

Changes in the formation of AAIW and storage of anthropogenic carbon in the South Atlantic in the 1990s and 2000s

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Antarctic Intermediate Water (AAIW) is the most abundant intermediate water mass originating in the southern hemisphere and is easily recognized by its low salinity tongue located at depths between 500 m to 1500 m. As AAIW contributes to the upper limb of the Atlantic Meridional Overturning Circulation (AMOC), knowledge regarding its formation, associated variability, and its vulnerability with respect to the uptake of anthropogenic carbon (C_{ant}) is of high relevance in a world facing increasing atmospheric C_{ant} concentrations and global warming with direct impact on the AMOC strength and variability.

We have used transient tracer data (chlorofluorocarbon, CFC) covering the period 1982-2005 to calculate CFC inventories and to derive rates of AAIW formation in the South Atlantic. Tracer data collected prior to 1995 have been referenced to 1990 and data from 1995 onwards to the year 2000. This allows to assess the changes in formation between these two periods. As a major result, we find a significant decrease in the formation of AAIW in the South Atlantic.

Based on the tracer data and applying the transit time distribution (TTD) method, we have furthermore estimated changes in the inventories and storage of C_{ant} within the AAIW. We find that the reduction of AAIW formation has severe implications for the uptake of C_{ant} within this layer in the South Atlantic.

Our results are discussed in the light of long-term changes regarding the strength of the surface forcing over the western South Atlantic and variations in the phase of the Southern Annular Mode (SAM). A decrease in the AAIW formation can partly be attributed to a weakening in the surface forcing that correlates to variations in the SAM.