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Atlantic Meridional Overturning Circulation: Transport and water mass variability at Line W (39oN, 70oW) 2004-2010

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Located on the continental slope southeast of New England, Line W is a sustained observational program which has been providing high resolution measurements of the North Atlantic's deep western boundary current (DWBC) since spring 2004. The study is focused on quantifying temporal variability in the cold limb of the Atlantic Meridional Overturning Circulation near the boundary between the subtropical and subpolar gyres. The field study consists of a 6-element moored array, spanning the continental slope and underlying an altimeter satellite ground track, with periodic reoccupations of a full-depth hydrographic section along the line extending from the continental shelf towards Bermuda. The 6-year time series of mean and time-varying meridional transport has been analyzed in 4 density layers corresponding to water masses ventilated upstream in the subpolar and subarctic seas: Upper and Classical Labrador Sea Waters, Iceland-Scotland Overflow Waters, and Denmark Strait Overflow Waters. Between 2004-2008, the 4-layer-summed meridional transport estimates ranged between -3.5 and -79.5 Sv (1 Sv = 106 m3 s-1), averaging -22.7 Sv with standard deviation of 15.9 Sv. Total (surface to seafloor) time mean transport estimates for this period were -36.2 ± 3.4 Sv - within error bars of previous estimates based on measurements acquired there from 1988-1990. We thus conclude that there has been no detectable change - with a caveat of substantial uncertainties -- in average cold limb transports between these time periods. Changes in water mass properties (temperature, salinity, potential vorticity, dissolved oxygen, chemical tracers) and flow characteristics observed at Line W are related on advective timescales to upstream changes in convection and ventilation occurring in the subpolar and subarctic seas, and to coordinated shifts in the position of the Gulf Stream and strength of the Slope Water circulation system.