We thank Referee #1 for the useful comments and suggestions.

The main revisions includes:

1. All figures are redrawn accordingly.
2. We clarify the data and method with more details and formulas.
3. The sensitivity of result to parameters are discussed in a new subsection.
4. The possible vertical process are also discussed in a new subsection.
5. The changes according to Referee #1, #2, and editor are marked with red, blue, and green, respectively.

Q:* line 65: “the products are available on a daily scale with a 0.25_ _ 0.25_ resolution in the global ocean as DUACS DT14 [Pujol et al., 2016].”
It is important to remind the readers that this 0.25 degree resolution is only the data resolution, not the physical signal resolution. The real signal resolution of Aviso is mostly only 100-200 km.

A: Thanks, we have added this notation accordingly.

Q:* line 100: “In the present study, both H 0 and H 1 are chosen to be 200 m, partly according to some recent observations” is your result sensitive to your choice of 200m? Need some discussion here.

A: We have added the discussion in a new section accordingly.

Q:* line 20: “During their lifetime, complex dynamic processes occur, such as merging and splitting, which are associated with an eddy’s genesis and termination. ” While eddy merging and splitting are an important topic, please clarify that you mainly focus on coherent eddies in this study (e.g. those you can count and recognize) rather than general eddy field. Note that eddies include not only coherent vortexes (your focus) but also all the rotational but incoherent turbulent structures such as chaotic filaments and fronts. Most of eddy kinetic energy (EKE) in the ocean are not from coherent eddies but from incoherent ones; and eddy transport of tracers is mostly due to incoherent motions: e.g. see and cite the following papers: Partitioning Ocean Motions Into Balanced Motions and Internal Gravity Waves: A Modeling Study in Anticipation of Future Space Missions, Journal of Geophysical Research, 123, 8084–8105 and this paper: Ocean submesoscales as a key component of the global heat budget. Nature Communications, 9, 775. Another example is your line 75 “Surface eddies are distinguished from subsurface eddies by whether their core is in the surface layer or located inside the water column (Fig. 1a)”. Incoherent eddies usually do not have a core and do not have the concept of eddy radii. This is not a trivial comment and you should treat seriously: your first paragraph seems to mix/confuse these two together.

A: Thanks for the useful information, we have clarified this according to your suggestion. We also add “Besides, there are incoherent eddies, which usually do not have a core and do not have the concept of eddy radii. These incoherent eddies are also important, since most of eddy kinetic energy (EKE) in the ocean are from incoherent ones [Torres et al., 2018]; and eddy transport of tracers is mostly due to incoherent motions [Su et al., 2018]”.

Q:* line 245: “we calculated the change of eddy gravitational PE” Most people will not understand this term. Define “eddy gravitational PE”, its meaning and difference from EPE and indicate how you calculate it.

A: Suggestion followed, we have added the formula as Eq. (10).

Q:* around line 280: “This strong stratification provides a large PE support for eddy mergers.” Is this correct? usually a stronger stratification has a weaker PE, e.g. see QG PE density b’^2/b_z This is nice but it will benefit the readers by citing related papers here such as the paper on the nonlinear interaction of eddies (e.g. inverse cascade): e.g. a review paper Klein et al. 2019. Ocean-Scale Interactions from Space. Earth and Space Science, 6, 795-817.
A: Suggestion followed, we have cited the paper.
Q:* line 260: “eddy PE dominates the increase of total mechanical energy, and that the EPE increase is converted from the eddy body sink.” Most people will get lost by what you mean of “mechanical energy”. Do you mean EKE+ EPE? Please explain clearly. Also, explain what you mean by eddy body sink and why you have this sink? Avoid unusual jargon as much as possible.
A: Yes, it is EKE+EPE. We have added Eq. (10) to illustrate this.
Q:* line 240: “The large increase of PE cannot be explained by the loss of EKE, since that eddy PE is, in general, an order of magnitude larger than the EKE” This is correct but it is better to support this by citing related papers here such as this one: On the Minimum Potential Energy State and the eddy-size-constrained APEDensity. JPO, 46, 2663–2674.
A: Thanks, we have added the reference.
Q:* This paper use the method of a two-layer model, which has its advantage but you should discuss the limitation caused by using this simple model. E.g., discuss how much uncertainty it may cause.
A: Thanks for the suggestion, we have added a new section to discuss this.
Q: * line 274: “The eddy merging process provides an effective means of mesoscale genesis, which might be a link in the chain for another long-term problem of what physical processes govern the seasonal variability of EKE [Marshall et al., 2002].” Eddy merging is indeed a potential important mechanism affecting eddy seasonality. But you should mention explicitly here that submesoscale itself usually has a seasonality (which affect mesoscale by inverse cascade). For example, recently there is a significant observation in North Atlantic about the seasonality of submesoscale, which you may cite: Yu et al. 2019. An Annual Cycle of Submesoscale Vertical Flow and Restratification in the Upper Ocean. JPO, 49, 1439–1461.
A: Thanks, we mention this explicitly according to your suggestion.

++++++++++++++++++ minor comments:
Q: * line 201: “we find the second conservation law of total circulation. ” Do you mean “we find that the second conservation law of total circulation holds”? Why call it second conservation law? do you invent this term? Do you mean the second conservation law is about the conservation of total circulation? It reads confusing.
A: We are sorry for the unclear. The second conservation law is about the conservation of total circulation. We have modified it.
Q:* around line 25: please specify the structures/sections of your paper here.
A: We specify the structures/sections of the paper at the last paragraph of section 1.
Q:* around line 90: “For a two-layer model, : : :” Do you mean you use a two-layer model? or this is set up of a usual two-layer model?
A: A usual two-layer model.
Q:* line 120: “The first merging event : : :” what do you mean by “first” here? relative to

what?
A: we remove “first”.
Q:* around line 140: “It is noted that the vorticity of AE2 is significantly smaller, although it had a larger amplitude.” what quantity do you mean here for larger amplitude? It is confusing.
A: we are sorry for the confusing, it is eddy amplitude, a parameter associated with SLA in Eq. (1). We have clarified this.
Q:* line 192: “Finally, we calculated the energies of eddies. Both the EKE and EPE had similar variations before merging.” So what? any explanation or implication by this result? clarify what is the point here?
Q:* line 230: “which is hardly calculated in complex environments.” Do you mean “which is hard to calculate” here?
A: Yes. We have modified it.
Q:* around line 280: “The strong eddy activity in turn modulates the mixed layer depth [Gaube et al., 2019].” This is correct but it is very helpful to mention that eddy activity in general modulate the isopycnals (more than just mixed layer depth), e.g. may see and cite this paper: An idealized model of Weddell Gyre export variability. JPO, 44, 1671-1688.
A: Thanks for suggestion, we have added the words.
Q: * around line 255: “A rarely known paper illustrates such a phenomenon [Carnevale and Valli’s, 1990].” The sentence is awkward; suggest to remove the word “rarely known”.
A: Thanks for suggestion, “rarely known” is removed.
Q: * line 201: “In both cases, the total circulation of the eddies seldom changes.” Please specify number or figure to show this result, if any
A: We add figures.
Q: * line 266: “The eddy enstrophy also decreased after merging, even smaller than mean enstrophy of eddies.”Specify the figures for this result, if any.
A: We add figures.
Q: * line 232: “0.121 PJ to 0.094 PJ” The unit of PJ is awkward here; no one will have a feel on it. Please change to (m/s)ˆ2
A: We have modified it accordingly.