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Vortex Ring Induced Mixing in a "Step" Stratification JASON OLSTHOORN, STUART DALZIEL, University of Cambridge — The dynamics of fully developed turbulence in a density stratified fluid is highly complex. The highly unstable nature of stratified turbulence and its large range of length scales impede the analysis of the mixing of the density field. In the present work, we consider the mixing induced by coherent vortex rings. Vortex rings provide a reproducible source of kinetic energy and vorticity and have a well defined length scale. By measuring the mixing induced by the isolated mixing events as a result of a vortex ring interacting with a density stratification, we hope to shed insight into stratified turbulent mixing. We initialize a stable density stratification of two different density salt-water layers with a sharp pycnocline between them. We generate vortex rings in the less dense upper layer, and allow these rings to propagate into the more dense lower layer. The result is a pycnocline disturbance which mixes the fluid. Analyzing the change in potential energy of the fluid over multiple vortex ring/pycnocline interactions, we determine that after an initial setup period, the Richardson number dependence of the mixing is balanced by the change in pycnocline height resulting in a constant mixing rate. We present the analysis of the experimental work and discuss its implications.

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