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Atlantic Meridional Overturning Circulation: Sustained observations of the Labrador Sea outflow at 53°N

Rainer Zantopp[†]; J,rgen Fischer; Nuno Nunes; Martin Visbeck; Torsten Kanzow
[†] IFM-GEOMAR, Germany
Leading author: rzantopp@ifm-geomar.de

The formation and spreading of water masses in the Labrador Sea, characterized by a cyclonic boundary current surrounding one of the most active areas of wintertime water mass transformation in the world's ocean, are the central aspect of this OceanSites component in climate research. Along the Labrador shelf break, the three components of the North Atlantic Deep Water (NADW) merge into the Deep Western Boundary Current (DWBC) as a major contribution to the cold water limb of the Meridional Overturning Circulation (MOC). Therefore, this location at 53°N is well suited to observe - and potentially monitor - the outgoing component of those water masses which enter the subpolar North Atlantic from the Arctic Ocean. For more than a decade, from 1997 to 2010, and currently ongoing, moored observatories have been deployed over varying time intervals and spatial coverage near the western exit region of the Labrador Sea. The most prominent signal during the last decade was a well-documented warming of the upper 2000 m of the water column over the entire Labrador Sea, caused primarily by the weakened or absent formation and deep convection of Labrador Sea Water at densities greater than 27.80. Our data show fluctuations on seasonal to interannual timescales, plus an initial estimate of the decadal variability, which seemingly have little to no relation to the above-mentioned warming trend, and they clearly document the remarkable stability in strength and structure of the DWBC at 53°N. Transport estimates for the upper and deep limbs of the boundary current contributing to the MOC are reviewed for different time periods. An assessment of the monitoring scheme for the cold water export based on strategic current meter placement shows that more than 70% of the transport variability can be monitored by a single instrument. The reconstruction of full-length transport time series from 'gappy' data is evaluated.