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Turbulent-laminar patterns in plane Couette flow LAURETTE TUCKERMAN, LIMSI-CNRS, DWIGHT BARKLEY, University of Warwick, United Kingdom — We study turbulent-laminar patterns in large-aspect-ratio plane Couette flow. These states consist of regular alternations of turbulent and laminar flow over large length scales. We simulate these patterns by extending the minimal-flow-unit methodology to computational domains with one long dimension that can be tilted at any prescribed angle to the streamwise direction. At a tilt of 24 degrees, we reproduce experimentally observed oblique patterns. As Re is decreased from 420, uniform turbulence is succeeded by intermittency at Re=410 and then by three well-defined bands at Re=390 which persist to Re=320 and are replaced by two bands at Re=310. Surprisingly, during this entire evolution, the temporally averaged total kinetic energy remains constant. Thus, the turbulence in the bands (which occupy only a portion of the domain) is more intense than the uniform turbulence, in such a way as to compensate for the laminar regions. In a geometry with a long streamwise and a short spanwise direction, turbulent patches repeatedly disappear abruptly and then re-nucleate gradually, for Reynolds numbers as low as 220. When the spanwise direction is long and the streamwise direction short, transition occurs abruptly from uniform turbulence to laminar Couette flow at Re=400.

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