Surface Estimates of the Atlantic Overturning in Density Space in an Eddy-Permitting Ocean Model

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A method to estimate the variability of the Atlantic Meridional Overturning Circulation (AMOC) from surface observations is investigated using an eddy-permitting ocean-only model (ORCA-025). The approach is based on the estimate of dense water formation from surface density fluxes. Analysis using 78 years of two repeat forcing model runs reveals that the surface forcing based estimate accounts for over 60 % of the interannual AMOC variability in density co-ordinates between 37 ºN and 51 ºN. The analysis provides correlations between surface-forced and actual overturning that exceed those obtained in an earlier analysis of a coarser resolution coupled model. Our results indicate, that in accordance with theoretical considerations behind the method, it provides a better estimate of the overturning in density coordinates than in z coordinates in sub-polar latitudes. The inclusion of the anomalous Ekman Transport increases the amount of variance explained by an average 16 % throughout the North Atlantic and provides the greatest potential for estimating the variability of the AMOC in density space between 33 ºN and 54 ºN. In that latitude range, 70-84 % of the variance is explained and the RMS difference is less than 1 Sv. Results from the method can be compared with other emerging estimates and proxies of mid-latitude AMOC variability.