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Shear-induced breaking of internal gravity waves[1] COLM-CILLE CAULFIELD, BPI/DAMTP, University of Cambridge, CHRISTOPHER HOWLAND, JOHN TAYLOR, DAMTP, University of Cambridge — Motivated by observations of turbulence in the strongly stratified ocean thermocline, we use direct numerical simulations to investigate the interaction of a sinusoidal shear flow and a large-amplitude internal gravity wave. Despite strong nonlinearities in the flow, linear ray tracing theory proves qualitatively useful in describing the refraction of the wave by the shear. Consistent with the linear theory, the energy of the wave accumulates in regions of negative mean shear where we observe evidence of both convective instabilities and shear instabilities. Streamwise-aligned convective rolls emerge fastest, but their contribution to irreversible mixing is dwarfed by shear-driven billow structures that develop later. Although the wave strongly distorts the buoyancy field on which these billows develop, the mixing efficiency of the subsequent turbulence is similar to that arising from KelvinHelmholtz instability in a stratified shear layer. We discuss the complex interaction between the mean flow, internal gravity wave and turbulence, and its implications for internal wave-driven mixing in the ocean.

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