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Discussions
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Interactive comment on "Seasonal variability of subsurface high salinity water in the northern South China Sea and its relationship with the northwestern Pacific currents" *by* A. Wang et al.

A. Wang et al.

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Reply to Anonymous Referee #1:

This paper looks into the seasonal variability of subsurface high salinity water in the northern South China Sea with a particular focus on its relationship with the northwestern pacific currents by analyzing a high-resolution ocean model – HYCOM. The results are very interesting and shown with a careful and elaborate analysis. I recommend a publication in Ocean Science after addressing the following points.

Thank you very much for your positive evaluations and helpful comments to our work. Here we copy your original comments, which are followed by our replies.

Major comments: 1.Page 4, line 12-18: "due to the scarcity of in situ observations, . . .we use a state-of-the-art oceanic model assimilation product to study the SHSW distribution and the mechanisms responsible for its seasonal variability". Page 8, line 1-2: "The above seasonal features are basically consistent with Qu etal.". Page 9, line 3-4: ". . . which is basically consistent with many previous studies". However, what's the difference between previous observational studies and your high-resolution model study? There should be a more comprehensive comparison to observations.

Thank you for pointing out this issue. We have now discussed this point in the appropriate position in the revised paper (Page 5, line 16). Referring to Qu et al. (2000) (Figure A1 below), we have also drawn the maps of salinity distribution on 25.0 $\sigma\theta$ surface that intersects NPTW using the HYCOM output (Figure A2). The patterns are generally similar to those shown in Figure A1, except that the high salinity tongue is slightly weaker and the southward expansion is relatively small in the model simulations. In addition, we also compared the NECBL in HYCOM and some previous studies in Table 1. The consistent seasonality of NECBL in these works demonstrates the ability of HYCOM in reproducing the seasonal circulation changes in the western Pacific. Please see Page 9, Line 4 and Table 1 for the details of our comparison.

2.Lack of explanation is often seen in the manuscript, such as: Page 6, line 19: ". . .and their vertical depth in study region", how do you define the vertical depth? The authors should describe more precisely about your calculation.

Thank you for pointing out this issue. We have added more precisely description about our calculation in the revised paper(Page 6,line18)."The vertical depth of the subsurface salinity maximum is defined as the layer with a zero diapycnal salinity gradient between 23.5 and 25.5$\sigma\theta$."

Page 7, line 4-8: ". . .As shown in Fig. 4, the volume of . . . The seasonal variance contribution . . . is 0.97" What's the left and right panel of Fig. 4? What is the red and black line representing?

We have redrawn figure 4. The relevant figure caption is also modified to explain the meaning of red and blue lines. Please see Page 18 for the revisions.

How can you conclude “This indicates that the advection through the LS may play an important role in the intrusion of SHSW”?

Thanks for your comments. We have calculated the subsurface salinity budget between 50-250m layers (fig.A3).The advection term accounts for mostly contribution of the salinity tendency. This indicates that the advection through the LS may play an important role in the intrusion of SHSW.

Minor comments: 1. Page 2, L24-25: The subsurface high salinity water (SHSW) ->The SHSW

Corrected as suggested.

2. Page 5, Line 15: Due to -> Compare to?

Corrected as suggested.

3. Page 5, Line 22: Which two layers do you selected?

The two layers are the upper and lower interfaces of the subsurface layer, i.e., 23.5 and 25.5 potential density (see the next section).In the revision text we have changed "between two layers" to "in the subsurface layer".

4. Page 8, Line 5-6: “In order to show the vertical structure of the SHSW along the Kuroshio, we draw the . . . (Fig. 7) along the pink band”. Why you choose the pink band for section, which neither represents the annual mean stream function nor seasonally variability.

The averaged acceleration potential provides an overview of the geostrophic circulation of the subsurface layer. The pink band represents the Kuroshio mainstream. Thus the salinity distributions along this section could well indicate the advection of SHSW by the Kuroshio.

5. Figure 1, How do you define the subsurface water?

The layer between 23.5 and 25.5$\sigma\theta$ that occupied by the high salinity water (see figure 2).

6. Figure 3, Is it the seasonal variation? Please clarify.

Yes, it is. We have clarified it in the caption of Figure 3 (Page 17).

7. Figure 4, what’s the difference between your left and right panel.

We have changed the figure 4 caption in our revised paper (page 18).

8. Figure 6, what is KT and LST short for?

KT is short for Kuroshio transport; LST is short for Luzon Strait transport. We have clarified this in the revised paper (page 21).

9. Figure 9, Seasonal variation or Annual variation?

Yes, through figure 9 we could derive the annual variation. But in this paper we focus on the seasonal variation. In figure 9, we try to get in which season the SHSW agreed well with the NECBL.

Supplementary References: WANG, Q. and HU, D.: Bifurcation of the North Equatorial Current derived from altimetry in the Pacific Ocean. Journal of Hydrodynamics, Ser. B, 18(5), 620-626, 2006. Chen, Z. and Wu, L.: Dynamics of the seasonal variation of the North Equatorial Current bifurcation. Journal of Geophysical Research: Oceans (1978–2012), 116(C2),2011.

Please also note the supplement to this comment:
http://www.ocean-sci-discuss.net/11/C1231/2015/osd-11-C1231-2015-supplement.pdf

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Interactive comment on Ocean Sci. Discuss., 11, 2423, 2014.

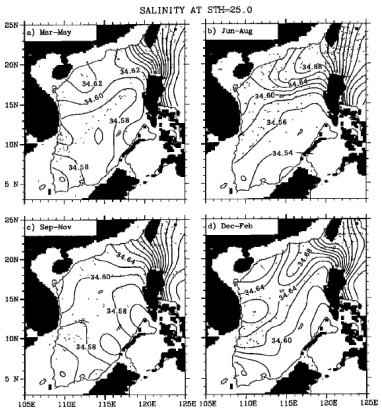

Figure A1.Seasonal variation of salinity (psu) on 25.0 σ_θ surface. From Qu et al. (2000).

Fig. 1.

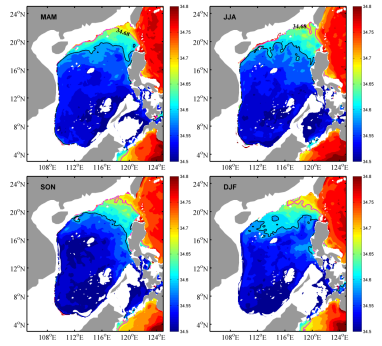

Figure A2.Seasonal variation of salinity (PSU) on 25.0 σ_θ surface from HYCOM data. The pink and black contours indicate the location of the 34.68 PSU contour and 34.6PSU contour, respectively.

Fig. 2.

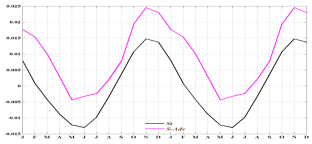

Figure A3. Seasonal variation of subsurface salinity budget from HYCOM. St (black line) represents the salinity tendency; S-Adv(pink line) represents the advection term.

Fig. 3.