The Contribution of Double Diffusion versus Shear-Driven Turbulent to Diapycnal Mixing in the Cape Ghir Upwelling Region

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ABSTRACT

One oceanographic survey was carried out within a project multidisciplinary (PROMECA) from 18 to 29 October 2010 in the Canary Basin. During three days, conductivity–temperature-depth (CTD), expandable bathythermograph temperature (XBT), microstructure turbulence (free-fall turbulence profiler) and acoustic Doppler current profiler (ADCP) data were collected in several stations in the Cape Ghir upwelling region. The results show how the vertical distribution of the dissipation rate of the turbulent kinetic energy, $\varepsilon$, and of the dissipation rates of thermal variance, $\chi$, are modified by the filaments present in the region. These oceanographic structures intensify the vertical shear of the flow and modify the vertical gradients of temperature and salinity, thus influencing the sources of mixing processes associated (Kelvin-Helmholtz instabilities and double diffusion). The $\varepsilon$ values range between $10^{-7}$ and $10^{-10}$ W/kg in the first 500 m of the water column with maximum values near the surface or associated to the filaments. By examining vertical distributions of density ratio, $\rho_R$, and gradient Richardson number, $R_i$, together with $\varepsilon$ and $\chi$, we found zones of the water column where dominates salt fingers or shear-driven turbulence. Applying an analysis based on the intermittency factor with a model based on the dissipation ratio, we estimate the net turbulence diffusivities when processes of double diffusion and shear-driven turbulence are present in the same region.