Abstract View

Volume 4, Issue 4 (October 1974)

Journal of Physical Oceanography
Article: pp. 557–569 | Abstract | PDF (1.04M)

Dynamics of Small-Scale Oceanic Fronts

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(Manuscript received April 23, 1974, in final form June 28, 1974)

DOI: 10.1175/1520-0485(1974)004<0557:DOSSOF>2.0.CO;2

ABSTRACT

An integral model of the steady-state dynamics of a shallow, small-scale oceanic front is developed. Such fronts have been observed at the boundaries of river plumes discharging into coastal sea water. They share with larger scale oceanic fronts the features of persistence in time, despite sharp horizontal gradients in properties, and strong horizontal convergence at the surface front with consequent sinking. For a steady state to exist in a reference frame moving with the front, the model shows that interfacial friction and/or upward mass entrainment is required to balance the net pressure gradient produced by the sloping sea surface and frontal interface in the light water pool. Maintenance of this balance dictates that the Richardson number be of order unity; thus, friction and entrainment coefficients are kept low allowing sharp property gradients in the steady state. Strong surface convergence is also a prominent feature of the model dynamics. Comparisons are made with the observations of Garvine and Monk and show acceptable qualitative agreement.