Internal tide dissipation, mixing, and vertical nitrate flux at the shelf edge of NE New Zealand.

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Submitted to Journal of Geophysical Research, 16 August 2000.

1. Abstract

An energetic internal tide on the NE shelf of New Zealand was observed with a combination of moored temperature loggers and current meters, and vertical profiling with a microstructure probe. Internal tide energy flux across the shelf edge was calculated to be approximately 640 W m^{-1}, with considerable variability driven by the passage of a storm through the region. Dissipation of the internal tide calculated from the energy loss between two of the moorings was estimated to be 20 ± 14 mW m^{-2}. The estimate of tidally-averaged dissipation from the microstructure profiles was 10 (9 to 12, 95% confidence limits) mW m^{-2}. Associated vertical eddy diffusivities were (5 ± 3) × 10^{-4} m^2 s^{-1} from the mooring observations, and 2.0 (1.7 to 2.4, 95% confidence limits) × 10^{-4} m^2 s^{-1} using the microstructure observations. The observations of vertical eddy diffusivities are combined with measurements of the vertical nitrate gradient to suggest that mixing driven by the internal tide is the dominant mechanism for driving diapycnal nutrient supply. The calculated flux of about 4 – 12 mmol N m^{-2} day^{-1} into the photic zone is suggested to drive significant new sub-surface production throughout the summer, amounting to a possible contribution to annual new production on the shelf of between 30 and 110 g C m^{-2}.