Response to reviewers

We would like to deeply thank the reviewers for their constructive comments which greatly improve the manuscript. The followings are detailed response to each comment. Corresponding modifications are highlighted in the new submission.

To Reviewer 1,

(1) The authors have addressed all my questions and made improvements. I appreciate the effort of the authors and recommend the paper to be accepted.

One thing you may want to consider is the heat budget analysis of the mixed layer in Figure 12 and Section 3.4, which is added in the revision. The residual term is generally larger than the tendency term in the period from 2018 to 2021, which makes all the description sound unconvincing. I think that the authors can retain most of the results without Figure 12. So, I recommend deleting Figure 12 and the heat budget analysis or moving them into the discussion section. In the latter case, the authors may need to carefully describe the results.

Response: We thank the reviewer's valuable comment and recommendation. According to the reviewer's suggestion, we have moved the Figure 12 and the heat budget analysis in the original manuscript into the discussion section while carefully describing the results in the new submission (L460-473).

To Reviewer 2,

1. The authors successfully addressed my comments. I appreciate author's efforts for the revision. However, I have still one concern as written below. I am so sorry for a new comment, but this point would be crucial for this study. The authors may want to address it.

Sugimoto and Hanawa (2014) clearly showed from Argo Float observations that warmer and lighter NPSTMW (with potential temperature of 19.0−19.5℃ and potential density of 24.5−25.0 kg m−3) than usual is formed when the Kuroshio south of Japan takes meander paths including the large meander path. So, in order to investigate the NPSTMW during the Kuroshio large meander, the authors must consider much lower density range (e.g. 24.5−25.6) than that focused in the present manuscript.

Reference:

Sugimoto and Hanawa (2014): Influence of Kuroshio Path Variation South of Japan on Formation of Subtropical Mode Water. Journal of Physical Oceanography, doi:10.1175/JPO-D-13-0114.1

Response: We thank the reviewer's valuable comment and recommendation. Following the reviewer's suggestion, we have obtained the monthly time series of volume of NPSTMW in σ_θ=24.5–25.5 kg m^{-3}, σ_θ=25.0–25.5 kg m^{-3} and σ_θ =24.5–25.0 kg m^{-3} obtained from the RGA dataset (as shown in Figure R1). From Figures R1(a) and R1(b), the variations of NPSTMW in σ_θ=25.0–25.5 kg m^{-3} contributes mostly to the changes of NPSTMW in σ_θ=24.5–25.5 kg m^{-3} including the NPSTMW in much lower density range, which accounts for 86.5%. Meanwhile, the variation tendency of NPSTMW in σ_θ=25.0–25.5 kg m^{-3} is consistent with that of NPSTMW in σ_θ=24.5–25.5 kg m^{-3}. However, the NPSTMW in σ_θ=24.5–25.0

kg m^{-3} (much lower density range) has not shown a significant tendency of decrease in 2018-2021 (Figure R1c) as the depiction in Figure R1(a) and R1(b).

In addition, the NPSTMW in σ_θ=24.5−25.0 kg m^{-3} (with potential temperature of 19.0−19.5℃) is formed mainly south of the Kuroshio to the west of 140°E, while the distribution of the NPSTMW in σ_θ=25.0−25.5 kg m^{-3} is concentrated in the east of 140°E (Sugimoto and Hanawa, 2014; Oka et al., 2021; Liu et al., 2017). Meanwhile, the NPSTMW in σ_θ=24.5−25.0 kg m^{-3}, which is mostly formed in south of the Kuroshio to the west of 140°E, has no significant decrease in 2018-2021 (Figure R1c). The decline of the NPSTMW in σ_θ=25.0−25.5 kg m^{-3} in 2018-2021, which is consistent with the interannual variability of the NPSTMW in σ_θ=24.5−25.5 kg m^{-3} in 2018-2021, is most noteworthy to studies (Figures R1a and R1a). Ultimately, our studies pay much attention on the changes of the NPSTMW in σ_θ=25.0−25.5 kg m^{-3} which is mostly formed in the east of 140°E.

Thus, even though considering the much lower density range in σ_θ=24.5−25.0 kg m^{-3}, the most of the results in current manuscript will remain unchanged. Finally, much lower density range (σ_θ=24.5−25.0 kg m^{-3}) is not focused in the present manuscript.

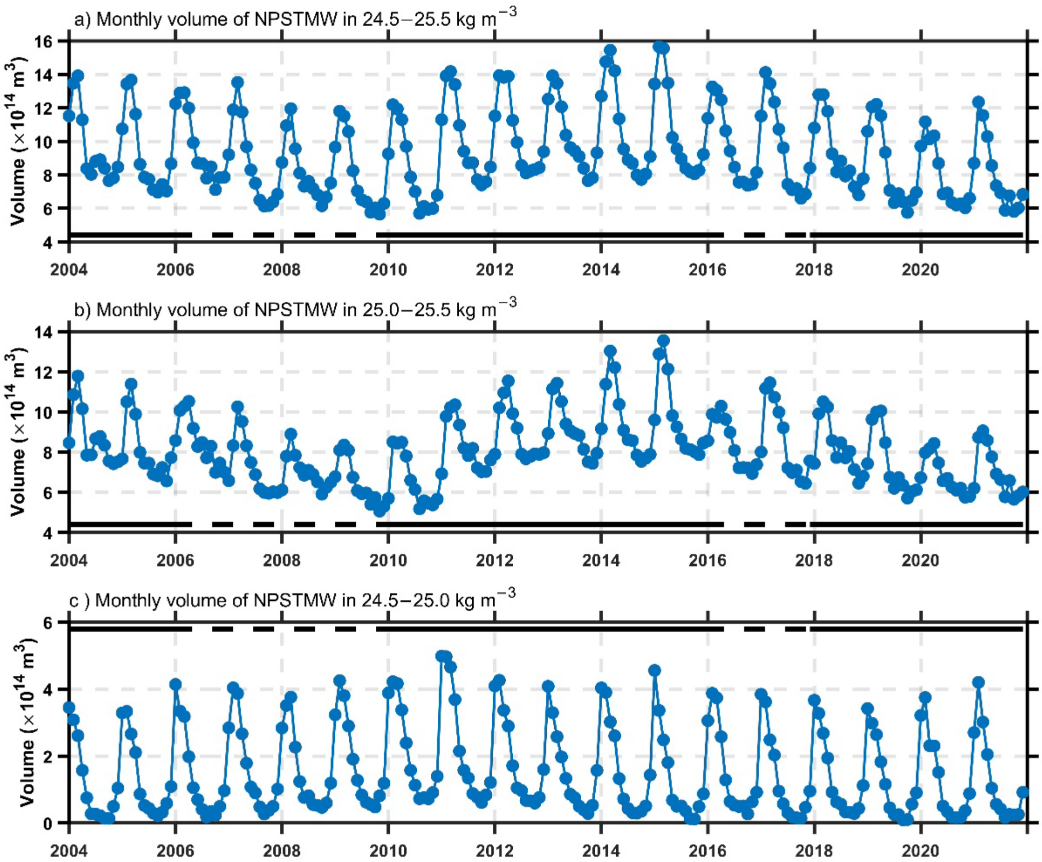

Figure R1: Monthly time series of volume of NPSTMW in (a) σ_θ=24.5−25.5 kg m^{-3} (b) σ_θ=25.0−25.5 kg m^{-3} (c) σ_θ=24.5−25.0 kg m^{-3} obtained from the RGA dataset. Solid (dashed) bars indicate stable (unstable) periods of the KE.

Sugimoto, Shusaku, & Hanawa, K. (2014). Influence of Kuroshio Path Variation South of Japan on Formation of Subtropical Mode Water. Journal of Physical Oceanography, 44(4), 1065–1077. https://doi.org/10.1175/JPO-D-13-0114.1

Oka, E., Nishikawa, H., Sugimoto, S., Qiu, B., & Schneider, N. (2021). Subtropical Mode Water in a recent persisting Kuroshio large-meander period: part I—formation and advection over the entire distribution region. Journal of Oceanography, 77, 781–795.

Liu, Cong, Xie, S., Li, P., Xu, L., & Gao, W. (2017). Climatology and decadal variations in multicore structure of the N orth P acific subtropical mode water. Journal of Geophysical Research: Oceans, 122(9), 7506–7520.

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