

Enhanced diffusive nitrate fluxes by double diffusive convective mixing

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For understanding the detailed mixing processes and resulted nutrient fluxes along the frontal region between the Oyashio and the Tsugaru Warm Current (TWC), we conducted zigzag surveys crossing the front from the merging area of the two current systems at off Cape Erimo to the down stream by R/V *Wakataka-maru* (with an underway-CTD and a turbulence profiler), and an underwater glider. The observed frontal structure indicates the subduction and the intrusion processes of the cold and fresh Oyashio water to the beneath of the warm and salty TWC water, along a layer between 26.2 to 26.8 sigma theta. The Oyashio subduction resulted favorable conditions for the double diffusive convective mixings. The active double diffusive convections were confirmed by the direct turbulence measurements ($K \sim 10^{-3} \text{m}^2/\text{s}$) at the interface layers where Turner Angle is larger (less) than 45 (-45) degree. The large nitrate flux caused by the double diffusive convection ($F_{\text{NO}_3} \sim 10 \text{ mmol/m}^2\text{day}$) was directly quantified by combinational use of a turbulence profiler and an attached in-situ nitrate sensor.

Keywords: double diffusive convection, turbulent mixing, nitrate flux