Abstract View

Volume 27, Issue 5 (May 1997)

Journal of Physical Oceanography
Article: pp. 749–761 | Full Text | PDF (433K)

Temperature and Salinity Variability in the Deep Western Boundary Current

Shari L. Vaughan

Prince William Sound Science Center, Cordova, Alaska

Robert L. Molinari

National Oceanic and Atmospheric Administration, Atlantic Oceanographic and Meteorological Laboratory, Miami, Florida

(Manuscript received September 12, 1995, in final form October 9, 1996)

DOI: 10.1175/1520-0485(1997)027<0749:TASVIT>2.0.CO;2

ABSTRACT

A ten-year time series (1984–1993) of repeat hydrographic sections from offshore Abaco Island, the Bahamas (26.5°N), is used to define the mean and time dependent characteristics of the deep western boundary current (DWBC). The DWBC flow is divided into four vertical layers based on chlorofluorocarbon (CFC) concentration and formation regions (upper layer: CFC core, $\theta \sim$ 3.9°–5.0°C; second layer: classical Labrador Sea Water, $\theta \sim$ 3.2°–3.9°C; third layer: CFC minimum, $\theta \sim$ 2.4°–3.2°C; deepest layer: CFC core, $\theta \sim$ 1.85°–2.4°C). Time series analysis of mean layer properties and their anomalies showed that the temperature and salinity of each layer did not increase or decrease monotonically with time. Variations in temperature and salinity were characterized by 2–3-yr period oscillations. Variability between years is illustrated by subtracting repeat sections of temperature and salinity along levels of both constant pressure and constant potential density. To determine an original water mass modification that could be responsible for the observed variability in the section differences, an analytical method, which uses both types of differencing schemes, was applied to the DWBC data. Variability in the upper layer between 1987 and 1993 was shown to originate primarily from an increased salinity of the source waters for this layer. Variability in the second layer was shown to arise from a combination of cooling and salinification. Variability in the two deepest layers seemed to be almost entirely due to vertical movement of the isopycnals. Increases in potential temperature and salinity observed in a sublayer of the second layer defined by $\sigma_{1.5} \sim$ 34.68–34.74 (classical Labrador Sea Water) from 1991 to 1993 was shown to be mainly the result of cooling. It is suggested that this cooling may have originally occurred in the central Labrador Sea during the period of active deep water renewal in the early 1970s.

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.