Turbulent layering beneath the pycnocline in a strongly stratified pit-lake

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ABSTRACT: Temperature microstructure observations from a pit lake show alternate layers of high and low turbulence beneath a very strong pycnocline. The layers were clearly defined, around 0.3-0.5 m thick, and were found both at the edge and in the center of the pit lake. In the most energetic regions, the turbulent energy dissipation rate reached $\varepsilon = 10^{-6}$ m^2 s^{-3} and the dissipation rate of thermal variance almost reached $\chi_\theta = 10^{-4.5}$ C^{2}s^{-1}. The turbulent fluid in the middle of the lake had a higher dissipation ratio, the thermal component of potential energy gain vs. kinetic energy loss, when compared with the sidewalls. This is attributed to different forcing mechanisms for the turbulence. We hypothesize that basin-scale internal waves, in conjunction with the topography, create sidewall boundary layers. In the interior regions of the pit lake, the turbulent layers are probably generated by instability due to focusing of short-wavelength internal waves.

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