Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

DNS of stratified spatially-developing turbulent thermal boundary layers GUILLERMO ARAYA, LUCIANO CASTILLO, Department of Mechanical Engineering, National Wind Resource Center, Texas Tech University, KENNETH JANSEN, Aerospace Engineering Sciences, University of Colorado — Direct numerical simulations (DNS) of spatially-developing turbulent thermal boundary layers under stratification are performed. It is well known that the transport phenomena of the flow is significantly affected by buoyancy, particularly in urban environments where stable and unstable atmospheric boundary layers are encountered. In the present investigation, the Dynamic Multi-scale approach by Araya et al. (JFM, 670, 2011) for turbulent inflow generation is extended to thermally stratified boundary layers. Furthermore, the proposed Dynamic Multi-scale approach is based on the original rescaling-recycling method by Lund et al (1998). The two major improvements are: (i) the utilization of two different scaling laws in the inner and outer parts of the boundary layer to better absorb external conditions such as inlet Reynolds numbers, streamwise pressure gradients, buoyancy effects, etc., (ii) the implementation of a Dynamic approach to compute scaling parameters from the flow solution without the need of empirical correlations as in Lund et al (1998). Numerical results are shown for ZPG flows at high momentum thickness Reynolds numbers ($\sim$ 3,000) and a comparison with experimental data is also carried out.

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Date submitted: 27 Jul 2012 Electronic form version 1.4