Abstract View

Volume 9, Issue 1 (January 1979)

Journal of Physical Oceanography
Article: pp. 19–36 | Abstract | PDF (1.23M)

An Integral Hydrodynamic Model of Upper Ocean Frontal Dynamics: Part II. Physical Characteristics and Comparison with Observations

Richard W. Garvine

College of Marine Studies, University of Delaware, Newark 19711

(Manuscript received March 22, 1978, in final form August 2, 1978)

DOI: 10.1175/1520-0485(1979)009<0019:AIHMOU>2.0.CO;2

ABSTRACT

The physical characteristics of a model of an upper ocean density front are examined and compared to observations. The model was developed and analyzed in a companion paper. It applies to the mean circulation and hydrography of established, persistent fronts. The results for a case where turbulent transport and earth rotational effects are both important are examined in detail. The circulation then contains a jet for the velocity parallel to the front including a cyclonic shear zone but with speeds that are below geostrophic values. The circulation normal to the front shows strong two-sided convergence and sinking near the surface front. The question of upward versus downward mass entrainment is examined in terms of its impact on the model circulation. Five frontal cases are examined and compared to field observations. These cover a wide range of frontal scales from a river plume front to the Gulf Stream front. The river plume front nearly corresponds to a limiting case for the model where rotation is negligible and turbulent dissipative effects dominant, while the Gulf Stream front corresponds nearly to the opposite limiting model case where dissipation is negligible and rotation dominant. The other cases fall between these two limits.