Stratified shear flow in an inclined duct: equations and scalings

SIMON VINCENT, PIERRE AUGIER, Univ of Cambridge, COLIN MEYER, Harvard University, PAUL LINDEN, Univ of Cambridge — We present a theoretical approach to model the behaviour of a stratified shear flow in an inclined duct, and relate the scalings emerging from these equations to the experimental work realized on this problem. We consider a system composed of two reservoirs, filled with fluids of different densities, connected by a square duct inclined from the horizontal. We observe from the experiments that a counterflow is established inside the duct with the denser fluid flowing beneath the less dense fluid, exhibiting a wide range of different regimes as the density difference and the inclination angle are increased. Our model shows that the velocities of the flow scale differently depending on the type of regime the system is in. We compare those scalings to the experimental data and show that the transition from the laminar regimes to the more turbulent ones can be described by different non dimensional numbers depending on the inclination angle and the Reynolds number.

Simon Vincent
Univ of Cambridge