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Deep-water salinity changes in the northern North Atlantic: attribution of the recent freshening reversal

A. Sarafanov (1), H. Mercier (2), A. Falina (1), A. Sokov (1), and P. Lherminier (2)

(1) P.P. Shirshov Institute of Oceanology, Moscow, Russia (sarafanov@mail.ru) , (2) Laboratoire de Physique des Océans, Ifremer, Plouzané, France

Recent decadal salinity changes in the Greenland–Scotland overflow-derived deep waters are quantified using the data from repeated hydrographic sections in the Irminger Sea. The Denmark Strait Overflow Water salinity record shows the absence of any net change over the 1980s–2000s; changes in the Iceland–Scotland Overflow Water (ISOW) layer and in the water column, enclosing both overflows, show a distinct freshening reversal in the early 2000s. The observed freshening reversal is a lagged consequence of the persistent ISOW salinification that occurred upstream, in the Iceland Basin, after 1996 in response to salinification of the northeast Atlantic waters entrained into the overflow. The entrainment salinity increase was, in turn, caused by the North Atlantic Oscillation (NAO)-induced contraction of the subpolar gyre and corresponding northwestward advance of subtropical waters that started within 1–2 years after the NAO drop in the winter of 1995/1996 and continued through 2005. Remarkably, the ISOW freshening reversal is not associated with changes in the Faroe-Shetland overflow water salinity. This suggests that the NAO-dependent relative contribution of subpolar and subtropical waters to the entrainment south of the Iceland–Scotland Ridge may dominate over changes in the Norwegian Sea freshwater balance with respect to their effect on the ISOW salinity.