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The inhibiting effect of stratified mixing on surface-stress-driven flow in a cylinder C.P. CAULFIELD, BPI & DAMTP, University of Cambridge, A. SHRAVAT, AOPP, University of Oxford, C. CENEDESE, WHOI — We extend previous work of Boyer, Davies & Guo (1997: Fluid Dyn. Res. Vol. 21 pg 381-401) to consider the evolution of an initially two-layer stratified fluid in a cylindrical tank which is driven by a horizontal rotating disc. The flow induced by the disc drives entrainment at the interface, and the layer nearer to the disc deepens. Through high-frequency conductivity probe measurements, we establish that the deepening layer is well-mixed, and the interface depth between the two evolving layers appears to be largely constant. Under certain circumstances, we find that the rate of increase in depth of the deepening layer decreases with time, at variance with the results of Boyer et al, and implying that the characteristic velocities in the deepening layer decrease as the upper layer deepens. Such imperfect, decaying spin-up is a natural consequence of the total energy budget of the flow, as the combined power requirements of entrainment and layer homogenization can inhibit the characteristic velocities of the deepening layer approaching the (constant) velocities of the driving disc, as assumed by Boyer et al. We investigate the dependence of both the entrainment and the efficiency of the mixing on the external parameters of the flow, in particular the bulk Richardson number defined in terms of the initial layer depth, interfacial reduced gravity, and disc azimuthal velocity.

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