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Lagrangian Observations of Labrador Sea Water Export Pathways from the Subpolar North Atlantic

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Profiling floats exiting the Labrador Sea in the Deep Western Boundary Current (DWBC) in the 1990s showed almost no evidence of a continuous DWBC pathway around the Grand Banks. To further investigate the export pathways of LSW without the potential bias introduced by profiling, 76 acoustically tracked RAFOS floats were released sequentially in the DWBC near 50N during 2003-2006. With the assistance of the Northwest Atlantic Fisheries Centre, nominally six floats were deployed in the DWBC every three months between the 1400 and 2600-m isobaths, three at 700 m (Upper Labrador Sea Water) and three at 1500 m (Classical Labrador Sea Water). Like the profiling floats, many of the RAFOS floats leave the boundary current and drift eastward along the subtropical-subpolar gyre boundary, never reaching the Tail of the Grand Banks at 42N within their two-year drifting mission. Unlike the profiling floats, some RAFOS floats continuously follow the DWBC path around the Tail of the Grand Banks, but the number (< 10 percent) still seems small in light of the commonly held view of the DWBC as a conduit for the abyssal limb of the Atlantic Meridional Overturning Circulation. About 25 percent of the RAFOS floats also reveal a new pathway not seen with the profiling floats, namely southward from the Newfoundland Basin into the interior subtropical gyre. For comparison, a large number of “e-floats”, both isopycnal and isobaric were released in a high-resolution, eddy-resolving general circulation model of the North Atlantic (FLAME – Family of Linked Atlantic Model Experiments). The simulated trajectories show a pattern of dispersal similar to the RAFOS floats and no significant differences between isobaric and isopycnal e-floats. By carefully tracking the volume of LSW that exits the Labrador Sea in the DWBC and crosses 32N within 15 years, we find that very little follows a continuous path along the DWBC, and most crosses through the subtropics via an interior pathway.