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An exploration of the laminar/turbulent transition boundary in stratified Plane-Couette flow

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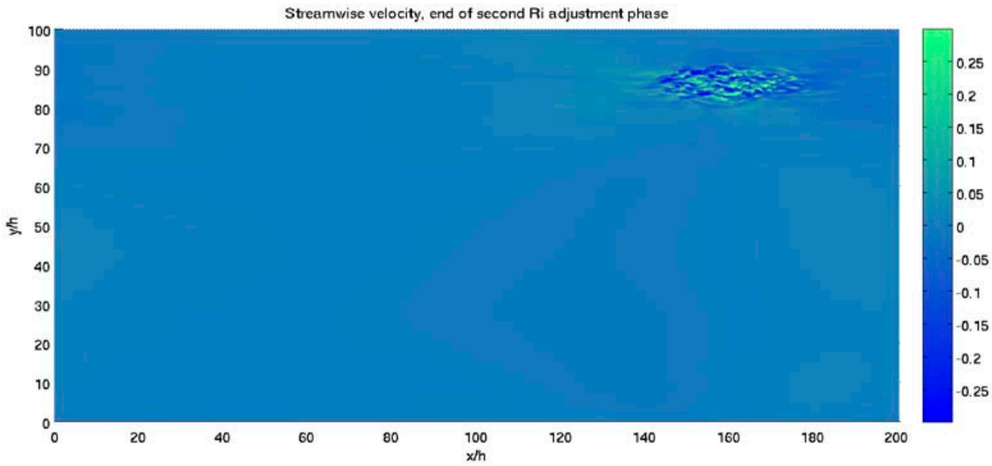
We will describe recent results from direct numerical simulations (DNS) of stratified plane-Couette flow. The flow is described by three nondimensional parameters: Reynolds number, *Re*, Richardson number, *Ri*, and Prandtl number, *Pr*. Here, we restrict our attention to a fixed Prandtl number, *Pr* = 0.7. In this case, the flow can be categorized into three regimes depending on the values of *Ri* and *Re.* For large *Re* and small *Ri* the flow is highly turbulent, while for small *Re* and large *Ri* the flow is laminar. Between these extremes, laminar and turbulent flows can co-exist in a spatio-temporally intermittent regime. Here, we will focus on efforts to describe the transition boundary between intermittent and laminar flows.

First, we will present a series of numerical experiments, each starting from a single realization of spatially intermittent flow in a computational domain with a very large horizontal extent. At the start of each simulation, *Ri* is abruptly increased. For modest increases in *Ri*, the flow re-settles to a new intermittent state with a lower turbulent kinetic energy (TKE). However, large increases in *Ri* can cause the flow to become fully laminar. The rate of decrease in TKE is characterized as a function of *Ri.*

Using insights gained from the decay of stratified turbulence, a new control scheme is implemented, whereby *Ri* is adjusted based on the rate of change in TKE. Using this strategy, we have isolated intermittent states with large *Ri* and low mean TKE. These states consist of highly localized turbulent patches, surrounded by a large area of laminar flow (see figure below). These newly found flow states are also very close to the boundary separating laminar and intermittent stratified turbulence and may help describe generic features of intermittent stratified turbulence.



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