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Estimates of Heat Content Variations from Sea Level Measurements in the Central and Western Tropical Pacific from 1979 to 1985

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ABSTRACT

A method is developed to estimate oceanic heat content (0–300 m) variations from sea level measurements in the tropical Pacific. To this end, statistical relationships between heat content and steric level, used as a surrogate variable for the sea level, are derived from climatological data. These relationships are then applied on independent datasets and the predictive ability of the method is determined regionally by comparing heat content estimated from XBT and sea level measurements recorded in three tropical Pacific islands (Christmas Fanning and Truk) during the 1979–85 period.

Good qualitative agreements are found between the two heat content estimates with correlations $R = 0.78$ to 0.94 and rms differences of average temperature of 0.25° to 0.50°C over an observed range of 6°C . Quantitative disagreements are observed in the central Pacific during the fall 1982 (El Niño) period. These deficiencies in the method are found to be primarily due to intense and unusual salinity fluctuations at the surface which notably contribute to sea level variations. The difference between heat content variations deduced from sea level and calculated ones (from XBT) is significantly correlated ($R = 0.54$) with these sea surface salinity fluctuations.

For the investigated areas, the adopted method thus indicates that: 1) 2- and 3-month averaged sea level measurements can account for 61% to 88% of the 0–300 m heat content variations and, 2) special attention is required in its application when intense and unusual sea surface salinity anomalies occur.

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