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The stability of baroclinic diffusion-driven boundary layers in the abyssal ocean BRYAN KAISER, Massachusetts Institute of Technology - Woods Hole Oceanographic Institution, LAWRENCE PRATT, Woods Hole Oceanographic Institution — The diffusion of adiabatic boundary conditions at sloping boundaries into stratified, diffusive flows produces baroclinic vorticity that drives laminar boundary layer (BL) flows. Many studies have investigated laminar solutions but observations of BLs in the abyssal ocean depict vigorous turbulence. The turbulent BLs generate upwelling and downwelling on long time scales and therefore may play an important role in the global overturning circulation and ultimately in the climate state. We investigate the stability of BLs in stratified, diffusive flows on sloping boundaries subjected to tidal oscillations and rotation for conditions typical of the extra-polar abyss on shallow slopes in order to gain insight into the structure of the observed turbulence. While linear stability analysis can predict the onset of instability in some flows (such as Rayleigh-Bénard and Taylor-Couette flows), it fails to predict the onset of instabilities due to shear forces (such as Poiseuille and Couette flow). Both shear instability and convective instability are possible in the BLs of interest, therefore we use a combined approach of linear stability analysis and simulation to determine stability criteria. We present the physical mechanisms of instability as well as the stability criteria.

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