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Turbulent boundary layer development over a step change in multiscale roughness[1] JOHN LAWSON, BHARATHRAM GANAPATHISUBRAMANI, University of Southampton — We examine the development of the turbulent boundary layer across a step-change transition between four different three-dimensional, multiscale, cuboidal roughness surfaces. We collected wind-tunnel measurements of the flow above the canopy layer in spanwise stereo-PIV planes at 72 streamwise locations up- and downstream of the transition, as well as direct measurements of the skin-friction drag immediately downstream of the transition. This extensive dataset allows us to quantify the development of the resultant internal boundary layer in terms of its mean velocity profile, Reynolds and dispersive stresses, using true repeating-unit averaging. In addition, we compare measurements of surface drag to estimates from a recently-developed morphometric drag prediction model (Yang et al. 2016). Our findings are relevant to the prediction of drag and boundary layer development over urban surfaces and roughness transition in the presence of secondary flows.

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