ANNUAL VARIATION IN THE DEPTH
OF 14°C IN THE TROPICAL PACIFIC OCEAN

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ABSTRACT

Annual variation in the depth of 14°C throughout the
tropical Pacific Ocean between 30°N and 30°S is studied on
the basis of 156,000 bathythermographs. Large amplitude
variations are found in the region between 4°N and 15°N.
Near 6°N the variations in depth propagate westward. Near
10°N they have the same phase across the ocean from the
American coast to 145°E. A simple model of large-scale,
low frequency currents can account for the variations. The
model is driven by divergence in the Ekman layer set up by
the surface wind stress, called Ekman pumping. It also
incorporates the planetary, geostrophic divergence inherent
on a rotating sphere. The rate of change in depth at 10°N
is in phase with the Ekman pumping velocity. The geostrophic
divergence is small because the variations do not have an
appreciable east-west slope. Both Ekman pumping and geos-
trophic divergence are active at 6°N, because the oceanic
response has the form of a westward propagating wave. This
is a nearly resonant response due to the zonal length scale
of the Ekman pumping velocity field, which is nearly equal
to the half wave length of a free non-dispersive Rossby
wave with a period of 1 year.