## 4.2 Investigation of WRF-LES using realistic convective boundary layer forcings

**Gibbs, Jeremy A.** and Evgeni Fedorovich, *University of Oklahoma*

In this study, the ability of two downscaling techniques to represent turbulence flow within the atmospheric convective boundary layer (CBL) under realistic environmental forcings is investigated. Large-eddy simulations (LESs) of turbulent flow were conducted for four cases of a clear and dry CBL developing over the central plains of the United States and were compared with observational data.The first technique for this study was the WRF model applied in an LES mode (WRF-LES). The process involved downscaling regional atmospheric data through two mesoscale WRF model grids and two WRF-LES grids. For the second technique, a traditional LES code was employed using a force-restore nudging procedure to connect the simulation with important large-scale information. This was accomplished by using horizontal mean vertical profiles of temperature, wind, and moisture produced every minute from the outer mesoscale WRF model grid.

Basic atmospheric fields, higher-order turbulence statistics, and velocity spectra are presented and discussed to enable comparison of the CBL flow obtained with each simulation technique. Results show that the transition of turbulence scales across nests yields a well-known eddy-deficient region at the inflow portions of the WRF-LES domain. In addition, the finest mesoscale and coarsest LES domains likely reside within the problematic scale range for which the flow's turbulence characteristics are neither sufficiently resolved explicitly nor correctly represented statistically as subgrid-scale phenomena. These problems, coupled with numerics inherent to the WRF model's solver, have been shown to affect the reproducibility of the smallest scales of motion. At the same time, it is shown that more physically meaningful nudging procedures can improve the applicability of a traditional LES code with realistic atmospheric forcings provided by the WRF model.