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Numerical model error in large-eddy simulations of a stable atmospheric boundary layer GEORGIOS MATHEOU, University of Connecticut — Aspects of a large-eddy simulation model performance are investigated in simulations of a moderately stable boundary layer. The model utilizes the constant-coefficient Smagorinsky–Lilly subgrid-scale closure. Three model parameters are considered: the grid spacing, the value of the SGS model constant and the order of accuracy (resolving power) of the advection discretization. Depending on the value of the model constant, two main error-producing mechanisms are identified. For high values of the model constant, spurious turbulence collapse is observed. For low values of the model constant, numerical discretization errors dominate, leading to accumulation of energy at small scales and over-prediction of the magnitude of the surface heat flux. Surface fluxes vary for different model constants, even for finely resolved runs with high-order advection discretizations. Although the impact of the surface fluxes on the boundary-layer dynamics is expected, the observed differences are relatively large given that the flow configuration is identical. The present runs show the importance of the feedback between boundary-layer turbulence and surface flux. To eliminate the feedback between turbulent flow and surface heat flux, a series of runs with prescribed surface heat flux was carried out.

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