Stratified shear flow in an inclined square duct[1] COLIN MEYER, Harvard Univ, PAUL LINDEN, Cambridge Univ — We present results of experiments on stratified shear flow in an inclined duct. The duct connects two reservoirs of fluid with different densities, which drives a counterflow with a dense layer flowing beneath a less-dense layer moving in the opposite direction. Depending on the dimensionless Atwood number A and duct angle θ, we identify four flow states: a laminar L state, a Holmboe wavemode H state, a spatio-temporally intermittent I state, and a fully developed turbulent T state. We map a state diagram of these flows in the Atwood number $-\theta$ plane and examine the force balances that determine each of these states. We find the L and H states to be hydraulically controlled at the ends of the duct and the flow is determined by the pressure difference associated with the density difference between the reservoirs. The I and T states are associated with increasing dissipation within the duct. We replot the state-space in the Grashof number $-\theta$ phase plane and find the transition to the T-state is governed by a critical Grashof number. We then evaluate the level of turbulence by examining scalings for the thickness of interfacial region between the two layers.

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Date submitted: 29 Jul 2014   Electronic form version 1.4