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Dynamics of particle laden plume in linearly stratified environment HARISH MIRAJKAR, SRIDHAR BALASUBRAMANIAN, Department of Mechanical Engineering, Indian Institute of Technology Bombay, India — Particle laden plumes, which are common in geophysical flows, were simulated experimentally and their flow dynamics was studied. Particles having mean size, $d_p = 100\mu m$, density, ρ_p=2500 kgm^{-3}, and volume fraction, ϕ_v= 0-0.7%, were injected along with lighter buoyant fluid into a linearly stratified medium (N=0.67 s^{-1}). It was observed that a particle-laden plume intruding at the neutral layer is characterized by four spreading regimes: (i) radial momentum flux balanced by the inertia force; (ii) inertia buoyancy regime; (iii) fluid-particle inertia regime, and (iv) viscous buoyancy regime. The maximum height, Z_m for $\phi_v > 0\%$ was observed to be consistently lower than the single-phase case. In the inertia-buoyancy regime, the radial spread, R_f, for the particle laden plume advanced in time as $R_f \approx t^{0:68}$ which is slower compared to the single-phase plume that propagates at $R_f \approx t^{0.74}$. It was observed that the jet cone angle is higher for the case of particle-laden plume owing to flaring of the plume. Due to the presence of particles, 'particle fall out' effect occurs forming a parabolic cloud below the plume spreading height. With increasing ϕ_v, secondary umbrella formation was also observed.

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