Abstract View

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A Simple Model of the Wind-Driven Tropical Ocean

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ABSTRACT

A simple analytic theory for some aspects of the wind-driven circulation in the tropical oceans is described. The nearly geostrophic subsurface currants and the pressure field are studied by means of a single-layer model. The flow is forced by the locally determined pattern of convergence and divergence in the wind-driven surface boundary layer. Simple zonally symmetric divergence patterns are used. The response consists of long, damped equatorial waves.

This mechanism is strong enough to account for the strength of observed currents, as well as for typical patterns. The model's response to a uniform easterly wind is a strong eastward currents centered on the equator, with weaker westward currents to the north and south. The eastward current at the equator is due to a Kelvin wave coming from the western boundary to satisfy the mass flux condition there. The model's undercurrent shifts south in response to a southerly wind component also at the equator. A band of boundary layer divergence is associated with the intertropical convergence zone. In the model this causes a trough in the ocean pressure field, and therefore an eastward equatorial countercurrent on its southern side.