Abstract Submitted
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Wind-tunnel experiments of turbulent flow over a surface-mounted 2-D block in a thermally-stratified boundary layer[1] WEI ZHANG, Cleveland State University, COREY MARKFORT, FERNANDO PORTÉ-AGEL, Ecole polytechnique fédérale de Lausanne — Turbulent flows over complex surface topography have been of great interest in the atmospheric science and wind engineering communities. The geometry of the topography, surface roughness and temperature characteristics as well as the atmospheric thermal stability play important roles in determining momentum and scalar flux distribution. Studies of turbulent flow over simplified topography models, under neutrally stratified boundary-layer conditions, have provided insights into fluid dynamics. However, atmospheric thermal stability has rarely been considered in laboratory experiments, e.g., wind-tunnel experiments. Series of wind-tunnel experiments of thermally-stratified boundary-layer flow over a surface-mounted 2-D block, in a well-controlled boundary-layer wind tunnel, will be presented. Measurements using high-resolution PIV, x-wire/cold-wire anemometry and surface heat flux sensors were conducted to quantify the turbulent flow properties, including the size of the recirculation zone, coherent vortex structures and the subsequent boundary layer recovery. Results will be shown to address thermal stability effects on momentum and scalar flux distribution in the wake, as well as dominant mechanism of turbulent kinetic energy generation and consumption.

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