

Tracing the lower limb of the AMOC in the South Atlantic

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Abstract

The pathways of North Atlantic Deep Water (NADW) that constitute the lower limb of the Atlantic Meridional Overturning Circulation (AMOC) have been the subject of discussion for years, mostly due to the lack of observations. Knowledge of the pathways of the AMOC in the South Atlantic is a first order prerequisite for understanding the fluxes of climatically important properties. In this paper, historical and new observations, including hydrographic sections, Argo data and chlorofluorocarbon measurements, are examined together with two different analyses of the Ocean General Circulation Model for the Earth Simulator (OFES) to trace the pathway of the Deep Western Boundary Current (DWBC) through the South Atlantic. Together, observations and model outputs indicate that after crossing the equator, the DWBC flows with the characteristics of NADW and a total volume transport of approximately 14 Sv (1 Sv = 10^6 m³/sec). It crosses 5°S mostly along the western boundary and breaks up into rings near 8-11°S. When this very energetic eddying flow reaches the Vitória-Trindade ridge (~20°S), the flow branches due to conservation of potential vorticity. The main portion of the flow continues along the continental shelf of South America in the form of a strong reformed DWBC, while a smaller portion, about 20%, is advected towards the interior of the basin.

It is hypothesized that this eastward motion results from eddy thickness flux divergence due to overlying Agulhas Ring decay and enhanced mixing caused by the energetic eddy field at the Vitória-Trindade ridge.