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Confinement effects in shock/turbulent-boundary-layer interaction through wall-modeled LES[1] IVAN BERMEJO-MORENO, University of Southern California, LAURA CAMPO, Stanford University, JOHAN LARSSON, University of Maryland, College Park, JULIEN BODART, Universite de Toulouse, ISAE, France, DAVID HELMER, JOHN EATON, Stanford University — Wall-modeled large-eddy simulations (WMLES) are used to investigate three-dimensional effects imposed by lateral confinement on the interaction of oblique shock waves impinging on turbulent boundary layers (TBLs) developed along the walls of a nearly-square duct. A constant Mach number, $M = 2.05$, of the incoming air stream is considered, with a Reynolds number based on the incoming turbulent boundary layer momentum thickness $Re_\theta \approx 14,000$. The strength of the impinging shock is varied by increasing the height of a compression wedge located at a constant streamwise location that spans the top wall of the duct at a 20 angle. Simulation results are first validated with particle image velocimetry (PIV) experimental data obtained at several vertical planes. Emphasis is placed on the study of the instantaneous and time-averaged structure of the flow for the stronger-interaction case, which shows mean flow reversal. By performing additional spanwise-periodic simulations, it is found that the structure and location of the shock system and separation bubble are significantly modified by the lateral confinement. Low-frequency unsteadiness and downstream evolution of corner flows are also investigated.

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