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Error Quantification in Simulations of Variable Density Low Mach Number Turbulent Flows NICHOLAS ROBERTSON, SIDDHARTHA VERMA, GUILLAUME BLANQUART, California Institute of Technology — In numerical simulations of low Mach number flows, the density is often expressed as a function of one or several transported scalar quantities through the use of an equation of state (EOS). As a result, these scalars play a critical role in controlling the accuracy of the overall simulation. This study aims at understanding and quantifying the sources of errors introduced in performing simulations of variable density low Mach number laminar and turbulent flows. As a first step, the relative importance of the order of accuracy of the scalar transport scheme and the velocity scheme is analyzed in canonical variable density test cases. Then, various implementations of the EOS are investigated in laminar flows. Particular importance is placed on the robustness, the convergence, and the accuracy of these implementations. Finally, the different scalar transport schemes and implementations of the EOS are combined and evaluated in simulations of turbulent planar jets. Following this analysis, guidelines for performing accurate and robust simulations of variable density low Mach number laminar/turbulent flows are proposed.

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