Abstract View

Volume 16, Issue 3 (March 1986)

Journal of Physical Oceanography
Article: pp. 549–561 | Abstract | PDF (972K)

The Subthermocline Lens D1. Part II: Kinematics and Dynamics

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(Manuscript received September 24, 1984, in final form May 24, 1985)

DOI: 10.1175/1520-0485(1986)016<0549:TSLDPI>2.0.CO;2

ABSTRACT

The dynamics of a subthermocline lens observed during the POLYMODE Local Dynamics Experiment are examined using density data and measurements of the velocity field obtained by an absolute velocity profiler. It is shown that the momentum balance is nonlinear. The lens' potential vorticity contours are closed in the horizontal and vertical, trapping low-salinity water at the lens core. The lens's dynamics are explained by a series of elementary models based on the classical Bessel-tunction vortex. The models show that nonlinearity enters in two ways, through the nonlinear momentum balance and through the finite character of the stretching vorticity. The models suggest a lens anatomy: the core; a boundary layer at the velocity maximum; a buffer zone; and a geostrophic region. The first two terms are self-explanatory. The buffer zone extends from the velocity maximum to a radius we term the geostrophic radius; at which there is a salinity front. On either side of this front the character of the mixing processes is quite different. At larger radii the momentum balance is geostrophic, and the lens remains a coherent structure through finite stretching vorticity.