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Investigation of flow transition problems at WRFs nested-domain interfaces

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Many contemporary atmospheric simulation models employ a grid nesting capability that permits large-eddy simulations (LES) to be conducted over subsets of larger bounding simulations, with the bounding-domain solutions providing lateral boundary conditions for the nested domains within. While grid nesting has been successfully applied at GCM to mesoscale resolutions, such nesting behavior at higher resolutions, including those appropriate for LES, is less well understood. We investigate such grid nesting capabilities for conducting an LES inside both larger-scale LES and mesoscale simulations using the Weather Research and Forecasting (WRF) model. Comparisons among the velocity and stress profiles inside the nested domain relative to both the outer domain and non-nested simulations indicate that errors contributed from the bounding domains are observed within the nested-domain solution. We also examine the spatial scales required for flow structures to equilibrate to the finer mesh as flow enters a nest, and how equilibration depends on several parameters, including mesh resolution and the type of turbulence subfilter-scale stress model used.