MS No.: egusphere-2025-283

Title: Enhancement of near-inertial waves by cyclonic eddy in the northwestern South China Sea during spring 2022

Point-by-Point Response to Reviewers

In this point-by-point response, we reproduced the comments (**black font**), provided our responses (**blue font**), and highlighted the corresponding revisions in **red**.

Responses to Reviewer #1

1. Utilizing a mooring array, this study investigates the interaction between a cyclonic eddy (CE) and near-inertial waves (NIWs) in the northwestern South China Sea (SCS). Results demonstrate that NIWs were significantly amplified by the passage of a cyclonic eddy. Overall, the manuscript presents a well-structured analysis of an interesting topic. While the work appears suitable for publication in Ocean Science, a few minor clarifications are requested to strengthen the paper prior to final acceptance.

Response: We appreciated for the reviewer's comments.

Specific Comments

2. Line 24: "power of the first five NIWs modes were promoted significantly and dominated by the second and third modes." Use "was promoted" for subject-verb agreement.

Response: 'were promoted' has been replaced with 'was promoted'.

3. **Line 53:** "Chen et al. (2011) suggest that eddies present 35%--60% of the time in the northern SCS..." Replace "present" with "occur" for clarity.

Response: 'present' has been replaced with 'occur'.

4. **Line 60:** "making this place as a seemly area for investigating NIWs..." "seemly" is incorrect; replace with "suitable" or "ideal."

Response: 'seemly' has been replaced with 'ideal'.

5. **Line 81–82:** "flow velocity compensation correction was applied to ADCP data, which was calculated based on depth change and flow direction. Clarify the exact method used for compensation (e.g., reference to a specific algorithm or equation).

Response: We have added the specific algorithm of velocity compensation correction in the data section as below:

The method for ADCP velocity flow velocity compensation correction is as follows:

$$\vec{V}_{\text{true}}(t) = \vec{V}_{\text{measured}}(t) + \vec{V}_{\text{platform}}(t)$$

$$\vec{V}_{\text{platform}}(t) = \frac{\Delta x}{\Delta t}\vec{i} + \frac{\Delta y}{\Delta t}\vec{j}$$

$$(x, y) = (\rho cos\theta, \rho sin\theta)$$

$$(\rho, \theta) = (\sqrt{L^2 - {z_{\text{top}}}^2}, \alpha)$$

where $\vec{V}_{\text{true}}$, $\vec{V}_{\text{measured}}$ and $\vec{V}_{\text{platform}}$ are the true velocity, observed velocity and the platform movement velocity, respectively. (ρ, θ) is the polar coordinate position of the ADCP with the initial position as the origin. L, z_{top} and α are the length of the rope at the position of the ADCP, the depth of the ADCP and the direction angle of the horizontal projection.

6. **Line 82:** Does the lack of data in the upper tens of meters of the mooring data lead to errors in energy calculations and filtering?
Response: As shown in Figures 2e-h, the peak of NIKE occurs around 100 m. While, NIKEs have already significantly weakened above 100 m. Therefore, we conclude that the missing data does not lead to significant errors in the results.

7. **Line 95:** Since calculating the energy conversion rate requires gradients in the x and y directions, the mooring array is a section. How is this considered when calculating the energy conversion rate?
Response: The reviewer is right that calculating geostrophic currents in S_s and S_n requires gradients in the x and y directions, which cannot be satisfied by mooring observations. Therefore, we use 3D velocity data from CMEMS reanalysis (6-hourly resolution) for these calculations. Since NIKE in the equations does not involve gradient computations, we directly apply filtering to mooring-derived observations to better reflect real conditions like the method applied by Chen et al. (2023).

8. **Line 97:** “moving average of 3 internal tide periods.” The analysis in the article focuses on near-inertial internal waves, not internal tides. Therefore, it should be 3 “internal wave periods”.
Response: We have rewritten the sentence as ‘The $\langle\cdot\rangle$ represents a moving average of 3 internal wave periods.’. ‘internal tide’ has been replaced with ‘internal wave’ as well.

9. Is this the only CE throughout the year? Or why was this particular CE selected for analysis?
Response: Thanks for raising this insightful question. This is not the only CE observed during the observation period. According to the AVISO eddy dataset, six CEs were detected near the mooring location throughout the year. Among them, four were locally generated due to flow field adjustments, characterized by short durations

or weak energy. The remaining two CEs propagated westward to the observation area, both exhibiting stronger energy compared to the others. The first of these propagating eddies lasted longer, with a trajectory perpendicular to the observation transect, and triggered the most significant vertical displacement of the mooring during the observation period. Therefore, we focused our analysis on this particular eddy.

10. **Line 116:** "near-inertial frequency with peak value of 0.616 cpd" Define "cpd" (cycles per day) upon first use.
Response: We have rewritten the sentence as 'near-inertial frequency with peak value of 0.616 cycles per day (cpd)'. Definition of cpd has been added.

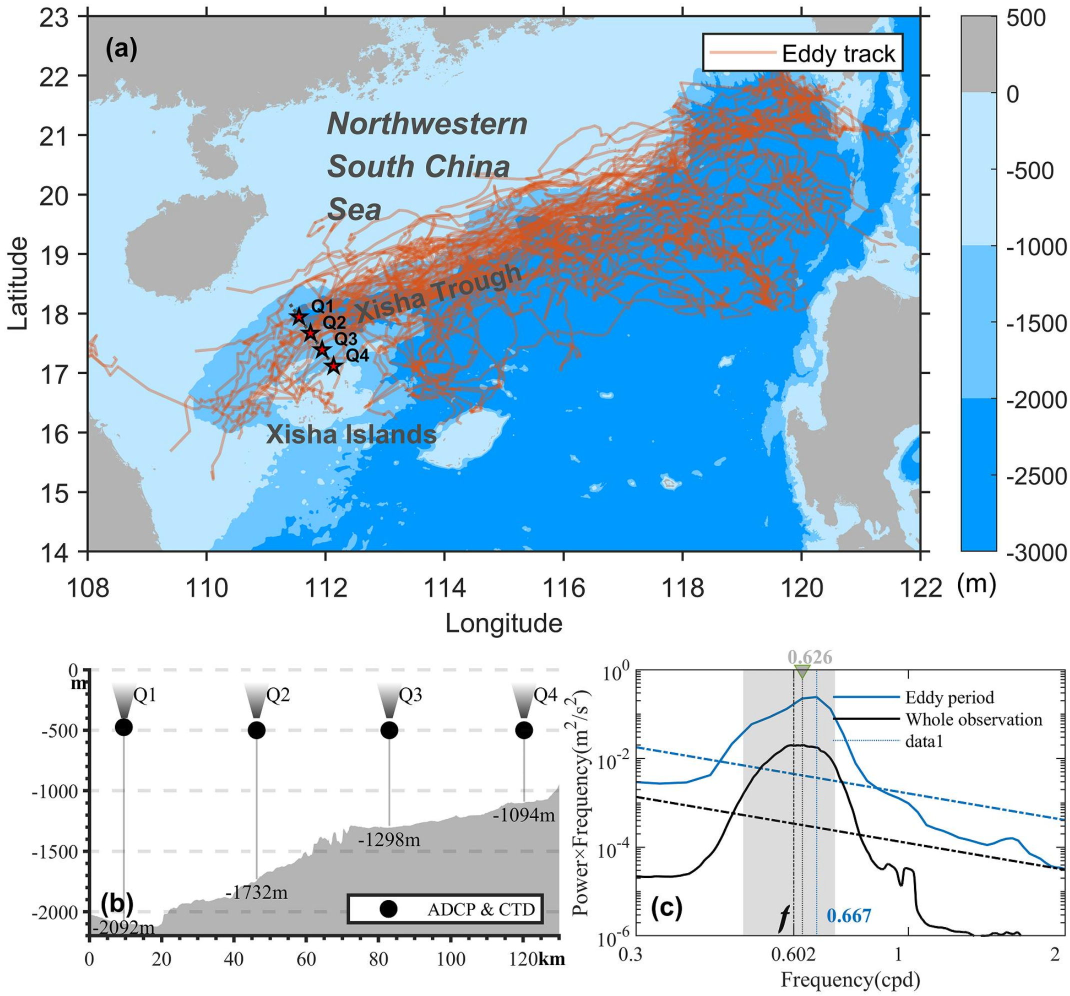
11. **Line 160:** "Low modes rose from 46% (Q2) and 54.4% (Q3) during Period1 to 87.6% (Q2) and 79.5% (Q3) during Period2..." Clarify what "46%" refers to (e.g., percentage of total energy?).
Response: We have rewritten the sentence as 'Low modes rose from 46% (Q2) and 54.4% (Q3) of total energy during Period1 to 87.6% (Q2) and 79.5% (Q3) during Period2, respectively'.

12. **Line 200–201:** "The differences may be attributed to the strength of eddies, their rotation direction and the intensity of NIWs." Expand on how rotation direction (cyclonic vs. anticyclonic) impacts energy transfer.
Response: We have expanded the sentence as 'The differences may be attributed to the strength of eddies, their rotation direction and the intensity of NIWs. Previous studies have shown that eddy rotation plays a critical role in energy transfer and NIWs propagation due to differences in vorticity input and stratification modulation (Alford et al., 2016; Jing et al., 2017).'

13. **Line 206:** "NIWs draw energy from background flow with small energy ratio between them, vice versa." Rephrase for clarity (e.g., "NIWs draw energy from the background flow when the energy ratio is small, and vice versa").
Response: We have rewritten the sentence as 'NIWs draw energy from the background flow when the energy ratio between them is small, and vice versa'.

14. **Line 229:** "This study is helpful for us to understand multi-scale interaction..." Replace "for us" with "for understanding" to maintain objectivity.
Response: We have rewritten the sentence to 'This study is helpful for understanding multi-scale interaction and energy cascade in the northwestern SCS.'. 'internal tide' has been replaced with 'internal wave'.

15. **Figure 1:** Panel (c): Label the x-axis of the power spectra.
Response: Thank you. We have added the label to this figure.



16. “The mooring dataset used for plotting Figure for this paper are available at”, the grammar is incorrect.

Response: We have rewritten the sentence as “The data used for plotting Figures for this paper is available at ……”.

17. Ensure consistent use of hyphens (e.g., “near-inertial” vs. “near inertial”).

Response: Thank you. The revised manuscript now consistently uses “near-inertial” throughout the text. Thanks.

18. Use “cyclonic eddy (CE)” consistently after first introduction.

Response: Following the revision, the term “cyclonic eddy (CE)” is now consistently presented with its full form and abbreviation in the abstract. For maintaining conceptual continuity and precision, the full term “cyclonic eddy (CE)” is reintroduced in the introduction, with subsequent references using “CE” only.