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Wintertime re-ventilation of the East Greenland Current's Atlantic-origin Overflow Water in the western Iceland Sea

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The Deep Western Boundary Current constitutes the lower limb of the Atlantic Meridional Overturning Circulation, and, as such, is a crucial component of the Earth's climate system. The largest and densest contribution to the current stems from the overflow plume that passes through Denmark Strait. A main source of Denmark Strait Overflow Water (DSOW) is the East Greenland Current (EGC). The DSOW transported by the EGC originates from the Atlantic inflow into the Nordic Seas. This is then transformed into Atlantic-origin Overflow Water while progressing northward through the eastern part of the Nordic Seas. Here we show, using measurements from autonomous gliders deployed from fall 2015 to spring 2016, that the Atlantic-origin Overflow Water transported toward Denmark Strait by the EGC was re-ventilated while transiting the western Iceland Sea in winter. In summer, this region is characterized by an upper layer of cold, fresh Polar Surface Water that is thought to prevent convection. But in fall and winter this fresh water mass is diverted toward the Greenland shelf by enhanced northerly winds, which results in a water column that is preconditioned for convection. Severe heat loss from the ocean to the atmosphere offshore of the ice edge subsequently causes the formation of deep mixed layers. This further transforms the Atlantic-origin Overflow Water and impacts the properties of the DSOW, and hence the deepest and densest component of the lower limb of the Atlantic Meridional Overturning Circulation.