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A Comparative Analysis of Reynolds-Averaged Navier-Stokes Model Predictions for Rayleigh-Taylor Instability and Mixing with Constant and Complex Accelerations[1] OLEG SCHILLING, Lawrence Livermore National Laboratory — Two-, three- and four-equation, single-velocity, multicomponent Reynolds-averaged Navier–Stokes (RANS) models, based on the turbulent kinetic energy dissipation rate or lengthscale, are used to simulate $At = 0.5$ Rayleigh–Taylor turbulent mixing with constant and complex accelerations. The constant acceleration case is inspired by the Cabot and Cook (2006) DNS, and the complex acceleration cases are inspired by the unstable/stable and unstable/neutral cases simulated using DNS (Livescu, Wei & Petersen 2011) and the unstable/stable/unstable case simulated using ILES (Ramaprabhu, Karkhanis & Lawrie 2013). The four-equation models couple equations for the mass flux a and negative density–specific volume correlation b to the K–ϵ or K–L equations, while the three-equation models use a two-fluid algebraic closure for b. The lengthscale-based models are also applied with no buoyancy production in the L equation to explore the consequences of neglecting this term. Predicted mixing widths, turbulence statistics, fields, and turbulent transport equation budgets are compared among these models to identify similarities and differences in the turbulence production, dissipation and diffusion physics represented by the closures used in these models.

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