Generation of Vertical Density Layering by Moving Boundaries[1]

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— A vertically moving boundary in a stratified fluid can create and maintain vertical layering of density (i.e., a horizontal density gradient). We theoretically and experimentally investigate the scenario in which the gradient of density is sharp and localized, as well as non-diffusive. A careful experimental study of a vertically towed fiber through a sharp, stably stratified, highly viscous fluid will be presented. We observe a vertical column of dense fluid entrained by the moving fiber with a well-defined diameter. We investigate various theoretical models for predicting the diameter of this column, including an approach from an unbounded fluid domain limit, a lubrication model, and finally linear stability analysis of a family of exact solutions for bounded and unbounded domains. We compare these theoretical predictions with the experimental observations.

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