

Atlantic meridional overturning circulation: Propagation pathways of classical Labrador Sea Water from its source region to 26N

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More than two decades of hydrography on the Abaco line east of the Bahamas reveals decadal variability in the salinity of classical Labrador Sea Water (cLSW), despite the long distance from its source region in the North Atlantic Ocean. Hydrographic time series from the Labrador Sea and from the Abaco line show a pronounced decrease in salinity; between 1985 and 1995 in the Labrador Sea and between 1995 and 2010 near the Bahamas, indicating a time lag between the two locations of approximately 10 years. The amplitude of the anomaly at the Abaco line is about 50% of the amplitude in the Labrador Sea, due to mixing with interior Atlantic waters, particularly with saline Mediterranean Outflow Waters. A similar time lag and decay in amplitude is found in the high-resolution OFES model, in which salinity anomalies can be observed propagating through the Deep Western Boundary Current as well as through a broad interior pathway. Surprisingly, data-assimilative models generally have difficulty reproducing the observed freshening signal at Abaco, despite relatively good reproduction of the decadal changes in the Labrador Sea. In the OFES model, the freshening signal beginning at Abaco in 1995 is seen to result from two distinct freshening pulses in the Labrador Sea that occurred during 1985 to 1995, that merge to form the single broad decadal event observed at Abaco. As yet there is no evidence for an expected reversal to saltier DWBC conditions off Abaco following the trend toward warmer and saltier cLSW in the Labrador Sea since 1995.