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Non-invasive turbulent mixing across a density interface in a turbulent Taylor-Couette flow C.P. CAULFIELD, BPI & DAMTP, U. of Cambridge, ANDREW W. WOODS, (BPI), J.R. LANDEL, (BPI & DAMTP), A. KUESTERS, (BPI) — We present experimental measurements of the turbulent transport of salt across an interface between two layers of fluid of different salinities, confined to a cylindrical annulus with gap L where the inner cylinder rotates to produce an approximately irrotational mean azimuthal flow, with narrow boundary layers. We focus on the limit of high Richardson number flow, defined as $Ri = g\Delta\rho H/(\rho_0 u_{rms}^2)$ where ρ_0 is a reference density, $\Delta\rho$ is the time-dependent difference of the layers' mean densities, u_{rms} is the rms of the turbulent velocity fluctuations and H is the layer depth. The mean flow has $Re \sim 10^4 - 10^5$, and the turbulent fluctuations in the azimuthal and radial directions have rms speed of order 10% of the mean azimuthal flow. The interface between the two layers remains sharp, each layer remains well-mixed, and the vertical flux of salt between the layers, $F_s \sim (1.15 \pm 0.15) Ri^{-1} \mathcal{A}(H/L) u_{rms} \Delta S$, where ΔS is the spatially-averaged time-dependent salinity difference between the layers and $\mathcal{A}(H/L)$ is a function of the aspect ratio. The salt transport appears to be caused by turbulent eddies scouring and sharpening the interface and implies a constant rate of conversion of the turbulent KE to PE, independent of the density contrast between the layers.

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