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The scaling laws for the energy-containing range of second-order structure functions above a dense vegetation canopy YING PAN, National Center for Atmospheric Research, MARCELO CHAMECKI, Pennsylvania State University — Theoretical and experimental results show that the energy-containing range of second-order streamwise spatial structure function within the logarithmic layer of moderate- and high-Reynolds-number wall turbulence is scaled by the dissipation length scale. We extend these scaling laws for turbulent flows above a dense vegetation canopy, where the structure of turbulence is more analogous to a free shear layer than a wall boundary layer. The imbalance between production and dissipation of turbulent kinetic energy (TKE) within the canopy shear layer is much greater than that within the logarithmic layer of wall turbulence. For evaluation of the scaling laws, we use large-eddy simulation (LES) results that well reproduce field experimental data of the second-order streamwise temporal structure function of filtered velocity above the canopy. Within the shear layer above the canopy, LES results of second-order streamwise spatial structure function of filtered velocity are correctly scaled by the dissipation length scale, confirming the theoretical extension of the scaling laws. This work is a preliminary step towards universal scaling laws for turbulent shear flows.

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