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A Study of Geostrophy in Tropical Pacific Ocean Currents during the NORPAX Tahiti Shuttle using a Shipboard Doppler Acoustic Current Profiler

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ABSTRACT

Continuous velocity measurements from a shipboard Doppler acoustic long on the NORPAX shuttle experiment in the central equatorial Pacific are presented. The time mean of these velocities shows the classical zonal equatorial currents as well as their meridional circulation. The velocities are used with concurrent CTD data to examine the geostrophic balance of zonal currents in the upper 117 m. Estimates of the errors of the acoustic data are produced from a comparison between that data and concurrent profiling current-meter data, and are used to establish the reliability of the balances observed. Both the time mean and the time varying balances are investigated, as well as the departures from geostrophic balance. The mean zonal velocities between 4°S and 10°N are found to be in approximate geostrophic balance. Departures from geostrophy in the mean are observed near the surface at the equator. The meridional advection of meridional momentum appears to be only partly responsible for this departure. The time varying flow was partly geostrophic poleward of 1°, but not so equatorward. A large excess of geostrophic velocity variance (relative to observed velocity variance) exists near the equator, probably due to high frequency internal wave signals in the density data. North of 4°N an excess of observed velocity variance was found, due probably to near-internal waves. In both latitude bands the fluctuating departures from geostrophy are probably to near-inertial waves. In both latitude bands the fluctuating departures from geostrophy are probably balanced by meridional acceleration. More than sufficient acceleration exists near the equator to account for the observed imbalance, while in the North Equatorial Countercurrent the acceleration is barely sufficient, implying a close balance between acceleration and nongeostrophic pressure gradients.

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