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The role of double diffusion on the entrainment in turbulent plumes M. DADONAU, J. L. PARTRIDGE, P. F. LINDEN, DAMTP, University of Cambridge — Turbulent plumes are common features in environmental fluids, which occur whenever buoyant fluid is persistently released from a localised source. Such flows play a fundamental role in a large number of geophysical and industrial applications. The evolution and ultimate fate of the plume fluid is largely determined by the process of turbulent entrainment. It is not uncommon for the buoyancy to arise from two components with different molecular diffusivities, forming a double-diffusive configuration, e.g. a plume of cold and fresh meltwater rising along the sidewall of a melting iceberg in a relatively warm and salty ambient ocean. We study the effect of molecular diffusion on turbulent entrainment through experimental investigation of doubly-diffusive plumes. The experiments used the filling-box technique developed by Baines (1983), with water as the working fluid. To ensure mass and energy conservation, instead of the conventional temperature-salinity combination, double-diffusive configurations were obtained by releasing sucrose solution into a salty ambient. Our findings suggest that the entrainment rate is decreased when the source of buoyancy is double-diffusive. Thus, it seems that turbulent entrainment can depend on mixing processes and diffusion at the molecular level.

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