Geophysical Research Abstracts
Vol. 19, EGU2017-4434, 2017
EGU General Assembly 2017

Water Mass Variability at the Mid-Atlantic Ridge and in the Eastern North Atlantic

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The strong warming and salinification of the Eastern North Atlantic starting in the mid 1990s has been attributed to a westward contraction of the sub-polar gyre and stronger inflow of waters from the sub-tropical gyre. Temporal changes in the shape and strength of the two gyres have been related to the major mode of atmospheric variability in the Atlantic sector, the NAO. Hydrographic conditions along the Northwest European shelf are thus the result of different processes such as variations in transports, varying relative contributions of water masses from the two gyres and property trends in the source water masses.

The North Atlantic Current (NAC) can be regarded as the southern border of the sub-polar gyre transporting water from the tropical regions northward. On its way towards the Mid Atlantic Ridge (MAR) the NAC has partly mixed with waters from the sub-polar gyre and crosses the MAR split into several branches.

For the study we analyzed data of water mass variability and transport fluctuations from the RACE (Regional circulation and Global change) project (2012-2015) which provided time series of transports and hydrographic anomalies from moored instruments at the western flank of the MAR.

The time depending positions of the NAC branches over the MAR were obtained from mooring time series and compared to sea surface velocities from altimeter data. The results show a high variability of NAC pathways over the MAR. Transition regimes with strong meandering and eddies could be observed as well as periods of strong NAC branches over the Fracture Zones affecting water mass exchange at all depth levels. A positive temperature trend at depths between 1000-2000 m was found at the Faraday Fracture Zone (FFZ). This warming trend was also detected by Argo floats crossing the MAR close to the FFZ region.

During the second phase of RACE (RACE-II, 2016-2018) a mooring array across the eastern shelf break at Goban Spur was deployed to monitor the poleward Eastern Boundary Current transport and hydrographic property anomalies from the sub-tropical source region. Together with the information about the water mass variability at the MAR it is possible to assess the sources of water mass variations being advected into the Nordic Seas and the Arctic Ocean.