Point-by-Point Response for Reviewer 1

We acknowledged the referee's comments. In this point-by-point response, we reproduced the comments (black font), gave our responses (blue font), and highlighted the revisions in new version of the paper in *Italics*. The point-by point responses are below.

Main Comments: The Authors certainly have the promise of a very exciting data set that I would like to see published. Unfortunately, there are some major issues with this paper that mean it should be rejected, although if corrected could be resubmitted to this journal possibly.

Reply: Thank you for your valuable comments. Based on the subsequent comments, we have revised the entire manuscript:

(1) Based on comments 1 and 5, we have uploaded all the data that has undergone quality control according to the IOOS standard. The data is stored in the format of Argo data and can now be downloaded at https://doi.org/10.57760/sciencedb.11996.
(2) Based on comments 2, we have removed some interpretations of the dataset that are explicitly excluded by the aims of the journal.
(3) Based on comment 3, 6 and 7, we have adjusted the structure of the manuscript and included relevant references and necessary details about the vehicles themselves and the motivation of data collection.
(4) Based on comments 4, we have utilized 'CMOcean_balance' as the colormap to modify the colors of all figures to maintain consistency in the visual style of the manuscript and ensure color accessibility for individuals with color blindness.

1. Comment: The data itself as found at the link in the abstract are unusable and seem to be incomplete. The data set spoken about in this paper needs to be completely detailed and metadata provided. There are international best practices for what to include as glider data metadata e.g. oceangliders.org. The data provided here are not even close to that and so are not really usable by the scientific community.

Reply: Following your suggestions, we have uploaded all the data stored in the format of NC, and can now be downloaded at https://doi.org/10.57760/sciencedb.11996.

2. Comment: The journal's aims specifically exclude the interpretation of the dataset which I believe the authors begin to do. While it is exciting to see what can be learned from such a data set it is best left for another paper (which I hope the authors write).

Reply: Following your valuable suggestions, we restructured the introduction part. Our UG and AUV experiments are designed to investigate mesoscale eddies, therefore, we also provided the scientific background in this manuscript.

3. Comment: The paper needs a restructure so that the motivations of the data collection are in the introduction. These need to be properly referenced.

Reply: We have adjusted the structure of the manuscript and included relevant references about the motivation of data collection.

In the introduction part, we have added the related descriptions,

"Attributed to the positively track, AUVs and UGs become more and more important tools in exploring marine environment over last two decades, due to the advantages of low cost, long-duration, controllability and reusability. Our group has collected dense UGs and AUVs observations across MEs. UGs adjust buoyancy to generate gliding motion through water columns by a pair of wings, and hybrid underwater gliders have been developed since 2004 (Bachmayer et al., 2004; Caffaz et al., 2010).UG Many international products of UGs were operated, such as "Seaglider" (Eriksen et al., 2001), "Spray" (Sherman et al., 2001), "Slocum" (Webb et al., 2001), "Deepglider" (Osse and Eriksen, 2007), "SeaExplorer". UGs' product companies and related information are listed in Table 2. UGs moves in a sawtooth trajectory at a slow speed of 0.3 m/s, while AUVs are propeller-driven, acting as sawtooth and drifting mode at the maximum speed of 1 m/s (Hobson et al., 2012). It takes around 8/3 days for a UG/AUV to pass a quasi-steady eddy with mean radius of ME (100 km) in SCS. Kinds of sensors, such as, conductivity-temperature-depth(CTD), GPS are installed on the UGs and AUVs to measure marine environment. Hence, UGs and AUVs have been

successfully used in detecting strongly varying features in some marginal seas, such as estimation of trends of Gulf Stream (Todd and Ren, 2023), the water mass exchanges between Bay of Bengal and Arabian Sea (Rainville et al., 2022). We reported UGs experiments since 2014 (Qiu et al., 2015), and made AUV experiments since 2018 (Huang et al., 2019; Qiu et al., 2020). Here, we present 9-year (2014-2022) AUVs and UGs datasets in SCS, and try to show their potential abilities in detecting the evolutions of MEs and the associated submesoscale processes."

4. Comment: The colouring of all figures should be reviewed with colourblind folks in mind. E.g. Figure 1 could have the SLA in grey scale.

   Reply: We have utilized 'CMOcean_balance' as the colormap to modify the colors of all figures to maintain consistency in the visual style of the manuscript and ensure color accessibility for individuals with color blindness.

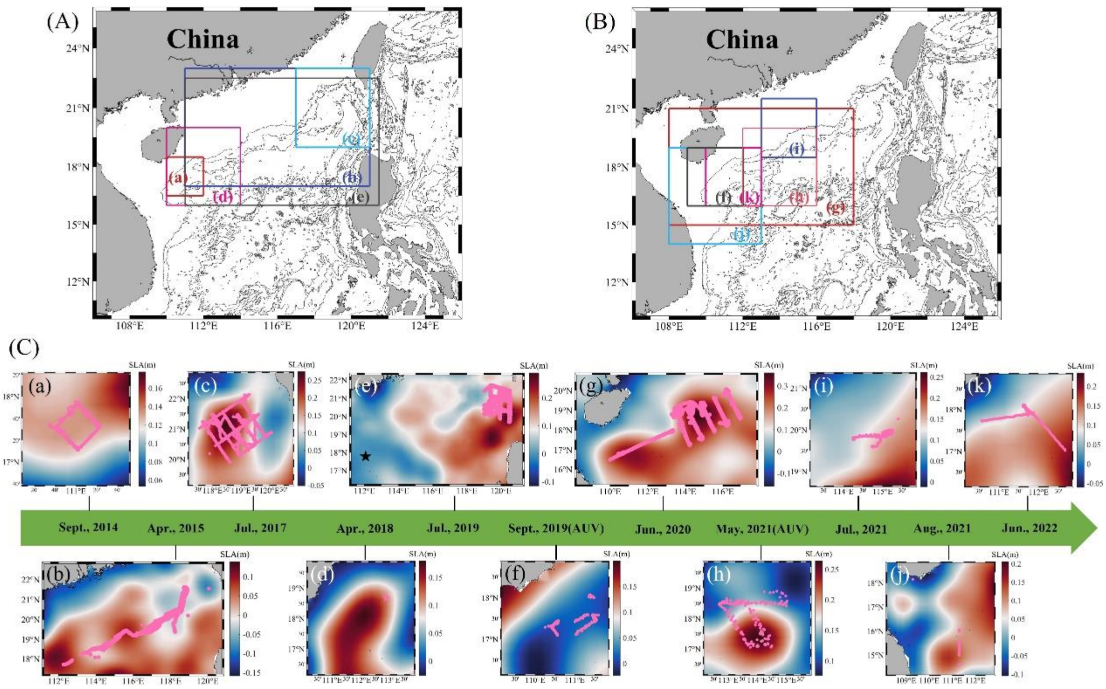

Figure 1. Underwater glider (UG) and autonomous underwater vehicle (AUV) observation sites. (A) observation area for subplots (a)-(e); (B) area for subplots (f)-(j). The grey lines in (A) and (B) are the water depth. (a)-(j) Observation stations (pink dots) with sea level anomaly (SLA, shading colors). The observation times are (a) September, 2014; (b) April, 2015; (c) July, 2017; (d) April, 2018; (e) July, 2019; (f) September, 2019; (g) June, 2020; (h) May, 2021; (i) July, 2021; (j) August, 2021; and (k) June, 2022.

5. Comment: QA/QC of this data set should be undertaken as per international standard where it exists – e.g. IOOS. That could be taken further and local knowledge applied as per 3.1, but choices of acceptable salinity ranges etc. should be justified (referenced).

   Reply: We have performed quality control on the data in accordance with IOOS's publication, "Manual for Quality Control of Temperature and Salinity Data Observations from Gliders," and have conducted the following tests:

   "Before investigating oceanic phenomena, we did data quality control following standard of integrated ocean observing system (IOOS). The quality control for UG (https://repository.oceanbestpractices.org/handle/11329/289?show=full) includes 9 steps: (1) Timing/Gap Test: Test determines that the profile has been received within the expected time window and has the correct time stamp; (2) Syntax Test: Ensures the structural integrity of data messages (3) Location Test: Test if the reported physical location (latitude and longitude) is within the reasonable range determined by the operator. (4) Gross Range Test: Ensure that the data points do not exceed the minimum/maximum output range of the sensor; (5) Pressure Test: Test if the pressure records increase monotonically with depth, sorted the vertical depth values and removed any duplicate depth values; (6) Climatology Test: Test if the data points are within the seasonal expectation range; (7) Spike Test: Test if the data points exceed the selected threshold compared to adjacent data points, excluded the data with temperature/salinity larger than 35 ℃/35 psu; (8) Rate of Change Test: Test if the rate of change in the time series exceeds the threshold determined by the operator; (9) Flat Line Test: Test for continuously repeated observations of the same value, which may be the result of sensor or data collection platform failure. After that a natural neighbored interpolation is utilized to the temperature and salinity to 1-m vertical resolution data."

6. Comment: The vehicles themselves can be referenced – other works have previously described them.

   Reply: We have added relevant references describing the vehicles.

   "UGs adjust buoyancy to generate gliding motion through water columns by a pair

of wings, and hybrid underwater gliders have been developed since 2004 (Bachmayer et al., 2004; Caffaz et al., 2010).UG Many international products of UGs were operated, such as "Seaglider" (Eriksen et al., 2001), "Spray" (Sherman et al., 2001), "Slocum" (Webb et al., 2001), "Deepglider" (Osse and Eriksen, 2007), "SeaExplorer". UGs' product companies and related information are listed in Table 2. UGs moves in a sawtooth trajectory at a slow speed of 0.3 m/s, while AUVs are propeller-driven, acting as sawtooth and drifting mode at the maximum speed of 1 m/s (Hobson et al., 2012). It takes around 8/3 days for a UG/AUV to pass a quasi-steady eddy with mean radius of ME (100 km) in SCS. Kinds of sensors, such as, conductivity-temperature-depth (CTD), GPS are installed on the UGs and AUVs to measure marine environment."

7. Comment: Important detail about collection of the data are missing, these could include:

   Reply: The deploying time, installed sensors, and diving depths of UGs/AUVs experiment were shown in Table 3. More detailed information, including vehicle serial number, waypoints, matching time, latitude, and longitude is stored in the data with *.NC format.

   (1) Vehicle name/serial number

   Reply: We have provided the time, latitude, longitude in the new datasets.

   (2) Deployment location and recovery

   Reply: We have provided the time, latitude, longitude in the new datasets.

   (3) Waypoints

   Reply: We have provided the time and location (latitude, longitude) in the new datasets.

   (4) Any challenges during missions e.g. malfunctioning sensors, bad/false bottom hits, requirements or challenges for vehicle course

   Reply: We have added the challenges in the conclusion parts,

   "During the mission, we met some challenges: (1) under strong background current, UGs and AUVs get disturbed and cannot follow the customized routes; (2) Under

bad weather, the it's difficult for piloting team to deploy and recovery UGs and AUVs; (3) data receiving capacity depends on the satellite transmission capacity. If both the bio-chemistry and CTD data are included, the data resolution have to be lowered. These challenges require piloting team and oceanographer to work together."

(5) Accumulation of biofouling

Reply: As our deploying positions are in open sea, seldom biofouling are found on the UGs and AUVs. The UG recovery could support this (Figure below).

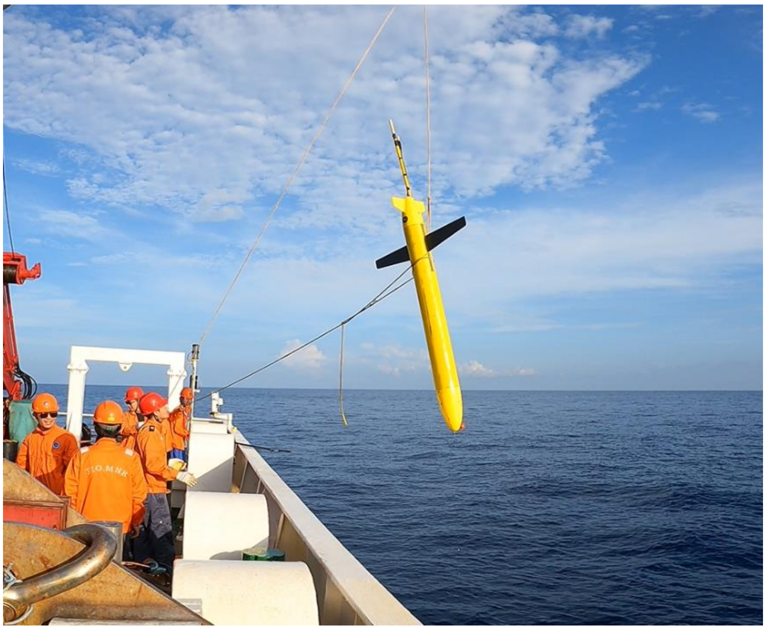

Figure. Underwater glider recovery on March. 30th, 2024.

(6) Power management strategies that may affect any of the data

Reply: The battery life may influence the endurance of UG and AUV, but don't influence the data quality. Only if under very low voltage, the CTD and GPS may not work. During the underwater glider works, we keep watching its status as shown in Figure below. If it works under normal status, we will click the diving menu, otherwise (e.g., low voltage), we will recover it. Therefore, the power did not affect the data in previous missions.

(7) Any other notes from the piloting team

Reply: See comments (4).

(8) All oceanographic data need a matching time, latitude, and longitude. How the location underwater was determined needs to be noted, and any interpolation

needs to be explained fully. Any derived values (e.g. density) also need to be described. All units must be provided.

Reply: We have provided the time, latitude, longitude in the new datasets, and the derived values of density has described in the text.

"*3.3 Density derived from temperature and salinity*

The value of seawater density (ρ, in kg/m³) can be calculated based on temperature (T in °C), salinity (S in psu), and pressure (P in dbar). The UNESCO formula provides a simplified approach to estimate seawater density as follows:

$$\rho(S,T,P) = \frac{\rho_0(S,T)}{1 - \frac{P}{K(S,T,P)}} \tag{2a}$$

$$\begin{aligned}\rho_0(S,T) = \rho_{sw}(T) + (b_0 + b_1 T_{68} + b_2 T_{68}^2 + b_3 T_{68}^3 + b_4 T_{68}^4)S \\ + (c_0 + c_1 T_{68} + c_2 T_{68}^2) S\sqrt{S} + d_0 S^2\end{aligned} \tag{2b}$$

$$\rho_{sw}(T) = a_0 + a_1 T_{68} + a_2 T_{68}^2 + a_3 T_{68}^3 + a_4 T_{68}^4 + a_5 T_{68}^5 \tag{2c}$$

$$T_{68} = T \times 1.00024 \tag{2d}$$

where K(S,T,P) is secant bulk modulus, a_0 and others are coefficients. This formula accounts for the haline and thermal contraction of seawater. The detailed method is related to https://unesdoc.unesco.org/ark:/48223/pf0000188170."

(9) Sampling intervals should be noted.

Reply: The initial position has been provided in the new datasets.

(10) Very importantly these are AUTONOMOUS underwater vehicles and AUTONOMOUS underwater gliders not "automatic". This must be corrected throughout. The authors need to take care to use the correct words so that their work fits appropriately within the greater body of knowledge and can be searched.

Reply: We have appropriately used the words "AUTONOMOUS" and "AUTOMATIC" based on the specific context of the manuscript.

(11) Table 3 indicates that there are data channels (chlorophyll, dissolved oxygen etc.) that are not evident in the downloadable data files, those data should be made available or mention of them removed.

Reply: Following your suggestions, we have deleted the data (chlorophyll, dissolved oxygen, etc.) to ensure that the manuscript's description is consistent with the uploaded data.

Point-by-Point Response for Reviewer 2

We acknowledged the referee's comments. In this point-by-point response, we reproduced the comments (black font), gave our responses (blue font), and highlighted the revisions in new version of the paper in in *Italics*. The point-by point responses are below.

Main Comments: The authors present a 9-year dataset (2014-2022) collected by AUGs and AUVs to observe mesoscale eddies (MEs) in the South China Sea (SCS). These high-resolution data (<7 km, <6 hours) allow the study of the distinct life stages of MEs and their associated submesoscale instabilities. It is an invaluable dataset of observations from autonomous platforms, which has led to significant advances in the understanding of MEs dynamics in the SCS, as detailed by the authors. Despite the importance of the dataset, there are major issues with this paper, and in its current state, it should be rejected. However, if the necessary revisions are made, it could be resubmitted to this journal.

Reply: Thank you for your valuable comments. Based on the subsequent comments, we have revised the entire manuscript:

(5) Based on comments 1 and 2, we have uploaded all the data that have und ergone quality control according to the IOOS standard. The data are stored in the format of Argo data (NetCDF) and can now be downloaded at https: //doi.org/10.57760/sciencedb.11996.

(6) Based on comments 3, we have added a discussion on how the slow movement limitations of gliders apply to the temporal evolution of mesoscale eddy.

8. Comment: The dataset, in its current form, is unusable by the scientific community due to a lack of proper metadata and description. Key information is missing, such as:

   (1) The location and dates of the measurements,

   (2) The measured parameters,

   (3) The units of measurement,

(4) The instruments used for the measurements,

(5) The geographic coordinates,

(6) The data processing or correction methods applied.

Additionally, the dataset is not in the widely adopted NetCDF format, which is the standard for ensuring interoperability and accessibility across platforms and software in the scientific community. Without these essential elements, the dataset cannot be effectively utilized or shared, and its scientific value is significantly diminished.

Reply: Following your suggestions, we have uploaded all the data that stored in the format of Argo data and can now be downloaded at https://doi.org/10.57760/sciencedb.11996. Key information (1)-(6) has been displayed in these NetCDF format data files.

9. Comment: L. 141-147: The authors describe the quality control (QC) performed on the data. However, no information regarding this QC process is included in the dataset itself. It is difficult to properly assess the dataset without knowing the various processing steps and the corresponding quality flags (which are absent). For instance, in systems like ARGO, one should be able to trace the QC steps and quantify the impact of each stage on the final data product. This is not possible with the current dataset.

Reply: We have performed quality control on the data in accordance with IOOS's publication, "Manual for Quality Control of Temperature and Salinity Data Observations from Gliders," and have conducted the following tests:

"Before investigating oceanic phenomena, we did data quality control following standard of integrated ocean observing system (IOOS). The quality control for UG (https://repository.oceanbestpractices.org/handle/11329/289?show=full) includes 9 steps: (1) Timing/Gap Test: Test determines that the profile has been received within the expected time window and has the correct time stamp; (2) Syntax Test: Ensures the structural integrity of data messages (3) Location Test: Test if the reported physical location (latitude and longitude) is within the reasonable range

determined by the operator. (4) Gross Range Test: Ensure that the data points do not exceed the minimum/maximum output range of the sensor; (5) Pressure Test: Test if the pressure records increase monotonically with depth, sorted the vertical depth values and removed any duplicate depth values; (6) Climatology Test: Test if the data points are within the seasonal expectation range; (7) Spike Test: Test if the data points exceed the selected threshold compared to adjacent data points, excluded the data with temperature/salinity larger than 35 ℃/35 psu; (8) Rate of Change Test: Test if the rate of change in the time series exceeds the threshold determined by the operator; (9) Flat Line Test: Test for continuously repeated observations of the same value, which may be the result of sensor or data collection platform failure. After that a natural neighbored interpolation is utilized to the temperature and salinity to 1-m vertical resolution data."

10. Comment: The authors describe the applications of this dataset for tracking the evolution of mesoscale eddies, indicating that these data can resolve the MEs' spatial scales (50-300 km). As is typically the case when sampling large eddies with slow-moving platforms like gliders, the issue of synopticity needs to be addressed, particularly given the stated goal of capturing the evolution of mesoscale eddies. Gliders are relatively slow vehicles, though no specific information about their speed is provided in the paper. At an average speed of around 0.20 m/s, it would take approximately 18 days for a glider to cross a 300 km eddy, assuming favorable currents, which could further impact their ability to capture synoptic features. While AUVs might operate at higher speeds and thus be less affected by this issue, it is essential to discuss how these limitations apply to the gliders used in the study, particularly in relation to the temporal evolution of the MEs.

    Reply: It's an interesting topic. It's true that it takes more than 10 days for one UG crossing a 300 km-radius ME. In South China Sea, the mean radius of ME is 100 km, which needs 8 days for a UG to pass by. Therefore, we seldom use only one UG to track the evolution of ME, but deploy several UGs at different positions of the ME to observe it at the same time, which could successfully capture the ME's evolution.

Minor comments:

1. Comment: Tables or figures can be viewed independently of the article, so all acronyms must be defined within them. For example, in Table 1, "SCS" should be defined.

   Reply: We have modified all acronyms in the tables or figures to make them independently readable.

2. Comment: L. 133-134: What are the technical characteristics of the platforms used in this study (AUGs, AUVs)? For example, the similarities and differences between the platforms described in Table 2 should be clarified.

   Reply: Following your suggestions, we have added the descriptions in the introduction part,

"Attributed to the positively track, AUVs and UGs become more and more important tools in exploring marine environment over last two decades, due to the advantages of low cost, long-duration, controllability and reusability. Our group has collected dense UGs and AUVs observations across MEs. UGs adjust buoyancy to generate gliding motion through water columns by a pair of wings, and hybrid underwater gliders have been developed since 2004 (Bachmayer et al., 2004; Caffaz et al., 2010).UG Many international products of UGs were operated, such as "Seaglider" (Eriksen et al., 2001), "Spray" (Sherman et al., 2001), "Slocum" (Webb et al., 2001), "Deepglider" (Osse and Eriksen, 2007), "SeaExplorer". UGs' product companies and related information are listed in Table 2. UGs moves in a sawtooth trajectory at a slow speed of 0.3 m/s, while AUVs are propeller-driven, acting as sawtooth and drifting mode at the maximum speed of 1 m/s (Hobson et al., 2012). It takes around 8/3 days for a UG/AUV to pass a quasi-steady eddy with mean radius of ME (100 km) in SCS. Kinds of sensors, such as, conductivity-temperature-depth(CTD), GPS are installed on the UGs and AUVs to measure marine environment. Hence, UGs and AUVs have been successfully used in detecting strongly varying features in some marginal seas, such as estimation of trends of Gulf Stream (Todd and Ren, 2023), the water mass exchanges

between Bay of Bengal and Arabian Sea (Rainville et al., 2022). We reported UGs experiments since 2014 (Qiu et al., 2015), and made AUV experiments since 2018 (Huang et al., 2019; Qiu et al., 2020). Here, we present 9-year (2014-2022) AUVs and UGs datasets in SCS, and try to show their potential abilities in detecting the evolutions of MEs and the associated submesoscale processes."

3. Comment: Table 3: How was the number of qualified profiles determined? Additionally, it would be important to specify how many profiles were discarded and at which stage of the data processing they were eliminated.

   Reply: Thanks for your suggestions. We have added the eliminated profiles in Table 1.

4. Comment: Table 3: The table summarizes the shared dataset, but there is no trace of oxygen, chlorophyll-a, or current data in the shared matrices. Therefore, these should either be removed from the table or it should be clearly stated that these data are not provided in the current dataset.

   Reply: We have deleted the data (chlorophyll, dissolved oxygen, etc.) to ensure that the manuscript's description is consistent with the uploaded data.
5. Comment: Figure 1: It would be beneficial for all tick marks across the subplots to be of the same size; for instance, the coordinates are readable in subplot 1b, but not in subplot 1h. Additionally, it is challenging to clearly locate the study area—an overview map showing the general region, such as the SCS, would be helpful. Finally, the legend should mention that the SLA was averaged over the entire duration of the campaign, as indicated in the text.

   Reply: We have modified Figure 1 to make all tick marks across the subplots to be of the same size. Besides, an overview map showing SCS has been provided and the legend has been modified.

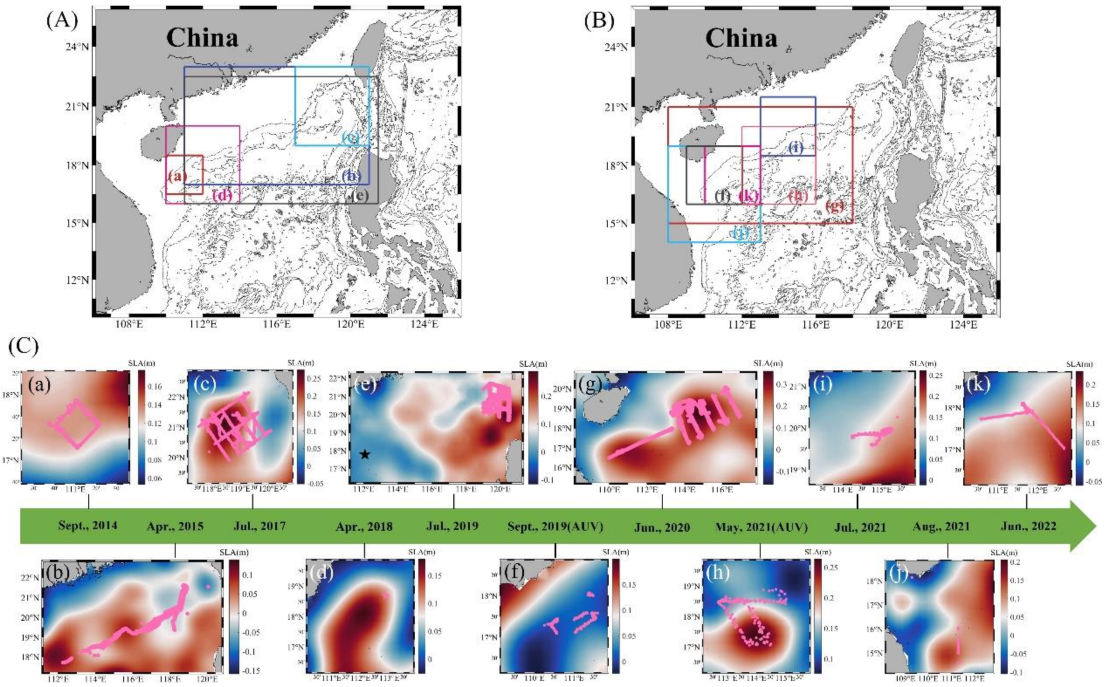

Figure 1. Underwater glider (UG) and autonomous underwater vehicle (AUV) observation sites. (A) observation area for subplots (a)-(e); (B) area for subplots (f)-(j). The grey lines in (A) and (B) are the water depth. (a)-(j) Observation stations (pink dots) with sea level anomaly (SLA, shading colors). The observation times are (a) September, 2014; (b) April, 2015; (c) July, 2017; (d) April, 2018; (e) July, 2019; (f) September, 2019; (g) June, 2020; (h) May, 2021; (i) July, 2021; (j) August, 2021; and (k) June, 2022.

6. Comment: L. 150: I do not see a black star in Figure 1e as mentioned.

   Reply: we have added the black star in Figure 1e.

7. Comment: Figure 3: What type of interpolation was applied? Was it linear interpolation or objective mapping? It is crucial to discuss the interpolation method used and its impact on the final dataset or results.

   Reply: We have tested four interpolation methods: Nearest neighbor interpolation (Nearest), Linear interpolation (Linear), Natural neighbor interpolation (Natural), and Cubic interpolation (Cubic). The results indicate (as shown in the figure below) that Natural neighbor interpolation yields more accurate and smoother results. The outcomes from Linear interpolation and Nearest neighbor interpolation are not smooth enough, and Cubic interpolation produces outliers. So we use natural neighbor interpolation for the data.

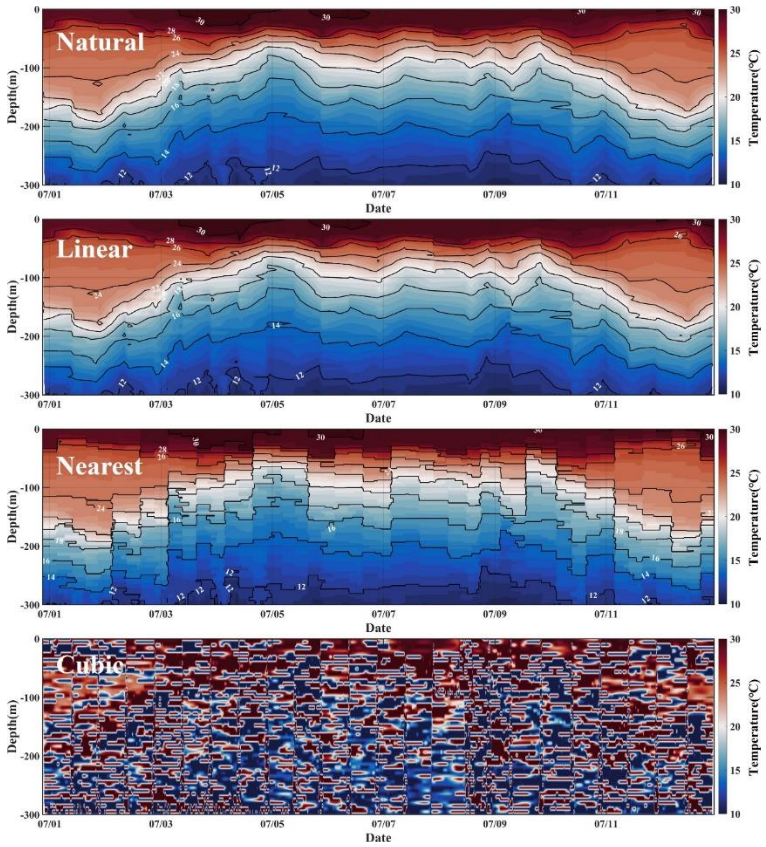

Figure R2. Comparison between different interpolation methods for temperature.

8. Comment: Figure 4: It is unclear whether AUVs or AUGs, or both, are being compared with the ship CTD, as the text refers to "ship installed CTD and AUV installed CTD" and later mentions "Different symbols are the different AUG." A clear legend is needed to distinguish between AUVs and AUGs, as they are not the same platforms.

   Reply: We corrected the captions. This validation is for AUGs.

9. Comment: Figure 5: The legend is incomplete, with parts c-f missing.

   Reply: The legend has been completed.

10. Comment: L. 189: Specify "negative temperature anomaly."

    Reply: ", which is the value minus the zonal mean value"

11. Comment: L. 238: Specify "geostrophic velocity."

    Reply: "The ME follows geostrophic balance, that is, the geostrophic velocity could be derived under the force balances between pressure gradient and Coriolis force.”

12. Comment: L. 205: The reference "Yi et al., 2024" is missing in the bibliography.

    Reply: The reference "Yi et al., 2024" has been added in the bibliography.

    Yi, Z., Qiu, C., Wang, D., Cai, Z., Yu, J., Shi, J.: Submesoscale Kinetic Energy Induced by Vertical Buoyancy Fluxes During the Tropical Cyclone Haitang, J. Geophys. Res. Oceans, 129(7), https://doi.org/10.1029/2023JC020494, 2024.

13. Comment: Gliders are not "automatic" but "autonomous".

    Reply: We have appropriately used the words "AUTONOMOUS" and "AUTOMATIC" based on the specific context of the manuscript.