

Interactive comment on “Shelf–Basin interaction along the Laptev — East Siberian Seas” by Leif G. Anderson et al.

Leif G. Anderson et al.

leif.anderson@marine.gu.se

Received and published: 28 February 2017

We are grateful for the referee's constructive comments as well as the kind words. Referees comments are in red.

Referee #2 General comments: This paper presents analyses of hydrographic and biogeochemical data obtained from the East Siberian Arctic Seas, where only the limited data are available. Therefore, the dataset is significantly valuable. From the data, the authors proposed a new image of the Siberian shelf water spreading into the Arctic basins. Furthermore, they suggested the origin of deep silicate maximum water, which was not clear in the previous studies. This is an interesting paper that is in general clearly written and well-laid out. I recommend the paper for publication in Ocean Science after some revisions.

C1

Specific comments: P. 1, L. 1 (Title): Did you discuss about Laptev Sea – Makarov Basin interaction with the present data? If not, it might be better to delete "Laptev" from the title or use such as "East Siberian Arctic Seas". As we don't really discuss the Laptev Sea this will be deleted from the title.

P. 1, L. 25: Can you say that the water of $S\sim 34.5$ is lower halocline water? If so, it might be better to add sentences to distinguish from the explanation about upper halocline water. For example, '... $S\sim 34.5$, where the water is classically named lower halocline water. Here, we found new characteristics of the water ... P. 1, L. 25: The $S\sim 34.5$ water changes property along the slope thus making it complicated to name it lower halocline water. We will take a close look if it is possible to better describe this feature.

P. 2, L. 4: Probably, some references would be given. P. 2, L. 4: The following reference will be added, Charkin, A.N., Dudarev, O.V., Semiletov, I.P., Kruhmalev, A.V., Vonk, J.E., Sánchez-García, L., Karlsson, E., and Gustafsson, Ö.: Seasonal and interannual variability of sedimentation and organic matter distribution in the Buor-Khaya Gulf: the primary recipient of input from Lena River and coastal erosion in the southeast Laptev Sea. *Biogeosciences*, 8, 2581–941, 2011.

P. 2, L. 7: Also, please see the paper below for the Makarov Basin (e.g., Figure 3 in this paper). Nishino, S., M. Itoh, W. J. Williams, and I. Semiletov (2013), Shoaling of the nutricline with an increase in near-freezing temperature water in the Makarov Basin, *J. Geophys. Res. Oceans*, 118, 635-649, doi:10.1029/2012JC008234. P. 2, L. 7: We add this reference.

P. 2, L. 14-15: This kind of sentences might be better to move to the Method section. P. 2, L. 14-15: The intention was to give this information already in the introduction as a description of this contribution, but as it also is given in the methods section we delete it here.

P. 3, L. 15: In addition to the introduction on the upper halocline water, it might be better to introduce some previous studies on the lower halocline water and deep sili-

C2

cate maximum, because this topic is another important part of the present study. You should describe more clearly what is still unknown about the deep silicate maximum. I think that the origin of the deep silicate maximum water was not clear in the previous study, but the present study sheds light on the origin from the wide-area hydrographic and biogeochemical surveys including the first SF6 measurements. P. 3, L. 15: We appreciate this comment and will add some text along the suggestions.

P. 4, L. 9: Is CFC-12 data used in the present study? P. 4, L. 9: CFC-12 is not used in this study although it was measured simultaneously with SF6. The reason for not using CFC-12 is the decreasing atmospheric concentration in the atmosphere which causes indistinct information about ventilation due to the relative homogeneous distribution in the surface and intermediate layers. The analytical results from the CFC-12 measurements are now removed from the method section and it is now referred to the cruise report instead.

P. 5, L. 11-12: Is the surface low salinity with strong stratification an influence of Lena River? If possible, please explain in the discussion section. P. 5, L. 11-12: Yes the low salinity water over the Lomonosov Ridge is a Lena river plume signature. We will add some text on this.

P. 5, L. 17-18: Is the surface high silicate an influence of Lena River? If possible, please explain in the discussion section. P. 5, L. 17-18: And the silicate is one of its signatures, so this will also be added in the discussion part.

P. 6, L. 26 (Figure 6): It would be helpful to depict positions or a line of $S=34.5$ connecting each section from A to F. Or it might be better to depict SF6 distribution on the isohaline surface of $S=34.5$ to identify the less ventilated area. P. 6, L. 26 (Fig. 6): It would be difficult to put a $S=35$ line in the figure as these are the bottom water concentrations. A figure of SF6 on the $S=34.5$ surface is also illustrative and we suggest to include this together with a plot of S versus silicate, as suggested by referee #3, in a revised version. However Fig. 6 shows the bottom water concentrations also in the

C3

deep basin that add to the story and thus we don't want to delete it.

P. 6, L. 32: Where did you assume the reference level in the geostrophic shear calculation? Only the density field, we don't know whether the bottom currents are eastward or westward. Probably, we need discussion from current data or chemical tracer data to infer the flow direction. P. 6, L. 32. It is a well-known fact from long term moorings that the mean current is eastward along the shelf slope. Although it is not possible to determine the absolute current velocity from just the geostrophic calculation, our data together with the known direction of the mean flow suggest that we have a bottom intensified flow in the eastward direction. We will make this clearer in the revised text.

P. 7, L. 4-6: I can't understand what you want to mention here. Do you want to describe implications of the bottom-intensified eastward flow? P. 7, L. 4-6: It illustrates that the deeper waters penetrate up on the shelf slope, which in turn have an implication for the bottom-intensified flow. We will expand on this in the text.

P. 7, L. 5 (Figure 7): In Figure 7, it is not easy to understand the increase in salinity ALONG THE SHELF SLOPE with the temperature increase. Does "ALONG THE SHELF SLOPE" mean "ALONG AN ISOBATH"? If so, why didn't you show vertical sections ALONG AN ISOBATH or ALONG THE SHELF SLOPE to explain these distributions? P. 7, L. 5 (Figure 7): We obviously used the wrong word here. The figure shows the profiles at a short longitudinal range and we should thus use the word "at" instead of "along". The intention with this figure is to show the vertical correlation between T , S , Si and N^{**} as a complement to Fig 8 that shows the properties versus salinity. We will clarify this in the text.

P. 7, L. 24: and? P. 7, L. 24: We add "to that".

P. 8, L. 1: It might be proper to describe such as "ice formation periods with cooling and convection". P.8, L. 1: We will add text along the suggested lines.

P. 9, L. 5: Based on the SF6 distribution, the deep silicate maximum water (SF6 min-

C4

imum and AOU maximum water) might not be related to the brine production (i.e., ventilation). P. 9, L. 5: This is true and we will make this point explicitly.

P. 9, L. 7: Figure 4 of Nishino et al. (2013; JGR) indicated the variation of nutrient maximum water along the Siberian continental margin. The variation is also associated with the recent sea ice reduction over the East Siberian Sea during the ice formation period. P. 9, L. 7: Figure 4 of Nishino et al 2013 covers the slope east of 175, which is the eastern part of our study. We will cite this article and look into if it adds anything to our assessment.

P. 9, L. 15 (Figure 11): Please describe why you selected the calculation area (76-80N, 140-150E). P. 9, L. 15 (Fig 11): We did this to see if there is a potential for more brine as well as organic matter production/decay in the western part of the study area as we observe the nutrient max water further to the west than earlier has been done. A statement on this will be included.

P. 9, L. 22: Please explain what a purpose of the analysis in Figure 12 is. Why do you need to discuss the shelf plumes penetrating down into the central deep basin? Why does this discussion limited to the eastern part of the study area? P. 9, L. 22: This is part of shelf-basin exchange that this contribution addresses. The signatures of plumes are only seen in the east and this information will be added to the text.

Interactive comment on Ocean Sci. Discuss., doi:10.5194/os-2016-95, 2016.