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Physical description of boundary layer velocity-vorticity products at high and low Reynolds numbers PATHTHAGE PRIYADARSHANA, Dept. of Mechanical Engineering, Univ. of Utah, JOSEPH KLEWICKI, Dept. of Mechanical Engineering, Univ. of New Hampshire — The mean wall-normal gradient of the Reynolds stress is directly related to mean momentum transport and can be represented by velocity-vorticity products, $v\omega_z$ and $w\omega_y$. Here, u, v, and w are streamwise, wall-normal and spanwise velocity components and, ω_y and ω_z are wall normal and spanwise vorticity components. Physical experiments were conducted to study the effects of scale separation associated with increasing Reynolds number on these velocity-vorticity products. The high Reynolds number data ($R_\theta \simeq O(10^6)$, θ-momentum thickness) were acquired in the near neutrally stable atmospheric surface layer flow over a salt playa under both smooth and rough wall conditions. The low R_θ data were from a database acquired in a large scale laboratory facility at $1000 < R_\theta < 5000$. Spectral analyses were conducted on $v\omega_z$ and $w\omega_y$ at wall normal locations, $y_p/2$ and $2y_p$, where, y_p is the peak wall-normal position of Reynolds stress. The cospectra between velocity and vorticity indicate that there is a scale selection occuring at wavenumbers near the peak of the participating velocity and vorticity components. Physical interpretations are proposed to effectively identify these scale selections. This work was supported by the National Science Foundation (grant monitor Dr. Michael W. Plesniak) and the Office of Naval Research (grant monitor Dr. Ronald D. Joslin), respectively.

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