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Nested high-resolution atmospheric boundary layer simulations using WRF-LES

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The WRF model provides a potentially powerful framework for coupled simulations of flow covering a wide range of spatial and temporal scales via a successive grid nesting capability. Nesting can be repeated down to turbulence-resolving large eddy simulation (LES) scales, providing a means for significant improvements of simulation of turbulent atmospheric boundary layers. In order to achieve this goal, LES of atmospheric flows requires accurate modeling of subfilter scale (SFS) stresses. The Smagorinsky and TKE SFS models used in WRF-LES both use constants that can not be generalized to work well across different grid resolutions, and predict incorrect near-wall behavior. Dynamic SFS models, on the other hand, do not have any adjustable constants, hence are more general. In this study, the scale-dependent Lagrangian dynamic SFS model and the dynamic reconstruction SFS model are tested in simulating turbulent atmospheric boundary layers.