Abstract View

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Alternative Interpretations for Microstructure Patches in the Thermocline

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ABSTRACT

Two interpretations of microstructure patches measured in the main thermocline of the North Pacific by Gregg (1980) are questioned. He concludes that the observed microstructure is not fossil-temperature turbulence and that the observed Cox numbers imply vertical diffusivities by turbulent mixing which am about 10^{-2} times smaller than canonical values of order 10^{-4} m^2 s^{-1}. The first conclusion that the micro-structure is not fossil depends on an unnecessary assumption that in order to be fossil the microstructure must not be moving: actually, fossil-turbulence microstructure must always have internal wave and laminar restratification motions. The second conclusion depends on the first. The pattern of Thorpe-displacement scales for the patches containing zero temperature gradients implies they were produced by turbulence with vertical scales as large as several meters. However, the large distances separating the zero-gradient points implies that the microstructure is fossil at all scales at the time of observation. Because the microstructure is fossil it follows that the observed Cox numbers C are small compared to their previous values C_0 when the microstructure was actively turbulent at all scales. Model calculations give $C_0 \approx 0.2\, L_T^2\, N/D$ values in the patches as large as 4×10^5 compared to observed C values less than 10^3, where L_T is the maximum Thorpe displacement. The data sample is apparently too small to include representative active turbulent regions because such regions are so intermittent in time and patchy in space. Turbulent vertical diffusivity estimates corrected for undersampling are well within the canonical range of values.

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