1. Introduction

In the northern North Atlantic, warm surface waters of subtropical origins are progressively densified through atmospherically-driven and internally-driven processes before returning southward in the deep ocean. This light-to-dense conversion of water masses drives the so-called Meridional Overturning Circulation (MOC), a key contributor to the climate-relevant heat transport in the North Atlantic sector. Of particular interest is the contribution of convectively-formed Labrador Sea Water (LSW) to the basin-scale MOC, an issue rarely assessed with observational datasets. The present study is aimed to:

1. quantify the impact of Labrador Sea Water (LSW) formation rate on the recent (1990's versus 2000's) MOC variability.
2. provide a time-mean estimate of the MOC across the merged AR7W/A25-Ovide line during the 2002-2010 time span.
3. The 2002-2010 time-mean circulation

2. Tools and Methods

Repeated hydrographic surveys along the AR7W section in the Labrador Sea (summer 2002-04-06-08-10 and summer 1990-92-94-96) and A25-Ovide section between Greenland and Portugal (2002-04-06-08-10) provide time-mean gridded hydrographic and relative velocity fields in the subpolar gyre. The absolute velocity fields at AR7W are retrieved by adding the absolute surface geostrophic currents at each depth level, obtained from the mean dynamic topography of Rio and Hernandez (2004) and altimetry-derived sea-level anomalies from the AVISO 1/3° topography (e.g. Sarafanov et al., 2012, JGR). An inverse model was used for the A25-Ovide section (Lherminier et al., 2010, DSIR).

3. The 2002-2010 time-mean circulation

4. Decadal variability at AR7W (1990's vs. 2000's)

Both the MOCz and MOCo underwent important decadal changes in their intensity and spatial structure (Figure 4).

The MOCz

The maximum MOCz reached 3.7 ± 1.2 Sv at 1500 m in 1990-96. Assuming no changes at A25-Ovide, this leads to a total MOCz 1.4 Sv stronger than in the 2000's and a transport weighted depth of its lower limb 613 m deeper.

The MOCo

The maximum MOCo reached 7 ± 1.5 Sv at σ_1 = 32.35 in 1990-96. Interestingly, assuming no changes at A25-Ovide, the magnitude of the total MOCs remained unchanged between both decades, while the transport-weighted density of its lower limb switched from 32.47 to 32.36.

5. Conclusion

In the 2002-2010 years, the total MOCz (10.7 ± 1.4 Sv) was primarily induced by net sinking of Greenland (77%). The total MOCo (18 ± 1.8 Sv) was largely induced by the densification of Atlantic waters in the eastern subpolar gyre and in the Nordic Seas (83%). About 40% of the basin-scale water mass transformation occurred in the horizontal plane.

Further examination of the preceding decade (1990-1996) suggests strong variability in the Labrador Sea: the MOCz and MOCo underwent important changes in their intensity and spatial structure (Figure 4).

Further examination of the preceding decade (1990-1996) suggests strong variability in the Labrador Sea: the MOCz and MOCo underwent important changes in their intensity and spatial structure (Figure 4).