## Abstract View

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# The Ventilation of the World's Oceans: Maps of the Potential vorticity Field

**Thomas Keffer**

*Department of Physical Oceanography, Woods Hole Oceanographic Institution, Woods Hole, MA 02543*

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ABSTRACT

Maps of potential vorticity ($q$) within four different density layers are presented for the North and South Atlantic, North and South Pacific, and Indian Oceans. Potential vorticity is evaluated as $(f/\rho)\partial\rho_0/\partial z$, a prescription that is valid for large slow scales and that allows its mapping from hydrographic data alone. Here, $f$ is the Coriolis frequency, $p_0$ the potential density, and $z$ the vertical coordinate.

It is shown that the character of a layer within the thermocline of a subtropical gyre will vary greatly depending on the extent to which the layer is isolated from surface boundary conditions and forcing. Fluid particles recirculating within “ventilated” layers have their potential vorticity and other properties reset with virtually every circuit round the gyre when they pass through the outcrop zone. By contrast, particles within “unventilated” or “dynamically isolated” layers have time to share their properties with neighboring particles and approach a common, “homogenized” state.

The North Atlantic thermocline is shown to be highly anomalous. The extensive outcropping of its density surfaces equatorward of the zero wind-stress curl line, and the resulting strong downward Ekman pumping, allows the surface boundary conditions to control the interior thermocline structure in the manner of Luyten, Pedlosky and Stommel. The other oceans show a much greater tendency towards homogenization, even at great depth, suggesting that their dynamical isolation is relatively complete. Only in the very shallowest layers, where fluid particles are exposed to direct atmospheric forcing, is there a tendency for the outcrop properties to propagate into the interior. In these regions, wintertime stratification properties are advected into the interior as tongues of high or low $q$.

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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
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