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Changes in Thermal Structure of the Equatorial Pacific during the 1972 El Niño as Revealed by Bathythermograph Observations

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ABSTRACT

Bathythermograph data from the equatorial Pacific are used to study changes in upper ocean thermal structure during the period 1971–73 using data averaged over 2- or 3-month segments. This gives reasonable descriptions of the changes in two regions—the central Pacific (particularly in a section crossing the equator at 170–160°W) and along the eastern boundary. The behavior in the two regions is quite distinct, e.g., in the central Pacific, thermocline depth anomalies do not correlate well with surface temperature anomalies, but they do along the eastern boundary. The first baroclinic mode can be used to describe changes in vertical structure in the central Pacific, but the major changes near the eastern boundary are much more like those associated with the second baroclinic mode.

Subsurface changes along the eastern boundary are extremely large, e.g., the 14°C isotherm at the equator plunged from the 100 m level in January–February 1972 to the 250 m level in May–June. It did not get back to the 100 m level until the second half of 1973. The very large excursions are mainly within 10° of the equator, but the isotherm depth anomaly often had the same sign over the whole section from 20°S to 30°N.

Near the eastern boundary, the surface was nearly always anomalously warm when the thermocline was anomalously deep, but in the central Pacific there was not a strong relationship between surface temperatures and isotherm depth. In fact, the very large positive temperature anomaly found at 170–160°W during the September–November 1972 season occurred when the 20°C isotherm was shallower than normal.

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