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On the fate of the lower North Atlantic Deep Water at the equator.

M. Dengler (1), P. Brandt (1), C. Eden (1), and J. Toole (2)

(1) Leibniz-Institut für Meereswissenschaften, FB1 - Physical Oceanography, Kiel, Germany (mdengler@ifm-geomar.de, +49 431 600 4101), (2) Woods Hole Oceanographic Institute, Woods Hole, MA, USA

The Deep Western Boundary Current (DWBC) transports North Atlantic Deep Water (NADW) into the South Atlantic. It forms along the continental slope east of Greenland and carries dense and cold water masses from the Denmark Strait overflow (lower North Atlantic Deep Water, lNADW), the Iceland - Scotland sills (middle NADW) and the Labrador Sea (upper NADW). In the equatorial zone, our knowledge of the DWBC continuation is incomplete. Due to topographical constraints at about 8°N the DWBC splits into a shallow (<2500m) branch with a core at 2000m depth carrying about 13 Sv and a deep (>2500m) branch. At 35°W, the deep branch is found to be attached to the Parnaiba Ridge slightly north of 2°S carrying about 7 Sv of mNADW and 5 Sv of lNADW. A large part but not all of the NADW arriving at 35°W appears to continue southward at the western boundary. The DWBC is reestablished at 5°S having a velocity core at about 2000m depth. Its southward transport there is confined to the uNADW and mNADW layers and amounts to about 20 Sv, which is comparable to the eastward transports within the same two layers at 35°W. There is, however, no net southward transport in the lNADW layer at the western boundary in the tropical Atlantic south of the equator. Fritz Schott formulated the problem as follows: “The fate of the lNADW is one of the major oceanographic questions remaining today which may involve circuitous zonal routes into the interior of the basin and interactions with topography of the Mid-Atlantic Ridge" (Schott et al., 2005). In this contribution, we investigate possible processes contributing to the fate of the lNADW in the equatorial Atlantic. In previous invers studies, abyssal upwelling through diapycnal mixing has been invoked to explain the deep equatorial circulation. However, microstructure data from the equator at 13°W indicate very low mixing rate that account for small abyssal upwelling transports. Similarly, repeat sections at 23°W suggest little eastward transport of lNADW in the equatorial region. Recent model studies have suggested that the equatorial deep jets are forced in the western and central part of the equatorial basins by instability of intraseasonal equatorial waves. These jets are capable of advecting water mass properties zonally on long time scales and their generation and maintenance may enhance diapycnal water mass transformation.