Abstract View

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An Investigation of the Occurrence of Oceanic Turbulence with Respect to Finestructure

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ABSTRACT

Data obtained from the cycling mode of a towed system operated in the North Pacific are used to investigate the relationship of small-scale mixing to the finestructure which seems to be such a common characteristic of vertical profiles of oceanic water properties. The signal from a high-frequency response platinum-film thermometer is used, with the local mean vertical temperature gradient, to produce variables proportional to heat flux and an eddy diffusivity for heat. Along with measured values for the local vertical salinity and density gradients, this information is used to examine some questions of interest in the general understanding of turbulence and finestructure. First, it is shown that in regions where the vertical density structure is distinctly layered, there is no noticeable tendency for mixing to occur preferentially on “sheets,” the high-density-gradient regions which separate “layers" of lower density gradient. Instead, mixing events seem to occur at random with respect to the density field, suggesting that such events do not arise predominantly as small-scale Kelvin-Helmholtz instabilities on pre-existing finestructure. Instead, the evidence points to a much closer connection between turbulent mixing and the processes which act to produce and destroy finestructure. Between 60 and 70% of the turbulence encountered in our tows is associated with “active” regions, areas where the vertical profiles of temperature and/or salinity show finestructure inversions. The density profile in such regions is often “steppy” but invariably statically stable on vertical scales greater than about a meter, so that some basically horizontal process, such as inertial waves or density-driven interleaving, is required to produce the inversions in T and S. Whatever process is involved in forming the finestructure inversions in the “active” regions also produces an incidence of turbulence which is higher by a factor of 2 than that which is typical of “inactive” regions. This increased incidence of turbulence could arise either directly through increased vertical shears or else, partly indirectly, through double-diffusive processes which become possible in local regions produced by the inversions. The observations show fairly strong statistical evidence for increased microstructure activity in regions where the *local* vertical gradients of T and S are suitable for double-diffusive processes.

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