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Subgrid-scale Modeling and Resolution Sensitivities in Wall Modeled LES of High-Lift Aircraft Configurations[1] KONRAD GOC, Center for Turbulence Research, Stanford Univ, SANJEEB BOSE, Cascade Technologies, PARVIZ MOIN, Center for Turbulence Research, Stanford Univ — The prediction of the onset of stall in high-lift aircraft configurations is of paramount importance in the design of aircraft. Prior simulations (Goc et al., 2020) have demonstrated that aerodynamic performance of the JAXA Standard Model, including at maximum lift conditions, could be predicted with tractable computational cost using wall modeled LES. This investigation assesses the sensitivity of those calculations with respect to subgrid-scale modeling closures and grid resolution across all angles of attack in the lift curve. The geometry includes the nacelle installation, wind tunnel mounting system and tunnel sidewalls. Two subgrid closures (Vreman and dynamic Smagorinsky) on grids ranging in size from approximately 10 to 200 million control volumes are considered for the sensitivity analysis. We find that the solutions exhibit weakening sensitivity to resolution as the grid is refined, suggesting that quantities of interest are approaching a grid converged state in the wall modeled limit as the number of points spanning the trailing edge boundary layer nears 20 points, particularly in the linear region of the lift curve. Sensitivity to SGS closures is weaker and more uniform across the lift curve, with the DSM outperforming the static coefficient Vreman model.

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