Geophysical Research Abstracts
Vol. 21, EGU2019-16644, 2019
EGU General Assembly 2019

Preconditioning favored deep convection in the Irminger Sea in winters 2016, 2017 and 2018

Patricia Zunino (1), Herlé Mercier (2), and Virginie Thierry (3)

(1) ALTRAN TECHNOLOGIES, ALTRAN OUEST, Brest, France (pzuninor@ifremer.fr), (2) CNRS, Brest, France, (3) IFREMER, Brest, France

Given the current anthropogenic forcing, ocean models project a warmer climate, an increase of freshwater inputs due to ice melting, a slow-down of the Meridional Overturning Circulation, and a reduction, or even a shut-down, of deep convection in the North Atlantic Ocean. The deep convection happens in the Labrador Sea and less commonly in the Irminger Sea. Surprisingly, deep convection events have been observed in the Irminger Sea in the winters 2008, 2009, 2012 and an exceptional event occurred in winter 2015, all of them coincided with very intense atmospheric forcing.

In this context, we used Argo data to investigate deep convection in the Irminger Sea over the period 2016-2018. We showed that deep convection occurred in the Irminger Sea during winters 2016, 2017 and 2018, reaching convection depths of 1325 m, 1400 m and 1100 m, respectively. We thus reveal that deep convection has been established in the Irminger Sea during four continuous winters (2015 – 2018).

Considering the expected increase in freshwater inputs, we investigated the respective role of atmospheric forcing and preconditioning of the water column on the deep convection in terms of buoyancy and not only in terms of heat. The buoyancy air-sea flux is 10 % weaker than the heat air-sea flux because the non-negligible effect of the freshwater air-sea flux. The buoyancy flux over the Irminger Sea during winters 2016, 2017 and 2018 was close to climatological average, different to the very negative buoyancy flux occurred during winter 2015.

The preconditioning of the water column was studied by computing the buoyancy that needs to remove from the water column during the winter to homogenize it down to a given depth. We found that for winters 2016, 2017 and 2018, the buoyancy to remove at each depth was low compared to the mean 2008 – 2015, but most importantly, it remained nearly constant with depth between the intermediate and the deep levels, meaning that once the water column was homogenized down to the intermediate level (∼800 m) little additional buoyancy loss resulted in homogenization down to the deep level (∼1400m). This was due both to the continuous cooling of the intermediate (200 – 800 m) waters and to the salinity decrease in the layer 1200 – 1400 m, which reduced the density of this layer, and so the density difference with the overlying water. The cooling of the intermediate layer is related to the cold blob of the North Atlantic, which was intensified by the deep convection event of winter 2015. The salinity decrease in the deep water likely resulted from the lateral advection of less saline water formed in the Labrador Sea during the very deep convection of winters 2014 and 2015. Finally, these results show that recent changes in the hydrographic properties of the water column favor deep convection in the Irminger Sea, despite “normal” atmospheric forcing.