



Formation of Denmark Strait Overflow Water via boundary currents and transformation in the central Iceland Sea

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The Deep Western Boundary Current constitutes the lower limb of the Atlantic Meridional Overturning Circulation (AMOC), and, as such, is a crucial component of the Earth's climate system. Dense water formed north of the Greenland-Scotland Ridge returns southward by flowing through gaps in the ridge as overflow plumes. The largest of these is the Denmark Strait Overflow Water (DSOW) which forms the densest component of the AMOC. The primary source of DSOW is commonly thought to be the East Greenland Current (EGC). However, this view has been called into question with the discovery of the Northwest Icelandic Jet (NIJ) – a deep-reaching current flowing along the continental slope of Iceland. Here we show, using high-resolution shipboard hydrographic and velocity measurements, that the NIJ advects overflow water into the Denmark Strait and constitutes a pathway distinct from the EGC. During two surveys in October 2008 and August 2009, the NIJ was found to supply both the densest overflow water and approximately half of the total overflow transport. Model simulations suggest that the process forming the NIJ is dependent upon the import of warm, salty water from the northward-flowing North Icelandic Irminger Current (NIIC) in conjunction with transformation in the interior Iceland Sea. This represents a new scenario for the formation of DSOW.