

## ***Interactive comment on “Combining physical and geochemical methods to investigate lower halocline water formation and modification along the Siberian continental slope” by Matthew B. Alkire et al.***

**Anonymous Referee #1**

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This manuscript examines the importance of river water and sea-ice melt/brine in lower halocline water (LHW) formation through mixing. The study is based on observations/sampling in the Eurasian basin of the Arctic Ocean and along the continental slope of the Kara, Laptev, and East Siberian Seas during summers of 2013 and 2015. The study, which uses  $\delta^{18}\text{O}$  along with CTD measurements, suggests that LHW is formed by convective mechanisms with two stages of convective mixing during the transit along the continental slope and thus offers an alternative hypothesis to the study published by Bauch et al. (2016). The Alkire study makes an important contribution

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to the understanding of the mechanism which may impact the vertical heat fluxes between the (seasonally) ice covered surface layer and the underlying “warm” Atlantic water (AW). The paper is concise, well structured, and well written.

The main issue that needs to be addressed is the result presented in the last sentence of the abstract. The authors postulate that: “These mixing regimes appear to have been robust since at least 2000”. This means that the mixing regimes are stable although the region experienced significant changes in sea ice cover and temperature/volume of AW during the last two decades (references in the manuscript). Does that also mean that the intensity of vertical mixing between LHW and AW has not changed since 2000? Considering the importance of these conclusions I’m not convinced that they are a result of the analysis presented in this paper. The authors state that the conclusion was drawn based on a comparison against other data sets (?) collected between 2000 and 2015 (page 8, line 14). This description seems too vague to me. It should be discussed in more detail.

Technical corrections:

The citation “Janout et al. (2015)” from the list of references is missing in the text/figures.

The citation “Rudels et al. (1994)” from the list of references is missing in the text/figures. Is it Guay et al 2001 (text) or 2011 (references)?

The map shown in figure 1 is too small (at least for me). Maybe it would be better to show a map of the entire Arctic Ocean with the research area highlighted. Because this is the first map presented in the manuscript you should add longitude and latitude.

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