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Interactive comment on “Frontal structures in the West Spitsbergen Current margins” by W. Walczowski

Anonymous Referee #1

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This paper addresses an important issue of polar oceanography: the structure and variability of the Arctic Front in the Nordic seas, including along- and transfrontal transports, front instability and variability. The main message of this paper is that baroclinic instability on jet streams and advection of baroclinic eddies is the dominant transfrontal transport process, which enables cross-frontal exchange of water and properties. This finding is supported by analysis of oceanographic data recently collected in the R/V Oceania cruises.

The paper merits being publishing in the Ocean Science, because the addressed subject is of interest to ocean science, the methodology of the study is consistent with the goal and conclusions are generally supported by the analysis. The manuscript is well organized and clearly written. Figures are readable and appropriately referenced in the

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text. The manuscript may be accepted in the present form, provided that the author takes into consideration the following comments to the text.

Comments

Page 989, line 21: “Baroclinic currents across sections were calculated with reference to the bottom (i.e. taking zero current at the bottom irrespective of depth). For horizontal distributions, currents were calculated with reference to 1000 dbar. The current vectors indicate only the baroclinic 25 component of the flow, but offer a good representation of the general pattern of the flow (Walczowski et al., 2005). The heat content was calculated with respect to a temperature of -0.1 C.”

I wonder why the reference level at sections was taken at the bottom, while for spatial distributions it was taken at 1000 dbar? It is also not explained why heat content was calculated with respect to -0.1 C? I would suggest the author to clarify his choice.

Page 996, line 7: “Water particles moving down along the inclined isopycnic surfaces...” I suggest to remove the word “down” in this sentence, because as a result of baroclinic instability water particles are moving in both directions (up and down), depending on their density.

Page 1005, line 12: “Due to significant transformation and densification, the AW in this region usually subducts under the layer of Polar Waters”.

The idea of AW subduction under the Polar Waters is somehow misleading. Rudels et al. (Rudels B., L.G.Anderson, E.P.Jones. Formation and evolution of the surface mixed layer and halocline of the Arctic Ocean// Journ. of Geophys. Res. – V.101, NC4.- 1996.-P.8807-8821) was probably the first who introduced the concept of gradual cooling and freshening of AW on its motion along the Eurasian continental margin to the east without actual subducting. Mooring observations at the North Barents Sea slope (about 31E, 81N) generally confirmed this hypothesis (see: Ivanov V.V., I.V. Polyakov, I.A. Dmitrenko, E. Hansen, I.A. Repina, S.S. Kirillov, C. Mauritzen, H. Simmons, L.A.

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Timokhov, Seasonal Variability in Atlantic Water off Spitsbergen // Deep Sea Res. I, 56, 1-14, 2009, doi:10.1016/j.dsr.2008.07.013). Therefore I would suggest rewording this sentence like say: “Due to intensive heat loss to the atmosphere and freshening through mixing with the ice melted water the AW upper portion cools and freshens, which leads to the isolation of the AW warm core from the ocean surface.”

Interactive comment on Ocean Sci. Discuss., 10, 985, 2013.

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