

Review on “The coherence of the oceanic heat transport through the Nordic Seas: oceanic heat budget and interannual variability” by Anna Vesman, Igor Bashmachnikov, Pavel Golubkin, Roshin Raj submitted to the Ocean Science journal.

General comments

The authors investigated the heat flux in several sections northward in the Nordic Seas along the pathways of Atlantic Water into the Arctic. This was done using the ARMOR3D dataset that derives from in-situ temperature and salinity data and satellite data. The heat flux variability is discussed in relation to atmospheric forcing that includes different weather regimes and North Atlantic Oscillation. The topic is of high scientific interest and this work could contribute to our understanding of the heat transport toward the Arctic. However, it is not clear what is the new findings in this paper. This should be more highlighted and discussed in the paper. The paper is well structured but the discussion should be improved (as mentioned above) and there are also too many errors or unexplained (or not shown) statements in the paper (see my comments below) to be accepted for publication.

Detailed comments

Since the ARMOR3D and mooring observation have monthly values and there is strong seasonality in both data sets, there is not unexpected that the correlation between them is relatively high (Line 231-245 and figure 5). To compare the two datasets for interannually variability the seasonal signal should be removed before the correlation analysis.

Line 56-58: Several currents are mentioned but the East Iceland Current transports Arctic water and what is the West Icelandic Current? the (North-Icelandic) Irminger Current seems to be more relevant. Also, what is the Norwegian Atlantic Coastal Current? The location of the most central currents should be included in the map (Fig. 1.).

Line 90: What stands ARMOR3D for? There are many abbreviations without explanation (e.g. ARMOR3D, CMEMS, NAACLIM, CLIMODE, COARE, ...).

Line 119: “Vangengeim suggested...”. Reference is missing.

Line 130: “Vangengeim – Giers classification...” What is this classification?

Line 151: The depth interval and the reference temperature for the heat fluxes are missing.

Line 160-162: “...even a small change in the position of the transect can lead to a significant change in the integral flux through the section.... These uncertainties must be taken into account when calculating balances within the studied areas” I cannot see that this has been done or have been discussed.

Line 188-189: The authors use potential density thresholds for the definition of AW. Table 2 seems to be unnecessary and has several errors: Mork and Blindheim (1999) does not exist, Orvik et al. 2001 only studied the Svinøy section and not the whole Norwegian Sea (the ref.

is also missing), Orvik and Niiler (2001) used 30 cm/s currents as AW pathways (not as definition of AW), reference of Furevik et al (2007) is missing, etc.

Line 205-208: The reason for why $dz=100$ m was chosen is lacking? “ dT is the temperature differences between the lower boundary of AW and surrounding waters” Is the surrounding waters 100 m ($=dz$) below the boundary of AW?

Line 209-229: I don't see that this calculation is necessary. Why not just use the constant value from Fer et al. with the reference. The uncertainties of K_z is probably less important than compared to other variables (e.g., dT and dz) or the chose of the reference temperature in eq. 1.

Line 286-288: “The imbalance account to 10-20% ...that reflect the warming of AW... We should take into account uncertainties...” I cannot see that the uncertainties are discussed in the paper (e.g., what will be the uncertainties), and if this imbalance reflects the warming, how much will this be (in temperature/heat). This should then be compared with other works.

Line 300: “...dropping to insignificant levels...”. What is the significant level?

Line 301-303: That the correlation drops between Svinøy and Jan Mayen sections might also be due to the AW lies deeper and has longer residence time in the Lofoten Basin (e.g., Nilsen and Falck, 2006; Skagseth and Mork, 2012).

Line 306-307: “...the cross-correlation analysis suggests the maximum correlations at zero time lag”. Is this done?

Line 381-382: “... is mostly shaped by the variations in the current velocity...” This should then be shown.

Line 385-387: Could the 10-20% of the incoming heat be due to reduced air-sea heat loss? See also my comments on Line 286-288.

Figure 1: the position of NwAFC is wrong.

Figure 2: Are the currents from ARMOR3D? At which depth? Is it same as for temperature (50m)?

Figure 7. The correlation should also be done with time lags. While the velocity might have no or short time lag the temperature might have 1-2 year time lag (see e.g., Holliday et al., 2008; Skagseth et al., 2008; Chafik et al., 2015) which was also mentioned by the authors.

Figure 9. The figure with wavelet amplitudes seems to be wrong. The amplitude should only be positive. Why is the heat flux integrated to 500 m? Why not use the boundary level of AW defined in the paper?

Table 2. What is the significant level.