Response to Reviewer #2

Dear Reviewer:

We would like to thank you for the constructive comments and suggestions, which help to improve the quality of our work. We have replied each comment point-by-point and modified the manuscript. According to the suggestions, we have detailed the degradation of the concentric and intersecting closed contour types, answered the nearshore issue in the process of "*Searching for SLA peaks*". Now a regional experiment has been conducted to explain the determination of the parameter Dt. In addition, the reasoning of complement eddy among the state of "-tracked-missing-" has been added in the revised manuscript.

In the following responses, *the original comments are quoted in Italic font*, the replies are in blue letters, the revised sentences are in red color in the revised manuscript, and the yellow highlights indicate the number of lines in the revised manuscript. Please check out the detailed responses to the comments below.

The suggestions are as follows:

(1) *Nowadays, researches towards eddy are highly connected to the automatic eddy identification algorithms. The paper presents a new one based on the SLA dataset and rule of scale-selective, which is well-organized and in a good theme. The authors highlight two improvements featuring in the detection and tracking processes when compared to the previous methods. The apply of the new algorithm verify its validity.*

Still, there were some questions which came to my mind while reading the paper and hence I suggest the authors to put some more effort and improve this work. There are several things need to be clarified before publishing, particularly about the preset parameters of the new algorithm. Therefore, I recommend this manuscript to be minor revision.

We thank the reviewer for the constructive comments and suggestions, which have been considered carefully and responded to in detail.

(2) *In the section 2.2, the authors mentioned that "we consider only the simple contour condition with only one core (Fig. 1b): the concentric (Fig. 1c) and intersecting (Fig. 1d) closed types degrade to this type." How is this "degrade" achieved? More explanation is needed.*

Sincerely thanks for your suggestions. Now we have added more explanation and rewritten some sentences in the revised manuscript as follow:

"SEIA is run in MATLAB, where contours are interpolated from the original data and there will be no intersecting closed contours in this step." (Lines 147-149)

"With scale-selective scheme, unqualified ($P<P_{min}$, $P>P_{max}$) SLA contours will be removed. For each SLA peak, SEIA will take the contour with the maximum grid points as eddy boundary among all the concentric closed contours, ensuring that the eddy area is captured as much as possible without overestimating the boundary. All chosen boundaries can have only one SLA peak to avoid the appearance of concentric type in Fig. 1c. Peaks without any closed contours will be removed as well. With boundary and peak, other eddy information, such as radius, can be obtained. Finally, all eddies are detected in a Euler manner for one snapshot (Fig. 2d)." (Lines 183-192)

(3) *Among the process of "(i) Searching for SLA peaks", a moving 3 3 grid window is addressed to search peaks of SLA. In Fig. 2a, there are so many peaks occurring nearshore. Is it rational, and how did the authors remove them? Also in this process, the authors mentioned that "SLA shallower than certain depth (50 m for SEIA) will be masked" because of the AVISO nearshore issue. Why did the depth set as 50 m. Any references?*

Thanks for pointing this out and we feel sorry to make you confused. As mentioned in the manuscript, *"SLA shallower than certain depth (50 m for SEIA) will be masked"*, thus the peaks occurring nearshore will be removed. Furthermore, *"Peaks without any closed contours will be removed as well"*. After these two operations, there will be no singular SLA peaks anymore.

Yuan et al. (2006) suggested that the satellite data contain aliases from tides and

internal waves. Thus, it's better to mask the data over the shallower shelf in the eddy identification process. Xiu et al. (2010) set the depth at 1000 m, while Chen et al. (2010) believed that the exclusion of large areas may filter lots of eddies and set at 100 m. Under the comprehensive consideration, the depth of this study is set at 50 m. Corresponding sentences also have been changed in the revised manuscript:

"Notably, due to the nearshore issue of containing signal from tides and internal waves (Yuan et al., 2006), SLA shallower than certain depth (50 m for SEIA) will be masked." (Lines 144-145)

Chen, G. X., Hou, Y. J., Zhang, Q. L., and Chu, X. Q.: The eddy pair off eastern Vietnam: Interannual variability and impact on thermohaline structure, Continental Shelf Research, 30, 715-723, 10.1016/j.csr.2009.11.013, 2010.

Xiu, P., Chai, F., Shi, L., Xue, H. J., and Chao, Y.: A census of eddy activities in the South China Sea during 1993-2007, Journal of Geophysical Research-Oceans, 115, 10.1029/2009jc005657, 2010.

Yuan, D., Han, W., and Hu, D.: Surface Kuroshio path in the Luzon Strait area derived from satellite remote sensing data, Journal of Geophysical Research Oceans 111.C11, 2006.

(4) *In the determination of the parameter Dt, the intersecting ratio, the authors illustrated that 0.39 is too ideal for a real scenario and set to 0.25. The value of 0.25 is based on what kind of consideration? There is no good explanation.*

Thank you for pointing this out. Under your suggestion, we conducted a sensitive experiment by selecting a random area for eddy identification for one year to test the changing of eddy number with different Rt. The results show that too small or too large value of Rt will bias the eddy number, and a proper eddy number occur when Rt is set to 0.25 (Fig. 4). This part of explanation has been added to the revised manuscript:

"To determine what value of Rt gives SEIA the best eddy tracking effect, we conducted a regional sensitivity experiment by selecting a random sea area for eddy

detection and tracking for one year. The effect of Rt on the number of eddies is tested by continuously adjusting the value of Rt (Fig. 4).

With small Rt, two eddies with small overlapping areas will be tracked as the same one, resulting in a decrease in the eddy number; while with large Rt, the size of the overlapping areas is filtered too strictly, resulting in some eddies splitting into multiple ones and a sharp increase in the eddy number. The Fig. 4 shows that the eddy number maintain a reasonable increase when Rt is around 0.25, which ensures neither overestimation nor underestimation. Therefore, the value of Rt is set to 0.25. Good performance is achieved in the assessment in the northwestern Pacific with Rt=0.25 (Fig. 3), which is the recommended value on a global scale." (Lines 243-254)

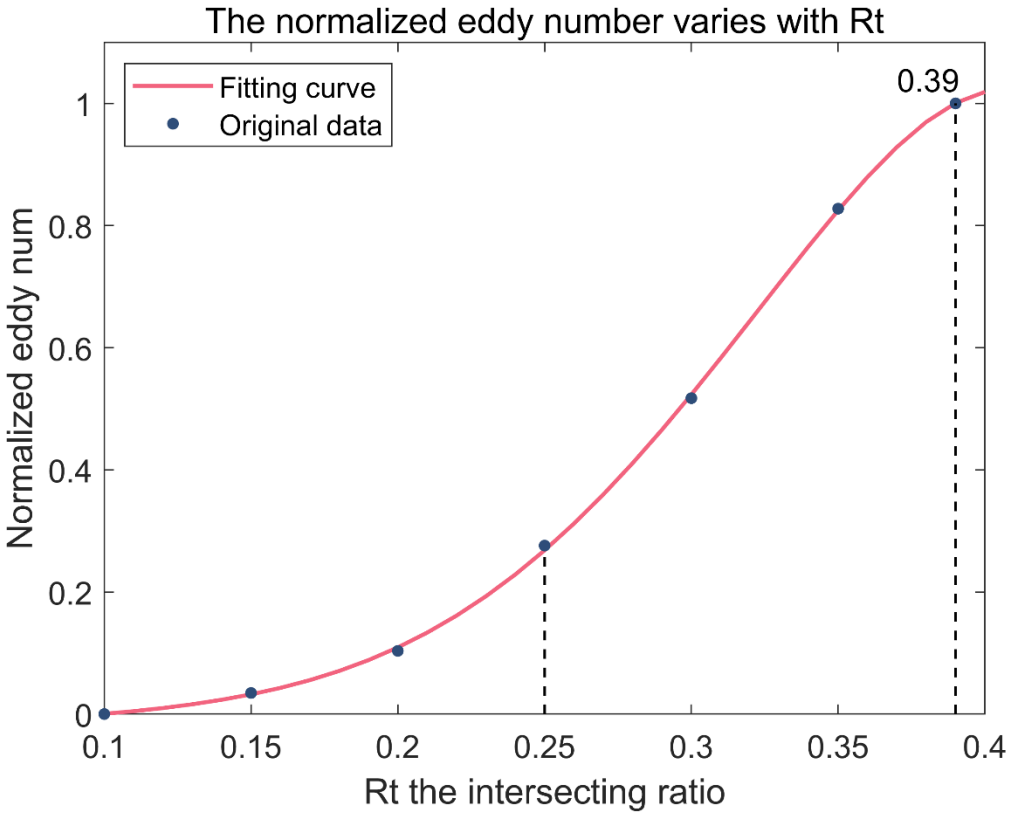

Figure 4. Variation curve of normalized eddy number with overlap rate Rt.

(5) *"…when an eddy has a state of "-tracked-missing-" in two continuous time steps, all the missing information is temporally replaced with the former tracked information and seen as a complement state, allowing the tracking procedure to continue." Is it reasonable to base eddy tracking on this complement eddy?*

Thank you for pointing this out. Due to the noise of dataset, there will be events of missing eddies, which means an eddy fails to be tracked in the next time step. As detailed in Faghmous et al. (2015), fake eddies will be inserted with an 'M' label representing missing eddies (Fig. A1). Following such idea, in our work, missing eddies will be temporally replaced with the former tracked eddies and seen as complement state, allowing the tracking procedure to continue. If an eddy missing for two consecutive time steps, it will be considered as real extinction rather than error due to data noise.

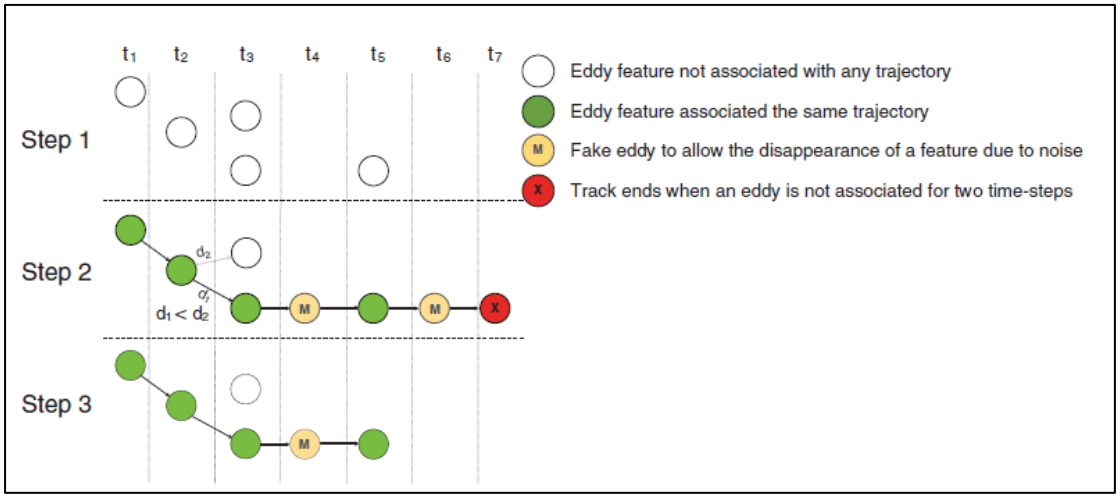

Figure A1. An illustrative example of how the eddy tracking algorithm works (Faghmous et al., 2015).

Faghmous, J. H., Frenger, I., Yao, Y., Warmka, R., Lindell, A., and Kumar, V.: A daily global mesoscale ocean eddy dataset from satellite altimetry, Scientific Data, 2, 10.1038/sdata.2015.28, 2015.