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Ocean Science Discussions

Interactive comment on "Effect of mesoscale eddy on thermocline depth over the global ocean: deepen and uplift" *by* Xiaoyan Chen and Ge Chen

Anonymous Referee #1

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Based on Argo dataset and satellite altimetry, this study examined effects of mesoscale eddy on thermocline depth over the global ocean. The authors reached some interesting conclusions. The manuscript is clearly written and logically organized. I suggest to accept this manuscript after addressing the following concerns.

1. Lines 30-45. "The role eddies play in large scale ocean circulation and transport systems. . .". ". . .anticyclonic eddies cause thermoclines to deepen. . ." Mesoscale eddies significantly modulate the thermocline depth and thus could induce larger eddy transport in the thermocline. Please read Chen et al. (2012) for details.

Chen, G., J. Gan, Q. Xie, X. Chu, D. Wang, and Y. Hou (2012), Eddy heat and salt transports in the South China Sea and their seasonal modulations, Journal of Geophysical Research, 117(C5), C05021, doi:10.1029/2011JC007724.

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2. When you reviewed effects of mesoscale eddies on the thermocline, I suggest to:

(1) quantify eddy-induced thermocline anomalies

(2) emphasize the spatial discrepancy of eddy-induced thermocline anomalies.

To this end, you may want to read, for example:

Chen, G., Y. Hou, Q. Zhang and X. Chu (2010), The eddy pair off eastern Vietnam: Interannual variability and impact on thermohaline structure, Continental Shelf Research, 30, 715-723.

Chu, X., H. Xue, Y. Qi, G. Chen, Q. Mao, D. Wang, F. Chai (2014). An exceptional anticyclonic eddy in the South China Sea in 2010, Journal of Geophysical Research, doi: 10.1002/2013JC009314.

Lasitha Perera, G., G. Chen, M. J. McPhaden, T. Priyadarshana, Ke. Huang and D. Wang (2019). Meridional and Zonal Eddy-Induced Heat and Salt Transport in the Bay of Bengal and Their Seasonal Modulation. Journal of Geophysical Research: Oceans, 124. https://doi.org/10.1029/2019JC015124.

Chu, X., G. Chen, and Y. Qi (2020). Periodic mesoscale eddies in the South China Sea. Journal of Geophysical Research: Oceans, https://doi.org/10.1029/2019JC015139.

3. You define the thermocline intensity Tz in Section 3.3. Have you shown any results with this parameter?

4. Lines 148-150. Please try to quantify the results. The temperature shown in Figure 2 is related to not only the eddies but also the background temperature. Could you show the temperature cycle with no eddy for comparison? What does the black line in Fig. 2c and 2d represent? Please add some explanation about the black line in Figure 2 caption.

5. Are the results shown in Figures 3-5 affected by the uneven distribution of Argo profiles (shown in Figure 1)?

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6. In addition to eddy amplitude and eddy radius shown in Figure 6, you may want to show the relationship between eddy-induced thermocline depth and other eddy parameters, e.g., the mean eddy kinetic energy, the mean vorticity, and so on.

7. Line 46: “layer has little to no effect on the exchanges”?

8. Line 198: “had an almost linear relationship with”. It seems that the relationship shown in Figure 6 is not linear when the amplitude is larger or the radius is smaller. You may want to try the least square fitting with a curve instead of the straight line.

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