Abstract View

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The Depth Variability of Meridional Gradients of Temperature, Salinity and Sound Velocity in the Western North Pacific

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ABSTRACT

In the western North Pacific, meridional gradients of temperature, salinity and sound velocity show considerable variation with depth. Gradients of frontal intensity (more than three times the rms value) occur in the upper 600 m of the ocean. Fronts in the surface layer are spaced at irregular intervals. Many deep fronts have no surface manifestation and are spaced at intervals between 300 and 600 km. A spectral analysis of the meridional gradients as functions of depth and longitude was carried out for the wavenumber range between 0 and 13.4 cycles per 1000 km (c.p. 1000 km). The shape of the power density spectra strongly depends on depth. In the upper 150 m the shape is irregular. Between 300 and 600 m, the spectra show a well-defined peak between 1.5 and 3.3 c.p. 1000 km and a sharp decrease in power beyond 10 c.p. 1000 km. While the shape of the power density spectra shows little variation with longitude, there is a substantial decrease in the total power when crossing the Emperor seamount chain. Meridional gradients at the sea surface are coherent with those in the upper 150 m and incoherent with those below. Meridional gradients at 300 m have a good coherence with those at greater depths. The coherence between meridional temperature and salinity gradients increases with increasing depth. The depth dependence of the spectra and coherence is attributed to different processes of gradient formation in the upper and lower layers of the sea. A comparison of the wavenumber spectra of the meridional gradients with the wavenumber spectra of zonal gradients derived from Bernstein and White's (1977) and Wilson and Dugan's (1978) data shows that in each case the dominant spectral peak occurs between about 1.5 and 3 c.p. 1000 km, indicating the prevalence of features with zonal and meridional wavelengths in the 300–600 km range.

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