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Laminar-turbulent cycles in strongly-confined lock-exchange flows YUKIE TANINO, Imperial College London, FREDERIC MOISY, JEAN-PIERRE HULIN, FAST Laboratory, CNRS, Pierre & Marie Curie - Paris 6 and Paris-Sud 11 Universities — It is well established that certain shear flows display a transitional regime in which they alternate regularly between laminar and turbulent states. Here, we consider laminar- turbulent cycles in strongly-confined lock-exchange flows in an inclined tube. Simultaneous measurements of density and velocity fields using laser-induced fluorescence and particle image velocimetry demonstrate that the axial velocity evolves in a distinctive ramp-cliff pattern during each laminar-turbulent cycle. This pattern indicates that the flow accelerates as it relaminarizes, then decelerates rapidly with the breakdown of Kelvin-Helmholtz billows. In contrast to conventional interpretation, a single value of the Richardson number does not distinguish flows that subsequently exhibit turbulence from flows that do not. While the density contrast drives the shear flow macroscopically, local stratification does not directly control the onset of instability within experimental conditions. Instead, the measurements suggest that a necessary criterion for a ramp-cliff laminar-turbulent cycle in this flow configuration is for the local Reynolds number to exceed 2200-2300.

Yukie Tanino
Imperial College London

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