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Transport, dispersion and mixing in quasi-two-dimensional steady jets J.R. LANDEL, BPI & DAMTP, U. of Cambridge, C.P. CAULFIELD, (BPI & DAMTP), ANDREW W. WOODS, (BPI) — The study of turbulent jets in relatively enclosed geometries is relevant to many chemical engineering processes. Predicting the concentration of chemical reactants in time and space requires a good understanding of the jet dynamics. We consider experimentally and theoretically the behaviour of liquid jets in a quasi-Hele-Shaw cell, where the jets are constrained in a narrow gap whose width is two orders of magnitude smaller than the other two flow dimensions. Classical theoretical models for plane jets are in excellent agreement with time-averaged experimental results obtained using both dyed jets and PIV techniques. Detailed examination of instantaneous structures of the flow reveals a high-speed sinuous core at the centre of the jet and large vortical structures on each side, which we analyse quantitatively using a variety of techniques. These structures have a large impact on the mixing and dispersion properties of the jet. We use a virtual-particle-tracking technique to assess and understand this effect. Comparisons between the instantaneous and the time-averaged velocity field show the importance of the inherently time-dependent vortical structures in the mixing and stretching of the fluid, substantially modifying the mixing and (vertical) dispersion within the jet.

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