Abstract View

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Deep Currents and Their Interpretation as Equatorial Waves in the Western Pacific Ocean

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ABSTRACT

Vertical profiles of current and density made within 5° latitude of the equator along longitudes 168 and 179°E (the vicinity of the Gilbert Islands) reveal multiple deep current reversals which are confined to the equator. These current jets have amplitudes of roughly 5–20 cm s^{-1}, vertical scales of order hundreds of meters, and time scales longer than the one month of measurements during the cruise.

Spectral analysis of profiles indicates that 1) meridional trapping varies roughly as the square root of the vertical scale, 2) both east and north currents are coherent over meridional separations of 0°45′ within roughly 1°30′ of the equator; and 3) zonal current lags vertical displacement by π/4 in depth within 0°45′ of the equator. Zonal coherence scales are smaller than the smallest separation of 3°30′ along the equator. Kinetic energy decreases near the island chain.

Current-meter records taken over nearly two years near the islands suggest strong quasi-annual variability in deep currents near the equator, which is not present at latitudes of a few degrees. Mean currents are much smaller than fluctuations.

Simple sums of linear free equatorial Rossby, Kelvin and mixed Rossby-gravity waves are consistent with the observed equatorial intensification. Rossby modes with periods of at least one year must be included. The jets are confined too broadly to be explained by Kelvin or mixed Rossby-gravity modes alone, but these waves appear to dominate motions within 0°45′ of the equator. The model spectra also suggest more energy in long than short Rossby wards. Coherences calculated from the models are consistent with those observed.

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