Abstract Submitted
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Inertia and Compressibility Effects in the Boussinesq Approximation[1] ANUP SHIRGAONKAR, SANJIVA LELE, Stanford University — The Boussinesq approximation is typically applied to flows where buoyancy is the dominant driving force. To extend its applicability to flows with substantial inertial perturbations, we examine the flow equations using perturbation analysis about the hydrostatic state. The physical effects corresponding to stratification, compressibility, small initial entropy perturbations, and inertia are characterized in terms of nondimensional parameters derived from the analysis. A simple and computationally efficient extension to the traditional Boussinesq approximation is proposed to include the interaction of buoyancy and inertia. The role of *fluid compressibility* in stratified low Mach number flows is highlighted and distinguished from the *flow compressibility* which is caused by motion. A nondimensional parameter is derived to demarcate compressible and nearly-incompressible hydrostatic states. The significance of the extended Boussinesq approximation is illustrated with numerical solutions to model problems. Application to the problem of aircraft vortex wake-exhaust jet interaction is discussed.

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