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Wind-Driven Cross-Equatorial Flow in the Pacific Ocean

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ABSTRACT

A scheme for calculation of cross-equatorial flow is presented which permits an estimation of meridional velocity at the equator from hydrographic station data and surface wind stress. It is offered to rationalize the observations that surface winds are neither zonal nor spatially uniform at the equator and that large-scale patterns exist in the meridional slope of the dynamic height field at the equator. Using historical data in the equatorial Pacific for surface wind stress and dynamic height, a large-scale estimate of meridional velocity is presented for the upper 2000 m with a zonal resolution of 10° of longitude. The flow across much of the central equatorial Pacific is northward in the upper 200 m and southward at greater depth. Southward near-surface currents are estimated east of 120°W , in agreement with direct current measurements at 110°W . The frictional component to the flow, although determined only in the vertically integrated sense, is included assuming an exponential decay from the surface. Over much of the basin the pattern of northward surface, southward subsurface flow is responsible for an overall net positive heat transport across the equatorial Pacific Ocean of $0.5\text{--}1.1 (\times 10^{15} \text{ W})$.

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