Abstract View

Volume 17, Issue 10 (October 1987)

Journal of Physical Oceanography
Article: pp. 1707–1723 | Abstract | PDF (1.24M)

Wind Effects on the Buoyancy-Driven General Circulation in a Closed Basin Using a Two-Level Model

M. Ikeda

Department of Fisheries and Oceans, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada B2Y 4A2

(Manuscript received July 29, 1986, in final form May 5, 1987)

DOI: 10.1175/1520-0485(1987)017<1707:WEOTBD>2.0.CO;2

ABSTRACT

Wind effects on buoyancy-driven circulation in a two-level rectangular basin are studied. The ocean is driven by positive and negative buoyancy fluxes in the northern and southern portions as well as wind stress of constant curl. In a model with a flat and frictionless bottom, a barotropic component is determined only by wind forcing. A baroclinic component of the wind-driven circulation, associated with horizontal density gradient, is reduced by horizontal diffusion; i.e., the wind-driven circulation is more barotropic with stronger diffusion.

Meridional overturn induced by buoyancy fluxes is modified by the wind-driven circulation, for example, the southward upper-level flow, produced by positive and negative buoyancy fluxes in the northern and southern portions, greatly shifts to the western (eastern) boundary by cyclonic (anticyclonic) wind-driven circulation with realistic intensity. Relative importance of the wind-driven circulation to the buoyancy-driven circulation for meridional density transport is dependent on total Sverdrup transport of the wind-driven circulation, but independent of the buoyancy flux intensifies: the wind-driven circulation is less important with weaker wind stress and in a smaller zonal-size basin. A variable wind stress is also given, to examine effects of seasonal variabilities in wind.

The results are applied to the Baffin Bay/Labrador Sea system, and suggest that the circulation pattern is changed by wind stress cud of $\pm 10^{-7}$ N m^{-3}. With a steady wind stress, the meridional density transport is essentially determined by the buoyancy-driven overturn. However, with the variable wind stress, the density transport varies by more than ±50%, as the system tends to adjust to the wind stress.

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.