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Water mass variability observed at the Mid-Atlantic Ridge in the subpolar North Atlantic

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The intermediate and deep waters formed in the subpolar North Atlantic are an important contributor to the global meridional overturning circulation. Intermediate water masses, such as the Labrador Sea Water (LSW), which is formed in the Labrador Sea, follow different known pathways. Especially the LSW is thought to be detached from the western boundary towards the northeast Atlantic by the North Atlantic Current (NAC). The NAC carries these waters towards the northeast Atlantic. The Mid-Atlantic Ridge (MAR) acts as a barrier for these water masses that can only cross the ridge through fracture zones such as the Faraday Fracture Zone (FFZ), located at ∼50°N and ∼30°W. Recent years have shown major changes in the water mass properties in the subpolar North Atlantic. One key aspect for the present study is to investigate the properties and the spreading of water masses over the MAR into the eastern Atlantic.

To analyze the variability of water masses next to the MAR the German Federal Maritime and Hydrographic Agency placed a mooring array consisting of three deep sea moorings at the western entrance of the FFZ. These moorings were installed during three deployment periods from November 2009 to July 2012. They were equipped with sensors to measure current velocity, temperature, pressure, and salinity. To analyze the intra- to interannual variability the time series were smoothed by applying a 48h-lowpass filter that removed the influence of tidal signals. For better comparison of the time series derived from different deployment periods, the data were interpolated to a common instrument level by considering temperature and salinity gradients derived from CTD profiles taken during the deployment and recovery of the moorings. Furthermore, the temperature and salinity data of profiling Argo floats located within 80km radius of each mooring were used to support the mooring measurements and to extend the mooring time series back until 2002.

First results show that during the observation periods the NAC was located over the mooring positions for several times, which is visible in the velocity records as well as in the temperature and salinity measurements of the uppermost instruments moored at 300dbar. The mooring data indicate that the NAC was meandering over the moorings, crossing the MAR over the FFZ. This is confirmed by satellite based datasets of surface currents.

The moored time series show high variability in salinity throughout the whole water column. At the level of the deep LSW (1800dbar) the mooring time series show an increasing trend which is supported by the Argo measurements. An increasing decadal trend was already found in the Labrador Sea in the western subpolar North Atlantic, the formation region of the LSW. With the help of the mooring array this trend can be traced towards the MAR. Here, the time series of the different moorings are presented and the observed patterns of variability concerning intra- and interannual time scales are discussed.