Zonal fluxes in the deep water layers of the western South Atlantic

M. Vanicek and G. Siedler

Abstract

Zonal transports of North Atlantic Deep Water (NADW) in the South Atlantic are determined. For this purpose the circulation of intermediate and deep water masses is established on the basis of hydrographic sections from the World Ocean Circulation Experiment (WOCE) and some pre-WOCE sections, using temperature, salinity, nutrients and anthropogenic tracers. Multiple linear regression is applied to infer missing parameters in the bottle data set. A linear box - inverse model is used for a set of closed boxes given by sections and continental boundaries. After performing a detailed analysis of water mass distributions, eleven layers are prescribed. Neutral density surfaces are selected as layer interfaces, thus improving the description of water mass distributions in the transition regions between the subtropical and tropical latitudes in the north and the subtropical and subpolar latitudes in the south. Constraints for the inverse model include integral meridional salt and phosphorus transports, overall salt and silica conservation and transports from moored current meter observations. Inferred transport numbers for the mean meridional thermohaline overturning are given. Persistent zonal NADW transport bands are found, in particular eastward flow of relatively new NADW between 20°S and 25°S and a westward flow of older NADW to the north of this latitude range. The axis of the eastward transport band corresponds to the core of property distributions in this region, suggesting "Wuestian" flow. Part of the eastward flow appears to cross the Mid-Atlantic Ridge at the Rio de Janeiro Fracture Zone. Results are compared qualitatively with deep float observations and results from general circulation models.