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Inertial particles in a shearless mixing layer: direct numerical simulations PETER IRELAND, LANCE COLLINS, Cornell University — Entrainment, the drawing in of external fluid by a turbulent flow, is present in nearly all turbulent processes, from exhaust plumes to oceanic thermoclines to cumulus clouds. While the entrainment of fluid and of passive scalars in turbulent flows has been studied extensively, comparatively little research has been undertaken on inertial particle entrainment. We explore entrainment of inertial particles in a shearless mixing layer across a turbulent-non-turbulent interface (TNI) and a turbulent-turbulent interface (TTI) through direct numerical simulation (DNS). Particles are initially placed on one side of the interface and are advanced in time in decaying turbulence. Our results show that the TTI is more efficient in mixing droplets than the TNI. We also find that without the influence of gravity, over the range of Stokes numbers present in cumulus clouds, particle concentration statistics are essentially independent of the dissipation scale Stokes number. The DNS data agrees with results from experiments performed in a wind tunnel with close parametric overlap. We anticipate that a better understanding of the role of gravity and turbulence in inertial particle entrainment will lead to improved cloud evolution predictions and more accurate climate models. Sponsored by the U.S. NSF.

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