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Spatio-temporal characteristics of large scale motions in a turbulent boundary layer from direct wall shear stress measurement[1] ROMMEL PABON, CASEY BARNARD, LAWRENCE UKEILEY, MARK SHEPLAK, University of Florida — Particle image velocimetry (PIV) and fluctuating wall shear stress experiments were performed on a flat plate turbulent boundary layer (TBL) under zero pressure gradient conditions. The fluctuating wall shear stress was measured using a microelectromechanical 1mm $\times$ 1mm floating element capacitive shear stress sensor (CSSS) developed at the University of Florida. The experiments elucidated the imprint of the organized motions in a TBL on the wall shear stress through its direct measurement. Spatial autocorrelation of the streamwise velocity from the PIV snapshots revealed large scale motions that scale on the order of boundary layer thickness. However, the captured inclination angle was lower than that determined using the classic method by means of wall shear stress and hot-wire anemometry (HWA) temporal cross-correlations and a frozen field hypothesis using a convection velocity. The current study suggests the large size of these motions begins to degrade the applicability of the frozen field hypothesis for the time resolved HWA experiments. The simultaneous PIV and CSSS measurements are also used for spatial reconstruction of the velocity field during conditionally sampled intense wall shear stress events.

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