

Interactive comment on “The Barents Sea polar front and water masses variability (1980–2011)” by L. Oziel et al.

Anonymous Referee #1

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The authors investigate interannual variability and evolution of the water masses in the Barents Sea using a specially designed database covering the period of 1980–2011 supplemented by model simulations. They show that the polar front dissecting the Barents Sea splits into two branches east of 32E. The sea-specific water – Barents Sea Water – is enclosed inside these two branches. The authors focus on five water masses – the AW, NCCW, Arctic Water, Barents Seas Water and Fresh Water (which should've been defined as Barents Fresh Water to emphasize its local nature). They conclude that the interannual variability of the water masses is linked to the ice cover extend and that a strong temperature and salinity trends lead to “Atlantification” of the Barents Sea, with the Atlantic Water occupying progressively larger volume of the region. The paper is very interesting, contains some novel features and can eventually be published in Ocean Science Discussions online magazine. However, there are

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some important issues that should be address to make it publishable.

There are three major elements that need authors' attention.

Firstly, there is a new online “Climatological Atlas of the Nordic Seas and Northern North Atlantic” by Korabely et al (2014) that includes the Barents Sea with $\frac{1}{4}$ -degree resolution: <http://www.nodc.noaa.gov/OC5/nordic-seas/>. The database of the Atlas is quite large, so a comparison of the database used in the reviewed research and the one in the Atlas of Nordic Seas would be a good addition.

Secondly, there are several recent publications that focus on the same problem of the role of the Atlantic Water in the ocean climate of the Arctic Ocean and adjacent seas, including the Norwegian and Barents Seas – the seas where the Atlantic Water dominates. It is advisable to compare the results of the reviewed research with those in the mentioned papers (see the references below).

The paper by Seidov et al (2015) discusses the World Ocean Database holding in the high latitudes, so, again, it is important to compare the database employed in the reviewed research with the WOD depository. Moreover, the authors provide a new research of the NAO and AMO correlation with observed ocean variability in Greenland-Iceland-Norwegian Seas where Atlantic Water impact is quite strong.

Another paper, by Yashayaev and Seidov (2015), focuses directly on the Atlantic Water inflow in the Norwegian Sea and its transformation as it progresses northward up to the western part of the Barents Sea. It is shown that the salinity and temperature signal splits, presumably because of the sea-air interactions.

Levitus et al (2009) have shown that there was a shift in the Barents Sea thermohaline regime in the 80-es of last century and then a substantial warming in the beginning of 21st century. It was also shown that the upper layer temperature correlates quite well with Atlantic Multidecadal Oscillation index, so the BS variability may be more dependent on thermal regime in the northern North Atlantic than on the processes in

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the atmosphere reflected in the AO and NAO.

Regarding the model part, there were several recent modeling efforts, some with a very fine resolution. For example, Aksenov et al (2010) conveyed a high-resolution study of the Atlantic Water inflow to the Arctic Ocean; I advise the authors of the reviewed manuscript to cite this paper and to outline how their results differ from those by Aksenov et al.

Here are the mentioned papers:

Seidov, D., J. I. Antonov, K. M. Arzayus, O. K. Baranova, M. Biddle, T. P. Boyer, D. R. Johnson, A. V. Mishonov, C. Paver and M. M. Zweng, 2015: Oceanography North of 60N from World Ocean Database, Progress in Oceanography, v 132, p. 153-173; doi:10.1016/j.pocean.2014.02.003

Yashayaev, I. and D. Seidov, 2015: The role of the Atlantic Water in multidecadal ocean variability in the Nordic and Barents Seas, Progress in Oceanography, v 132, p. 68-127; doi:10.1016/j.pocean.2014.11.009

Levitus, S., Matishov, G., Seidov, D., Smolyar, I., 2009. Barents Sea multidecadal variability. Geophys. Res. Lett., 36, L19604; doi:10.1029/2009GL039847

Aksenov, Y., Bacon, S., Coward, A.C., Nurser, A.J.G., 2010. The North Atlantic inflow to the Arctic Ocean: High-resolution model study. Journal of Marine Systems, 79, 1-22; doi:10.1016/j.jmarsys.2009.05.003.

Third element that calls for closer attention is the structure of the manuscript. I have some difficulties in navigating the text. It is not always clear where does the observational part end and the model one begins. Did the authors apply the same analysis to model data as they did for observations? Why they don't compare data and model analyses for summer and why the results might differ (if they do)?

There are some contradictory statements. For example, the authors say that "Barents Sea Water does not strongly vary seasonally." Then why on p. 466 authors indicate

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that the volume of the BSW is small – relative to summer? If this is true, then seasonal variability is not small.

On page 455, line 21, there is a statement "However, this (density of data coverage in the eastern part of domain –reviewer) does not seem to have an impact on the results shown below." This statement has no proof anywhere in the text.

Why the very old version of the World Ocean Atlas published in 1998 is used for model initiation? A much more up-to-date version WOA13 was published in 2014 and is now available online: <http://www.nodc.noaa.gov/OC5/woa13/>.

On page 60, line 12, the authors say "The computation has been done for the summer data ...". Is this a model computation or data processing?

On page 469, line 1, it says: that Artun et al (2011) defined the "Atlantification" process as an increase ...", while in fact the Atlantification was defined in Arthun et al (2012).

Page 471, line 19, "Atlantic Waters used to invade this area ..." I guess it should be simply "Atlantic Waters invade ..."

On the same page, lines 21-22, it should be "... the BS accounts for 40% ..."

There are quite a number of grammatical errors throughout the text. Just one example on page 453, line 15, "...Arthun et al (2012) is defined by this author as ..." should be plural – "...Arthun et al (2012) is defined by these authors as ...". The authors need to edit their text to improve grammar and style. Although it is not critical for understanding, correcting small grammatical blunders can improve overall readability of the manuscript.

To conclude, I believe that the research is very interesting and solid. I have no doubts that after revision it will become publishable in Ocean Science Discussion. Thus, I recommend major revision of the text and resubmission with a very good chance for acceptance.

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***** Note: In most publications the “Atlantic Water” is singular; the “Atlantic Waters” sounds a bit unconventional.

Interactive comment on Ocean Sci. Discuss., 12, 449, 2015.