Thank you very much for your effort and time to read our paper and help us improve it. The comments are very insightful and constructive for us. We have revised the manuscript point by point to the comments as listed below.

Review1 General comments:

This study investigated the formation and main drivers of the Qingdao cold water mass by using numerical simulations from a series of ensemble experiments. The study pointed out that the geostrophic balance is no longer applicable in the Qingdao cold water mass region due to the considerable friction terms. A seasonal anticyclonic circulation system was detected around the cold water mass. Wind and tides were found to be the main factors to this circulation. As for the method, the authors introduced an ensemble methodology, which is seldom applied and discussed in many numerical studies. I think, it is an advantage that can help this study to stand out. However, some major points still remain unclear and need to be resolved before the publication. Therefore, I recommend the publication of the manuscript after major revision.

Response to the comment:

Many thanks for your helpful review, perspectives, and comments. We have changed the manuscripts according to your comments, please see the details below.

Major comments:

1. The logic of the manuscript is unclear. I spent a lot of time trying to figure out how the authors organize the manuscript. My understanding is (1) that there is a seasonal anticyclonic circulation system observed around the Qingdao cold water mass; (2) that the geostrophic balance is no-longer applicable in coastal Qingdao and cannot be used for explanation of the formation of this anticyclonic circulation system; (3) that this anticyclonic circulation system mostly results from the balance of pressure gradient force, the Coriolis force, and the friction force with an emphasize of the non-negligible friction in the shallow water and (4) that the wind and tidal forcings contribute significantly to the evolution of this anticyclonic circulation system through the adjustments to the friction term. The authors, for example, put a part of discussion of wind and tidal impacts at the beginning (section 2.2), which, I think, is a scattered way of thinking and makes the readers hard to capture the main points of this study. Similar *problems were found in the abstract and conclusion sections (see detailed comments below). Another example of this erratic or scattered way of thinking is reflected in the orders of figures shown. Figure 2,3, and 5b, 5c should go to the discussion section, while figure 5 should be merged with figure 15.*

Response to the comment:

Thanks for your suggestions. We have moved the discussion of wind and tidal impact at the beginning to the discussion section in the updated manuscript. The figures mentioned above have been reorganized as well. The problems mentioned in the abstract and conclusion sections have also been modified, please see the replies to the minor comments.

2. The manuscript is lack of in-depth discussion although a "Discussion" section is performed. Each subsection in section 4 seems like other result section without detailed quantification and comparison (against previous studies). Please see the detailed comments below.

Response to the comment:

The wind and tidal forcing effects on the Qingdao cold water mass which were in the discussion section, now has moved to result section. And the discussion has been modified as four sub-sections: The existence of upwelling in the vicinity of the Qingdao cold water mass, statistic test, perspective and implication of the model results, limitations of the study. Additionally, we have added the comparison against previous studies. Please see lines 303-308, 309-315, 391-400:

Lines 303-308: Previous studies have investigated upwelling and the vertical secondary circulation in the Bohai and Yellow Seas and revealed that upwelling usually occurs in shallow areas along coasts, such as the Subei area and the region near the Korean Peninsula (Q. Wei et al. 2019; Lü et al. 2010). Lü et al. (2010) explained the tidal effect on upwelling, indicating that the front in the control run generates a relatively large baroclinic pressure gradient compared with when the tidal forcing is turned off, which further triggers distinct upwelling. In this work, we found that such an explanation can also explain the upwelling around the Qingdao cold water mass.

Lines 309-315: In this study, we also find that upwelling occurs from the surface layer to the bottom layer near the Qingdao cold water mass. Additionally, a refined analysis of the factors influencing upwelling around the Qingdao cold water mass has not yet been performed.

Lines 366-369 As introduced in subsection 2.2, statistical tests have many applications in numerical climate simulations to separate and validate that the variation is caused by internal variability or changes in external forcing or parameterization (Conover 1999; Weisse, Heyen, and von Storch 2000; von Storch and Zwiers 1999; Livezey and Chen 1983; Zwiers and von Storch 1995). However, for the ocean regional simulation community, statistical tests are seldom applied.

Lines 391-400: Previous studies have focused mainly on the seasonal variation in the formation of the Qingdao cold water mass and its mechanism (Ho et al. 1959; Q. Zhang et al. 2002; 2004; Yu et al. 2006; 2005; Zhang et al. 2016; Huang, Chen, and Lin 2019) but not the seasonal anticyclonic circulation around it. Some previous studies have reported an anticyclonic circulation around the Qingdao cold water mass (F. Zhang, Mao, and Leng 1987). The numerical results reveal that the northeastward current induced by the summer southwesterly.

However, the link between the Qingdao cold water mass and the seasonal anticyclonic circulation has not been analyzed quantitatively. Based on the momentum balance, in this study, although there is a significant temperature gradient and a mild salinity gradient near the Qingdao cold water mass, the resulting density gradient from these temperature and salinity variations does not directly drive the observed anticyclonic flow structure, as the geostrophic balance is not maintained.

3. There are some findings or points listed in the manuscript that are contradicted to each other weaking statements. I have listed them below.

Response to the comment:

Thanks for catching the problems. We have corrected and please see the replies below.

4. The manuscript is lack of quantitative analysis and comparisons no matter in the results but also the discussion sections. This can largely weaken the convincibility of the findings.

Response to the comment:

We have made modification as suggested, please see the replies in the minor comments.

Minor Comments:

1. The title is not specific enough. Saying "the seasonal anticyclonic circulation" may be too general. Per my understanding, the authors are investigating the mechanisms of the evolutions of this circulation. So, it could be better to point out the main purpose of the study in the title.

Response to the comment:

O.K. We have changed the title to "The evolutions of the seasonal anticyclonic circulation around the Qingdao cold water mass in the China marginal sea and its mechanism".

2. Lines 14-30. The abstract is not concise enough and is lack of a "main clue" to guide the reader to rapidly capture the findings (please see the above comments).

Response to the comment:

We have rewritten the abstract.

3. Lines 19-20. The authors should point out directly what results in the anticyclonic circulation rather than saying the cool poor is not the main cause.

Response to the comment:

We have improved the abstract, please lines 18-24:

Lines 18-24: Seasonal circulation mostly results from the balance of the pressure gradient, Coriolis, and vertical friction forces. The no-tide and no-wind numerical simulation results suggest that when the tidal forcing is turned off, unrealistically strong currents appear and are caused by the decrease in vertical friction in the no-tide simulation. Moreover, the direction of the eastern side of the anticyclonic circulation is reversed. Furthermore, the seasonal southwesterly monsoon contributes to the magnitude of the anticyclonic circulation, especially in the western portion of the anticyclonic circulation. Additionally, upwelling occurs vertically around the Qingdao cold water mass and is influenced by tidal and wind forcings.

4. Lines 22-24. Too verbose. Try to concise it.

Response to the comment:

We have added how many of the grid points are statistical in the manuscript. 51.29% and 89.68% of grid points of no-wind and no-tide runs are proven to be local statistically significant.

5. Line 105. 11 year? The simulation period of the climatological run is from Nov 2008 to Dec 2019.

Response to the comment:

Sorry about this confusion. The climatological run ending time is 1st Nov. 2018. It is 10-year. After 1st Nov. 2018, we used the realistic surface forcings (NCEP CFSv2) to run the ensemble simulation. We have corrected the manuscript.

6. Lines 127-134. This part should belong to the discussion section and same for figures 2–3.

Response to the comment:

We have moved it to the discussion (section 4.3).

7. Line 159. "Northeast" or "southeast"? Please double check. If "northeast", the corresponding temperature and salinity distribution should be shown, i.e., enlarge the coverage in Fig. 4.

Response to the comment:

It is southeast, thank you for catching this problem.

8. Lines 163 and 167. The location of the cold water mass center was mentioned twice but with different longitudes.

Corrected.

9. Lines 163–165. My understanding of the formation of cold water body is somehow slightly different from the explanation here. Firstly, during winter, water column is homogenized forming cold water from surface to bottom. Secondly, as in early summer, fast heating on the ocean surface induces strong and rapid stratification sealing the cold water below the thermoclines. Thirdly, vertical mixing due to wind disturb or upwellings is not strong enough to homogenized the water column, which results in the maintenance of near-bottom cold water mass. So, it may not be appropriate to emphasize only the role of thermocline to the cold water mass formation. In addition, citations are needed here as there is no clue shown in Fig. 4 that thermocline leads to the formation of the cold water mass.

Response to the comment:

The reviewer describes the formation of the cold water body more thoroughly, we have deleted the sentence which emphasizes the role of thermocline, and we have also added the reviewer's understanding of the formation of the cold water body in the manuscript. Thank you.

Lines 142-147: At this time, fast heating on the ocean surface induces strong and rapid stratification, sealing the cold water below the thermoclines. The vertical mixing due to wind disturbance or upwelling is not strong enough to homogenize the water column, resulting in the maintenance of a near-bottom cold water mass. In summary, the Qingdao cold water mass starts to merge in April, continues to develop in May, is accompanied by a strong horizontal temperature gradient, and disappears in June. The cold water mass center is at 122.20°–122.40°E, 36°–36.15°N, and the shape of the cold water mass has a northeast–southwest orientation.

10. Figure 5 should be merged with Figure 15, as they contain largely overlapping information. Arrows in figure 5 are not clear enough.

Response to the comment:

Sorry about this. We have replotted Fig. 5 (now Fig. 12 in the new manuscript). Figure 15 in the old manuscript has already been deleted since it contains largely overlapping information.

11. Lines 183–185. Is the southeasterly wind strong enough to induce vertically-homogenized the northward currents?

Response to the comment:

We can compare the Fig.3 (b) control run result in May with Fig. 8 (d) no-wind result. There is no obvious northern current in the no-wind run. Given on this model result, we conclude that southeasterly monsoon is causing the northward currents (25m layer).

12. Line 188. Could you also show the June pattern to support this statement?

Response to the comment:

Please see Fig. 3 in the manuscript, the circulation pattern in June is shown there.

13. Lines 190–192. This is an incomplete sentence. "As the water depth is shallow in the western portion of the anticyclonic circulation and the dominant southeasterly monsoon…" This part is incomplete. This is a conclusion-like statement. Model evidence are needed to support this causality.

Response to the comment:

We have deleted this sentence, since it is confusing for the readers.

14. Lines 200–201. I cannot see velocity increases with depth. Perhaps the authors need to replot the Figure 7 showing 5 separate 2D panels rather than using a 3D plot. The Figure 7 shown makes current arrows hard to compare. Also, the panels do not align with the corresponding depth, e.g., the first panel does not align with depth 25 m and so on.

Response to the comment:

We have replotted Fig. 7 in the old version, with 2D panels. Please see Fig. 4 in the latest version. We found it is true that it is not very obvious that velocity variation with depth, so we have deleted this sentence. This is a sentence describing the vertical variation of the velocities, which does not influence the main conclusion of this paper if we delete it.

15. Equation (1)–(2). Please also show the momentum equation in the vertical direction. Also please decompose the force terms in (1) and (2) into the term shown in Figure 8 and put all force terms to the right-hand side. It is important to provide the readers with the detailed mathematic expressions of the force terms shown in Figure 8 and others.

Response to the comment:

O.K. We have added a momentum equation in the vertical direction, please see equation (3). All force terms are put to the right-hand side. The detailed mathematic expressions of the force terms are explained in Lines 185-189.

Taking the zonal direction as an example (Equation (1)), the total pressure gradient term is $-g\frac{\partial \zeta}{\partial x}-\frac{1}{\rho}\frac{\partial}{\partial x}\int_z^\zeta \rho g dz$*, which comprises the barotropic pressure gradient force* $-g\frac{\partial \zeta}{\partial x}$ *induced by sea level and the baroclinic pressure gradient force* $-\frac{1}{\rho}\frac{\partial}{\partial x}\int_z^\zeta \rho g dz$ *induced by density; the Coriolis force* fv*; the vertical friction term* $\frac{\partial}{\partial z}\left(K_m\frac{\partial u}{\partial z}\right)$*; the local velocity time variation term* $\frac{\partial u}{\partial t}$*; the horizontal advection term* $-(u\frac{\partial u}{\partial x}+v\frac{\partial u}{\partial y})$*; the vertical advection term* $-w\frac{\partial u}{\partial z}$*; and the horizontal friction term* F_u*.*

16. Lines 215–216. Although horizontal friction is usually negligible in open ocean, in the coastal region this friction may not be negligible. The Qingdao cold water mass occurs *quite nearshore. So, please provide quantitative comparisons of all friction terms before removing any of them out of the analysis and discussion.*

Response to the comment:

We have checked the horizontal friction term intensity, which is 1-2 orders smaller than the main terms, namely, the Coriolis force, barotropic pressure gradient force, baroclinic pressure gradient force, and vertical friction force. If we plot the horizontal friction term distribution with the same colorbar as that for other main terms (the same colorbar as Fig. 5), the whole pattern for horizontal distribution is almost white, since it is much smaller than 0.1e-5 $m/_{s^2}$. To be quantitative, the magnitude of the area-mean horizontal friction term and Coriolis force at the layer 25m are 1.15$\times 10^{-8}$ $m/_{s^2}$, 7.68$\times 10^{-7}$ $m/_{s^2}$, respectively. At the depth of 40m, the magnitude of the area-mean horizontal friction term and Coriolis force are 3.35$\times 10^{-9}$ $m/_{s^2}$, 6.01$\times 10^{-7}$ $m/_{s^2}$.

17. Lines 216–218. Lack of evidence. At least, the difference of barotropic gradient force and the sum of baroclinic gradient force, Coriolis force, and vertical friction force are needed before addressing the balance of these terms.

Response to the comment:

We have added a diagram showing the sum of the barotropic gradient force, baroclinic gradient force, Coriolis force and vertical friction force is shown in Fig. A3.

18. Line 219. The "southwesterly wind stress" contradict against the "southeasterly monsoon" in Line 183. In the northern hemisphere, the southeasterly wind most likely induces southerly wind stress rather than southwesterly ones. Please overlap the wind patterns in Fig. A2.

Response to the comment:

Thanks for catching this point. We have overlapped the wind patterns in Fig. A2. Additionally, we have changed the direction of wind stress to "southwesterly wind stress" to make it consistent.

19. Lines 220–222. It is more like a hypothesis or an inference without necessary evidence. Also I doubt that the horizontal friction also considerably affects the Qingdao cold water mass which locates quite nearshore.

Response to the comment:

Here is the same comment regarding the horizontal friction, please see the reply to comment 16.

20. Figure 8. Please also show the mathematic expression of each term in each subplot because the signs of these shown force terms are also important to readers.

Response to the comment:

We have added the mathematic expression as suggested, please see the Fig. 5 and other momentum diagnose related diagrams as well.

21. Line 226. Format is wrong.

Corrected.

22. Figure 9. Same suggestion as for Figure 8

We have added the mathematic expression as suggested.

23. Lines 235. The difference of pressure gradient force and the sum of Coriolis force and friction force is needed to support this statement.

Response to the comment:

Thank you for pointing out this problem. We have added a new diagram Fig. 1* showing the difference of pressure gradient force and the sum of Coriolis force and friction force. We find a large value to the east of $121.75°E$, there is a large value in the surface, so have mentioned this in the lines 212-213.

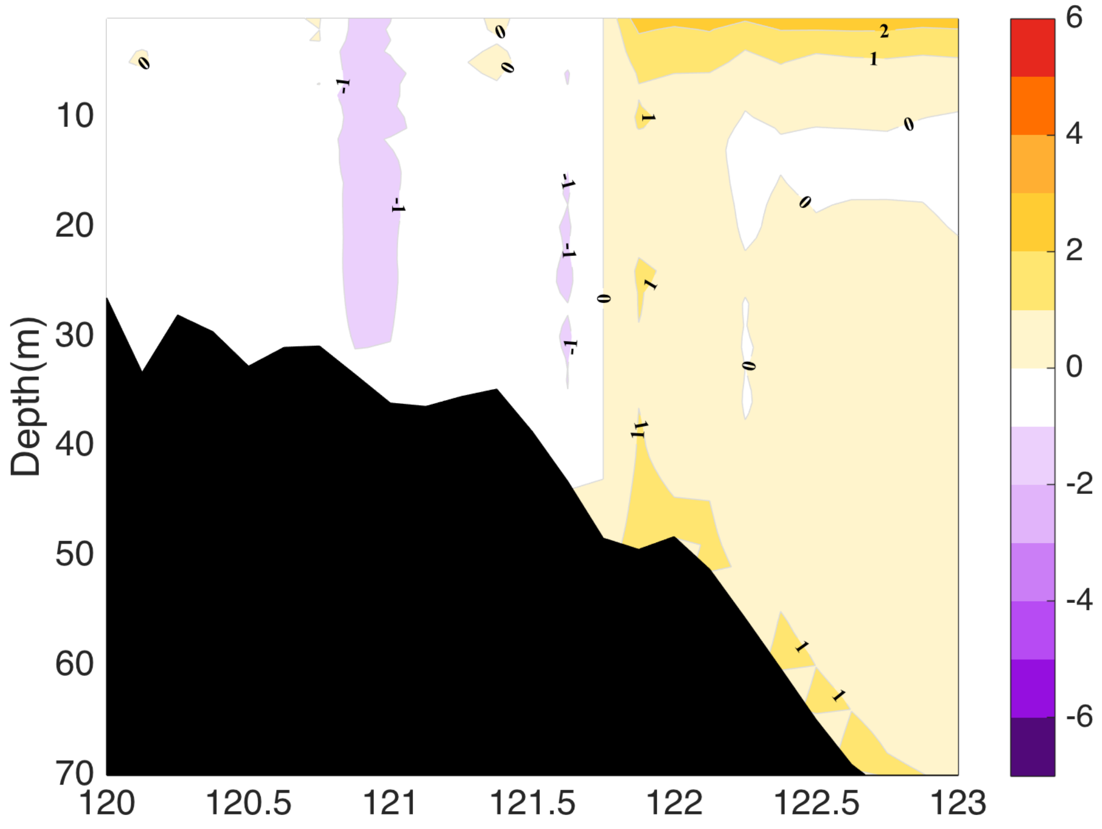

Figure A1. Vertical distribution of the difference in the pressure gradient force $-g\frac{\partial \zeta}{\partial x} - \frac{1}{\rho}\frac{\partial}{\partial x}\int_{z}^{\zeta}\rho g dz$ and the sum of the Coriolis force $\mathbf{fv}$ and friction force $\mathbf{F_u}$ along the 35.5°N profile of the control run.

Lines 212-213: east of 121.75°E, the Coriolis force and vertical friction has high values, caused by the large current magnitude and strong wind

24. Lines 239–243. Lack of horizontal friction. See above comment.

Response to the comment:

Please see the reply to the comment 16.

25. Lines 244–253. I think this part is a very important finding of this study and also the reason why the author wanted to dig deeper in the wind and tidal impacts in the discussion section. I suggest the authors provide more explanations and details here.

Response to the comment:

Thanks for the confirmation. We have rewritten this part, please see below.

Lines 225-245: The geostrophic balance describes the equilibrium between the horizontal pressure gradient and Coriolis forces. Temperature and salinity distributions directly influence *water density, altering the pressure gradient and affecting oceanic geostrophic currents. Near a Qingdao cold water mass, there are significant temperature and mild salinity gradients. However, owing to the lack of geostrophic balance, the density gradient caused by the temperature and salinity gradients associated with the Qingdao cold water mass is not the direct cause of the anticyclonic flow structure. This trend explains why, under the geostrophic balance, a cold center in the Northern Hemisphere would typically be associated with a cyclonic (counterclockwise) circulation, whereas the flow around the Qingdao cold water mass would exhibit a clockwise circulation pattern. The friction induced by tidal forcing disrupts the original geostrophic balance.*

To some extent, the seasonal anticyclonic circulation is the dynamic reason for the Qingdao cold water mass. As mentioned in subsection 3.2, this type of anticyclonic structure prohibits heat transfer between the cold temperature center and the surrounding water column (Huang et al., 2019), but the seasonal anticyclonic circulation is not caused by the special temperature and salinity structure around the Qingdao cold water mass.

Since the geostrophic balance is not the direct reason for the circulation, other causes of the seasonal anticyclonic circulation around the Qingdao cold water mass should be identified. Tides play a significant role in the circulation processes of regional seas, contributing substantial amplitude, momentum, and energy flux. Early studies (B.H. Choi 1980; Byung Ho Choi, Eum, and Woo 2003; Moon, Hirose, and Yoon 2009; C. Xia et al. 2006) have shown that tidal characteristics in the Bohai and Yellow Seas are highly complex and play a significant role in local circulation and modulate dissipation, vertical mixing, and tidal energy. Owing to the large input of tidal energy and the combined effects of bottom friction related to shallow shelf topography, the dissipation of M_2 *tidal energy (the principal lunar semidiurnal constituent) in shallow regions reaches 180 GW, accounting for approximately 11.1% of the global total (i.e., 2 TW). Additionally, the local seasonal monsoon may influence the structure of the anticyclonic circulation around the Qingdao cold water mass. Consequently, no-tide and no-wind simulations were conducted to analyze the impacts of tidal forcing and wind forcing on anticyclonic circulation.*

26. Line 244–246. It is not surprised that the geostrophic balance is not satisfied as it is a state of large-scale ocean flows in open ocean. In the coastal region, the authors may want to focus more on the theories of boundary layer. So then the friction is very important and may need more analysis and discussion.

Response to the comment:

Since topography and bottom friction play a role in the coastal area, it is worthwhile to further explore boundary layer theories. We put it in the discussion section 4.4 limitations of the study and will have another analysis about smaller scale features around the seasonal anticyclonic circulation around the Qingdao cold water mass. In this paper, we limited ourselves to the relatively large-scale feature of such anticyclonic circulation.

Lines 414-416: Also, this study focused on submesoscale horizontal and vertical circulation around the Qingdao cold water mass, and further exploration of boundary layer theories is worthwhile since topography and bottom friction play a role in the coastal area. Future analyses will investigate the boundary layer variation caused by tidal forcing.

27. Lines 270–271. But along the anticyclonic circulation, friction is lower in the no-tide experiment.

Response to the comment:

We try to express that in most of the area in Fig. 12 (d) (in the previous version before revision), when the tidal forcing is turned off, the friction intensity decreases, especially, where the depth is shallow, say, to the west of 122°E. If looking at the magnitude of the circulation, it is significantly increased to the west of 122°E, accordingly, the vertical friction decreases when the tidal forcing is turned off. But since this sentence causes confusion, we decided to delete it.

28. "…and Coriolis terms change direction…"? The force direction seems not change. For example, the changes in Coriolis force in the no-tide experiment is at an order of magnitude of 10E-6, while the Coriolis force in the control experiment is at an order of magnitude of 10E-5.

Response to the comment:

Thanks for pointing out this problem. You are right. This diagram shows the difference of the magnitude. We have plotted the Coriolis force for control run and no-tide run. The result show that the negative value of the difference is because of the magnitude of the Coriolis force in no-tide run is larger than control run. We have changed the expression in the manuscript, please see lines 258-261. Additionally, the order of the magnitude of the Coriolis force in control run and no-tide run are still at the same level (10^{-6}).

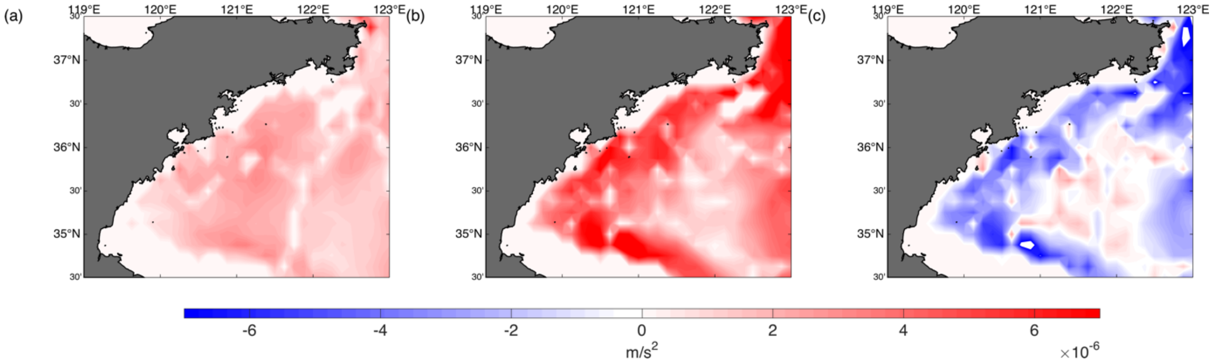

Figure. 2*. The difference of the magnitude of the Coriolis force in the control and no-tide runs. (a) The magnitude of the Coriolis force in control run; (2) the magnitude of the Coriolis force in the no-tide run; (3) the difference of magnitude (control run minus no-tide run).

Lines 258-261: Without tidal forcing east of 122°E, the magnitude of the Coriolis terms increases (Fig. 9a), which is combined with a change in the circulation direction, indicating the significance of the tides around the anticyclonic circulation. In addition, the magnitude of the current in the entire region significantly increases, which is unrealistic, indicating that the dissipation and friction caused by tidal forcing are important for modulating circulation in anticyclonic areas.

29. Figure 11b. Why control-no_tide? It different from other difference terms. Please make the calculation consistent.

Response to the comment:

We have changed it to the control run minus no-tide run, as suggested. Please see Fig. 8.

30. Lines 310–312. I did not understand this sentence.

Response to the comment:

We have reorganized this sentence, please see lines 293-295.

Lines 293-295: With a southwesterly wind (Fig. A3), to the west of 121°E, the surface elevation is lower in the control run (Fig. 10). Accordingly, the barotropic pressure gradient force, which is the force exerted due to horizontal pressure differences caused by variations in sea surface height, also decreases when the wind forcing is turned off (Fig. 9g).

31. Lines 312–314. The causality is misleading. It is not the decreases in water temperature that cause an increase in baroclinic pressure gradient force but the weaker mixing processes when wind is eliminated.

Response to the comment:

Thank you for pointing out this problem, we have rewritten this sentence, please see lines 295-299.

Lines 295-299: In contrast, in the no-wind run, the temperature of the Qingdao cold water mass decreased by 2°C (Fig. 11) in the absence of mixing between the warm surface water and cold bottom water. These weaker mixing processes cause an increase in the baroclinic pressure gradient force in the area around the Qingdao cold water mass (120.5°-121.75°E, 35.5°-36.5°N) when the wind is eliminated.

32. Lines 321–323. I did not observe a downwelling system from figure 5a.

Response to the comment:

Thanks for the correction. We have corrected the expression of downwelling.

33. Line 325. "For the western portion (122.625–123oE)" or "For the eastern portion (122.625–123oE)"?

Response to the comment:

Thanks for catching it. It should be the eastern portion. We have corrected it.

34. Line 326. The tidal mixing font is a new term here (not mentioned in previous sections). So, where is this tidal mixing font? Seems like it is a part of the decomposition of mixing. I am not sure. Please convince me.

Response to the comment:

Considered comment 34 and 37, we have reorganized the tides effects in section 3.5 and 4.1.

35. Lines 330–331. Below 20m, all flows seem eastward.

Response to the comment:

To be more precise, we have added "over 25m".

36. Lines 332–341. The part is not convincible to me. I would suggest the authors compare the difference of current velocity between control and no-tide runs and the difference between control and no-wind runs.

Response to the comment:

Sorry for the unclear visualization for Fig. 5 in the old version, we have plotted it (Fig. 12 in the new version). It seems that this time it is clearer that the "upwelling cycles occur in the red and blue rectangles in the control run, but in the no-wind experiment, the magnitude of upwelling cycling in the red rectangle decreases, as shown in Fig. 12".

37. I think one transect is enough. Lines 349–351. There is still temperature font found in Figure 5b, which means that when tides are excluded, the cold water mass maintains at the similar location. So, how can the tidal impacts be important to the cold water mass? As I observed, the impacts of winds outperform tidal impacts, as in Figure 5c, the location of the cold water mass shifts westward to 121.5oE.

Response to the comment:

We have added a sub-section about the tidal forcings influence on the Qingdao cold water mass and the seasonal anticyclonic circulation in Discussion, please see lines 334-344.

Lines 334-344: Tidal forcing plays a crucial role in shaping the characteristics of the thermocline, including the width of the front and the maximum temperature gradient. The front serves as a narrow transitional zone that separates stratified deep water from well-mixed shallow water, resulting in significant temperature (or density) differences across it. Owing to the mixing effects induced by tidal forces at the seafloor, isotherms near the bottom are predominantly orthogonal to the seabed topography at depths below 20 meters. Furthermore, in the control run, the front is both compressed and elevated. This study defines the front as the region where the magnitude of the horizontal and vertical temperature gradient ($\sqrt{\left(\frac{dT}{dx}\right)^2 + \left(\frac{dT}{dy}\right)^2}$*) exceeds 1*$°C/m$*. Under tidal forcing, the front is observed to exist within a depth range of approximately 2–20 m, whereas in the absence of tidal influences, the front extends from 2–25 m. A wider front correlates with a reduced intensity, indicating that the front is weaker in simulations without tidal effects. Additionally, the maximum vertical temperature gradient is greater in the control run (1.78*$°C/m$*) than in the no-tide simulation (1.73*$°C/m$*). Therefore, the front intensity decreases in the no-tide run, compared with the control run.*

Review2 General comments:

I appreciated the efforts the authors have made to reply to my comments. I have several follow-up suggestions and questions for this version. The line number refers to the tracked version.

Response to the comment:

We appreciate the reviewer's time and effort to read and give comments on our manuscript again.

Minor Comments:

1. *I would suggest adding a sentence like "Yet, it is unknown if the formation of this anticyclonic circulation is related to the Qingdao cold water mass" at the end of line 60 to state the research gap.*

Response to the comment:

Thanks, we have added it as suggested.

2. *please explain "internal variability" (line 70) and "weather variations" (line 109).*

Response to the comment:

O.K. We have added the internal variability in lines 117-121.

Lines 117-121: Internal variability is defined as the part that cannot be linked directly to the external forcing but is caused by unforced variability generated within a system. The unforced variability is unprovoked and chaotic. Since this paper focuses on the external forcing imprint on the seasonal anticyclonic circulation around the Qingdao cold water mass, more details about the concept of internal variability can be found in previous studies (Tang, von Storch, and Chen 2020; Lin et al. 2023).

For "weather variation," it may be more accurate to use the term "interannual variations." In realistic external forcing, daily weather typically differs from the same day in another year, but this aspect of variability is removed in the climatological forcing.

3. *the sentence "The model…" in line 112 is repeated with line 101.*

Response to the comment:

Thanks for catching the problem, we have corrected.

4. please add more explanations on "random effects" and "randomness" in the section of Ensemble experimental design.

Response to the comment:

O.K. We have added what "random effects" refer to and the cause of randomness.

5. The "low-salinity" in line 157 should be "moderate-salinity"?

Response to the comment:

Corrected. Thanks!

6. The center of the cold water mass is 122.4˚E (line 163) and 122.75˚E (line 167). It's better to be consistent or describe the center location as a range.

Response to the comment:

We have corrected. Additionally, we have changed it into a range "122.20°-122.40°*E* 36°-36.15°*N*".

7. line 179, the locations of the red and blue boxes in Fig. 5a don't match the caption "121.5-122" and "122.625-123". It's also not easy to see the arrow direction. In addition, what's behind the westward shift of the center of the cold water in the no-wind run (Fig. 5c)?

Response to the comment:

Thanks for catching the typos. The caption should be 122.375-122.5°E and 122.625-123°E.

We have replotted the diagram to see the arrow direction.

We did not understand the meaning of the last sentence. Could give us more hints about "what's behind the westward shift of the center of the cold water in the no-wind run (Fig. 5c)?"

8. "(not show)" in line 189 should be "(Fig. 6c)"?

Response to the comment:

Indeed, you are right. We actually show the diagram. Now we have made it consistent.

9. cite Fig 9d-f in lines 274-276.

Response to the comment:

Corrected. Thanks.

10. line 335, there is no Fig 15f.

Response to the comment:

Fig. 15 has been deleted because of the overlap information of the vertical temperature and salinity distribution.

11. Question about the direction of the Coriolis force in Fig 9a (I may have some misunderstanding so hope the authors could help explain it). Between 121˚E-122˚E, the current at 25m flows mainly toward the north (v>0, u≈0) averaged in May (Fig. 6b), so the Coriolis force -fv will be negative but it is positive in Fig 9a (?).

Response to the comment:

Sorry for causing such confusion, we should have added the mathematic expressions of each term earlier. Please see the caption. The Coriolis force for this diagram is expressed as $fv\vec{i} - fu\vec{j}$, so the Coriolis force is mostly positive.