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Experimental study of a forced plume in a linearly stratified environment using simultaneous measurements of velocity and density fields. HARISH MIRAJKAR, PARTHO MUKHERJEE, SRIDHAR BALASUBRAMANIAN, Indian Institute of Technology, Bombay India — We present the results of local small-scale measurements of a vertical forced plume ejecting into a linear stably stratified environment, with a stratification strength of $N = 0.4s^{-1}$. High-resolution measurements of velocity and density fields were acquired using simultaneous Particle Image Velocimetry (PIV) and Planar Laser Induced Fluorescence (PLIF). The refractive indices of the ambient and the plume fluids were matched to avoid optical aberrations. The energetics of an evolving forced plume were studied by measuring the terms in kinetic energy budget terms, such as mechanical production (P), buoyancy flux (B), and dissipation (ϵ). The P and ϵ magnitude decreases with increase in the height, while the magnitude of buoyancy flux, B, decreases with height and becomes zero at the neutral buoyant layer (Z_s). Below the neutral buoyant layer, the buoyancy flux, B, shows presence of unstable motions and its sign changes as the plume intrudes into the neutral buoyant layer, indicating stability. The Kolmogorov -5/3 spectral slope is evident in the one-dimensional spatial spectra, indicating the existence of the inertial subrange.

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