

Very strong turbulent mixing over 30-km and 200-m lateral and vertical scales in the Kuroshio near the continental slope in Hyuganada Sea

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The Kuroshio carries nutrients in its subsurface layer as a nutrient stream, which flows along the southern coast of Japan. The nutrients in the dark subsurface layers of the Kuroshio, however, are not available for phytoplankton unless they are supplied through diapycnal mixing processes and/or adiabatic upwelling to sunlit surface layers. It has been unclear whether and how these nutrients are supplied to euphotic zone on the continental shelves. In this study, using a state-of-the-art tow-yo microstructure profiler, it is shown that the very strong turbulence occurs over a scale of 30-km and 200-m along lateral and vertical direction, respectively, near the Kuroshio, which flows on the continental slope in Hyuganada Sea, southeast of Kyushu. The observed turbulent kinetic energy dissipation rates are $O(10^{-7} \text{ Wkg}^{-1})$ near the Kuroshio over a distance of 30-km, which corresponds to $O(10^{-3} \text{ m}^2\text{s}^{-1})$ of eddy diffusivity. Turbidity data suggest that this strong turbulence at the shelf edge provides sediment resuspension from the bottom to 50 m depth. Nitrate diffusive flux is estimated as large as $1\text{-}10 \text{ mmol N m}^2\text{day}^{-1}$ at the base of euphotic zone.

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