THE TERMINATION OF THE EQUATORIAL UNDERCURRENT IN THE EASTERN PACIFIC

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ABSTRACT

The historic hydrographic station data base was used to study the termination of the Equatorial Undercurrent (EUC) in the Eastern Tropical Pacific. Temperature, salinity, and dissolved oxygen were analysed in six meridional and four zonal sections in the area bounded by 5°N, 10°S, 100°W, and 80°W. The mean high-salinity core of the EUC is traced from 98°W to the coast of South America, and is coincident with eastward geostrophic flow, indicating that the EUC supplies the Peru-Chile Undercurrent. The mean zonal pressure gradient along the equator between the Galapagos Islands (91°W) and the coast of South America (81°W) is westward, and is not in Sverdrup balance because the zonal advection of zonal momentum in the EUC augments the mean zonal wind stress. In this sense, the mean EUC resembles a free inertial jet impinging upon a wall.

An annual "pulse" of the EUC penetrates to the coast of South America near the equator. The usually westward pressure gradient reverses during January/February, accelerating the current. This reversal is due to an increase in pressure along the equator to the west, rather than a decrease at the coast, and leads the reversal of the local zonal wind

stress. Pressure then increases at the coast as it decreases near the Galapagos Islands. When the current is weaker it appears to be advected south of the equator, extending southeastward from the Galapagos Islands to the upwelling area along the coast. This may be due to the cross-equatorial pressure gradient associated with the southerly component of the wind stress, or to an interaction of the current with the front that separates the Equatorial Surface Water from the Tropical Surface Water.

The seasonal variation of the hydrographic structure suggests that an equatorial Kelvin wave plays a role in the seasonal oscillation of the EUC. The meridional shape of the thermocline perturbation associated with the pulse in the EUC is well described by a Guassian profile (though asymmetric with respect to the equator) and has a meridional scale which implies a contribution from the second baroclinic mode. Upward propagation of the phase of the downwelling signal is found below the thermocline at 92°W and 82°W, suggesting downward propagation of energy via internal waves. The vertical phase speed is estimated at about 6×10^{-5} m/s. This vertical propagation of phase may explain the seasonal variation of the subsurface stratification in the region between the Galapagos Islands and the coast of Ecuador.