Generating atmospheric turbulence by a passive method in a boundary layer wind tunnel

Md M. Hossain, Darcy J. Corbin, Gregory A. Kopp
Boundary Layer Wind Tunnel Laboratory, Western University

Abstract

Atmospheric turbulence generation in wind tunnels is an important issue for the investigation of combusting jets in cross flow. Typically, combinations of roughness blocks, spires, barriers and grids are used to generate desired turbulence in atmospheric boundary layer wind tunnels. Among the choices, passive grids are selected to obtain the ideal turbulence intensities (I_u) and length scales (L_x) for model flare stacks. There is existing literature for physical grid construction for contraction-expansion sections in wind tunnels. However, the Boundary Layer Wind Tunnel (BLWT) at Western University is almost uniform in cross section and the cross sectional area is large when compared to other experimental wind tunnels in the existing literature.

A passive grid with specific mesh (M) and bar (b) sizes was used with different wind velocities and downstream measurement positions. It was found that the flow field is comparable with existing grid generated turbulent results and nearly isotropic, homogeneous. In this study we characterize the turbulence by means of energy spectra and match up the model scale with full scale atmospheric turbulence. An in-depth study will be conducted to capture the mechanics involving in jet wake and stack wake region which can depict the basic mechanisms associated with changes to combustion efficiency.