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Turbulent boundary layer over a convergent and divergent superhydrophobic surface MUHAMMAD NADEEM, JINYUL HWANG, HYUNG JIN SUNG, KAIST — Direct numerical simulation (DNS) of spatially developing turbulent boundary layer (TBL) over a convergent and divergent superhydrophobic surface (SHS) was performed. The convergent and divergent SHS was aligned in the streamwise direction. The SHS was modeled as a pattern of slip and no-slip surfaces. For comparison, DNS of TBL over a straight SHS was also carried out. The momentum thickness Reynolds number was varied from 800 to 1400. The gas fraction of the convergent and divergent SHS was the same as that of the straight SHS, keeping the slip area constant. The slip velocity in the convergent SHS was higher than that of the straight SHS. An optimal streamwise length of the convergent and divergent SHS was obtained. The convergent and divergent SHS gave more drag reduction than the straight SHS. The convergent and divergent SHS led to the modification of near wall-turbulent structures, resembling the narrowing and widening streaky structures near the wall. The convergent and divergent SHS had a relatively larger damping effect on near-wall turbulence than the straight SHS. These observations will be further analyzed statistically to demonstrate the effect of the convergent and divergent SHS on the interaction of inner and outer regions of TBL.

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