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TITLE: Oxygen trends over five decades in the North Atlantic

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ABSTRACT:

We investigate long?term trends in dissolved oxygen in the North Atlantic from 1960 to 2009 on the basis of a newly assembled high?quality dataset consisting of oxygen data from three different sources: CARINA, GLODAP and the World Ocean Database. Oxygen trends are determined along isopycnal surfaces for eight regions and five water masses using a general least?squares linear regression method that accounts for temporal auto?correlation. Our results show a significant decrease of oxygen in the Upper (UW), Mode (MW) and Intermediate (IW) waters in almost all regions over the last 5 decades. Over the same period, oxygen increased in the Lower Intermediate Water (LIW) and Labrador Sea Water (LSW) throughout the North Atlantic. The observed oxygen decreases in the MW and IW of the northern and eastern regions are largely driven by changes in circulation and/or ventilation, while changes in solubility are the main driver for the oxygen decrease in the UW and the increases in the LIW and LSW. From 1960 until 2009 the UW, MW, and IW horizons have lost a total of ?57 ± 34 Tmol, while the LIW and LSW horizons have gained 46 ± 47 Tmol, integrating to a roughly constant oxygen inventory in the North Atlantic. Comparing our oxygen trends with those of the oceanic heat content, we find an O 2 to heat change ratio of ?3.6 ± 2.8 nmol J ?1 for the UW, MW and IW, and a ratio of ?2.8 ± 3.4 nmol J ?1 for the LIW and LSW. These ratios are substantially larger than those expected from solubility alone.

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