Overflow Water Pathways in the North Atlantic: New Observations from the OSNAP Program

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As part of the international Overturning in the Subpolar North Atlantic Program (OSNAP), 135 acoustically-tracked deep floats were deployed from 2014 to 2016 to track the spreading pathways of Iceland-Scotland Overflow Water (ISOW) and Denmark Strait Overflow Water (DSOW). These water masses, which originate in the Nordic Seas, compose the deepest branch of the Atlantic Meridional Overturning Circulation. The OSNAP floats provide the first directly observed, comprehensive Lagrangian view of ISOW and DSOW spreading pathways throughout the subpolar North Atlantic. Contrary to a decades-long expectation for how these deep water masses move equatorward, the collection of OSNAP float trajectories, complemented by model simulations, conclusively reveals that their pathways are (a) not restricted to western boundary currents, and (b) remarkably different from each other in character. The spread of DSOW from the Irminger Sea is primarily via the swift deep boundary currents of the Irminger and Labrador Seas, whereas the spread of ISOW out of the Iceland Basin is slower, more diffusive, and along multiple export pathways. The characterization of these overflow water pathways has important implications for our understanding of the Atlantic Meridional Overturning Circulation (AMOC) and its variability. Finally, reconstructions of AMOC variability from proxy data, involving either the strength of boundary currents and/or the property variability of deep waters, should account for the myriad pathways of DSOW and ISOW, but particularly so for the latter.