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Effect of Reynolds Number on the Buoyant Jet Puffing Instability[1] MICHAEL MEEHAN, University of Colorado, Boulder, NICHOLAS WIMER, National Renewable Energy Laboratory, PETER HAMLINGTON, University of Colorado, Boulder — Buoyant plumes display a global instability near the jet exit in which coherent vortical structures are regularly shed due to buoyancy accelerating the lighter fluid, creating a "puffing" phenomenon. These flow structures are commonly found in nature or as a result of combustion processes; the instability is also important in providing oxygen in buoyancy-driven reacting flows. In this work, we study axisymmetric helium plumes using high-fidelity three-dimensional numerical simulations with adaptive mesh refinement. We investigate, in particular, the effects of Reynolds number on the structure and dynamics of the puffing motion for different Richardson numbers. As the flow transitions to fully turbulent with increasing Reynolds number, we find that: (i) secondary vortices form along and normal to the shear layer, ejecting helium to create "finger-like" structures; and (ii) the puffing dynamics become increasingly complex from both spatial and temporal perspectives. We quantify the dependence of the puffing frequency on the Reynolds number and connect the present results with prior computational and experimental studies of puffing in buoyancy driven flows.

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