Estimates of eddy diffusivities using fast response thermistors

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We assess the performance of the CTD (conductivity-temperature-depth profiler) system equipped with a microstructure profiler called MicroRider (MR, manufactured by Rockland Scientific Inc.) in measuring microstructure in the deep ocean through the field observation carried out in 2017. Temperature overturns were detected by the fast response thermistor (FPO-7). The overturning scales (the Thorpe scale L_T) are converted into energy dissipation rates, which are then compared with those directly measured by Vertical Microstructure Profiler (VMP) in the same region in 2016. We find that, although the difference between the eddy diffusivities obtained by MR and VMP is large in the upper layer, it diminishes as the measuring depth increases. This motivates us to introduce the ratio R_{OT} of the Ozmidov scale L_O to the Thorpe scale L_T which depends on the density stratification. We define the value of R_{OT} as $\alpha N/N_{ave}$ (N is the buoyancy frequency, and N_{ave} is the average value of N) and estimate suitable α. It is found that, compared to the case using constant ratio $R_{OT} = 0.8$, the root mean square (rms) between the eddy diffusivities obtained by MR and VMP is decreased by an order. Thus, using the corrected factor R_{OT} obtained in this study, the eddy diffusivities estimated by MR become comparable to those directly measured by VMP, except for the layers affected by the background temperature inversions and double diffusion.

Keywords: Thorpe scale, Temperature overturn, MicroRider

