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Effect of Small Roughness Elements on Thermal Statistics of Turbulent Boundary Layer at Moderate Reynolds Number ALI DOOSTTALAB, GUILLERMO ARAYA, Texas Tech University, RONALD ADRIAN, Arizona State University, LUCIANO CASTILLO, Texas Tech University — DNS simulations of the zero pressure gradient turbulent boundary layer subject to forced convection over a transitionally rough surface with $k^+ \approx 11$ and Reynolds numbers based on momentum thickness of 2400, are presented for the first time. Prescribing realistic turbulent inlet conditions for rough surface and spatial evolving flows is extremely challenging. In order to solve the computationally intensive simulations, a dynamic method proposed by G. Araya *et al.* (*JFM,* vol. 670, pp. 581-605, 2011) for prescribing realistic inflow boundary conditions is used for simulations of spatially developing thermal turbulent boundary layers. Preliminary results showed how a transitionally rough surface alters thermal statistics in the inner and outer layers. Based on variations of C_f and St, the validity of Reynolds analogy was tested and confirmed in the rough case and an increase to isotropy was obsereved. Furthermore, it was found that roughness enhances wall-normal heat flux transport in the inner layer and reduce it in the outer region of boundary layer. In addition. The rough surface decreased the ratio of Reynolds stress to turbulent heat flux in the near wall region, leading to a decreased turbulent Prandtl number.

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