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Atlantic meridional overturning transport at 14.5° N and 24.5° N during 1989-1992 and 2013-2015

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We analyzed the Atlantic meridional overturning circulation (AMOC) from transatlantic sections along 14.5° N, occupied in 1989 and 2013, in combination with data along a section at 24.5° N, occupied in 1992 and 2015. By applying a box inverse model, volume, salt, and heat conservation in layers, defined by neutral density surfaces, was applied. Considering direct and indirect Ekman transport estimates and specific transport features, such as the deep western boundary current, as constraints, the reference velocity for each station pair and the dianeutral velocity for each property across neutral density surfaces was determined.

Our analysis shows that the Antarctic Intermediate Water (AAIW) has become significantly warmer and saltier along the 14.5° N section, while the North Atlantic Deep Water (NADW) has become colder and fresher at both sections. At 24.5° N, the water mass transport from the inverse model is in good agreement with that from the RAPID-MOCHA-WBTS arrays. At 14.5° N, we observed a decent of the upper boundary of the northward flowing Antarctic Bottom Water (AABW) by one density layer (from 28.141 to 28.154 kg m^{-3}).

The AMOC was generally stronger in 1989/1992 than in 2013/2015 (19.3±6.8 Sv versus 16.5±7.1 Sv at 14.5° N, and 20.3±5.2 Sv versus 18.8±5.8 Sv at 24.5° N, respectively). In the inverse model solution the transport changes are caused by a reduction of the northward AAIW and AABW transport and a corresponding reduction of the southward NADW transport at both sections. Comparison between our AMOC estimates at 14.5° N and results from the $GECCO_2$ ocean synthesis data shows that the observed changes between the two time periods could be explained by the seasonal cycle and interannual changes found in $GECCO_2$. Heat and freshwater fluxes through each section were estimated using the inverse results.