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Flow around new wind fence with multi-scale fractal structure in an atmospheric boundary layer SARAH MCCLURE, Cleveland State University, SANG-JOON LEE, Pohang University of Science and Technology, WEI ZHANG, Cleveland State University — Understanding and controlling atmospheric boundary-layer flows with engineered structures, such as porous wind fences or windbreaks, has been of great interest to the fluid mechanics and wind engineering community. Previous studies found that the regular mono-scale grid fence of 50% porosity and a bottom gap of 10% of the fence height are considered to be optimal over a flat surface. Significant differences in turbulent flow structure have recently been noted behind multi-scale fractal wind fences, even with the same porosity. In this study, wind-tunnel tests on the turbulent flow and the turbulence kinetic energy transport of 1D and 2D multi-scale fractal fences under atmospheric boundary-layer were conducted. Velocity fields around the fractal fences were systematically measured using Particle Image Velocimetry to uncover effects of key parameters on turbulent flows around the fences at a Reynolds number of approximately 3.6×10^4 based on the free-stream speed and fence height. The turbulent flow structures induced by specific 1D/2D multi-scale fractal wind fences were compared to those of a conventional grid fence. The present results would contribute to the design of new-generation wind fences to reduce snow/sand deposition on critical infrastructure such as roads and bridges.

Sarah McClure
Cleveland State University

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