Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Thermal transport processes in stable boundary layers WALTER GUTIERREZ, GUILLERMO ARAYA, National Wind Resources Center, Texas Tech University, Lubbock, TX, USA, PRAJU KILIYANPILAKKIL, SUKANTA BASU, Department of Marine, Earth, and Atmospheric Sciences; North Carolina State University, Raleigh, NC, USA, ARQUIMEDES RUIZ-COLUMBIE, National Wind Institute, Texas Tech University, Lubbock, TX, USA, LUCIANO CASTILLO, National Wind Resources Center, Texas Tech University, Lubbock, TX, USA — Using the 200-m tower data (Reese, Texas), profiler and Mesonet data, and WRF runs, a 4-dim model is introduced which summarizes the main features of the Low Level Jet (LLJ) in stable boundary conditions over the aforementioned region and shows its patterns along the year. We also demonstrate the importance of LLJs for wind energy production. It has been observed that during a LLJ event the level of turbulence intensities and TKE are significantly much lower than those during unstable conditions. The major salient results from this study include: the vertical shears in the LLJ are very large at the current wind turbine heights, causing higher static and cyclical aerodynamic loads. The WRF model has accurately captured the beginning and end of the LLJ event; however, the local maximum wind speed at the LLJ "nose" has been under-predicted by approximately 15%, which highlights the difficulties WRF still faces in predicting this phenomenon. Furthermore, power spectra and time-autocorrelations of thermal fluctuations will help us in the understanding of the thermal coherent structures involved in moderate and strong LLJ.

Walter Gutierrez
National Wind Resources Center, Texas Tech University, Lubbock, TX

Date submitted: 31 Jul 2014 Electronic form version 1.4