This is an important and timely study that provides a valuable quantitative analysis of internal tide (IT) incoherence. The theoretical framework is robust and the results are significant for the field. The following suggestions are intended to further strengthen the manuscript's clarity and impact.

Thank you very much for your positive feedback and useful suggestions. Our point-by-point response is below. The text will be modified accordingly as soon as the interactive discussion period is closed.

Major comments

Expand on Physical Interpretation and Regional Differences.

- *The paper excellently identifies advection by the mean flow as the primary driver of decoherence. The discussion would be more powerful if it delved deeper into the physical reasons (line no. 232-233, 318-320) "why" this advection leads to a loss of phase relationship with the astronomical forcing.*

The underlying dynamical process can be described as follows: at leading order, (i.e., provided the wave field can be described as a superposition of local plane waves), the advection term corresponds to the transport of the wave by the mean flow. This results in a local phase perturbation that propagates afterwards. As this process is not constant over time because the mesoscale flow evolves, the wave field becomes randomly perturbed and hence incoherent. Generally speaking, any term in the linearised equations that is not constant over time results in a loss of coherence, since, in the frequency domain, these terms are associated with triadic interactions between different frequencies. This introduces frequencies that are distinct from the initial coherent IT constituents.

- *Furthermore, please expand the comparison of the three subdomains (Gulf Stream, Azores, Northern Europe). Explaining how the specific dynamics of each region (e.g., strength of jets, eddy activity) lead to the observed differences in coherence loss would significantly enhance the scientific narrative. (Line no. 308-310)*

Following your suggestion and a comment from another reviewer, we will extend the description of the three different subdomains in the 'Data & Methods' section. Regarding the second part of your question, we will try to find a link, although this would probably require a dedicated study.

- *Are the time-periods and areas analyzed in this manuscript representative of the broader North Atlantic?*

The observed months cover late summer to winter. They should therefore be representative of the conditions one can encounter in the North Atlantic. The three areas chosen were also selected for their specific internal tides and mesoscale characteristics (as previously mentioned, we will expand on the description of these subdomains in the revised paper). Although this is based on our previous study, which did not specifically investigate the loss of coherence, these regions seem representative of the broader North Atlantic, with the obvious exception of the equatorial and Arctic zones. Extension of our analysis to a broader domain, including other ocean basins, would of course be valuable.

Clarify Methodological Choices and Scope.

The study's conclusions rely on key methodological choices that should be more thoroughly justified to ensure the results are robust and reproducible.

- *Please state and justify the number of vertical modes used /resolved in the analysis. The paper notes that truncation error is negligible for modes below 5, but the total number used isn't specified. (Line no. 185)*

Eleven modes were used in the present paper, ranging from n = 0 (barotropic tide) to n = 10 (internal tide). This number of modes is generally sufficient to describe most of the internal tide energy (see, for example, Falahat et al., 2014), particularly away from the generation site. Furthermore, the spatial resolution of the simulation does not allow higher modes to be resolved everywhere in the basin. These details will be added to the text.

- *The choice of a one-month window to separate coherent and incoherent tides is critical. The authors rightly note this is to avoid issues with a time-varying stratification basis, but a more detailed discussion of how a shorter or longer window might affect the results would be beneficial. (Line no. 308-310)*

We will expand on the discussion of the results obtained with a three-month time window compared to the one-month analysis. In general, the longer the time window, the greater the level of incoherence and the greater the associated coherent-to-incoherent energy transfers (although we will not attempt speculating on the behaviour at an infinite time limit). More specifically, a longer time window captures more fluctuations of the advection term (which are contained in the mean for a shorter time window). This results in greater loss of coherence, associated with an increase in A_(nm)^(ci).

- *Briefly explain the rationale for the filter choices, such as the 2-day low-pass filter, to help readers understand their impact on the separation of the IT field and the mesoscale flow. (Line no. 188)*

The two-day low-pass filter was chosen to retain as much mesoscale variability as possible while discarding the diurnal tide and most of the near-inertial waves (except near the equator --the near-inertial period is two days at a latitude of 14°). The complex demodulation period was chosen to fall in the middle of the three semi-diurnal tidal components. This will be specified in the text, alongside an expanded description of the internal tide signal extraction process.

Strengthen the Link to Observations and Applications.

T*he work is highly relevant to satellite altimetry, especially the SWOT mission. The paper would have greater impact if you explicitly discuss how these model findings can guide the interpretation or processing of real-world observational data. A discussion on how this analysis could improve the detection of incoherent internal tides in global SWOT data would be really useful.*

We will expand upon the discussion in the final section. Indeed, our results suggest that over the time window corresponding to the typical revisit time of satellite altimeters (especially SWOT), loss of coherence is active and largely induced by interaction with the mean flow (more specifically, via the advection term). Our analysis suggests that intermodal coupling for the internal tide is not dominant in this process and that low-mode mesoscale modes are primarily involved. This suggests that simple models with low-mode truncation are capable of capturing the core dynamics.

Future Directions.

Suggest concrete next steps. For example, could this framework be applied to more regions, longer datasets, or models with different resolutions? What are the limitations/challenges if this work has to extended beyond the regions discussed here?

Following this suggestion and your previous comment, we will clarify the perspectives and indicate some remaining questions that should be answered. In particular, the role of varying stratification (and the resulting variation in the propagation speed of the IT modes) has been investigated previously in the literature (*e.g.* Savage et al 2020, Zaron \& Egbert 2014). Its role in this context could still be clarified and compared with the more direct effect of interaction with mesoscale dynamics. This will provide a more complete and robust view of IT dynamics and loss of coherence over sub-seasonal timescales.

Minor comments

- *Figure Clarity. The interaction matrices are very informative, but their clarity could be improved. Please ensure the captions for Figures 3 and 4 explicitly define the sign convention to make them more immediately* *understandable.*

Will do, thanks.

References

1. Falahat, S., Nycander, J., Roquet, F. & Zarroug, M. Global Calculation of Tidal Energy Conversion into Vertical Normal Modes. J. Phys. Oceanogr. 44, 3225–3244 (2014).
2. Savage, A. C., Waterhouse, A. F. & Kelly, S. M. Internal tide nonstationarity and wave-mesoscale interactions in the Tasman Sea. J. Phys. Oceanogr. 1–52 (2020) doi:10.1175/JPO-D-19-0283.1.
3. Zaron, E. D. & Egbert, G. D. Time-Variable Refraction of the Internal Tide at the Hawaiian Ridge. Journal of Physical Oceanography 44, 538–557 (2014).