Observed variations in mixing efficiency in the deep ocean

*Takashi Ijichi[1], Toshiyuki Hibiya[1]

1. Department of Earth and Planetary Science, Graduate School of Science. The University of Tokyo

Recent progress in direct numerical simulations (DNS) of stratified turbulent flows has led to increasing attention to the applicability of the constant mixing coefficient Γ in the Osborn's eddy diffusivity model, Γ = 0.2. Motivated by lack of observational estimates of Γ particularly in the deep ocean, this study examines variations of Γ using deep microstructure profiles collected in various regions of the North Pacific and the Southern Ocean. It is shown that Γ is not constant but varies significantly with the ratio of the Ozmidov scale to the Thorpe scale R_{OT} in a fashion similar to that obtained by previous DNS studies. Efficient mixing events with Γ ~ $O(1)$ and R_{OT} ~ $O(0.1)$ tend to be frequently observed in the deep ocean, while moderate mixing events with Γ ~ $O(0.1)$ and R_{OT} ~ $O(1)$ tend to be observed in the upper ocean. Furthermore, the observed negative relationship between Γ and R_{OT} is consistent with a simple scaling Γ proportional to $R_{OT}^{-4/3}$ that can be derived from classical turbulence theories. In contrast, the observed results exhibit no definite relationships between Γ and the buoyancy Reynolds number Re_b, although Re_b has long been thought to be another key parameter controlling Γ.

Keywords: Turbulent Mixing

