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Convection and deep water export in the Irminger Sea

Isabela Le Bras (1), Fiamma Straneo (1), James Holte (1), and Penny Holliday (2)

(1) Scripps Institution of Oceanography, CASPO, United States (ilebras@ucsd.edu), (2) National Oceanography Centre, Southampton, United Kingdom

In the standard view of the Atlantic Meridional Overturning Circulation (AMOC), deep water is formed by convection and flows equatorward in the AMOC's deep lower limb. However, the connection between deep water formation and its export is not well understood and observations that may clarify this connection are severely lacking. We use the first year-round moored observations extending from the southeastern coast of Greenland to the central Irminger Sea to explore this link. These observations, which span from summer 2014 to summer 2016 and were collected as part of the Overturning in the Subpolar North Atlantic Program (OSNAP) and the Oceans Observatories Initiative (OOI), coincide with a period of intense deep convection in the Irminger Sea.

Waters formed by convection have a distinct low potential vorticity signature and inject a cold, fresh anomaly into the ocean interior, allowing us to trace these water masses across the moored array. We find a potential vorticity minimum just offshore of the boundary current at depths of 500-1000m, whose properties match those of waters formed in the central Irminger Sea. We do not see evidence that this water is entrained into the boundary current. Instead low potential vorticity signals observed in the boundary current appear to be ventilated in much shallower mixed layers closer to the slope. Such water mass transformations within the boundary current may play a significant role in the AMOC. This Irminger Sea case study provides a detailed view of the connection between waters formed by deep convection and the adjacent boundary currents, contributing to a more complete understanding of the AMOC.