Subject: Response to Anonymous Referee #1

9 Dec 2025

Dear Madam/Sir,

We sincerely thank you for taking the time to review our manuscript, *"Internal Solitary Waves Refraction and Diffraction from Interaction with Eddies off the Amazon Shelf from SWOT"* and to provide your comments and suggestions for enhancing the quality of this paper. Below, we present a detailed, point-by-point response.

Response to Anonymous Referee #1

Comment 1: « My major concern is about the wavenumber spectra shown in Figure 8 and corresponding descriptions, especially for the internal wave modal content. According to my understanding, mode-3 internal tides (ITs) off the Amazon Shelf may have a horizontal wavelength of approximately 50km. However, it cannot be concluded that any signal with a horizontal wavelength of approximately 50 km corresponds to mode-3 ITs (Line 331). Actually, comparing spectra #2, #3 and #4 as well as the ADT_swot snapshots in Figures 8G and 8H, the peak appearing at approximately 50 km on spectrum #2 might be ISW packets rather than mode-3 ITs. »

Response 1: Thank you for your comment, but I am not sure I fully understand the meaning of your question.

If your comment refers to ISW packets as "intra-packet" distances (i.e., the distances between crests within the same wave packet), Macedo et al. (2023) showed that ISW packets are characterized by intra-packet distances typically ranging between 10 and 20 km (**Figure a**), which is smaller than the typical wavelengths of mode-3 waves. However, it is indeed more difficult to distinguish, based solely on the spectrum, between mode-4 or mode-5 ISWs and these intra-packet distances. To do so, it is necessary to examine the main solitary wave of the ISW packet.In addition, we produced a 1D along-track transect of the SWOT swath for the NE case (**Figure b**). Downstream of the seamount, we observe peaks separated by approximately 25 km. These crests are independent from one another and do not display the morphology of an ISW packet (i.e., a leading large-amplitude crest followed by secondary, decaying waves).

If, on the other hand, your question concerns the distinction between mode-3 ISWs and mode-3 internal tides (ITs), at our current level of understanding it is difficult to reliably separate the two. The most plausible hypothesis is that the mode-3 signals we observe correspond to ISWs carried by an internal tide through an instability of the IT's leading crest. This issue lies beyond the central questions addressed in this study; therefore, for clarity, we use the expression “mode-3 ITs” to collectively refer to both mode-3 ITs and mode-3 ISWs observed in the data.

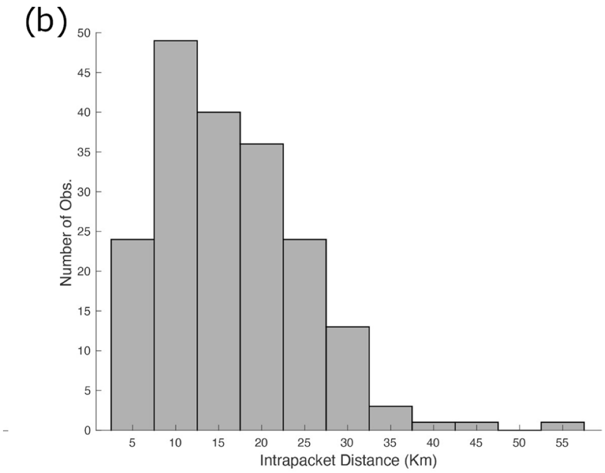

Figure a. *Figure from de Macedo et al, 2023: ISW intra-packet distance distribution.*

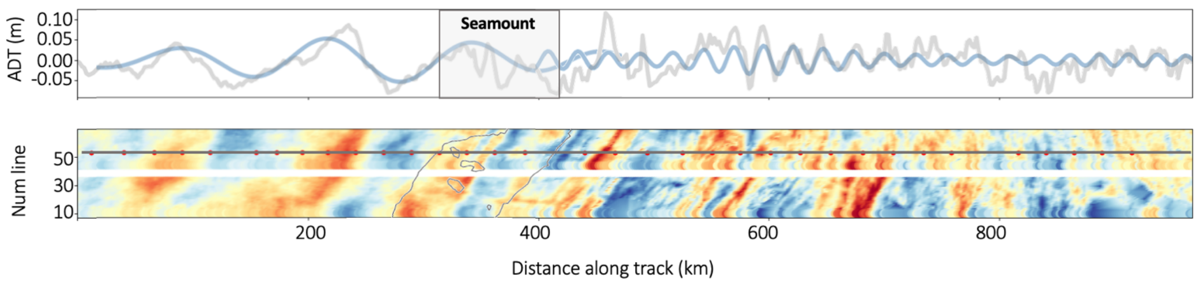

Figure b. *SWOT ADT_swot in the NE case (bottom panel). The grey line represents the 1D section shown in the top panel, corresponding to the ADT_swot along-track signal at pixel line number 52. The grey line shows the raw ADT_swot signal, while the blue line represents the signal filtered with a band-pass filter: 200–100 km between 0 and 505 km, and 30–20 km between 400 and 900 km.*

Comment 2: « Moreover, the authors mentioned in section 5.4.1 that the mode-3 ITs are reproduced in numerical investigations (Kouogang et al., 2025b, in preparation). I think that it is necessary to show some key results that support the generation of mode-3 ITs in this study or in a supporting material. »

Response 2: We appreciate the reviewer's interest in the comparison with the results of Kouogang et al., 2025b. However, these results are part of a separate study that will be submitted before the end of the year. The scattering processes that might occur in our study have been largely described by other studies. For example, Johnston & Merryfield, 2003; Johnston et al., 2003; Mathur et al., 2014. If the kouogang's papers is in preprint before this manuscript passes the review process I will cite it. Otherwise I will remove this reference to this work because other studies already tackle this issue.

Comment 3: « My second concern is also related to the no-eddy (NE) case. In both the anticyclonic eddy (AE) and cyclonic eddy (CE) cases, ISW packets are observed prior to encountering the mesoscale eddy/seamount. In the NE case, however, only isolated ISWs are observed before reaching the seamount. To draw robust conclusions regarding the influence of mesoscale eddies on ISWs, it is recommended to identify an example where ISW packets exist before the seamount interaction for the NE case. »

Response 3: We agree that having an NE example with ISW packets before the seamount interaction would strengthen the comparison.We have identified a new, more robust showcase show in **Figure c** (SWOT pass 227, cycle 012, which samples the ISW fluxes generated at sites A on 2024-03-14) that leads to the same results as in the previous case and in addition shows ISWs packet before any interaction. These figure is now described section 'Signature of ISW, refraction and diffraction from the interaction with eddies' (section 4.2) lines 296 -330.

So the topography and the seamount are not indispensable for the formation of ISWs packets in this case even if they migth contribute to them (Johnston & Merrifield, 2003; Lamb, 2004; Mathur et al., 2014). This observation is well aligned with the hypothesis formulated in Kouogang et al. (2025), which shows increased mixing at station ST14 in the AMAZOMIX data—upstream of the seamount—that the authors suggest may result from wave–wave interactions. It is also consistent with the findings of Solano et al. (2023), who show that the interference pattern between mode-1 and mode-2 waves induces nonlinear energy transfers less than 400 km from the slope.

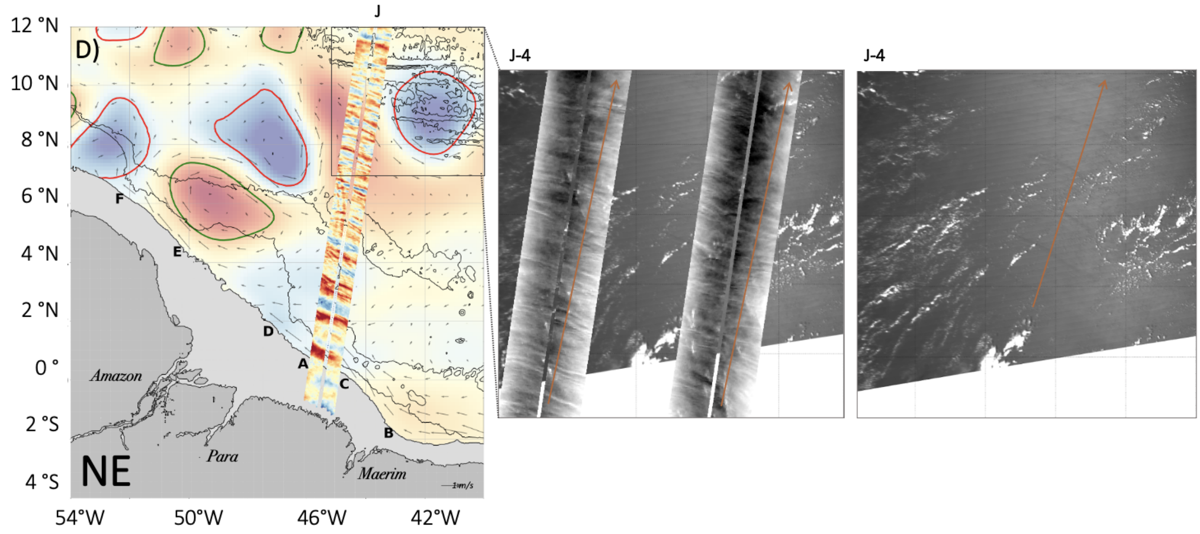

Figure c. *Eddy detection maps based on MIOST L4 ADT and ADT_swot SWOT cycle 012, passes 227, from 2024-03-14 combined with Level 1B optical imagery MODIS-Aqua from 2024-03-10. Cyclonic eddies and anticyclonic eddies are marked by red and green circles, respectively. NE=no interaction eddy case . Bathymetry is represented using isocontours at –400 m, –3000 m, –100 m, and 0 m*

Comment 4: « Figures 7A-C. It is recommended that the authors present these figures using the same spatial domain, if possible. »

Response 4: Thank you for this helpful suggestion. Unfortunately, it is not possible to present Figures 7A–C with the same spatial domain because they correspond to sunglint images acquired at different times by different satellites (MODIS Terra and MODIS Aqua). We used multiple satellites because sunglint observations are strongly constrained by the factors : (1) few usable MODIS images, (2) the need for temporal and spatial coincidence with SWOT tracks, and (3) the requirement that ISWs propagate in regions free of mesoscale eddy influence. In particular, sunglint images are especially limited by cloud cover and suitable solar illumination conditions required to detect ISWs, which significantly reduce the number of usable scenes in this region

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Comment 5: « There are two "section 5.5" in this paper, with one appearing ahead of "section 5.4". »

Response 5: Thank you for this comment.We have carefully revised the manuscript to correct the section numbering, ensuring that the sequence now follows the proper order without duplication.