Abstract View

Volume 17, Issue 6 (June 1987)

Journal of Physical Oceanography
Article: pp. 763–783 | Abstract | PDF (1.30M)

^{3}H and ^{3}He in the Beta Triangle: Observations of Gyre Ventilation and Oxygen Utilization Rates

William J. Jenkins

Departmet of Chemistry, Woods Hole Oceanographic Institution, Woods Hole, MA 02.543

(Manuscript received April 12, 1985, in final form November 15, 1986)

DOI: 10.1175/1520-0485(1987)017<0763:AITBTO>2.0.CO;2

ABSTRACT

Isopycnal maps of ^{3}H–^{3}He age (τ) with about 100 km resolution have been obtained for a 1000-km scale area in the eastern subtropical North Atlantic. The midscale texture of the maps is consistent with isopycnal diffusivities of order 500 m^{-2} s^{-1}. Analysis of the distributions within the context of advection-diffusion equations reveals that the larger scale ^{3}H–^{3}He age gradients observed within the area are not seriously affected by mixing on those surfaces that outcrop in the region of Ekman downwelling. Thus, isopycnal velocities can be estimated from $1/\nabla\tau$, but record only the velocity component normal to the outcrop. The velocities thus obtained agree well with geostrophic estimates, although the comparison is flawed by the fundamental mismatch in timescales between the two techniques. Backward extrapolation of the maps to zero-age outcrop positions indicate that the contribution of unventilated, older, recirculated water to the gyre flow above 600 m depth is small in this area (no more than 20%). Ventilation of these density horizons thus is two to three times greater than inferred from Ekman pumping alone. A simple argument concerning the interaction of large scale flow with the topography of the depth of winter mixing shows that it is consistent with this process being a primary ventilation/subduction process for the subtropical gyre thermocline.

Advection–diffusion analysis of the AOU distributions on these surfaces indicates that oxygen utilization rates may be estimated using $\delta AOU/\delta\tau$ to an accuracy of order 10%. Such estimates appear consistent with previous work, and curvature in the AOU versus τ relationship may be a reflection of a southeastward increase in surface primary productivity.

top

Headquarters: 45 Beacon Street Boston, MA 02108-3693
DC Office: 1120 G Street, NW, Suite 800 Washington DC, 20005-3826
amsinfo@ametsoc.org Phone: 617-227-2425 Fax: 617-742-8718
Allen Press, Inc. assists in the online publication of *AMS* journals.