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Volume 16, Issue 3 (March 1986)

Journal of Physical Oceanography
Article: pp. 532–548 | Abstract | PDF (1.26M)

The Subthermocline Lens D1. Part I: Description of Water Properties and Velocity Profiles

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(Manuscript received September 12, 1983, in final form August 12, 1985)

DOI: 10.1175/1520-0485(1986)016<0532:TSLDPI>2.0.CO;2

ABSTRACT

One remarkable result of the Local Dynamics Experiment in POLYMODE is the discovery of a large number of small energetic eddies. Using CTD data, SOFAR float tracks, and profiles of absolute velocity, we describe one of these features—the subthermocline eddy D1. The feature has an advective time scale of 1 day, and its primary mode of movement is advection by the ambient flow field. The eddy is resolved into a coordinate system moving with the velocity of the ambient flow, which ranges from 11–16 cm s^{-1}. Its phase speed is less than 2 cm s^{-1}.

The eddy is a lens centered at 1500 db. Velocity profiles show the lens has no detectable signal in and above the main thermocline or below about 3000 db. Its subsurface velocity maximum is 28.6 cm s^{-1} at 1500 db, 15 km from the center. The radial variation of the azimuthal velocity is Gaussian inside the velocity maximum but decays as e^{-br} beyond. There is little evidence of the eddy beyond a radius of 25 km.

Inside the velocity maximum, the eddy is characterized by a salinity minimum of 34.965‰ over a potential temperature range of 3.838°–3.917°C and an oxygen maximum of 6.1 ml l^{-1}. The freshest water is located in the lower half of the eddy about 10 km from the dynamic axis. However, the eddy is uniformly fresher than the ambient water over most of its density range.

The water property data on any density surface show radial and azimuthal structure. Well mixed, 50–100-db thick layers may indicate active mixing in the interior. Hence this eddy may have at one time been colder and fresher than

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observed here. Outside the velocity maximum to a radius of 25 km the water is a mixture of eddy water and the surrounding water. Based on water properties, the eddy core is predominantly of Labrador Sea origin.

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