Abstract View

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Upper Ocean Water Masses and Transports in the Western Tropical Pacific (165°E)

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ABSTRACT

As part of the international TOGA program, the ORSTOM Center in Nouméa (New Caledonia) initiated in January 1984 a series of semi-annual cruises along the 165°E meridian from 20°S to 10°N, across the equatorial current system of the western Pacific. This paper presents an analysis of the first six hydrographic (0-1000 m) and current (0-600 m) sections.

A detailed description of "typical" January 1986 vertical structures of temperature, salinity and zonal measured velocity is offered. Differences are noted with structures previously obtained in the tropical Pacific. Compared to the central and eastern Pacific, the 165°E dataset evidences a much weaker equatorial upwelling and deeper surface isothermal layer and subsurface currents. Compared to the few western Pacific measurements, the two speed cores of the Equatorial Undercurrent (EUC) previously reported at 100 and 200 m are not observed here.

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Special attention is given to the eastward equatorial jet (2°S-2°N; 0-75 m) measured in January 1985 when westerly winds were present from the north of New Guinea to 160°E.

For the purpose of volume transport calculations, eastward flows at 165°E are not sufficiently separated to be easily differentiated. A definition based on an isodensity surface (sigma-t=23.5 kg m^{-3}) is thus adopted to discriminate the EUC and the North and South Subsurface Countercurrents (NSCC, SSCC) from the North and South Equatorial Countercurrents (NECC, SECC). The EUC is assumed to lie within 2 degrees of the equator below sigma-t = 23.5 kg m^{-3}. Using these current boundaries, transports of the South Equatorial Current (SEC), EUC and NECC agree within 30% with estimates previously computed in the western, central and eastern Pacific; e.g., the mean NECC transport is 27 ± 13 10^6 m^3 s^{-1}. A noticeable exception is the SECC transport which is two to four times as much as that estimated for the central Pacific. The weaker (stronger) EUC and the farthest northern (southern) NECC were observed during the three January (June-July) cruises.

Large transport variability was observed and calls for a denser time-space sampling rate of observation. Hence, the credibility of dynamic height and geostrophic currents calculated from XBT (0-400 m) and mean temperature-salinity (*T-S*) curves are investigated. Major limitations, stressed by the semiannual transects, are caused by:

1) notable density variations in the 400–1000 m layer, and

2) the effects of variability of the *T-S* relation in the 0–400 m layer.

These two points can each result in signals of as much as 6 dyn cm in the surface dynamic height and therefore significant errors in geostrophic velocities calculated from individual cruises. These errors are generally not accounted for when the geostrophic method is applied to XBT data. However, poleward of 2° latitude, a fair agreement is observed between mean geostrophic and measured currents (5 cm s^{-1} rms difference), after eliminating the errors introduced by the 400 db reference level and mean *T-S* curves. In the 2°S-2°N band, the agreement is only qualitative (30 cm s^{-1} rms difference) and better in the EUC than in surface flows.

Deeper temperature sampling and a better knowledge of *T-S* variability than the present one are particularly recommended to monitor the equatorial current system from XBTs in the western tropical Pacific Ocean.

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