current, potentially favouring wider proliferation. Stranding removes nearshore biomass and limits its persistence. Interannual variability depends on both upstream biomass supply and its position relative to Cape Palmas, especially in autumn. Both are linked to the Atlantic Meridional Mode, with negative phases shifting biomass southward and enhancing eastward transport into the n-GoG. These results

provide a process-based framework for interpreting sparse observations and improving seasonal risk assessment and coastal preparedness in West Africa."

Introduction

The introduction overall provides good context and research gaps of the problem, though the authors should review the section structure to take care that they are telling a linear story and not revisiting statements or themes already partially mentioned and returning to ideas later within the introduction.

We reorganized the Introduction to progress from the basin-scale problem and its impacts, to the GASB and proposed source mechanisms, then to the West African knowledge gap and the aims of this study. Repeated and speculative statements were removed. The final paragraph now explicitly presents the logical sequence of the Methods, Results, Discussion and Conclusions: [lines 24–95; overview paragraph, lines 87–95.]

"We investigate when and why Sargassum reaches the n-GoG and identify the physical and biogeochemical conditions associated with unusually strong coastal events. We combine 1/12° NEMO-Sarg simulations (Jouanno et al., 2021) with Lagrangian trajectories computed using Parcels (Delandmeter and Van Sebille, 2019). Sect. 2 describes the satellite product, numerical model, and analysis methods. Sect. 3 first evaluates the simulations against previous studies and remotely sensed Sargassum distributions. Backward Lagrangian analyses are then used to identify the main source regions and quantify transport times toward the Gulf of Guinea. The mechanisms controlling the seasonal cycle and interannual variability of Sargassum arrivals are subsequently investigated by relating the NEMO-Sarg modelled distribution to environmental forcing and through a suite of sensitivity experiments. Sect. 4 discusses the physical mechanisms underlying the modelled variability, together with the main limitations of the study, and Sect. 5 summarizes the principal conclusions and their broader implications."

The introduction is missing many references for reporting of large strandings in all noted regions, there are other central American publications and from the USA as well.

Our study focuses on West Africa, so this region remains more extensively documented than the USA or Caribbean. Nevertheless, we added representative references for strandings in the Caribbean and Gulf of Mexico, Brazil, and West Africa. The opening paragraph now reads: [lines 24–31.]

"*Pelagic Sargassum has become a major oceanographic and societal issue in the tropical Atlantic. Since 2011, large strandings have been documented in the Caribbean and Gulf of Mexico (Franks et al., 2012; Jouanno et al., 2025a; León-Pérez et al., 2021), along the Brazilian coast (Amorim et al., 2025; Sissini et al., 2017), and on West African shores (Sowah et al., 2022). These events involve the two holopelagic species Sargassum natans and Sargassum fluitans, both historically associated with the Sargasso Sea (Carpenter and Cox, 1974; Niermann, 1986). Over the past decade, however, persistent populations have also proliferated in the tropical belt, forming the Great Atlantic Sargassum Belt (GASB), which extends from West Africa to the Caribbean and Gulf of Mexico (Wang et al., 2019). The GASB is considered the main source of the recurrent mass strandings affecting Caribbean coastlines.*"

L28/29 Sentence needs rephrasing: "the floating species involved are..."

The sentence was rephrased as follows: [lines 28–31.]

"These events involve the two holopelagic species *Sargassum natans* and *Sargassum fluitans,* both historically associated with the Sargasso Sea (Carpenter and Cox, 1974; Niermann, 1986)."

L37 Reference needed: "... while stranded Sargassum releases hydrogen sulfide and ammonia"

We added the requested supporting reference: [lines 43–47.]

"*Accumulated biomass depletes oxygen levels, degrades water quality, and harms seagrasses and corals (van Tussenbroek et al., 2017); during decomposition, stranded biomass also emits hydrogen sulfide and ammonia, potentially causing respiratory irritation, headaches, nausea, and other neurological symptoms in exposed populations (Resiere et al., 2018).*"

Around L50-56 or ~L70 consider including the newly published paper where the authors discuss source and movement pathways of sargassum particularly in GoG: Beron-Vera, F.J., Olascoaga, M.J., Miron, P. and Bonner, G., 2026. Tracing the origin of tropical North Atlantic Sargassum blooms to West Africa.

We added Beron-Vera et al. (2026) to the Introduction and bibliography and now compare its source-inversion result directly with our findings in the new Sect. 4.3, "The Guinea–Sierra Leone winter reservoir and its connection to the n-GoG." The Introduction states: [lines 62–65 and 447–452.]

"A recent source-inversion study instead identified coastal West African waters as the most likely origin of the first major 2011 tropical Atlantic bloom (Beron-Vera et al., 2026)." The Discussion states: *"Our study does not contradict the West African origin inferred by Beron-Vera et al. (2026). One year before the exceptional 2011 bloom, their most likely source lies near Guinea, close to the winter reservoir identified here, while at longer lead times their inferred source extends into the Gulf of Guinea. [...] In our reference simulation, biomass transported from the Guinea–Sierra Leone reservoir accumulates and strands along the northern Gulf coast. The n-GoG therefore acts predominantly as a sink for Sargassum rather than as a recurrent source for the wider tropical Atlantic, although occasional export under anomalous circulation conditions cannot be excluded."*

L55/6 The authors interpret from the literature that sargassum appears to or is suggested to reach West African coasts. It categorically does reach West African coasts as empirically observed in papers that are referenced in this study already, this shouldn't be stated with speculation, sargassum is found on the beaches of West African nations but this is also made clear in the first sentences of the introduction and doesn't need repeating.

We agree. The speculative wording was removed. The Introduction now states categorically: [lines 64–67.]

"It also recurrently reaches West African coasts, including the n-GoG (Fidai et al., 2025)."

L74/5 'and by' does not make sense, sentence phrasing needs reviewing, suggest "...2011, and identify the..."

The sentence was replaced by a direct statement of the study aims: [lines 87–95.]

"We investigate when and why Sargassum reaches the n-GoG and identify the physical and biogeochemical conditions associated with unusually strong coastal events. We combine 1/12° NEMO-Sarg simulations (Jouanno et al., 2021) with Lagrangian trajectories computed using Parcels (Delandmeter and Van Sebille, 2019). Sect. 2 describes the satellite product, numerical model, and analysis methods. Sect. 3 first evaluates the simulations against previous studies and remotely sensed Sargassum distributions. Backward Lagrangian analyses are then used to identify the main source regions and quantify transport times toward the Gulf of Guinea. The mechanisms controlling the seasonal cycle and interannual variability of Sargassum arrivals are subsequently investigated by relating the NEMO-Sarg modeled distribution to environmental forcing and through a suite of sensitivity experiments. Sect. 4 discusses the physical mechanisms

underlying the modeled variability, together with the main limitations of the study, and Sect. 5 summarizes the principal conclusions and their broader implications."

<u>Methods</u>

L87-95 / Section 2.1 is significantly lacking in detail. The authors note the start year of data collection, but the end date of the data/study should also be included. Additionally, satellites should be named in full, not only acronyms. The authors should also add detail on how the satellite data was processed and not simply cite another paper, what cloud masking was employed? How was sun glint removed? What atmospheric processing was undertaken? What sargassum detection algorithms were used? How were they applied? What is the accuracy of the chosen detection algorithm? What is the temporal and spatial resolution of the input data? What output does the detection give; is it aerial extent or volume of biomass? These are essential information which are missing. The authors need to clarify if they undertook satellite detection of sargassum or are using data from another source.

We substantially expanded Sect. 2.1 and renamed it "Satellite-derived Sargassum fractional cover data." It now identifies the data provider and study period, states that no new retrieval was performed, names MODIS and its platforms in full, summarizes the processing and quality controls, defines FC and its units, reports the grid and temporal averaging, and describes the published retrieval evaluation. The revised section reads: [lines 98–111.]

"*We used daily Sargassum fractional coverage (FC) fields for January 2010-December 2024 from the AERIS/ICARE database processed by Descloitres et al. (2021). We did not perform a new Sargassum retrieval or detection in this study. The product is derived primarily from the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Aqua and Terra satellites. The processing applies ocean-colour atmospheric correction, cloud and sun-glint screening, contextual filtering of false detections, and coastal masks. FC is the dimensionless fraction of the ocean surface within a pixel covered by floating Sargassum; it is an areal-coverage metric, not a direct measurement of volume or wet mass. The underlying MODIS AFAI approach was evaluated against concomitant 20 m Sentinel-2/MSI observations, with coefficients of determination of 0.53–0.69 across three study sites and regression slopes not significantly different from unity. The detection threshold adopted in the retrieval was previously reported to capture approximately 95% of Sargassum-containing pixels (Wang and Hu, 2016). Daily retrievals were averaged to weekly and monthly means on a 0.25° grid. We retained the number of valid daily observations per grid cell and month as a sampling-quality indicator. Cloud, sun glint, land adjacency, shallow water, suspended sediments, and coloured dissolved organic matter can reduce coverage or contaminate optical retrievals, particularly beneath the ITCZ and near the coast (Podlejski et al., 2022; Wang and Hu, 2016). These limitations are evaluated in Sect. 4.1.*"

It is very unusual to discuss method limitations and discuss literature in this section, authors should say what they included/excluded and justify their approach, but limitations should be discussed in the discussion only to avoid repetition and increase clarity.

We retained only the information needed to define the satellite product and its sampling indicator in Sect. 2.1. The interpretation of observational limitations was moved to Sect. 4.1. The Discussion now states: [lines 98–111 and 405–420.]

"*Direct quantitative validation remains difficult because published coastal records are sparse and uneven among countries and generally document only the presence and timing of strandings rather than standardized FC or biomass. Satellite observations provide broader coverage but are strongly limited by clouds, land contamination and optically complex coastal waters, particularly beneath the ITCZ. (Figure 3, right column). These limitations complicate the interpretation of several discrepancies. Satellite signals south of the main n-GoG region, including off the Congo* *coast (e.g., Figure 3), cannot currently be independently verified and may include false-positive detections associated with turbidity, river plumes or coloured dissolved organic matter. Similarly, the exceptionally high satellite peaks in September 2021 and November 2023 (Figure 2) lack corresponding reports in the available literature, but the absence of systematic coastal monitoring prevents determining whether they represent real extreme events or retrieval overestimates.*"

Section 2.3: The authors need to describe how the sargassum cover index is computed.

The index is now defined explicitly: [lines 147–150.]

"*The Sargassum index is calculated as the spatial mean of the dimensionless fractional cover (FC) over all ocean grid cells within each box.*"

Section 2.3: The authors need to describe their data sources where are the currents/winds/SST etc data from? What is their spatial and temporal resolution?

The sources and spatiotemporal resolutions are now summarized in Table 1 and referenced directly from Sect. 2.3. The revised text reads: [Table 1, lines 129–143; Sect. 2.3, lines 151–155.]

"*Within each box, we examine potential physical and biogeochemical drivers of Sargassum arrivals in the n-GoG. These variables include surface currents, sea surface temperature and salinity, 10 m winds, Stokes drift, chlorophyll, and nutrient concentrations; their sources and spatiotemporal resolutions are summarized in Table 1. Fields are averaged to monthly means before regional averaging and statistical analysis. Upstream signals are related to coastal events using the lags defined in Sect. 2.6*."

I think Table 3 doesn't add much extra information, as this is described in text/Figure 1, the lat/lon can be added to Figure 1 caption.

We agree. The former table containing only the box coordinates was removed, and the n-GoG, Cape Palmas and e-TA domains are now shown and defined directly in Figure 1 and Sect. 2.3. [Figure 1, lines 33–41; Sect. 2.3, lines 145–150.]

Section 2.4: The authors need to make it clearer how they identified where sargassum was present in their model and how they identified their particle starting points.

We now specify the release region, months, FC threshold and integration period: [lines 158–166.]

"For every simulation year, particles were released at mid-month in April and October from all n-GoG surface grid cells where simulated FC exceeded 2×10^{-5}, and were then integrated backward for 120 days."

Please add justification for 1% windage; previous studies such as Putnam et al. (2018) and Marsh et al. (2021) have used this in the Caribbean, can 1% windage be justified in the GoG? It's good to see you have explored no wind in section 2.5, but could the wind also be above 1%? In Section 2.3 0.1% windage is stated, please check this.

We clarified that the two coefficients refer to different formulations. In the Lagrangian experiments, 1% is an effective leeway parameter representing the combined effects of direct windage and wave-induced Stokes drift, following Marsh et al. (2021) and Putman et al. (2018). In NEMO-Sarg, Stokes drift is included explicitly and direct windage is parameterized separately as 0.1% of the 10 m wind. We also added the laboratory measurements of Olascoaga et al. (2023), which report direct Sargassum windage coefficients of 0.02–0.96%. [lines 129–131 and 160–163.]

"Particle advection was driven by GLORYS surface currents and an additional velocity equal to 1% of the 10 m wind velocity. In these Lagrangian experiments, this 1% coefficient is an effective leeway parameter used to represent the combined influence of direct windage and wave-induced

Stokes drift, consistent with previous particle-tracking studies (Marsh et al., 2021; Putman et al., 2018). This formulation differs from that used in the Eulerian NEMO-Sarg simulations, in which direct windage is parameterized as 0.1% of the 10 m wind velocity and Stokes drift is included explicitly as a separate velocity component (Sect. 2.2).”
Sect. 2.2 additionally states: *“Laboratory experiments have estimated direct Sargassum windage coefficients ranging from 0.02% to 0.96% (Olascoaga et al., 2023), encompassing the 0.1% value used here.”*

The authors have not provided a description of how they have validated their model outputs. This needs to be included in the methods. In the results it appears authors have collated in situ measurements from other papers to validate their model, but this is not described in the methods. I am also not convinced this is enough to validate the model, the authors need to explain this very clearly.

We added Sect. 2.7, “Model configuration and evaluation.” We now distinguish comparison with satellite FC from qualitative comparison with published coastal occurrences and explicitly state that this assesses seasonal and spatial consistency rather than formally validating stranded mass. We also describe the stranding-rate tests used to select the reference configuration. The section reads: [lines 198–206.]

“*We evaluate the simulation against two complementary but incomplete observational datasets. First, monthly and seasonal SARG12 FC is compared with the satellite FC product over the same 2010–2024 period for timing, spatial distribution, and relative event amplitude. Second, simulated coastal occurrences are compared qualitatively with published and institutional records of in situ or reported strandings compiled in Figure 2. Because these records are heterogeneous and satellite sampling is incomplete beneath the ITCZ, these comparisons assess seasonal and spatial consistency rather than formally validating stranded biomass. Their limitations are discussed in Sect. 4.1. Before selecting the reference configuration, we tested several coastal-stranding rates (0.30, 0.06, and 0.08 d^{-1}). Their influence on the persistence of coastal biomass was evaluated against satellite observations over the Côte d’Ivoire–Ghana and Togo–Benin–Nigeria sectors, using spatial distributions for the four seasons and seasonal and interannual FC variability. A stranding rate of 0.08 d^{-1} provided the closest overall agreement with the observed geographical distribution and temporal variability and was therefore retained in the reference configuration*.”

Results

The authors should consider restructuring the results, to present their time series and findings first and then present their literature-based validation afterwards. There is lots of discussion and some methods mixed in with the results. The results section should only state the results of the study. Further to this, the authors should consider what results are essential to the story and what is anecdotal/supporting and can be included in supplementary materials or appendices instead.

We reorganized Sect. 3.1 so that it first presents the SARG12 time series, then the comparison with satellite observations, and finally the comparison with published coastal reports. It now begins: [lines 208–252.]

“*The SARG12 time series shows a marked seasonal cycle of coastal Sargassum fractional cover (FC) in the n-GoG between 2010 and 2024 (Figure 2, top). Coastal FC generally increases during boreal spring and autumn, although the timing and magnitude of these peaks vary considerably among years. The spring maximum generally occurs between March and May, whereas the second and often larger maximum occurs between September and November. Simulated FC remains comparatively low during winter and summer, although some events extend beyond these main seasons.”*

We also revised the full Results section to improve the separation among Methods, Results and Discussion. Methodological definitions were moved to Sect. 2, while broader interpretations and limitations were transferred to Sect. 4. In particular, satellite-observation limitations were moved from Sect. 3.1 to Sect. 4.1; interpretation of local physicochemical controls was moved from Sect. 3.3 to Sect. 4.2; the role of the Guinea–Sierra Leone winter reservoir is now discussed in Sect. 4.3; and interpretation of the AMM relationship was moved from Sect. 3.5 to Sect. 4.4. Supporting diagnostics were transferred to Appendices A–H. [Results, lines 208–395; Discussion, lines 398–497.]

Figure 2 please increase the font size, and check citation formatting. Please explain how Sargassum can be a measured as concentration and include the units (this should be in the methods), it is usually aerial coverage or biomass weight.

We increased the font sizes in Figure 2 and revised its labels and caption. "Concentration" was replaced by fractional cover (FC). Sect. 2.1 now defines FC as follows: [Sect. 2.1, lines 98–103; Figure 2, lines 215–222.]

"FC is the dimensionless fraction of the ocean surface within a pixel covered by floating Sargassum; it is an areal-coverage metric, not a direct measurement of volume or wet mass."

The revised Figure 2 caption reads:

"Figure 2: Temporal and spatial distribution of coastal Sargassum in the Northern Gulf of Guinea (N-GoG), 2010–2024. Top) Time series of coastal Sargassum fractional coverage. The black line shows daily model-based mean coverage, while the grey line represents satellite observations. The dashed red line indicates the percentile-based event threshold. Blue and orange circles indicate high-Sargassum years in spring (MAM) and autumn (SON), respectively; blue and orange diamonds indicate the corresponding low-Sargassum years. Colored squares above the time series indicate the dates of Sargassum occurrences documented in the literature, with colors identifying the corresponding coastal sectors listed in the legend. Bottom) Map of documented Sargassum strandings along the N-GoG coastline, from Liberia to Nigeria. Points are color-coded by season of occurrence: blue (spring), yellow (summer), red (autumn), black (winter), and grey (undated). Numbers correspond to references in the bibliography (left)."

L195, an absence of in situ observation for an area does not make false detections likely, it makes it a possibility. Discussion of false detections should not be in the results section, but rather the discussion.

We agree. This interpretation was moved to Sect. 4.1 and the wording was made explicitly conditional: [lines 405–420.]

"*These limitations complicate the interpretation of several discrepancies. Satellite signals south of the main n-GoG region, including off the Congo coast (e.g., Figure 3), cannot currently be independently verified and may include false-positive detections associated with turbidity, river plumes or coloured dissolved organic matter. Similarly, the exceptionally high satellite peaks in September 2021 and November 2023 (Figure 2) lack corresponding reports in the available literature, but the absence of systematic coastal monitoring prevents determining whether they represent real extreme events or retrieval overestimates.*"

L204-214 is largely discussion not results. I have not continued to list lines which are discussion, but the whole section needs reviewing to separate results and discussion.

We carefully revised the manuscript to improve the separation between Methods, Results and Discussion. Section 3 now focuses on concise, figure-based findings. Definitions of events, composites and lags were moved to Sect. 2.6, and model evaluation procedures to Sect. 2.7. The corresponding interpretations of observational limitations, local physicochemical conditions, the Guinea–Sierra Leone winter reservoir and AMM-related mechanisms are now developed in Sects. 4.1–4.4, respectively. [Methods, lines 98–206; Results, lines 208–395; Discussion, lines 398–497.]

Figure 3 please write the months in full in the figure caption. The authors include in the figure caption that 2010-2024 is included but previously in the methods from 2002 was stated, please state clearly the dates of the study and data in the methods section.

The caption now spells out all months, and Sect. 2.1 states that the satellite and principal Eulerian analyses cover January 2010–December 2024. The revised caption reads: [Figure 3, lines 255–260; study period, lines 98–100 and 172–176.]

"*Figure 3: Seasonal climatologies of Sargassum fractional cover and satellite sampling in the Gulf of Guinea during 2010–2024. The left column shows modelled FC from the reference SARG12 simulation, the middle column shows satellite-derived FC from MODIS, and the right column shows the mean number of valid daily satellite observations per grid cell and month. From top to bottom, the rows correspond to December–February, March–May, June–August, and September–November. Along much of the n-GoG coast, fewer than 15 valid satellite observations per month are available on average.*"

Section 3.5.1 The composite definition and how high/low sargassum, seasons, application of time lags etc should be explained in the methods, not in the results.

We agree. These definitions were moved to Sect. 2.6, "Event definition, composites, and time lags." The revised methodological text reads: [lines 178–195.]

"*We identified high- and low-Sargassum seasons using the monthly SARG12 FC index averaged over the n-GoG for 2010–2024. High-Sargassum months were defined as months in which the index exceeded its 75th percentile over the complete analysis period. Consecutive above-threshold months within the same season were treated as a single event. Seasons were defined as December–February (DJF), March–May (MAM), June–August (JJA), and September–November (SON), although the interannual analysis focused on MAM and SON. For each season, a year was classified as a high-Sargassum year when at least one month within that season exceeded the 75th-percentile threshold. Years with no above-threshold month in the season were classified as low-Sargassum years. The classification was performed independently for MAM and SON; therefore, the same calendar year could belong to different categories in the two seasons. Composite differences were calculated as the mean of high-Sargassum years minus the mean of low-Sargassum years. Lagged relationships were used to account for the time required for Sargassum to be transported from upstream regions to the n-GoG. Lag selection was based on the backward Lagrangian experiments described in Sect. 2.4, which were first used to estimate characteristic transit times between the e-TA, the Cape Palmas gate, and the n-GoG. Accordingly, n-GoG arrivals in month M were compared with Sargassum FC at the Cape Palmas gate in month M-1 and in the e-TA during months M-2 to M-3. The corresponding transport-time diagnostics are presented in Sect. 3.2. To characterize the large-scale climate state preceding each coastal season, we calculated the minimum AMM index over the six months preceding the target month. This metric represents the strongest negative AMM phase experienced during the period in which the upstream Sargassum distribution and transport pathways develop. Its relationship with the meridional position of Sargassum is evaluated in Figure C1.*"

Discussion

Some of the discussion should be conclusions, there is an absence of conclusions. The authors need to review and rewrite this section alongside results. A conclusion must be added.

The Discussion was reorganized into dedicated subsections on model evaluation and observational limitations (Sect. 4.1), local physicochemical conditions (Sect. 4.2), the Guinea–Sierra Leone winter reservoir (Sect. 4.3), AMM influence (Sect. 4.4), the conditional southern cSEC export pathway (Sect. 4.5), and implications for future arrivals (Sect. 4.6). We added a separate Sect. 5, "Conclusions," which states: [Discussion, lines 398–497; Conclusions, lines 499–516.]

"*This study identifies the principal transport processes controlling seasonal and interannual Sargassum arrivals in the n-GoG. Two recurrent coastal maxima occur in spring and autumn. Spring arrivals are primarily connected to biomass retained off Guinea and Sierra Leone during winter, together with a secondary equatorial pool in some years. Autumn arrivals are mainly supplied by larger upstream stocks transported eastward through the NECC–GC corridor. The Lagrangian experiments indicate characteristic transport times of approximately two to three months from the e-TA and approximately one month from Cape Palmas.*

After passing south of Cape Palmas, southerly winds transport Sargassum toward the n-GoG coast and help maintain the biomass north of the Equator. Without windage and Stokes drift, Sargassum remains embedded in the GC, spreads more broadly across the Gulf, and is more readily displaced toward circulation connected with the cSEC. Stranding acts as an additional regulator by removing nearshore biomass and limiting its persistence after the seasonal arrival peaks.

Interannual variability reflects both the amount of upstream biomass and its latitudinal position relative to Cape Palmas, especially in autumn. Both factors are associated with the Atlantic Meridional Mode: negative AMM configurations favor a more southerly upstream distribution and stronger eastward transport toward the Gulf. Local environmental conditions ap-pear to exert a weaker influence on the magnitude of coastal arrivals, although they may affect survival and persistence after entry.

These results provide a process-based framework for interpreting sparse observations and improving seasonal risk assessment in West Africa. Upstream FC in the e-TA, biomass approaching Cape Palmas, and the preceding AMM state could provide complementary indicators of coastal arrival risk. The potential southern export pathway also warrants further investigation as a mechanism through which future changes in wind forcing could reorganize the tropical Atlantic Sargassum distribution."

General housekeeping

In text citation lists should be listed alphabetically or in time-order.

Citation-list ordering was checked and standardized throughout the revised manuscript.

Take care to only include last names in in-text citations ie L47, 58 should be Atiglo et al. 2024.

In-text author names were checked and corrected to use surnames only, including "Atiglo et al. (2024)." [see Atiglo et al. (2024), lines 69–70.]

L57/58 Take care to check where references got their information from and cite original sources as well; the statistic of 3% from Atiiglo et al. (2024) (not 3.5%) of studies comes from The Zotero 'Sargassum Reference Repository' database, which is available online at CERMES. This database is being updated and the proportion may have changed since you cited a paper from 2024.

We recalculated the statistic directly from the updated CERMES Sargassum Reference Repository and cited the repository. The revised text states: [lines 69–70.]

"*As of 4 August 2026, only 23 of the 676 records dated 2010 or later in the CERMES Sargassum Reference Repository were tagged "West Africa" (3.4%; CERMES, 2026), closely matching the proportion previously reported by Atiglo et al. (2024).*"

Fidai et al 2023 (PhD) thesis noted in Figure 2 for in situ data has a corresponding published paper and Zenodo link with the in situ data (see Fidai et al., 2024, Science of the Total Environment).

We replaced the thesis citation with the peer-reviewed publication. The Results now state: [lines 241–244.]

"*In Ghana, strandings were reported from January to August 2015 at Egyambra and Mumford (Addico and deGraft-Johnson, 2016), with additional observations during 2017–2019 at Mumford, Komenda and Elmina (Akrong et al., 2021) and field observations of stranded Sargassum at Sanzule in 2022 (Fidai et al., 2024).*"

There are a lot of figures in this paper, the authors should consider what is essential to communicate, and what is anecdotal/supporting and can be included in supplementary materials or appendices instead.

We reduced the number of figures in the main text. Seasonal biogeochemical and physical climatologies were moved to Appendices A and E; wind-driven composite differences to Appendix B; AMM–latitude diagnostics to Appendix C; local environmental relationships to Appendix D; the 2021 Côte d'Ivoire case study to Appendix F; and the MAM and SON composite maps to Appendix G. Appendix H was added during final revision to document the NEMO-Sarg salinity-limitation function and the coastal SSS distributions. The main Results retain only the figures essential for model evaluation, transport pathways, seasonal mechanisms, sensitivity experiments and interannual relationships. [main-text figures, lines 33–395; Appendices A–H, lines 530–600.]

We thank the reviewer again for the detailed comments, which substantially improved the methodological transparency, organization and clarity of the manuscript.