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Abundant Cyclonic Eddies in the Deep Boundary Current Around Southern Greenland

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The deep boundary current of the subpolar North Atlantic transports cold, dense North Atlantic Deep Water (NADW) equatorward, representing the lower limb of the Atlantic Meridional Overturning circulation (AMOC) at these latitudes. This current is typically illustrated as a continuous ribbon that cyclonically follows the boundaries of the three subpolar basins (Iceland, Irminger, Labrador), demonstrating the strong influence of topography on the pathways of these deep waters. As part of the Overturning in the Subpolar North Atlantic Program (OSNAP), about 120 acoustically tracked (RAFOS) floats were released between 2014 and 2017 at various locations along the deep boundary current path (at depths between 1800 and 2800 m) to determine where and why this topographic constraint breaks down, allowing boundary-interior exchange and water mass transformation. Anticipating that one such location might be the southern tip of Greenland due to the sharp curvature of the isobaths associated with the Eirik Ridge, a large number of floats were released on the OSNAP line just upstream of the ridge. Contrary to expectations, A relatively small number of floats separated from the continental slope at this location, but surprisingly, a significant number of floats exhibited cusping or looping behavior consistent with being trapped in coherent cyclonic eddies embedded in the boundary current. These eddies are also evident in the velocity and T/S measurements from OSNAP moored arrays just upstream and downstream of the ridge, indicating that at least some of these eddies are able to round the ridge and enter the Labrador Basin. The physical and kinematic properties of the eddies observed around southern Greenland are similar to the deep cyclonic eddies observed upstream in the deep boundary current, which are thought to form due to vortex stretching along the path of the descending Denmark Strait Overflow, suggesting that some of these upstream eddies are long-lived and remain intact all the way to the Labrador Basin. Using both the OSNAP moored and float observations, we will describe the velocity and hydrographic structure of the eddies around southern Greenland, which are numerous. On the one hand, NADW trapped in eddy cores will be isolated from lateral mixing with surrounding water, but the rotational velocity associated with the eddies may enhance stirring and mixing around their perimeters.