



Transport variability in the western subpolar North Atlantic at 47°N

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The southwestern part of the subpolar North Atlantic east of Flemish Cap is a key area for the Atlantic Meridional Overturning Circulation (AMOC). The area is characterized by strong meridional currents: the southward flowing deep western boundary current (DWBC), the northward flowing North Atlantic Current (NAC), and an adjacent southward return flow. The circulation and water mass properties east of Flemish Cap were studied by six repeat hydrographic sections along 47°N (2003–2011) and by a two-year long time series of current velocity, temperature, and salinity at the continental slope of Flemish Cap between summer 2009 and summer 2011. The time series data were collected at three moorings that were equipped with current meters and conductivity-temperature-recorders. The hydrographic observations were carried out on three mooring deployment and recovery cruises as well as on three earlier cruises.

Two distinctive cores of southward flow are found in the DWBC. One core is located directly at the steep continental slope, with maximum velocities found at mid-depth at about 2000 m. The second core is found farther east above the continental rise and characterized by bottom-intensified currents. The shipboard observations show a mean southward DWBC transport of 22 Sv, with two thirds at the continental slope and one third at the continental rise. The northward flowing NAC is located directly east of the boundary current. The observed northward transport of the NAC varies between 40 and 160 Sv. The mean NAC transport from the six realizations amounts to 90 Sv, 52 Sv of which in the deep water layer. Most of this northward flow recirculates just east of the NAC. The southward transport observed here amounts to 37 Sv in the deep water and 63 Sv in total, which reduces the net northward transport of the NAC to 27 Sv.

The time series measurements of the flow in the DWBC core at the continental slope show an mean southward transport of 19 Sv with a standard deviation of 5 Sv. The transport estimates from the mooring data agree well with shipboard measurements from the deployment and recovery cruises, although the mean transport from all repeats is lower, which indicates that the shipboard measurements in the boundary current were carried out during periods of relatively weak southward flow. In general the mooring data show a southwards flow that varies between 10 and 30 Sv with only one exception where a northward flow was observed for a period of several days. The power spectral density of the meridional velocity shows a maximum on time scales of 15 to 30 days.