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The relation between skin friction fluctuations and turbulent fluctuating velocities in turbulent boundary layers CARLOS DIAZ DANIEL, SYLVAIN LAIZET, JOHN CHRISTOS VASSILICOS, Imperial College London — The Townsend-Perry hypothesis of wall-attached eddies relates the friction velocity u_τ at the wall to velocity fluctuations at a position y from the wall, resulting in a wavenumber range where the streamwise fluctuating velocity spectrum scales as $E(k) \sim k^{-1}$ and the corresponding structure function scales as u_τ^2 in the corresponding length-scale range. However, this model does not take in account the fluctuations of the skin friction velocity, which are in fact strongly intermittent. A DNS of zero-pressure gradient turbulent boundary layer suggests a 10 to 15 degree angle from the lag of the peak in the cross-correlations between the fluctuations of the shear stress and streamwise fluctuating velocities at different heights in the boundary layer. Using this result, it is possible to refine the definition of the attached eddy range of scales, and our DNS suggests that, in this range, the second order structure function depends on filtered skin friction fluctuations in a way which is about the same at different distances from the wall and different local Reynolds numbers.

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