The fate of the Atlantic Deep Western Boundary Current

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The role of the Deep Western Boundary Current (DWBC) as a primary pathway for the cold, lower limb of the Meridional Overturning Circulation has been well documented in the North Atlantic Ocean. However the pathways and variability of the DWBC in the South Atlantic Ocean are less well known. Near 8°S the DWBC appears to break up into rings as it flows southward. According model simulations, the transport of North Atlantic Deep Water (NADW) into the South Atlantic Ocean in this latitude range is accomplished by migrating eddies rather than by a continuous flow. These model results were supported by observations that indicated that a mean DWBC exists at 5°S, but does not exist at 11°S because the DWBC dissolves into a sequence of deep eddies between the two latitudes. These results seem inconsistent with previous findings obtained further south from direct current measurements and geostrophic current estimates that indicated the existence of a DWBC between 20 and 28°S with a southward transport that ranges between 2 and 10 Sv. Recent observations at 34.5°S confirm the presence of the DWBC carrying recently ventilated NADW at that latitude. There is also evidence for a southward flow at the eastern boundary at 34.5°S with similar water masses characteristics. The objective of the study described here is to evaluate the pathways of the DWBC in the South Atlantic and to study the ocean dynamics that establish those pathways. Results are presented from a Lagrangian simulation conducted with output from a 27-year run of the Ocean General Circulation Model for the Earth Simulator (OFES). Model velocities are integrated forward in time to simulate floats released along a grid at 5°S, and the resulting trajectories into the western and eastern South Atlantic are analyzed to determine the mean pathways of the DWBC. Eulerian fields of the OFES output are also analyzed to study the dynamical mechanisms that result in the reattachment of the DWBC to the South American coast south of 11°S. These results are also compared to hydrographic tracer fields from existing WOCE/CLIVAR lines in the region.