Abstract View

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Short-Term Climatic Variability in the Volume Budget of the Western Tropical North Pacific Ocean during 1979–82

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ABSTRACT

Anomalous 14°C isotherm depth and anomalous geostrophic volume transport above the 14°C isotherm depth are calculated in the tropical Pacific for each bimonth of the four year period 1979 to 1982, based on 15 000 temperature/depth observations made by volunteer observing ships. The first two eigenfunctions (EOFs) of the anomalous 14°C isotherm depth, the anomalous zonal geostrophic volume transport, and the anomalous meridional Ekman volume transport explain 44%, 32% and 47% of their variances, respectively. Most of the variability explained by the first EOF is associated with the 1982–83 ENSO event. The EOFs indicate that a loss of anomalous volume above the 14°C isotherm in the western tropical North Pacific is correlated with an increase in anomalous volume in the eastern equatorial Pacific. There is a simultaneous intensification of anomalous eastward geostrophic currents across the width of the equatorial Pacific; however, from 150°E to 140°W there is also a simultaneous intensification of anomalous meridional Ekman currents convergent upon the equator. Net anomalous geostrophic volume transport into a rectangular study region defined by corners at (4°N, 160°E) and (16°N, 160° W) correlates at −0.60 with anomalous rate of change of volume above the 14°C isotherm depth. Net anomalous Ekman volume transport into the study region correlates at 0.76 with the anomalous rate of change of volume above the 14°C isotherm depth. When the net anomalous Ekman volume transport into the study region is added to the net anomalous geostrophic volume transport, the correlation between total net anomalous volume transport and anomalous rate of change of volume is 0.62. The magnitude of the interannual variability of total net anomalous volume transport is 5.5 sverdrups (sv = 10^6 m^3 s^{-1}), essentially equal to the magnitude of the interannual variability of the anomalous rate of change of volume of 5.9 Sv. Meridional Ekman and meridional geostrophic geostrophic volume transports through the southern boundary of the study region and zonal geostrophic transports through the eastern and western boundaries dominate the change in volume within the study region.

There is an anomalous drain of about 10 Sv from the study region during 1982, which includes the early and mature stages of the 1982–83 ENSO event. Anomalous Ekman volume transport through the southern boundary out of the study region is greater than this volume drop, but it is opposed by meridional anomalous geostrophic volume

transport into the study region. Although the North Equatorial Countercurrent is highly correlated with the loss of volume during 1982, most of the volume loss is not due to the divergence of anomalous zonal transports but is due to meridional Ekman transport out of the southern boundary of the study region.