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The effect of an obstruction on the Rayleigh-Taylor instability
CHRISTOPHER BROWN, STUART DALZIEL, University of Cambridge — This talk discusses the effect of an obstruction on the evolution of the Rayleigh-Taylor instability in a confined geometry at low Atwood numbers. The introduction of an obstacle at the height of the initial interface results in dramatic changes to the dynamics of mixing, even when this obstacle is only a few percent of the domain width. Two situations are investigated using laboratory experiments and implicit large eddy simulations. In the first case, a single horizontal opening connects the upper and lower layers. A bidirectional flow exchanges fluid through the opening, this establishes a circulation cell in each layer. These cells exist quasi-steadily for long periods, increasing the time required for mixing compared with the classical case and resulting in a more uniformly mixed final stratification. The second case has two horizontal openings, one either side of the obstruction. This results in markedly different dynamics. The flow through each of the openings switches back and forth between being bidirectional (as with the single opening case) and unidirectional, with the direction of the unidirectional exchange reversing with a constant period.

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