



Revealing LSW formation from a decade of tracer measurements in the subpolar North Atlantic

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The subpolar North Atlantic is the formation region of North Atlantic Deep Water (NADW) and its various components. Changes in the formation of the lightest NADW component, Labrador Sea Water (LSW), are suggested to be linked to changes in the strength of the meridional overturning. The availability of long-term time series related to the variability of LSW formation is thus highly desirable.

Based on tracer measurements spanning more than a decade the formation of LSW and the associated spreading in the subpolar gyre is investigated here by analyzing data from annual to biennial large-scale surveys conducted during 1997-2009. The tracer data set consists of chlorofluorocarbon-12 (CFC-12) and in the two most recent year also of sulphurhexafluoride (SF₆) profiles. Since the availability of tracer measurements was limited to the western subpolar gyre in some years, CTD measurements and T/S profiles stemming from the Argo program were taken into account to determine correlations between tracer extrema and hydrographic water mass properties. These were used to derive virtual tracer profiles and thus to increase the spatial resolution of the data set.

The changing convection activity in the Labrador Sea throughout the investigation period left different finger prints in the two modes of LSW, the upper and the deep LSW. The spatial distributions of water mass properties and tracer inventories during 1997-2009 serve to analyze the regional changes of the two modes in the Labrador Sea, the Newfoundland Basin, the Irminger Sea and to the east of the Mid-Atlantic Ridge. Temporal changes in the inventories are used to infer LSW formation rates thus allowing to update respective time series.